



Technical Specifications
Issued for Tender

National Capital Commission
Domestic Hot Water System

Project No. DC1110-25

December 15, 2014

Project 8014-087

_bpa (Bouthillette Parizeau Inc.)

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END OF SECTION

PART 1 General

1.1 DESCRIPTION OF WORK

- .1 The work of this contract is described by drawings and specification sections as identified in Index Sections.
 - .1 Work of this Contract comprises modifications to the domestic hot water system at 1 Sussex Drive, Ottawa, Ontario. The existing hot water tank located in the basement is being removed and the existing water heaters connected to the main hot water distribution. This contract consists of, but is not limited to the following:
 - .2 Removing the existing hot water tank in the basement mechanical room;
 - .3 Adding a circulation pump, piping, and accessories to connect the new tanks to the existing hot water heaters;
 - .4 Adding all required controls equipment;
 - .5 Various related architectural, electrical and mechanical work;
 - .2 Work of this contract must begin within 10 days of award of contract. Note the following:
 - .1 All site work during the summer season, between July 2nd 2015 and August 29 2015
 - .2 New hot water system to be fully commissioned by August 29, 2015.

1.2 PRECEDENCE

- .1 For Federal Government projects, Division 01 Sections take precedence over technical specification sections in other Divisions of the Project Manual.

1.3 SITE EXAMINATION

- .1 The submission of a tender shall be deemed as proof that the tenderer and his subtrades have complied with this requirement. Claims for additional compensation will not be entertained for any items of labour or material required to complete the work that could have been reasonably ascertained by the Site Examination.
- .2 The Contractor shall also make himself familiar with the security and site access routines of the site for daily operations and procedures to follow during the implementation of the work of this contract in order to properly assess the work procedures and deliveries for work of this contract and ensure minimum disruption to the occupants of the site.
- .3 The Contractor is responsible to verify all dimensions pertinent to work of this contract on site. Any discrepancies found during construction shall be borne by the contractor at no extra cost to this contract.
- .4 Assume responsibility for setting out the work, provide all instruments.

1.4 FIRE SAFETY REQUIREMENTS

- .1 Comply with the National Building Code of Canada 2010 (NBC) for fire safety in construction and the National Fire Code of Canada 2010 (NFC) for fire prevention, firefighting and life safety in building in use. Retain all fire safety documents and standards on site.
- .2 Welding and cutting:
 - .1 Before welding, soldering, grinding and/or cutting work, obtain a permit from the NCC Representative. Store flammable liquids in approved CSA containers; no open flame shall be used unless authorized by the NCC Representative.

- .2 At least 48 hours prior to commencing cutting, welding or soldering procedure, provide to NCC Representative:
 - .1 Notice of intent, indicating devices affected, time and duration of isolation or bypass.
 - .2 Completed welding permit.
 - .3 Return welding permit to Departmental Representative immediately upon completion of procedures for which permit was issued.
- .3 A fire watcher shall be assigned when welding or cutting operations are carried out in areas where combustible materials within 10m may be ignited by conduction or radiation.
- .4 Where work requires interruption of fire alarms or fire suppression, extinguishing or protection systems:
 - .1 Provide watchman service in general, watchman service is defined as an individual conversant with Fire Emergency Procedures, performing fire picket duty within an unprotected and unoccupied (no workers) area once per hour.
- .5 Immediately upon completion of work, restore fire protection systems to normal operation and verify that all devices are fully operational.
- .6 Inform fire alarm system monitoring agency and local Fire Department immediately prior to isolation and immediately upon restoration of normal operation.
- .7 Before welding, contractor to sit down with commissionaires to get approval to go ahead with shut down of fire alarm.
- .8 No engine-driven welding is allowed.
- .9 220V electric available for welding machine.

1.5 FIELD QUALITY CONTROL

- .1 Carry out Work using qualified licensed workers or apprentices in accordance with Provincial Act respecting manpower vocational training and qualification.
- .2 Permit employees registered in Provincial apprenticeship program to perform specific tasks only if under direct supervision of qualified licensed workers.
- .3 Determine permitted activities and tasks by apprentices, based on level of training attended and demonstration of ability to perform specific duties.

PART 2 Contract Administration

2.1 SCHEDULING OF WORK AND RESTRICTIONS

- .1 The Contractor shall schedule work activities to prevent and minimize any disruption to the occupants and users of the site. Disruptive work activities and their scheduling shall be done in co-ordination with the NCC Representative and site security
- .2 Scheduling constraints:
 - .1 Standard authorised hours of work are Monday to Friday, 07:00 hours to 18:00 hours:
 - .1 Shutdown time to be minimized and should not exceed 8 hours intervals per shutdown. To be coordinated with the NCC. Contractor to prepare all piping and fittings ahead of time for quick installation. The 8 hours shutdown is just an estimate. We may have system shut down for a whole weekend. The domestic

hot water must be available for use, connect temporary tank to allow for hot water during construction.

- .2 Obtain prior permission through NCC Representative for work outside of the standard authorised time frame. Assume any extra costs for labour, material or equipment associated with work performed outside of the standard authorised time frame unless specifically requested by Owner.
- .3 Work stoppages constitute a request from the NCC Representative for on-site work to be stopped and the vacating of the site by the Contractor's work forces for a determined period of time. The Contractor shall make provisions for the following as indicated in section 010000 Master General Requirements.

2.2 CANADIAN LABOUR AND MATERIAL

- .1 The Contractor shall use Canadian labour and materials in the design and performance of the Work to the full extent to which they are procurable, consistent with proper economy and the expeditious carrying out of the Work.
- .2 Subject to the above, the Contractor shall, in the performance of the work, employ labour from the locality where the work is being performed to the extent to which it is available.

PART 3 Execution

3.1 NOT USED

- .1 Not used.

END OF SECTION

PART 1 General

1.1 ADMINISTRATIVE

- .1 Submit to NCC 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 NCC 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 NCC 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 is co-ordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by NCC Representative's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by NCC Representative's 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 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.
- .3 Allow 10 days for NCC Representative's review of each submission.
- .4 Adjustments made on shop drawings by NCC Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to NCC Representative prior to proceeding with Work.
- .5 Make changes in shop drawings as NCC Representative may require, consistent with Contract Documents. When resubmitting, notify NCC Representative in writing of revisions other than those requested.
- .6 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.
- .7 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.
- .8 After NCC Representative's review, distribute copies.
- .9 Submit electronic copy in (.pdf) format of shop drawings for each requirement requested in specification Sections and as NCC Representative may reasonably request.
- .10 Submit electronic copy in (.pdf) format of product data sheets or brochures for requirements requested in specification Sections and as requested by NCC Representative where shop drawings will not be prepared due to standardized manufacture of product.
- .11 Submit electronic copy in (.pdf) format of test reports for requirements requested in specification Sections and as requested by NCC 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.
- .12 Submit electronic copy in (.pdf) format of certificates for requirements requested in specification Sections and as requested by NCC 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.
- .13 Submit electronic copy in (.pdf) format of manufacturer's instructions for requirements requested in specification Sections and as requested by NCC 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.
- .14 Submit electronic copy in (.pdf) format of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by NCC Representative.
- .15 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .16 Submit electronic copy in (.pdf) format and four (4) hard copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by NCC Representative.
- .17 Delete information not applicable to project.
- .18 Supplement standard information to provide details applicable to project.
- .19 If upon review by NCC Representative, no errors or omissions are discovered or if only minor corrections are made, electronic copy in (.pdf) format 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.
- .20 The review of shop drawings by NCC Representative is for sole purpose of ascertaining conformance with general concept.
 - .1 This review shall not mean that NCC 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 duplicate as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to NCC Representative's business address.
- .3 Notify NCC 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 NCC Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to NCC Representative prior to proceeding with Work.
- .6 Make changes in samples which NCC 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 Section 01 45 00 - Quality Control.

1.5 PHOTOGRAPHIC DOCUMENTATION

- .1 Submit electronic copy of colour digital photography in (.jpg) or (.tif) formats, standard resolution, as directed by NCC Representative.
- .2 Project identification: name and number of project and date of exposure indicated.
- .3 Number of viewpoints: 2 locations.
 - .1 Viewpoints and their location as determined by NCC Representative.
- .4 Frequency of photographic documentation: as directed by NCC Representative.
 - .1 Upon completion of: framing and services before concealment, of Work, and as directed by NCC Representative.

1.6 CERTIFICATES AND TRANSCRIPTS

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

PART 2 Products

2.1 NOT USED

- .1 Not Used.

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 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 Province of Ontario
 - .1 Occupational Health and Safety Act, R.S.O. 1990 Amended 2009.

1.2 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan: Within seven (7) days after date of Notice to Proceed and prior to 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.
- .3 Submit electronic copy in (.pdf) format or two (2) hard copies of Contractor's authorized representative's work site health and safety inspection reports to NCC Representative and authority having jurisdiction, 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 and Section 01 33 00 – Submittal Procedures.
- .7 NCC Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within five (5) days after receipt of plan. Revise plan as appropriate and resubmit plan to NCC Representative within five (5) days after receipt of comments from NCC Representative.
- .8 NCC 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 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to NCC Representative.
- .10 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 prior to beginning of Work.

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 NCC Representative prior to 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 NCC 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 Ontario Health and Safety Act, R.S.O.
- .2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.10 UNFORESEEN HAZARDS

- .1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise NCC 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 specific to activities associated with Construction.
 - .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 Province having jurisdiction, and in consultation with NCC Representative.

1.13 CORRECTION OF NON-COMPLIANCE

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

1.14 POWDER ACTUATED DEVICES

- .1 Use powder actuated devices only after receipt of written permission from NCC Representative.

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.

1.16 BUILDING SMOKING ENVIRONMENT

- .1 Smoking is not permitted in the Building. Obey smoking restrictions on building property

PART 2 Products

2.1 NOT USED

- .1 Not used.

PART 3 Execution

3.1 NOT USED

- .1 Not used.

END OF SECTION

PART 1 General

1.1 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 and applicable standards provided that in case of conflict or discrepancy, more stringent requirements apply.
- .2 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 NCC Representative.
- .2 PCB: Polychlorinated Biphenyl: stop work immediately when material resembling Polychlorinated Biphenyl is encountered during demolition work. Notify NCC Representative.
- .3 Mould: stop work immediately when material resembling mould is encountered during demolition work. Notify NCC Representative.

1.3 BUILDING SMOKING ENVIRONMENT

- .1 Comply with smoking restrictions and municipal by-laws.

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 NCC 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 NCC Representative instructions, or law of Place of Work.
- .3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .4 NCC 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, NCC Representative shall pay cost of examination and replacement.

1.2 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 NCC 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 opinion of NCC 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 NCC Representative.

1.3 REPORTS

- .1 Submit electronic copy in (.pdf) format or three (3) hard copies of inspection and test reports to NCC Representative.
- .2 Provide copies to subcontractor of work being inspected or tested and manufacturer or fabricator of material being inspected or tested.

1.4 TESTS

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

1.5 EQUIPMENT AND SYSTEMS

- .1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.
- .2 Refer to Sections for definitive 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 SUBMITTALS

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

1.2 WATER SUPPLY

- .1 Owner will provide continuous supply of potable water for construction use.
- .2 Owner will pay for utility charges at prevailing rates.

1.3 TEMPORARY VENTILATION

- .1 Provide temporary ventilation in enclosed areas as required to:
 - .1 Facilitate progress of Work.
 - .2 Provide adequate ventilation to meet health regulations for safe working environment.
- .2 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 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
- .3 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.
- .4 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.4 TEMPORARY POWER AND LIGHT

- .1 Owner will pay for temporary power during construction for temporary lighting and operating of power tools, to a maximum supply of 230 volts 30 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 Connect to existing power supply in accordance with Canadian Electrical Code.
- .5 Make good damage to electrical system caused by use under this Contract.

1.5 TEMPORARY COMMUNICATION FACILITIES

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

1.6 FIRE PROTECTION

- .1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction and 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 NOT USED

- .1 Not used.

END OF SECTION

PART 1 General

1.1 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
 - .2 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA O121-2008 (R2013), Douglas Fir Plywood.

1.2 INSTALLATION AND REMOVAL

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

1.3 GUARD RAILS AND BARRICADES

- .1 Provide secure, rigid guard rails and barricades around open shafts, open edges of floors and roofs.
- .2 Provide as required by governing agencies.

1.4 WEATHER ENCLOSURES

- .1 Provide weather right closures to 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.

1.5 DUST TIGHT SCREENS

- .1 Provide negative pressure dust tight polyethylene screens with double curtained doorway 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.

1.6 ACCESS TO SITE

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

1.7 FIRE ROUTES

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

1.8 PROTECTION OF BUILDING FINISHES

- .1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
- .2 Provide necessary screens, covers, and hoardings.
- .3 Confirm with NCC Representative, locations and installation schedule three (3) days prior to installation.

- .4 Be responsible for damage incurred due to lack of or improper protection.

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 specification section, reference may be made to reference standards. List of standards reference writing organizations is contained within each specification section.
- .2 Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .3 If there is question as to whether products or systems are in conformance with applicable standards, NCC Representative reserves right to have such products or systems tested to prove or disprove conformance.
- .4 Cost for such testing will be borne by NCC 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 NCC 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 NCC 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 NCC Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, NCC 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 sheet materials and lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .5 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.
- .6 Remove and replace damaged products at own expense and to satisfaction of NCC Representative.
- .7 Touch-up damaged factory finished surfaces to NCC Representative satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.5 TRANSPORTATION

- .1 Pay costs of transportation of products required in performance of Work.
- .2 Transportation cost of products supplied by Owner will be paid for by Owner. 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 NCC Representative in writing, of conflicts between specifications and manufacturer's instructions, so that NCC Representative will establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes NCC 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 NCC 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. NCC 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 NCC 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 NCC Representative if there is interference. Install as directed by NCC Representative.

1.10 REMEDIAL WORK

- .1 Refer to Section 01 73 00 - Execution Requirements.
- .2 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.
- .3 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 EQUIPMENT

- .1 Consider location of mechanical and electrical equipment indicated as approximate.
- .2 Inform NCC 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 stainless steel fasteners and anchors for securing exterior work.
- .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 NCC Representative.

1.15 EXISTING UTILITIES

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and/or building occupants.
- .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 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.

1.4 EXECUTION

- .1 Execute cutting, fitting, and patching 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 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.

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 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 GENERAL REQUIREMENTS

- .1 This Section provides guidelines to the existing building material refurbishment, as indicated on the Drawings, as specified herein and as required for a complete project, as well as requirements and limitations for cutting and patching the Work.
 - .1 Where indicated and required, patch and make good and/or reinstate finishes and assemblies with like materials to match existing finishes which are to remain, or new finishes to be provided.
 - .2 Complete work to extent required using appropriate transition points between existing or between existing and new assemblies to ensure neat consistent, finished appearance over entire surface.
 - .3 Where a smooth transition cannot be achieved in close proximity to the effected work, finish to appropriate transition points including:
 - .1 Intersection of ceiling or floor and wall plane
 - .2 Intersection of wall planes
 - .3 Intersection of other horizontal or vertical surfaces such as bulkheads
 - .4 Inside or outside corner at changes in surface plane.
- .2 Review construction documents and existing conditions at site assessment to ascertain extent of alterations required to meet the requirements described herein.

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 ALTERATIONS, CUTTING AND PROTECTION

- .1 Extent:
 - .1 Perform cutting and removal work so as not to cut or remove more than is necessary and so as not to damage adjacent work.
- .2 Shoring, Bracing and Capping:
 - .1 Provide shoring, needling and bracing as needed to keep the building structurally secure and free of deflection in all its parts and as needed for the installation of new work.
- .3 Responsibility and Assignment to Trades:
 - .1 The Contractor shall assign the work of moving, removal, cutting, patching and repair to trades under his supervision so as to cause the least damage to each type of work encountered, and so as to return the building as much as possible to the appearance of the new work.
 - .2 Assign patching of finish materials to tradesmen skilled in the work of the finish trade involved.
- .4 Protection:
 - .1 Protect remaining finishes, equipment and adjacent work from damage caused by cutting, moving, removal and patching operations. Protect surfaces which will remain a part of the finished work.

1.5 PATCHING, EXTENDING AND MATCHING

- .1 Skill:
 - .1 Patch and extend existing work using skilled tradesmen who are capable of matching the existing quality of workmanship. The quality of patched or extended work shall not be less than that specified in the applicable Sections of the Contract Specifications.
- .2 Patching:
 - .1 In areas where any portion of an existing finished surface is damaged, lifted, stained or otherwise found to be imperfect, patch or replace the imperfect portion of the surface with matching material.
 - .2 Do not incorporate salvaged or used material in new construction, except where small quantities of finish material which are difficult to match or duplicate are approved for patching or extending purposes by the NCC.
 - .3 Provide adequate support or substrate for patching of finishes.
 - .4 If the imperfect surface is a painted or coated one, repaint or recoat the patched portion in such a way that uniform colour and texture over the entire surface results.
 - .5 If the surrounding surface cannot be matched, repaint or recoat the entire surface to nearest natural break.

- .3 Quality:
 - .1 In the Sections of the Specifications to which these alteration procedures are applicable, products required for patching, matching, extending or replacing existing work have not necessarily been described. Obtain all required products in time to complete the Work on schedule. Provide products of quality equal to or better than the existing products.
- .4 Transitions:
 - .1 Where new work abuts or finishes flush with existing work, make the transition as smooth and workmanlike as possible. Patched work shall match existing adjacent work in texture and appearance, so as to make the patch or transition invisible to the eye at a distance of one metre.
 - .2 Where concrete, drywall, wood, metal or other finished surface is cut in such a way that a smooth transition with new work is not possible, terminate the existing surface in a neat fashion along a straight line at a natural line of division and provide trim appropriate to the finished surface.
- .5 Matching:
 - .1 Where not otherwise specified or indicated, restore existing work that is damaged during construction to a condition equal to its condition at the time of the start of the Work.
 - .2 At locations in existing areas where partitions are removed, patch the floors, walls and ceilings with finish materials to match adjacent finishes.

1.6 EXECUTION

- .1 Execute work by methods to avoid damage to other work, and which will provide proper surfaces to receive patching and finishing.
- .2 Use material to match existing.
- .3 Cut rigid materials using a masonry saw or core drill. Pneumatic or impact tools not allowed without prior approval.
- .4 Restore work with new products in accordance with requirements of Contract Documents.
- .5 Fit work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .6 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with fire rated materials and firestopping material, full thickness of the construction element.
- .7 Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.
- .8 Reinstall work in accordance with the conditions of the surface prior to cutting and patching.
- .9 Reconnect any services damaged due to cutting as part of patching and repairing of the damage area.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Debris:
 - .1 Remove debris promptly from the site each day. Removed material, except that listed or marked by the NCC for retention, becomes the property of the Contractor. Load removed material directly on trucks for removal from the site. Dispose of removed material legally.

- .2 Do not let piled material endanger structure.
- .2 Suppress dust. Prevent the occurrence of unsanitary conditions, dirt or debris.

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 DAILY CLEANING

- .1 Contractor to perform daily and final cleaning. Ensuring a high level of cleanliness for the continuous use of facility's operations.

1.2 PROJECT CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Owner or other Contractors.
- .2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by NCC Representative. Do not burn waste materials on site.
- .3 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .4 Provide on-site containers for collection of waste materials and debris.
- .5 Dispose of waste materials and debris off site.
- .6 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.
- .7 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .8 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .9 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .10 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.3 FINAL CLEANING

- .1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .3 Prior to final review remove surplus products, tools, construction machinery and equipment.
- .4 Remove waste products and debris other than that caused by Owner or other Contractors.
- .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by NCC Representative. Do not burn waste materials on site.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.

- .8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, and floors.
- .9 Clean lighting reflectors, lenses, and other lighting surfaces.
- .10 Vacuum clean and dust building interiors, behind grilles, louvres and screens.
- .11 Wax, seal, 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 equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.
- .16 Clean roofs, downspouts, and drainage systems.
- .17 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

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 Acceptance of Work Procedures:
 - .1 Contractor's Inspection: Contractor and Sub Contractor shall conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify NCC Representative in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.
 - .2 Request NCC Representative's inspection.
 - .2 NCC Representative's Inspection:
 - .1 NCC 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 Operation of systems: demonstrated to Owner's personnel.
 - .5 Work: complete and ready for final inspection.
 - .4 Final Inspection:
 - .1 When completion tasks are done, request final inspection of Work by NCC Representative, and Contractor.
 - .2 When Work incomplete according to Owner and NCC Representative, complete outstanding items and request re-inspection.
 - .5 Declaration of Substantial Performance: when NCC Representative considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.
 - .6 Commencement of Lien and Warranty Periods: date of Owner's acceptance of submitted declaration of Substantial Performance to be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.
 - .7 Final Payment:
 - .1 When NCC Representative considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment.
 - .8 Payment of Holdback: after issuance of Certificate of Substantial Performance of Work, submit application for payment of holdback amount in accordance with contractual agreement.

1.2 FINAL CLEANING

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

PART 2 Products

2.1 NOT USED

- .1 Not Used.

PART 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

PART 1 General

1.1 O&M MANUAL

- .1 O&M Manuals are to be assembled in a 1" or greater 3 ring binder labelled on the front cover and on the binder edge with the:
 - .1 Building Name and address
 - .2 Project Name
 - .3 Project Number
 - .4 Project Completion Date
- .2 O&M manuals are to include a Title Page with: building name, address, date, general contractor information: name address & phone numbers, consultant: name address & phone numbers.
- .3 O&M Manuals are to be indexed and sectioned as follows
 - .1 Signed Letter of warranty: dated; identifying project by name; project number; location and warranty period. Any extended equipment warranty must also be identified.
 - .2 Contact information for all sub-contractors & suppliers.
 - .3 Reports:
 - .1 Copy of all TAB reports for HVAC systems.
 - .2 Pre-functional tests and/or start-up reports.
 - .3 Functional test reports.
 - .4 Cabling verifications.
 - .5 Inspection Outcome Summary Report.
 - .6 Seismic Reports.
 - .7 Other required certifications required by National Building Code.
 - .4 Copy of approved shop drawings.
 - .5 Copy of the specific service and maintenance manual for new equipment.

1.2 AS -BUILT DOCUMENTS AND SAMPLES

- .1 Maintain, at site for NCC Representative and Owner 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 NCC Representative.

1.3 AS-BUILT DRAWINGS

- .1 NCC Representative will provide two sets of white prints for record drawing purposes.
- .2 Maintain project record drawings and record accurately all deviations from Contract documents as project progresses. Maintain on-going as-built records on site, ready for inspection during the course of the construction.
- .3 Update these drawings daily.
- .4 Record changes in red. Mark on one set of prints and at completion of project and prior to final inspection, neatly transfer notations to second set and submit both sets to NCC Representative.
- .5 Record the following information:
 - .1 Field changes of dimension and detail.
 - .2 Changes made by Addendum and Change Order.
 - .3 Final location of all devices and equipment.
 - .4 Location of conduit/cable runs, junction and pull boxes.
 - .5 Location of underground services.

1.4 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

- .1 Record information on set of black line opaque drawings, provided by NCC 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 locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .3 Field changes of dimension and detail.
 - .4 Changes made by change orders.
 - .5 Details not on original Contract Drawings.
 - .6 References to related shop drawings and modifications.
- .5 Specifications: mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.

- .2 Changes made by Addenda and change orders.
- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.
- .7 Provide digital photos for site records.

1.5 EQUIPMENT AND SYSTEMS

- .1 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .2 Provide servicing and lubrication schedule, and list of lubricants required.
- .3 Include manufacturer's printed operation and maintenance instructions.
- .4 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .5 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.
- .6 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .7 Include test and balancing reports as specified in Section 01 45 00 - Quality Control.
- .8 Additional requirements: as specified in individual specification sections.

1.6 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 Additional requirements: as specified in individual specifications sections.

1.7 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 NCC Representative.

1.8 WARRANTIES AND BONDS

- .1 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 (10) 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.
- .2 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.
- .3 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 HVAC balancing and commissioned systems such as fire protection, alarm systems, sprinkler 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 9 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.
- .4 Respond in timely manner to oral or written notification of required construction warranty repair work.
- .5 Written verification to follow oral instructions.
 - .1 Failure to respond will be cause for the NCC Representative to proceed with action against 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 REFERENCES

- .1 Test Requirements: CAN/ULC-S115-11, "Standard Method of Fire Tests of Through Penetration Fire Stops"
- .2 Test Requirements: UL 2079, "Tests for Fire Resistance of Building Joint Systems".
- .3 Inspection Requirements: ASTM E 2174, "Standard Practice for On-site Inspection of Installed Fire Stops.
- .4 Test Requirements: ASTM E 2307, "Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus"
- .5 International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments
- .6 CAN/ULC-S102-M, Standard Test Method for Surface Burning Characteristics of Building Materials
- .7 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .8 Underwriter's Laboratories of Canada (ULC)
 - .1 ULC-S115, Fire Tests of Fire stop Systems.

1.2 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; penetrating items that are cast in place in buildings of non-combustible 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.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 QUALITY ASSURANCE

- .1 A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.
- .2 Firestop System installation must meet requirements of CAN/ULC-S115-11 or UL 2079 tested assemblies that provide a fire rating as shown in Section 2.03 Clauses P, Q & R below.
- .3 Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.
- .4 For those firestop applications that exist for which no ULC or cUL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar ULC or cUL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgment drawings must follow requirements set forth by the International Firestop Council
- .5 Qualifications: Installer: company specializing in fire stopping installations approved by manufacturer.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .2 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate manufacturer &ULC markings.

- .2 Storage and Protection:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.

Part 2 Products

2.1 FIRESTOPPING – GENERAL

- .1 Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.
- .2 Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
- .3 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 as indicated.
- .4 Service penetration assemblies: systems tested to CAN-ULC-S115.
- .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 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.
- .9 Sealants for vertical joints: non-sagging.

2.2 MATERIALS

- .1 Use only firestop products that have been ULC or cUL tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
- .2 Pre-Installed firestop devices for use with non-combustible and combustible pipes (closed and open systems), conduit and/or cable bundles penetrating concrete floors and/or gypsum walls.
- .3 Sealants or caulking materials for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT).

- .4 Sealants, caulking or spray materials for use with fire-rated construction joints and other gaps.
- .5 Pre-formed mineral wool designed to fit flutes of metal profile deck; as a backer for spray material.
- .6 Intumescent sealants or caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe.
- .7 Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles.
- .8 Wall opening protective materials for use with cUL. / ULC listed metallic and specified non-metallic outlet boxes.
- .9 Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems) tested to 50 Pa. differential.
- .11 Materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways.
- .12 Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways.
- .13 For penetrations through a Fire Separation wall provide a firestop system with a "F" Rating as determined by ULC or cUL as indicated below:

| Fire Resistance Rating of Separation | Required ULC or cUL "F" Rating of Firestopping Assembly |
|--------------------------------------|---|
| 30 minutes | 20 minutes |
| 45 minutes | 45 minutes |
| 1 hour | 45 minutes |
| 1.5 hours | 1 hour |
| 2 hours | 1.5 hours |
| 3 hours | 2 hours |
| 4 hours | 3 hours |

- .14 For combustible pipe penetrations through a Fire Separation provide a firestop system with a "F" Rating as determined by ULC or cUL which is equal to the fire resistance rating of the construction being penetrated.
- .15 For penetrations through a Fire Wall or horizontal Fire Separation provide a firestop system with a "FT" Rating as determined by ULC or cUL which is equal to the fire resistance rating of the construction being penetrated.
- .16 Provide a firestop system with an Assembly Rating as determined by UL 2079 which is equal to the time rating of construction joint assembly.

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 SEQUENCES OF OPERATION

- .1 Proceed with installation only when submittals have been reviewed by Consultant.
- .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.

3.5 FIELD QUALITY CONTROL

- .1 Inspections: notify Consultant when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.

3.6 CLEANING

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

- .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.

3.7 SCHEDULE

- .1 Fire stop and smoke seal at:
 - .1 Penetrations through fire-resistance rated concrete and steel pan and concrete floor slabs.
 - .2 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls. Refer to 3.4.2
 - .3 Edge of floor slabs at curtain wall and precast concrete panels.
 - .4 Top of fire-resistance rated masonry and gypsum board partitions.
 - .5 Intersection of fire-resistance rated masonry and gypsum board partitions.
 - .6 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
 - .7 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
 - .8 Openings and sleeves installed for future use through fire separations.
 - .9 Around mechanical and electrical assemblies penetrating fire separations.
 - .10 Rigid ducts: greater than 129 cm²: 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 DOCUMENTS

- .1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections apply to this Section.

1.2 SUMMARY OF WORK

- .1 Work Included: The work of this Section includes the provision of all labour, materials, equipment and services required to execute sealant work, as indicated on the drawings, as specified herein and as required by job conditions and normally considered to be work covered by this Section.
- .2 The term "sealant" shall be interpreted as synonymous with the term "caulking" where used on the drawings and/or in the specifications.
- .3 Related Sections
 - .1 Section 09 21 16 - Gypsum Board Assemblies.

1.3 REFERENCES

- .1 American Society for Testing and Materials (ASTM):
 - .1 ASTM C834-00e1, Standard Specification for Latex Sealants.
 - .2 ASTM C920-05 Standard Specification for Elastomeric Joint Sealants
- .2 Underwriters' Laboratories of Canada (ULC):
 - .1 CAN/ULC-S101-04, Standard Methods of Fire Endurance Tests of Building Construction and Materials.
 - .2 CAN/ULC-S115-05, Standard Method of Fire Tests of Firestop Systems.
- .3 Health Canada / Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).

1.4 QUALIFICATIONS

- .1 The work of this Section shall be executed by an independent Trade Contractor whose primary business is in the application of caulking and sealants, using tradesmen skilled and trained in the techniques of caulking, and who are completely familiar with the published recommendations of the manufacturer of the caulking material being used.
- .2 If requested by the Departmental Representative, provide evidence of previously completed projects of a similar nature.
- .3 Indication of lack of skill or defective work to be sufficient grounds for the Departmental Representative to reject the installed caulking and to require its immediate removal and complete recaulking at no additional cost to the Owner during the warranty period.
- .4 Cooperate with the Departmental Representative and/or any inspection and testing agency the Departmental Representative may appoint.

1.5 COMPATIBILITY

- .1 Sealants used for the various building interior assemblies shall be selected from those specified in the respective assembly Section, and shall be coordinated with the sealant being provided under other Sections. Preferably, one sealant of the same manufacturer shall be used throughout. If different sealants are selected, from those specified, it is the responsibility of the respective Section to ensure compatibility between selected sealant, substrates, and sealants of other Sections which come in contact with the selected sealant.

1.6 SUBMITTALS

- .1 General: Submit each item in this Article according to the Conditions of the Contract and the applicable Division 01 Specification Sections.
- .2 Prior to commencement of the work, submit, for each type of sealant, a certificate signed by the sealant manufacturer which states:
 - .1 surface preparation requirements
 - .2 priming and application procedures
 - .3 verification that sealant materials are selected for use from those specified
 - .4 verification that sealants are suitable for their locality, purposes intended and joint designs
 - .5 verification that sealants are compatible with other materials and products with which they come in contact, including but not limited to sealants provided under other Sections, and finishes
 - .6 verification that sealants will not stain the substrates or finished products
 - .7 verification that sealant is suitable for temperature and humidity conditions at the time of application
- .3 Samples: Where sealant is to be exposed to sight, submit colour samples for the Departmental Representative's selection.
- .4 Submit two copies of WHMIS MSDS Material Safety Data Sheets in accordance with Section 01 35 29.06 - Health and Safety Requirements for sealants and primers. Indicate VOC content for each product.

1.7 ENVIRONMENTAL AND SAFETY 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 acceptable to Labour Canada.
- .2 Subject to compliance with other specification requirements, select low-odour, non-carcinogenic products in all locations for which such products are available.
- .3 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.
 - .1 Do not apply sealants when the temperature of the sealant and the materials to which it is applied is below the manufacturer's recommended application temperature, generally minimum -29°C.
 - .2 Should it become necessary to apply sealants when the temperature is below the manufacturer's recommended temperature, consult the sealant manufacturer and follow his recommendations.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact.
- .2 Store materials in strict accordance with the manufacturer's recommendations. Protect from moisture, water and contact with ground or floor.
- .3 Maintain temperature below 32°C in the storage area.

1.9 WARRANTY

- .1 For the work of this Section, the 12-months warranty period prescribed in the General Conditions of the Contract is extended to 5 years.
- .2 In addition to the 5-year warranty specified above, provide a manufacturer's warranty for silicone sealants for a period of 20 years.
- .3 Warrant that caulking work will not leak, crack, crumble, melt, shrink, bubble, run, lose adhesion or stain adjacent surfaces.

Part 2 Products

2.1 MANUFACTURERS

- .1 This specification is based on the specific sealant products named herein.
- .2 Requests for substitutions will be considered in accordance with provisions of Section 01 25 00 "Substitution Procedures". Acceptance of alternative products is subject to the approval of the Departmental Representative.

2.2 SEALANTS

- .1 Sealant Types:

| Application | Type | Description | Movement Capability | Standards | Comments |
|---|------|--|---------------------|--|--|
| Around interior door frames and windows, against drywall and where acoustical sealant is called for | A | Paintable, acrylic latex sealant for use in firestop and sound control applications. | | ASTM E1399 CAN/ULC-S115M CAN/ULC-S101M | Seal all gaps and openings on one side of each partition in ceiling plenum |
| Sealant for caulking countertops at wall, ceramic tile, plumbing fixtures, and in wet areas where not otherwise specified | B | One-part, acetoxy-cure, mildew-resistant, silicone sealant for non-porous substrates | ± 25% | | |

- .2 Colour of sealants: selected from the manufacturer's complete colour range to match adjacent materials, to the approval of the Departmental Representative.
- .3 Joint cleaner: xylol, methylethyleketon, IPA, or non-corrosive type recommended by sealant manufacturer and compatible with joint forming materials.

2.3 ACCESSORIES

- .1 Primers: type recommended by sealant manufacturer for each specific application.
- .2 Joint fillers: Chemically compatible with primers and sealants, outsized 30 to 50%, type recommended by sealant manufacturer for each specific application.
- .3 Bond breaker: pressure sensitive plastic tape, which will not bond to sealants.

Part 3 Execution

3.1 EXAMINATION

- .1 Examine areas and conditions under which work is to be performed and notify the Departmental Representative in writing of conditions detrimental to the proper and timely completion of the work.
- .2 For exterior sealants, arrange for a technical representative of the manufacturer to conduct adhesion tests for each joint condition and to make recommendations with respect to sealant type, primers (if required) and joint preparation. Do not deviate from the manufacturer's recommendations without prior written approval.
- .3 Do not proceed with the work until unsatisfactory conditions have been corrected to the satisfaction of the installer.
- .4 Commencement of the work of this Section will be construed as acceptance of the site conditions and, thereafter, the Contractor shall be fully responsible for satisfactory work as specified herein.

3.2 PREPARATION

- .1 Remove dust, paint, loose mortar and other foreign matter. Dry joint surfaces.
- .2 Remove rust, mill scale and coatings from ferrous metals by wire brush, grinding or sandblasting.
- .3 Remove oil, grease and other coatings from non-ferrous metals with joint cleaner.
- .4 Prepare concrete, glazed and vitreous surfaces to sealant manufacturer's instructions.
- .5 Examine joint sizes and correct to achieve depth ratio 1/2 of joint width with minimum width and depth of 6 mm. Maximum width 75 mm.
- .6 Install joint filler to achieve correct joint depth and shape with approximately 30% compression.
- .7 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.
- .8 Apply bond breaker tape where required to manufacturer's instructions.
- .9 Use primers where recommended by the sealant manufacturer. Prime sides of joints to sealant manufacturer's instructions immediately prior to caulking.

3.3 WORKMANSHIP

- .1 Caulk all joints between dissimilar materials.
- .2 Before application of any sealant, confirm that sealant material is compatible with the materials and finishes of the surfaces to which the material is applied or is in contact with.
- .3 Apply sealants in strict accordance with the manufacturer's printed directions for the specific applications of the particular materials used, using a gun with proper size nozzle. Use sufficient pressure to fill voids and joints solid. Superficial pointing with skin bead is not acceptable.
- .4 Concrete joints shall be a minimum of 6 mm wide x 6 mm deep. Depth shall be equal to width in joints up to 12 mm wide. For joints 12 mm to 25 mm wide, depth shall be 12 mm.
- .5 For joints in metal, glass and other non-porous surface, sealant depth shall be a minimum of 1/2 the applied sealant width, and shall in no case exceed the applied sealant width.
- .6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities. Neatly tool surface to a slight concave joint.
- .7 Cure sealants in accordance with manufacturer's instructions. Do not cover up sealant until curing is complete and proper seal has been achieved.

3.4 SEALANT APPLICATION

- .1 Apply caulking around the perimeter of every external wall opening, both sides; set exterior door thresholds in a continuous bead of sealant.
- .2 Apply sealant to all exposed control joints in concrete, and gypsum board walls, ceilings, and bulkheads, joints between adjacent building components.
- .3 Provide interior caulking in walls, floor finishes around all metal frames, door frames, access panels, built-in specialties; around pipes, ducts, grilles, outlet boxes, conduits, etc. penetrating floors, walls and ceiling.
- .4 Apply paintable acrylic latex caulking around wood trim and wipe smooth prior to painting.
- .5 Seal all gaps and openings on one side of each partition in ceiling plenum with sealant a flame spread rating of no greater than 25 and a smoke developed rating no greater than 50.
- .6 Caulk solidly around both outside and inside of all window/wall and door/wall joints, horizontal and vertical window and door surrounds, and all other exterior trim, to provide a weathertight seal and prevent condensation.
- .7 Caulk the connection between the tops of walls and the structure above, wherever exposed to sight.
- .8 Caulk around plumbing fixtures, base and rim of sinks with mildew resistant sealant.
- .9 Supply and install paintable sealant around all piping to sinks and lavatories where piping passes through walls.

3.5 CLEANING

- .1 Upon completion of the work of this Section remove from the premises all surplus material, dirt and debris caused by the work of this Section and leave the installation clean.
- .2 Clean any drippage or spills of sealant or primers from adjacent surfaces immediately and make good any damage caused by the work of this Section, using cleaners recommended by the manufacturer, as work progresses.

- .3 Remove masking tape after tooling of joints.

3.6 MANUFACTURER'S WARRANTY INSPECTION

- .1 Upon completion, arrange for inspection of exterior sealant work by a technical representative of the sealant manufacturer.
- .2 Correct any deficiencies.
- .3 Arrange for the issuance of the manufacturer's 20-year materials warranty for exterior sealants.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 00 10 – General Instructions.
- .2 Section 07 92 00 – Joint Sealants.
- .3 Section 09 22 16 – Non-structural framing

1.2 REFERENCES

- .1 American Society for Testing and Materials:
 - .1 ASTM A653/A653M-08, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM C11-08c, Standard Terminology Relating to Gypsum and Related Building Materials and Systems
 - .3 ASTM C840-07 Standard Specification for Application and Finishing of Gypsum Board.
 - .4 ASTM C475/C475M-02(2007), Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - .5 ASTM C754-04 Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
 - .6 ASTM C834-05, Standard Specification for Latex Sealants.
 - .7 ASTM C840-07 Standard Specification for Application and Finishing of Gypsum Board
 - .8 ASTM C919-08, Standard Practice for Use of Sealants in Acoustical Applications.
 - .9 ASTM C954-04 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
 - .10 ASTM C1002-07, Standard Specification for Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
 - .11 ASTM E84-08a, Standard Test Method for Surface Burning Characteristics of Building Materials.
 - .12 ASTM E90-04, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
 - .13 ASTM C413-01, Standard Classification for Rating Sound Insulation.
 - .14 ASTM E488-96(2003), Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements.
- .2 Gypsum Association (GA):
 - .1 GA-214-07, Recommended Levels of Gypsum Board Finish.

- .2 GA-216-07, Application and Finishing of Gypsum Panel Products.
- .3 GA-600-06, Fire Resistance Design Manual.
- .3 Underwriters' Laboratories of Canada (ULC):
 - .1 CAN/ULC-S101-04, Standard Methods of Fire Endurance Tests of Building Construction and Materials.

1.3 DEFINITIONS

- .1 Gypsum board construction terminology: Refer to ASTM C11 for definitions of terms for gypsum board construction not otherwise defined in this Section or other referenced standards.

1.4 REGULATORY REQUIREMENTS

- .1 Fire-resistance rated assemblies incorporating gypsum board: ULC fire resistive floor/ceiling and roof/ceiling design requirements.

1.5 DESIGN CRITERIA

- .1 Fire-Resistance Ratings: Where indicated, provide materials and construction which are identical to those of assemblies whose fire-resistance rating has been determined per CAN/ULC-S101 by a testing and inspecting organization acceptable to authorities having jurisdiction.
 - .1 Provide fire-resistance-rated assemblies identical to those indicated by reference to GA-600 to design designations in ULC fire rating listings, or in the listing of other testing and agencies acceptable to authorities having jurisdiction.
 - .2 Sound Transmission Characteristics: For gypsum board assemblies indicated to have STC ratings, provide materials and construction identical to those of assemblies whose STC ratings were determined per ASTM E90 and classified per ASTM E413 by a qualified independent testing agency.

1.6 SUBMITTALS

- .1 Submit each item in this Article according to Section 01 00 10 – General Instructions.
- .2 Submit Product Data for each type of product specified.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Keep materials dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.8 PROJECT CONDITIONS

- .1 Environmental Conditions, General: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C840 requirements or gypsum board manufacturer's recommendations, whichever are more stringent.
- .2 Room Temperatures: For non-adhesive attachment of gypsum board to framing, maintain not less than 4°C. For adhesive attachment and finishing of gypsum board, maintain not less than 10°C for 48 hours before application and continuously after until dry. Do not exceed 35°C when using temporary heat sources.

- .3 Ventilation: Ventilate building spaces as required to dry joint treatment materials. Avoid drafts during hot, dry weather to prevent finishing materials from drying too rapidly.

Part 2 Products

2.1 STEEL FRAMING AND FURRING COMPONENTS

- .1 General: Provide components complying with ASTM C754 for conditions indicated. Fabricate sheet steel products from Galvanized steel sheet to ASTM A653M with Z 180 hot-dipped galvanized finish.
- .2 Anchors and Fasteners: Anchors and fastener of types suitable for the applications indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers, and with the capability to sustain, without failure and with a safety factor acceptable to the authorities having jurisdiction, the load imposed by ceiling construction and items supported by the ceiling.
- .3 Wire Ties: ASTM A641/A641M, Class 1 zinc coating, soft temper, 1.6 mm thick.
- .4 Hangers: As required by loading conditions and fire resistant design requirements to the satisfaction of the authorities having jurisdiction, one or more of the following:
 - .1 Wire hangers: ASTM A641M, Class 1 zinc coating, soft temper, 4.1 mm diameter.
 - .2 Hanger Rods: Mild steel and zinc coated.
 - .3 Flat Hangers: Mild steel and zinc coated.
- .5 Channels: Cold-rolled steel, 1.5 mm minimum base metal (uncoated) thickness and 11 mm wide flanges. Sizes as required by loading conditions and fire resistant design requirements.
- .6 Steel Studs for Furring Channels: ASTM C645, 0.45 mm base metal thickness, unless otherwise indicated or required by loading conditions. Depth as indicated and as required by loading conditions.
- .7 C-H studs, ASTM A370, Cold-rolled steel, Sizes as required by loading conditions and fire resistant design requirements.
- .8 Steel Furring Channels:
 - .1 Rigid: ASTM C645, hat shaped, depth of 22 mm and minimum thickness of base (uncoated) metal of 0.45 mm, unless otherwise indicated or required by loading conditions.
 - .2 Resilient: Manufacturer's standard product designed to reduce sound transmission, fabricated from steel sheet complying with ASTM A653M or ASTM A568M to form 13 mm deep channel of single- or double-leg configuration: asymmetric-shaped channel with face connected to a single flange by a single-slotted leg (web) or hat-shaped channel, with 38 mm wide face connected to flanges by double-slotted or expanded-metal legs (webs).

2.2 GYPSUM BOARD PRODUCTS

- .1 General: Provide gypsum board of types indicated in maximum lengths available that will minimize end-to-end butt joints in each area indicated to receive gypsum board application, thicknesses as indicated. Requirements as follows except where otherwise indicated:
 - .1 Width: 1219 mm.

- .2 Thicknesses: as indicated.
- .3 Edges: for surfaces to be finished with joint compound: Tapered.
- .4 Ends: Square.
- .2 Gypsum Board to ASTM C840:
 - .1 Standard gypsum board unless otherwise indicated.
 - .2 Fire resistant gypsum board: Type X where required for fire-resistance-rated assemblies.

2.3 TRIM ACCESSORIES

- .1 Accessories for Interior Installation: Cornerbead, edge trim, and control joints complying with ASTM C 1047 and requirements indicated below:
 - .1 Material: Formed steel sheet zinc coated by hot-dip or electrolytic process.
 - .2 Shapes as required in accordance with ASTM C1047.
 - .1 LC-bead with both face and back flanges; face flange formed to receive joint compound. Use LC-beads for edge trim, unless otherwise indicated.
 - .2 L-bead with face flange only; face flange formed to receive joint compound. Use L-bead where indicated.
 - .3 One-piece control joint formed with V-shaped slot and removable strip covering slot opening.
 - .4 Note that standard "U" bead (J-trim) is not acceptable. Use "L" bead that is concealed when taped and filled.

2.4 JOINT TREATMENT MATERIALS

- .1 General: Provide joint treatment materials complying with ASTM C475 and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.
- .2 Joint Tape for Gypsum Board: Paper reinforcing tape as recommended by the gypsum board manufacturer.
- .3 Joint Compound for Gypsum Board: Factory-mixed, all-purpose compound formulated for both taping and topping compound.

2.5 MISCELLANEOUS MATERIALS

- .1 General: Provide auxiliary materials for gypsum drywall construction which comply with referenced installation standards and the recommendations of the manufacturer of the gypsum board.
- .2 Laminating adhesive: Adhesive or joint compound recommended for directly adhering gypsum boards to continuous substrates.
- .3 Spot grout: ASTM C475, setting-type joint compound of type recommended for spot grouting hollow metal door frames.
- .4 Fastening adhesive for metal: Special adhesive recommended for attaching gypsum panels to steel framing.

- .5 Steel drill screws complying with ASTM C1002 for the following applications:
 - .1 Fastening gypsum board to steel members less than 0.76 mm thick.
 - .2 Fastening gypsum board to gypsum board.
- .6 Steel drill screws complying with ASTM C954 for fastening gypsum board to steel members from 0.83 mm to 2.8 mm thick.
- .7 Water: All water used in joint system shall be clean and free from deleterious amounts of foreign material.
- .8 Other Materials: All other materials not specifically described but required for a complete and proper installation of gypsum drywall shall be as selected by the Contractor, subject to approval by the Departmental Representative.

Part 3 Execution

3.1 COORDINATION

- .1 Examine the mechanical and electrical drawings and coordinate with appropriate other trades to establish openings, additional support, furring out and other special provisions required for mechanical and electrical fixtures and fittings and access hatches built into the work of this Section.
- .2 Examine the architectural drawings and coordinate with appropriate other trades to establish openings, additional support and other special provisions required for items built into or partially supported by the work of this Section.
- .3 Work is to be reviewed and approved by Departmental Representative, Departmental Representative, and Commissioning Manager at the following intervals:
 - .1 After erection of steel stud wall framing
 - .2 After the installation of the Security Mesh
 - .3 After the installation of batt insulation
 - .4 After the installation and finishing of the first layer of gypsum board
 - .5 After the installation and finishing of the second layer of gypsum board
 - .6 Do not proceed until review has been carried out and approval given.
 - .7 Coordinate with Project Manager to give notice of anticipated completion of each interval so that reviews can be scheduled.

3.2 CEILING ANCHORAGES:

- .1 Coordinate installation of ceiling suspension systems with installation of overhead structural assemblies to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers that will develop their full strength and at spacing required to support ceilings.

3.3 INSTALLATION - STEEL FRAMING, GENERAL

- .1 Steel Framing Installation Standard: Install steel framing to comply with ASTM C754 and with ASTM C840 requirements that apply to framing installation.

- .2 Install supplementary fire-treated wood framing, blocking, and bracing at terminations in the work and for support of fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, and similar construction to comply with details indicated and with recommendations of gypsum board manufacturer, or if none available, with "Gypsum Construction Handbook" published by CGC.
- .3 Do not bridge building expansion and control joints with steel framing or furring members. Independently frame both sides of joints with framing of furring members or as indicated.
- .4 Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement. Comply with details shown on Drawings.

3.4 APPLICATION AND FINISHING OF GYPSUM BOARD

- .1 Gypsum Board Application and Finishing Standards: Install and finish gypsum board to comply with ASTM C840 and GA-216.
- .2 Install sound attenuation blankets where indicated, prior to gypsum board unless readily installed after board has been installed on one side.
- .3 Locate exposed end-butt joints as far from centre of walls and ceilings as possible and stagger not less than 600 mm in alternate courses of board.
- .4 Install ceiling boards across framing in the manner which minimizes the number of end-butt joints and which avoids end joints in the central area of each ceiling. Stagger end joints at least 600 mm, but not less than one framing member.
- .5 Install wall/partition boards in manner which minimizes the number of end-butt joints or avoids them entirely where possible. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs. Gypsum boards shall extend tight to floors and ceilings with no gaps.
- .6 Install abuse-resistant board from floor level to 1200 mm above floor level on all walls and partitions.
- .7 Install exposed gypsum board with face side out. Do not install imperfect, damaged, or damp boards. Butt boards together for a light contact at edges and ends with not more than 2mm open space between boards. Do not force into place.
- .8 Locate either edge or end joints over supports, except in horizontal applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Position boards so that like edges abut, tapered edges against tapered edges and mill-cut or field-cut ends against mill-cut or field-cut ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.
- .9 Attach gypsum board to steel studs so that leading edge or end of each board is attached to open (unsupported) edge of stud flanged first.
- .10 Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cutouts.
- .11 Form control joints and expansion joints at locations indicated, with space between edges of boards, prepared to receive trim accessories. If not shown on Drawings, control joints shall be installed as follows, in locations as approved by the Departmental Representative:
 - .1 A control joint shall be installed where a partition, wall, or ceiling traverses a construction joint (expansion, seismic, or building control element) in the base building structure.

- .2 Control joints shall be installed where a wall or partition runs in an uninterrupted straight plane exceeding 9 linear metres.
- .3 Control joints in interior ceilings with perimeter relief shall be installed so that linear dimensions between control joints do not exceed 15 m and total area between control joints does not exceed 232 m².
- .4 Control joints in interior ceilings without perimeter relief shall be installed so that linear dimensions between control joints do not exceed 9 m and total area between control joints does not exceed 83 m².
- .5 A control joint or intermediate blocking shall be installed where ceiling framing members change direction.
- .12 Where a control joint occurs in an acoustical or fire-rated system, blocking shall be provided behind the control joint by using a backing material consisting of 16 mm type X gypsum board.
- .13 Isolate perimeter of non-load-bearing drywall partitions at structural abutments. Provide 6 mm to 13 mm space and trim edge with "U" bead edge trim. Seal joints with acoustical sealant.
- .14 Where STC-rated gypsum board assemblies are indicated, seal construction at perimeters, control and expansion joints, openings and penetrations with a continuous bead of acoustical sealant including a bead at both faces of partitions. Comply with ASTM C-919 and manufacturer's recommendations for location of edge trim and close off sound-flanking paths around or through construction, including sealing of partitions above acoustical ceilings.
- .15 Space fasteners in gypsum boards in accordance with referenced gypsum board application and finishing standard and manufacturer's recommendations.

3.5 INSTALLATION - GYPSUM BOARD

- .1 Single-layer application: Install gypsum wallboard as follows:
 - .1 On ceilings, apply gypsum board prior to wall/partition board application to the greatest extent possible, and at right angles to framing, unless noted otherwise.
 - .2 On partitions/walls, apply abuse-resistant gypsum board horizontally for the first 1200 mm above floor level and then continue up the wall with regular gypsum board. Provide sheet lengths which will minimize end joints.
- .2 Multi-layer application: Install gypsum backing board for base layer and gypsum wallboard for face layer.
 - .1 On ceilings, apply base layer prior to applying base layer on walls/partitions; apply face layers in same sequence. Offset face-layer joints one framing member, but not less than 400 mm from parallel base-layer joints. Apply base layers at right angles to framing members unless otherwise indicated.
 - .2 On partitions/wall, apply base layer and face layers vertically (parallel to framing) with joints of base layer over supports and face layer joints offset at least, one stud or furring member, not less than 250 mm with base layer joints.
 - .3 On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with

vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.

- .3 Single-layer fastening methods: Apply gypsum boards to supports with steel drill screws.
- .4 Multi-layer fastening methods: Apply base layer of gypsum board and face layer to base layer as follows:
 - .1 Fasten both base layers and face layers separately to supports with screws.
 - .2 Direct-bonding (laminating) to substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members or base layer of gypsum board), comply with gypsum board manufacturer's recommendations, and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.6 INSTALLATION - TRIM ACCESSORIES

- .1 General: Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges to comply with manufacturer's recommendations.
- .2 Install corner beads at external corners.
- .3 Install edge trim where edge of gypsum panels would otherwise be exposed or semi-exposed. Provide edge trim type with face flange formed to receive joint compound except where other types are indicated.
- .4 Install edge trim where edge of gypsum board would otherwise be exposed or semi-exposed. Provide edge trim-type with face flange to receive joint compound except where other types are indicated.
 - .1 Install "LC" bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
 - .2 Install "L" bead where edge trim can only be installed after gypsum board is installed.
 - .3 Install U-type trim where edge is exposed, revealed, gasketed, or sealant-filled (including expansion joints).
- .5 Install specified extruded aluminum trim where indicated.

3.7 FINISHING OF GYPSUM BOARD ASSEMBLIES

- .1 General: Apply joint treatment at gypsum board joints (both directions), flanges of corner bead, edge trim, and control joints, penetrations, fastener heads, surface defects and elsewhere as required to prepare work for decoration and level of gypsum board finish indicated.
 - .1 Prefill open joints, rounded or bevelled edges, and damaged areas, using setting-type joint compound.
 - .2 Apply joint tape over gypsum board joints except those with trim accessories having concealed face flanges not requiring taping to prevent cracks from developing in joint treatment at flange edges.

- .2 Levels of Gypsum Board Finish: Provide the following levels of gypsum board finish per GA-214.
 - .1 Level 1 for ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistive-rated assemblies and sound-rated assemblies.
 - .2 Level 2 where water-resistant gypsum backing board panels form substrates for tile, and where indicated.
 - .3 Level 4 for gypsum board surfaces indicated to receive light-textured finishes, wallcoverings, and flat paints over light textures.
 - .4 Level 4 for gypsum board surfaces indicated to receive gloss and semi-gloss enamels, nontextured flat paints, and where indicated.
 - .5 Level 5 for gypsum board exposed ceilings to receive paint, or wall surfaces indicated to receive graphic wall covering murals.
- .3 For Level 4 gypsum board finish, embed tape in finishing compound plus two separate coats applied over joints, angles, fastener heads, and trim accessories using one of the following combinations of joint compounds (not including prefill), and sand between coats and after last coat.
- .4 Where Level 5 gypsum board finish is indicated, apply joint compound combination specified for Level 4 plus a thin, uniform skim coat of joint compound over entire surface. Use joint compound specified for the finish (third coat) or a product specially formulated for this purpose and acceptable to gypsum board manufacturer. Produce surfaces free of tool marks and ridges ready for decoration of type indicated.
- .5 Where Level 2 gypsum board finish is indicated, apply joint specified for first coat in addition to embedding coat.
- .6 Where Level 1 gypsum board finish is indicated, apply joint compound specified for embedding coat.
- .7 Allow not less than 24 hours drying time between coats.

3.8 ACCESS DOORS

- .1 Install access doors to electrical and mechanical fixtures and electrical panel boards specified in respective Sections.
- .2 Rigidly secure frames to furring or framing systems.

3.9 ACOUSTICAL SEAL AT PARTITION PERIMETERS

- .1 Minimize gaps between gypsum board and adjacent constructions and partition perimeters. Gaps greater than 13 mm wide are unacceptable.
- .2 Gaps between 6 mm and 13 mm to be packed with back-up rod and caulked with acoustical sealant specified in Section 07 92 00 - Joint Sealants. Gaps below 6 mm do not require back-up rod.
- .3 Apply acoustical sealant to the first layer of gypsum board and arrange for review by the Departmental Representative before application of the second layer of gypsum board.
- .4 Cut drywall neatly and tight around all penetrations at STC rated walls. Provide fitted drywall flanges around all mechanical penetrations. Complete drywall flange by caulking

full perimeter to penetrations and adjacent gypsum board. Caulking to be reviewed by the Departmental Representative before concealing.

- .5 Stagger electrical outlets or mechanical installations on opposing sides of STC rated walls. Ensure sound attenuation insulation runs behind all penetrations. All electrical outlets to have vapour hoods and cover plate gaskets.

3.10 ADJUST AND CLEAN

- .1 Promptly remove compound from door frames, windows, and other surfaces. Repair floors, walls, and other surfaces which have been stained, marred, or otherwise damaged during the framing and gypsum board work. Daily remove unused materials, containers, and equipment. Clean floors of all gypsum board and wood debris and leave broom clean.
- .2 Clean spilled or splattered materials from adjacent surfaces not to be coated, immediately before coating has achieved an initial set. Do not scratch or damage adjacent finished surfaces.
- .3 Remove from the premises all surplus material, dirt and debris caused by the work of this Section and leave the installation clean.

3.11 PROTECTION

- .1 Provide final protection and maintain conditions, in a manner suitable to installer, which ensures gypsum drywall construction being without damage or deterioration at time of Substantial Performance.

END OF SECTION

Part 1 General

1.1 RELATED DOCUMENTS

- .1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY OF WORK

- .1 Work Included: The work of this Section includes the provision of all labour, materials, equipment and services required to fabricate and install non-bearing steel stud systems for interior partitions, as indicated on the drawings, as specified herein and as required for a complete project.
- .2 Related Work
 - .1 Section 07 92 00 - Joint Sealants: Acoustical sealant.
 - .2 Section 09 21 16 - Gypsum Board Assemblies.

1.3 REFERENCE STANDARDS

- .1 American Society for Testing and Materials (ASTM):
 - .1 ASTM C645-09, Standard Specification for Non-structural Steel Framing Members.
- .2 Underwriters' Laboratories Canada or Warnock Hersey design requirements for fire resistant assemblies.

1.4 REGULATORY REQUIREMENTS

- .1 Fire-resistance rated floor/ceiling and roof/ceiling assemblies: Underwriters fire resistive floor/ceiling and roof/ceiling design requirements.

Part 2 Products

2.1 METAL FRAMING

- .1 Non-loadbearing channel stud framing: to ASTM C645, stud sizes, as indicated or as required by site conditions, roll formed from, hot dipped galvanized steel sheet, for screw attachment of gypsum board. Knock-out service holes at 460 mm o.c. Thickness:
 - .1 Where not otherwise specified: Minimum 0.51 mm (25 ga).
 - .2 Where abuse-resistant gypsum board is applied: Minimum 0.91 mm (20 ga).
- .2 Floor and ceiling tracks: to ASTM C645, in widths to suit stud sizes, Flange height 32 mm.
 - .1 Bottom channel: 32 mm.
 - .2 Deflection channel (fixed to u/s structure): 65 mm.
 - .3 Top channel: 50 mm.
- .3 Bridging: fabricated from same material and finish as steel studs, 38 mm x 13 mm.
- .4 Angle clips: fabricated from same material and finish as steel studs, 38 mm x 38 mm x depth of steel stud.

- .5 Heavier gauge framing: Provide heavier gauge framing members and/or additional reinforcing where stud length and loading conditions require. Provide additional reinforcing for members carrying a concentrated load, such as door jambs.

Part 3 Execution

3.1 ERECTION

- .1 Erect stud systems for walls exceeding one storey in height in strict accordance with the reviewed and accepted shop drawings.
- .2 Align partition tracks at floor and ceiling and secure at 600 mm o.c. maximum.
- .3 Place studs vertically at 400 mm o.c. and not more than 50 mm from abutting walls, and at each side of openings and corners. Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.
- .4 Erect metal studding to tolerance of 1:1000.
- .5 Extend partitions to underside of deck except where noted otherwise on drawings. Maintain clearance under deck, beams and joists to avoid transmission of structural loads to studs. Use double track slip joint.
 - .1 Install 50 mm deep deflection channel at top of partitions.
 - .2 Nest 65 mm deep top track into deflection channel a minimum of 30 mm and a maximum of 40 mm. Do not fasten tracks together.
 - .3 Attach each stud to bottom track bottom and top tracks, using screws. For each stud, carefully align anchorages top and bottom.
- .6 Brace steel studs with horizontal internal bridging at 1520 mm o.c. maximum. Fasten bridging to steel clips fastened to steel studs.
- .7 Coordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.
- .8 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified. Secure studs together, 50 mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.
- .9 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs. Secure track to studs at each end, in accordance with manufacturer's instructions. Install intermediate studs above and below openings in same manner and spacing as wall studs.
- .10 Install bridging at 450 mm o.c. vertical spacing.
- .11 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.
- .12 Provide 40 mm stud, furring channel or wood blocking, secured between studs for attachments to steel stud partitions.
- .13 Install steel studs or furring channel between studs for attaching electrical and other boxes.
- .14 Install continuous insulating strips to isolate studs from uninsulated surfaces.
- .15 Install two continuous beads of acoustical sealant or insulating strip under studs and tracks around perimeter of sound control partitions.

END OF SECTION

PART 1 General

1.1 RELATED DOCUMENTS

- .1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY OF WORK

- .1 Work Included: The work of this Section includes the provision of all labour, materials, equipment and services required to fabricate and install suspended acoustical panel ceilings, including suspension grids and lay-in acoustical ceiling panels, as indicated on the drawings, as specified herein and as required for a complete project.
- .2 Related Sections:
 - .1 Section 09 21 16 - Gypsum Board Assemblies: (Suspended gypsum board ceilings and bulkheads.)
 - .2 Division 23 - HVAC.
 - .3 Division 26 - Electrical.

1.3 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM A641/A641M-03 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
 - .2 ASTM A653/A653M-06a Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - .3 ASTM C423-07 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
 - .4 ASTM C635-04 Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
 - .5 ASTM C636-04 Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
 - .6 ASTM E1264-98(2005) Standard Classification for Acoustical Ceiling Products

1.4 QUALIFICATIONS

- .1 The work of this Section shall be fabricated by a manufacturer with minimum five (5) years experience in the actual production of the specified products.

1.5 DESIGN CRITERIA:

- .1 The suspension system to be capable of safely supporting the weight of all items which are designed to be supported by it, including, but not limited to:
 - .1 Light fixtures.
 - .2 Diffusers.
 - .3 Other items supported by the ceiling system.
- .2 Be advised that light fixtures will not be provided with separate support.

- .3 Design the suspension system to withstand normal and seismic loads.
- .4 Size attachment components for five times the design load indicated in ASTM C635, Table 1, direct hung except where otherwise indicated.
- .5 Size hanger wire for three times the design load indicated in ASTM C635, Table 1.
- .6 Maximum deflection: 1/360 of span to ASTM C635 deflection test.
- .7 Design the suspension system to provide lateral support to the tops of partitions which are attached to it.

1.6 SUSTAINABILITY REQUIREMENTS

- .1 Give preference to Products containing the highest percentage of recycled material content.
- .2 Where possible, provide Products which are regionally manufactured and extracted.

1.7 SUBMITTALS

- .1 General: Submit each item in this Article according to the Conditions of the Contract and the applicable Division 01 Specification Sections.
- .2 Samples: Submit a sample of each type of acoustical unit.
- .3 Shop Drawings:
 - .1 Show complete details of the suspension system.
 - .2 The suspension system, including all related connections and fastenings, shall be designed by a structural engineer permanently licensed to practise in the Province of Ontario. Each shop drawing submitted shall bear the stamp and signature of the aforesaid structural engineer.
- .4 Post-Installation Certification: After installation, provide written certification, signed by the Structural Engineer responsible for the shop drawings, that all items have been installed in accordance with the shop drawings.
- .5 Maintenance Materials
 - .1 Provide 1 unopened carton of ceiling panels.
 - .2 Deliver to site and store where directed.
 - .3 Maintenance materials to be of the same production run as the installed materials.
 - .4 Do not use maintenance materials for the correction of deficiencies or remedial work during the warranty period.

1.8 ENVIRONMENTAL CONDITIONS

- .1 Commence installation only after the building is enclosed, sufficient heat is provided and dust generating activities have terminated.
- .2 Permit wet work to dry before commencement of installation.
- .3 Maintain a uniform minimum temperature of 15°C and a relative humidity of 20% - 40% before and during installation.
- .4 Store materials in the work area for not less than 48 hours prior to installation.

PART 2 Products

2.1 MANUFACTURERS

- .1 This Specification is based on suspension system and ceiling panels as manufactured by CGC Interiors.
- .2 Equivalent products by Armstrong World Industries Canada Limited are acceptable alternatives.
- .3 Requests for substitutions will be considered. Acceptance of alternative products is subject to the approval of the Consultant.

2.2 SUSPENSION SYSTEM

- .1 To ASTM C365, exposed tee system, as follows:
 - .1 Material: Double web electrogalvanized sheet steel.
 - .2 Face dimension: 44 mm.
 - .3 Surface finish: Baked polyester paint, colour: White.
 - .4 Grid dimensions: To suit panel size.
 - .5 Standard of Acceptance: 15/16" Classic System by Certainteed.
- .2 Provide all accessories, including matching hemmed angle wall mouldings, #9 galvanised soft annealed steel hanger wire and suspension system accessories as required for a complete installation.

2.3 ACOUSTICAL CEILING PANELS

- .1 To ASTM E1264, Type III, Form 2, Pattern C E, characteristics as follows:
 - .1 Colour: White.
 - .2 Size: 609 mm x 1219 mm x 16 mm.
 - .3 Edge detail: Narrow Reveal
 - .4 Fire performance: Class A, flame spread 25 or under (UL labelled), Smoke Developed 50 or less.
 - .5 NRC: .50
 - .6 CAC: 35
 - .7 Light reflectance: 0.88.
 - .8 Standard of Acceptance: Sand Micro by Certainteed

2.4 ACCESSORY MATERIALS

- .1 Suspension system accessories: splices, clips, wire ties, retainers and wall moulding to complement the suspension system components, as recommended by the system manufacturer.
- .2 Hanger wire: Galvanized soft annealed steel wire to ASTM A641, Class 1, 2.6 mm diameter, pre-stretched
- .3 Hanger inserts: purpose made.
- .4 Retention clips: Armstrong Product No. 414, purpose made clips to secure tile to suspension system.

- .5 Touch-up paint: type and colour to match acoustical units, as provided by the acoustical unit manufacturer.

PART 3 Execution

3.1 INSTALLATION: SUSPENSION SYSTEM

- .1 Install ceiling suspension system to ASTM C636 and in accordance with the manufacturer's printed instructions.
- .2 Furnish hanger clips and inserts for installation by the applicable other Sections, with instructions for their correct placement.
- .3 Secure hangers to the overhead structure using attachment methods acceptable to the Consultant,
- .4 Except where otherwise indicated, lay out the grid symmetrically with border widths not less than 50% of standard unit widths.
- .5 Coordinate the ceiling system with related components.
- .6 Hang the suspension system independently of walls, columns, ducts, pipes and conduit. Provide additional hangers and carrying channels as necessary.
- .7 Provide additional hangers and framing as necessary to carry the weight of all items which are designed to be supported by the suspension system.
- .8 Frame at openings for light fixtures, air diffusers, speakers, and at changes in ceiling height.
- .9 Provide additional hangers at light fixtures, air diffusers, speakers, and other ceiling-supported items within 150 mm of each corner and at maximum 600 mm o.c. around the perimeter of the fixture.
- .10 Attach cross members to main runners to provide a rigid assembly.
- .11 Install wall trim to provide correct ceiling height. Install wall trim or suitable edge moulding to match existing at the interface between the acoustic tile ceiling and other materials, for the entire length of the joint. Secure to construction. Butt joints tightly, neatly, square, and in true alignment.
- .12 Arrange recessed items to replace or be centred on a panel unless indicated otherwise.
- .13 Finished ceiling system to be square with adjoining walls and level within 1:1000.

3.2 INSTALLATION: PANELS

- .1 Install acoustical panels in the ceiling suspension system, in accordance with the manufacturer's instructions.
- .2 Fit acoustical panels in place, free from damaged edges or other defects detrimental to appearance or function.
- .3 Install acoustical panels level in uniform plane and free from twist, warp, dents, damaged edges or other defects detrimental to appearance or function.
- .4 Cut panels to fit irregular grids and perimeter edge trim.
- .5 Install retention clips within 6 m of exterior doors.

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 Master Painters Institute (M PI):
 - .1 MPI Architectural Specification Manual, 2004 (referred to herein as "M PI Manual")
 - .2 MPI Approved Product List, August 2007 (Referred to herein as "M PI APL").
- .3 National Fire Code of Canada - 2010
- .4 Society for Protective Coatings (SSPC)
 - .1 SSPC Painting Manual, Volume Two, 8th Edition, Systems and Specifications Manual.
- .5 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings) of the Environmental Protection Agency (EPA).

1.2 QUALITY ASSURANCE

- .1 Contractor shall have a minimum of five years proven satisfactory experience. Provide a list of last three comparable jobs including, job name and location, specifying authority, and project manager.
- .2 Qualified journeymen who have a "Tradesman Qualification Certificate of Proficiency" shall be engaged in repainting work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with applicable trade regulations.
- .3 Conform to latest MPI requirements for interior repainting work including cleaning, preparation and priming.
- .4 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) shall be in accordance with the latest edition of the MPI Approved Product List and shall be from a single manufacturer for each system used.
- .5 Paint materials such as linseed oil, shellac, turpentine, etc. shall be the highest quality product of an approved manufacturer listed in MPI Maintenance Repainting Manual and shall be compatible with other coating materials as required.
- .6 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Owner's Representative.
- .7 Standard of Acceptance: When viewed using final lighting source surfaces shall indicate the following:
 - .1 Walls: No defects visible from a distance of 1000 mm at 90o to surface.
 - .2 Ceilings: No defects visible from floor at 45o to surface.
 - .3 Final coat to exhibit uniformity of colour and sheen across full surface area.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit product data and instructions for each paint and coating product to be used.
 - .2 Submit product data for the use and application of paint thinner.
 - .3 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOCs during application and curing.
 - .4 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .5 Submit manufacturer's instructions.
- .3 Samples:
 - .1 Submit full range colour sample chips to indicate where colour availability is restricted.
 - .2 Submit duplicate 200 x 300 mm sample panels of each paint, clear coating [special finish] with specified paint or coating in colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards.
 - .3 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.
 - .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .5 Closeout Submittals: submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals include following:
 - .1 Product name, type and use.
 - .2 Manufacturer's product number.
 - .3 Colour number[s].
 - .4 MPI Environmentally Friendly classification system rating.

1.4 MAINTENANCE

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

1.5 STORAGE AND HANDLING

- .1 Storage and Protection:
 - .1 Provide and maintain dry, temperature controlled, secure storage.
 - .2 Store materials and supplies away from heat generating devices.

- .3 Store materials and equipment in well ventilated area within temperature as recommended by manufacturer.
- .2 Fire Safety Requirements:
 - .1 Provide one 9 kg dry chemical fire extinguisher adjacent to storage area.
 - .2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
 - .3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.

1.6 SITE CONDITIONS

- .1 Heating, Ventilation and Lighting:
 - .1 Ventilate enclosed spaces.
 - .2 Provide heating facilities to maintain ambient air and substrate temperatures above 10 degrees C for 24 hours before, during and after paint application until paint has cured sufficiently.
 - .3 Provide continuous ventilation for seven days after completion of application of paint.
 - .4 Provide minimum lighting level of 323 Lux on surfaces to be painted.
- .2 Temperature, Humidity and Substrate Moisture Content Levels:
 - .1 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.
 - .4 Test for moisture using calibrated electronic Moisture Meter. Test concrete floors for moisture using "cover patch test".
- .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.
 - .2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.
 - .3 Apply paint when previous coat of paint is dry or adequately cured.

Part 2 Products

2.1 MATERIALS

- .1 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.

- .2 Provide paint materials for paint systems from single manufacturer.
- .3 Conform to latest MPI requirements for interior painting work including preparation and priming.
- .4 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) in accordance with MPI Architectural Painting Specification Manual "Approved Product" listing.
- .5 EQc4.2: Provide primers, paints, sealers, coatings and wood finishes with VOC quantities lower than limits stated in Green Seal's Standards GS-3 and GS-11 and SCAQMD Rule #1113, current editions.
- .6 Use only MPI listed materials having an "L" (LEED) rating designation.

2.2 COLOURS

- .1 Contractor to paint to match existing in surrounding locations.

2.3 MIXING AND TINTING

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

2.4 GLOSS/SHEEN RATINGS

| Gloss Level Category | Units @ 60o | Units @ 85o |
|----------------------|-------------|-------------|
| G1 matte finish | 0 to 5 | maximum 10 |
| G2 velvet finish | 0 to 10 | 10 to 35 |
| G3 eggshell finish | 10 to 25 | 10 to 35 |
| G4 satin finish | 20 to 35 | minimum 35 |
| G5 semi gloss finish | 35 to 70 | |
| G6 gloss finish | 70 to 85 | |
| G7 high gloss finish | > 85 | |

2.5 INTERIOR PAINTING SYSTEMS

- .1 For all paint types, contractor to match existing, provide draw downs for approval.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.
- .2 Perform preparation and operations for painting in accordance with MPI 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 the Departmental Representative damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.
- .2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

3.3 PREPARATION

- 1 Protection:
 - .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces as directed 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. Signs to approval of Departmental Representative.
 - .3 Clean and prepare surfaces in accordance with MPI Architectural Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements.
 - .4 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pre-treatment as soon as possible after cleaning and before deterioration occurs.

- .5 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.
 - .1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.
 - .2 Apply wood filler to nail holes and cracks.
 - .3 Tint filler to match stains for stained woodwork.
- .6 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.
- .7 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.
- .8 Touch up of shop primers with primer as specified.

3.4 APPLICATION

- 1 Method of application to be as approved Departmental Representative. Conform to manufacturer's application instructions unless specified otherwise.
- .2 Apply coats of continuous paint film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
- .3 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
- .4 Sand and dust between coats to remove visible defects.
- .5 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.
- .6 Finish top, bottom, edges and cut-outs of doors after fitting as specified for door surfaces.

3.5 FIELD QUALITY CONTROL

- .1 Field review of exterior painting operations to be carried out by Departmental Representative.
- .2 Advise Departmental Representative when each surface and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.
- .3 Co operate with Departmental Representative and provide access to areas of work.

3.6 CLEANING

- .1 Remove paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.
- .2 Keep work area free from an unnecessary accumulation of tools, equipment, surplus materials and debris.
- .3 Remove combustible rubbish materials and empty paint cans each day and safely dispose of same in accordance with requirements of authorities having jurisdiction.
- .4 Clean equipment and dispose of wash water used for water borne materials, solvents used for oil based materials as well as other cleaning and protective materials (e.g. rags, drop cloths, masking papers, etc.), paints, thinners, paint removers/strippers in accordance with the safety requirements of authorities having jurisdiction and as noted herein.

- .5 Painting equipment shall be cleaned in leak proof containers that will permit particulate matter to settle out and be collected. Sediment remaining from cleaning operations shall be recycled or disposed of in a manner acceptable to authorities having jurisdiction.
- .6 Paint and coatings in excess of repainting requirements shall be recycled as noted herein.

3.7 RESTORATION

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

END OF SECTION

Part 1 General

1.1 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 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.

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.
 - .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. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
- .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.

- .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 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.
- .4 Packaging Waste Management: Contractor to remove all waste from site.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for 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..

3.4 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control.

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 Trial usage to apply to following equipment and systems:
 - .1 Domestic hot water circulation pump.
 - .2 Controls equipment.
- .3 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.
- .4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .5 Instruction duration time requirements as specified in appropriate sections.

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 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 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.

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.
 - .2 Description of systems and their controls.
 - .3 Operation instruction for systems and component.
 - .4 Description of actions to be taken in event of equipment failure.
 - .5 Valves schedule and flow diagram.
 - .6 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. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
- .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.
- .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 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 NOT USED

- .1 Not used.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for 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.
 - .1 Controls commissioning.
 - .2 Pump commissioning.
 - .3 Pressure tests on new piping.

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 Trial usage to apply to following equipment and systems:
 - .1 Hot water recirculation pump.
- .3 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.
- .4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .5 Instruction duration time requirements as specified in appropriate sections.
- .6 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 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation for plumbing pumps.

1.2 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

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 data sheet for fixtures and equipment.
- .3 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.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Instructions: submit manufacturer's installation instructions.
- .6 Manufacturers' Field Reports: manufacturers' field reports specified.
- .7 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals, include:
 - .1 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.

1.4 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.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

- .2 Divert unused metal materials from landfill to metal recycling facility.
- .3 Unused sealant materials must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .4 Fold up metal and plastic banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 DOMESTIC HOT WATER CIRCULATING PUMPS

- .1 Vertical multistage inline pump.
- .2 Capacity:
 - .1 0.0.63 l/s (10 gpm)
 - .2 194 kPa (65 ft oh head)
 - .3 0.5 Horsepower
 - .4 120V/1PH/60Hz
- .3 Supports: provide as recommended by manufacturer.
- .4 Such as TACO VM0102 or approved equivalent.

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.

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.

3.4 START-UP

- .1 General:
 - .1 Procedures:
 - .1 Check power supply.
 - .2 Start pumps, check impeller rotation.
 - .3 Check for safe and proper operation.
 - .4 Check settings, operation of operating, limit, safety controls, over-temperature, audible/visual alarms, other protective devices.
 - .5 Test operation of hands-on-auto switch.
 - .6 Test operation of alternator.
 - .7 Adjust leakage through water-cooled bearings.
 - .8 Adjust shaft stuffing boxes.
 - .9 Adjust leakage flow rate from pump shaft stuffing boxes to manufacturer's recommendations.
 - .10 Check base for free-floating, no obstructions under base.
 - .11 Run-in pumps for 12 continuous hours.
 - .12 Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.
 - .13 Adjust alignment of piping and conduit to ensure full flexibility.
 - .14 Eliminate causes of cavitation, flashing, air entrainment.
 - .15 Measure pressure drop across strainer when clean and with flow rates as finally set.
 - .16 Replace seals if pump used to degrease system or if pump used for temporary heat.
 - .17 Verify lubricating oil levels.

3.5 DOMESTIC HW CIRCULATING PUMPS

- .1 Application tolerances:
 - .1 Flow: +/- 10%.
 - .2 Pressure: Plus 20%, minus 5%.
- .2 PV procedures:
 - .1 Measure differential pressure (DP) across pump.
 - .2 Measure amperage and voltage and compare with manufacturer's data sheets and motor nameplate data.
 - .3 If suction is different size than discharge connection, add velocity head correction factor to DP.
 - .4 Mark this DP on manufacturer's pump curve.
 - .5 If flow rate is higher than specified, slow close balancing valves until specified DP is reached.
 - .6 Repeat measurements of amps and volts. Compare with manufacturer's data sheets.
 - .7 Calculate BHP and compare with nameplate data.

3.6 REPORTS

- .1 Provide TAB reports upon completion of balancing.
- .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.

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 B16.15-06, Cast Bronze Threaded Fittings, Classes 125 and 250.
 - .2 ANSI/ASME B16.18-01, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .3 ANSI/ASME B16.22-01, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - .4 ANSI/ASME B16.24-01, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.
- .2 ASTM International Inc.
 - .1 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .2 ASTM A536-84(2004)e1, Standard Specification for Ductile Iron Castings.
 - .3 ASTM B88M-05, Standard Specification for Seamless Copper Water Tube (Metric).
- .3 American National Standards Institute/American Water Works Association (ANSI)/(AWWA)
 - .1 ANSI/AWWA C111/A21.11-[07], Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA B242-05, Groove and Shoulder Type Mechanical Pipe Couplings.
- .5 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act, 1999, c. 33 (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-67-02a, Butterfly Valves.
 - .2 MSS-SP-70-06, Gray Iron Gate Valves, Flanged and Threaded Ends.
 - .3 MSS-SP-71-05, Gray Iron Swing Check Valves, Flanged and Threaded Ends.
 - .4 MSS-SP-80-03, Bronze Gate, Globe, Angle and Check Valves.
- .8 National Research Council (NRC)/Institute for Research in Construction
 - .1 NRCC 38728, National Plumbing Code of Canada (NPC) - 2010.
- .9 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992, c. 34 (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.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Place materials defined as hazardous or toxic in designated containers.
- .2 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, and Regional and Municipal regulations.

Part 2 Products

2.1 PIPING

- .1 Domestic hot, cold and recirculation systems, within building.
 - .1 Above ground: copper tube, hard drawn, type L: to ASTM B88M.

2.2 FITTINGS

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

2.3 JOINTS

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

2.4 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.

2.5 BALL VALVES

- .1 NPS 2 and under, screwed:
 - .1 Class 150.
 - .2 Bronze body, stainless steel 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, stainless steel 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.

2.6 BUTTERFLY VALVES

- .1 NPS 2-1/2 and over, lug:
 - .1 To MSS-SP-67, Class 200.
 - .2 Cast iron body, ductile iron chrome plated disc, stainless steel stem, EPT liner.
 - .3 Lever 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 Plumbing Code.
- .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.

3.3 VALVES

- .1 Isolate equipment, fixtures and branches with butterfly or ball valves.
- .2 Balance recirculation system using balancing valves. Mark settings and record on as-built drawings on completion.

3.4 PRESSURE TESTS

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

3.5 FLUSHING AND CLEANING

- .1 Flush entire system for 8 h. Ensure outlets flushed for 2 hours. Let stand for 12 hours, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean to Federal 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.

3.7 DISINFECTION

- .1 Flush out, disinfect and rinse system.
- .2 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.
- .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 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 Confirm water quality consistent with supply standards, and ensure no residuals remain as result of flushing or cleaning.
- .3 Reports:
 - .1 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.

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
 - .1 ASTM A126-04(2014), Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
 - .2 ASTM B62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .2 American Water Works Association (AWWA)
 - .1 ANSI/AWWA C700-09, Standard for Cold Water Meters-Displacement Type, Bronze Main Case.
 - .2 ANSI/AWWA C701-12, Standard for Cold Water Meters-Turbine Type for Customer Service.
 - .3 ANSI/AWWA C702-10, Standard for Cold Water Meters-Compound Type.
- .3 CSA International
 - .1 CSA-B64 Series-11, Backflow Preventers and Vacuum Breakers.
 - .2 CSA B79-08, Commercial and Residential Drains and Cleanouts.
 - .3 CAN/CSA-B356-10, Water Pressure Reducing Valves for Domestic Water Supply Systems.
- .4 Efficiency Valuation Organization (EVO)
 - .1 International Performance Measurement and Verification Protocol (IPMVP).
 - .1 IPMVP 2007 Version.
- .5 Plumbing and Drainage Institute (PDI)
 - .1 PDI-G101-R2012, Testing and Rating Procedure for Grease Interceptors with Appendix of Installation and Maintenance.
 - .2 PDI-WH201-R2010, Water Hammer Arresters Standard.

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation Meetings:
 - .1 Convene pre-installation meeting 1 week prior to beginning work with all sub trades to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building construction sub-trades.
 - .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.
- .3 Shop Drawings:
 - .1 Indicate on drawings to indicate materials, finishes, method of anchorage, number of anchors, dimensions, construction and assembly details, accessories.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Instructions: submit manufacturer's installation instructions.
- .6 Manufacturers' Field Reports: manufacturers' field reports specified.

1.4 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 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 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.
- .2 Install in accordance with manufacturer's instructions and as specified.

3.4 STRAINERS

- .1 Install with sufficient room to remove basket for maintenance.

3.5 START-UP

- .1 Timing: start-up only after:
 - .1 Pressure tests have been completed.
 - .2 Disinfection procedures have been completed.
 - .3 Certificate of static completion has been issued.
 - .4 Water treatment systems operational.
- .2 Provide continuous supervision during start-up.

3.6 TESTING AND ADJUSTING

- .1 Timing:
 - .1 After start-up deficiencies rectified.
 - .2 After certificate of completion has been issued by authority having jurisdiction.
- .2 Application tolerances:
 - .1 Pressure at fixtures: +/- 70 kPa.
 - .2 Flow rate at fixtures: +/- 20%.
- .3 Adjustments:
 - .1 Verify that flow rate and pressure meet design criteria.
 - .2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.

-
- .4 Strainers:
 - .1 Clean out repeatedly until clear.
 - .2 Verify accessibility of cleanout plug and basket.
 - .3 Verify that cleanout plug does not leak.

3.7 CLEANING

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

3.8 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 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA B139-04, Installation Code for Oil Burning Equipment.
- .3 Green Seal Environmental Standards (GSES)
 - .1 Standard GS-11-2008, 2nd Edition, Environmental Standard for Paints and Coatings.
- .4 National Fire Code of Canada (NFCC 2005)
- .5 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
 - .1 SCAQMD Rule 1113-A2007, Architectural Coatings.
 - .2 SCAQMD Rule 1168-A2005, 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 Paints: 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:
 - .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.

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 and CSA B139.
- .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer and CSA B139 without interrupting operation of other system, equipment, components.

3.4 DRAINS

- .1 Install piping with grade in direction of flow except as indicated.
- .2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.
- .3 Pipe each drain valve discharge separately to above floor drain.
 - .1 Discharge to be visible.
- .4 Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

3.5 AIR VENTS

- .1 Install manual air vents to CSA B139 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 Install pipework to CSA B139.
- .2 Screwed fittings jointed with Teflon tape.
- .3 Protect openings against entry of foreign material.
- .4 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .5 Assemble piping using fittings manufactured to ANSI standards.
- .6 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main.
 - .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
- .7 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
- .8 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
- .9 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .10 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .11 Group piping wherever possible and as indicated.
- .12 Ream pipes, remove scale and other foreign material before assembly.
- .13 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .14 Provide for thermal expansion as indicated.
- .15 Valves:
 - .1 Install in accessible locations.
 - .2 Remove interior parts before soldering.
 - .3 Install with stems above horizontal position unless indicated.
 - .4 Valves accessible for maintenance without removing adjacent piping.
 - .5 Install globe valves in bypass around control valves.
 - .6 Use ball or butterfly valves at branch take-offs for isolating purposes except where specified.
- .16 Check Valves:
 - .1 Install swing check valves in horizontal lines on discharge of pumps and as indicated.

3.8 SLEEVES

- .1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and as indicated.
- .2 Material: schedule 40 black steel pipe.

- .3 Construction: use annular fins continuously welded at mid-point at foundation walls and where sleeves extend above finished floors.
- .4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.
- .5 Installation:
 - .1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.
 - .2 Other floors: terminate 25 mm above finished floor.
 - .3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.
- .6 Sealing:
 - .1 Foundation walls and below grade floors: fire retardant, waterproof non-hardening mastic.
 - .2 Elsewhere:
 - .1 Provide space for firestopping.
 - .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 firestopping within annular space between pipes, ducts, insulation and adjacent fire separation in accordance with Section 07 84 00 - Fire Stopping.
- .2 Insulated pipes and ducts: ensure integrity of insulation and vapour barriers.

3.11 FLUSHING OUT OF PIPING SYSTEMS

- .1 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 11 - Cleaning.
- .2 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 Piping: 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 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.
- .6 Insulate or conceal work only after approval and certification of tests by Departmental Representative

3.13 EXISTING SYSTEMS

- .1 Connect into existing piping systems at times approved by Departmental Representative.
- .2 Request written approval by Departmental Representative 10 days minimum, prior to commencement of work.
- .3 Be responsible for damage to existing plant by this work.

3.14 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 B40.100-2005, Pressure Gauges and Gauge Attachments.
 - .2 ASME B40.200-2008, Thermometers, Direct Reading and Remote Reading.
- .2 Canada Green Building Council (CaGBC)
 - .1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum 2007).
 - .2 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
 - .3 LEED Canada 2009 for Design and Construction-2010, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.
 - .4 LEED Canada for Existing Buildings, Operations and Maintenance-2009, LEED Canada 2009 Leadership In Energy and Environmental Design Green Building Rating System Reference Guide.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-14.4-M88, Thermometers, Liquid-in-Glass, Self Indicating, Commercial/Industrial Type.
 - .2 CAN/CGSB-14.5-M88, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.
- .4 Efficiency Valuation Organization (EVO)
 - .1 International Performance Measurement and Verification Protocol (IPMVP)
 - .1 IPMVP 2007 Version.
- .5 Green Seal Environmental Standards (GS)
 - .1 GS-11-11, Standard for Paints and Coatings.
 - .2 GS-36-11, 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 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, variable angle type, liquid filled, 125 mm scale length: to CAN/CGSB-14.4 ASME B40.200.
 - .1 Resistance to shock and vibration.

2.3 THERMOMETER WELLS

- .1 Copper pipe: copper or bronze.

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 DHW tanks.
- .3 Install wells 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 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 RELATED REQUIREMENTS

- .1 Section 22 11 16 - Domestic Water Piping.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
 - .1 ANSI/ASME B1.20.1- 2013, Pipe Threads, General Purpose (Inch).
 - .2 ANSI/ASME B16.18-2012, Cast Copper Alloy Solder Joint Pressure Fittings.
- .2 ASTM International
 - .1 ASTM A276-13a, Standard Specification for Stainless Steel Bars and Shapes.
 - .2 ASTM B62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.
 - .3 ASTM B283-14, Standard Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).
 - .4 ASTM B505/B505M-14, Standard Specification for Copper-Base Alloy Continuous Castings.
- .3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)
 - .1 MSS-SP-25-2013, Standard Marking System for Valves, Fittings, Flanges and Unions.
 - .2 MSS-SP-80-2013, Bronze Gate Globe, Angle and Check Valves.
 - .3 MSS-SP-110-2010, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit data for valves specified in this Section.

1.4 CLOSEOUT SUBMITTALS

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

1.5 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials/Spare Parts:
 - .1 Furnish following spare parts:
 - .1 Valve seats: one for every 10 valves each size, minimum 1.

- .2 Valve handles: 2 of each size.

1.6 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 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 10 keys of each size: malleable iron cadmium plated.
- .4 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.
- .5 Ball Valves:
 - .1 NPS 2 and under:
 - .1 Body and cap: cast high tensile bronze to ASTM B62.
 - .2 Pressure rating: Class125 2760-kPa CWP.
 - .3 Connections: screwed ends to ANSI B1.20.1 and with hexagonal shoulders solder ends to ANSI.
 - .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.

- .6 Circuit Balancing Valves
 - .1 “Y” pattern, equal percentage globe-style and provide three functions:
 - .1 Precise flow measurement
 - .2 Precision flow balancing
 - .3 Positive shut-off.
 - .2 Valve shall provide multi-turn, 360° adjustment with micrometer type indicators located on the valve handwheel. Valves shall have a minimum of five full 360° handwheel turns. Valve handle shall have hidden memory feature.
 - .3 Integral check connections, one on each side of seat, to allow connection of instruments. Such as model CB by Bell & Gossett
 - .4 Circuit balancing valves to be lead free for a domestic water application.
 - .5 NPS 2 and under:
 - .1 Bronze body, operating pressure of 2069 kPa (300 psi) at 121°C (250 °F), screwed fitting.

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 SUMMARY

- .1 Section Includes:
 - .1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems.

1.2 REFERENCES

- .1 Canadian Gas Association (CGA)
 - .1 CSA/CGA B149.1-10, Natural Gas and Propane Installation Code.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.
 - .2 CAN/CGSB-24.3-92, Identification of Piping Systems.
- .3 National Fire Protection Association (NFPA)
 - .1 NFPA 13-2013, Standard for the Installation of Sprinkler Systems.
 - .2 NFPA 14-2012, Standard for the Installation of Standpipe and Hose Systems.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Product data to include paint colour chips, other products specified in this section.
- .2 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.4 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.

1.5 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 MANUFACTURER'S EQUIPMENT NAMEPLATES

- .1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.
- .2 Lettering and numbers raised or recessed.
- .3 Information to include, as appropriate:
 - .1 Equipment: manufacturer's name, model, size, serial number, capacity.
 - .2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

- .1 Colours:
 - .1 Hazardous: red letters, white background.
 - .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).
- .2 Construction:
 - .1 3 mm thick laminated plastic matte finish, with square corners, letters accurately aligned and machine engraved into core.
- .3 Sizes:
 - .1 Conform to following table:

| Size # mm | Sizes (mm) | No. of Lines | Height of Letters (mm) |
|-----------|------------|--------------|------------------------|
| 1 | 10 x 50 | 1 | 3 |
| 2 | 13 x 75 | 1 | 5 |
| 3 | 13 x 75 | 2 | 3 |
| 4 | 20 x 100 | 1 | 8 |
| 5 | 20 x 100 | 2 | 5 |
| 6 | 20 x 200 | 1 | 8 |
| 7 | 25 x 125 | 1 | 12 |
| 8 | 25 x 125 | 2 | 8 |
| 9 | 35 x 200 | 1 | 20 |

- .2 Use maximum of 25 letters/numbers per line.
- .4 Locations:
 - .1 Terminal cabinets, control panels: use size # 5.
 - .2 Equipment in Mechanical Rooms: use size # 9.
- .5 Identification for 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.

2.3 EXISTING IDENTIFICATION SYSTEMS

- .1 Apply existing identification system to new work.
- .2 Where existing identification system does not cover for new work, use identification system specified this section.
- .3 Before starting work, obtain written approval of identification system from Departmental Representative.

2.4 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 |
|----------------------------|---------------------------|----------------|
| Domestic hot water supply | Green | DOM. HW SUPPLY |
| Dom. HWS recirculation | Green | DOM. HW CIRC |
| Domestic cold water supply | Green | DOM. CWS |

2.5 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.

2.6 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.

2.7 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.

2.8 LANGUAGE

- .1 Identification in English and 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 Number valves in each system consecutively.

3.7 CLEANING

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

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.
- .2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 QUALIFICATIONS OF TAB PERSONNEL

- .1 Submit names of personnel to perform TAB to Departmental Representative within 90 days of award of contract.
- .2 Provide documentation confirming qualifications, successful experience.
- .3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:
 - .1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2002.
 - .2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-1998.
 - .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.
- .4 Recommendations and suggested practices contained in the TAB Standard: mandatory.
- .5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.
- .6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.
- .7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.
- .8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.
 - .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
 - .2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.3 PURPOSE OF TAB

- .1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads

.2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.4 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.5 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.6 PRE-TAB REVIEW

.1 Review contract documents before project construction is started confirm in writing to Departmental Representative adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Departmental Representative in writing proposed procedures which vary from standard.

.3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.7 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in Division 23.

1.8 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by Departmental Representative for verification of TAB reports.

1.9 START OF TAB

.1 Notify Departmental Representative 7 days prior to start of TAB.

.2 Start TAB when building is essentially completed, including:

.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 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.

1.10 APPLICATION TOLERANCES

- .1 Do TAB to following tolerances of design values:
 - .1 Hydronic systems: plus or minus 10 %.

1.11 ACCURACY TOLERANCES

- .1 Measured values accurate to within plus or minus 2 % of actual values.

1.12 INSTRUMENTS

- .1 Prior to TAB, submit to Departmental Representative list of instruments used together with serial numbers.
- .2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.
- .3 Calibrate within 3 months of TAB. Provide certificate of calibration to Departmental Representative.

1.13 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit, prior to commencement of TAB:
- .2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.14 PRELIMINARY TAB REPORT

- .1 Submit for checking and approval of Departmental Representative, prior to submission of formal TAB report, sample of rough TAB sheets. Include:
 - .1 Details of instruments used.
 - .2 Details of TAB procedures employed.
 - .3 Calculations procedures.
 - .4 Summaries.

1.15 TAB REPORT

- .1 TAB report to show results in SI units and to include:
 - .1 Project record drawings.
 - .2 System schematics.
- .2 Submit 6 copies of TAB Report to Departmental Representative for verification and approval, in English in D-ring binders, complete with index tabs.

1.16 VERIFICATION

- .1 Reported results subject to verification by Departmental Representative.

- .2 Provide personnel and instrumentation to verify up to 30 % of reported results.
- .3 Number and location of verified results as directed by Departmental Representative.
- .4 Pay costs to repeat TAB as required to satisfaction of Departmental Representative.

1.17 SETTINGS

- .1 After TAB is completed to satisfaction of Departmental Representative, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.
- .2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

1.18 COMPLETION OF TAB

- .1 TAB considered complete when final TAB Report received and approved by Departmental Representative.

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 Section Includes:
 - .1 Thermal insulation for piping and piping accessories in commercial type applications.

1.2 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ASHRAE Standard 90.1-13, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM B209M-10, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate [Metric].
 - .2 ASTM C335-10e1, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .3 ASTM C411-11, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C449/C449M-07(R2013), Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C533-2013, Calcium Silicate Block and Pipe Thermal Insulation.
 - .6 ASTM C547-2012, Mineral Fiber Pipe Insulation.
 - .7 ASTM C795-08(R2013), Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - .8 ASTM C921-10, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma-01, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
 - .2 CAN/CGSB-51.53-95, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts
- .4 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Assessment Act (CEAA), 2012, c. 37.
 - .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
 - .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .6 Manufacturer's Trade Associations
 - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2004).

- .7 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .3 CAN/ULC-S702-09, Standard for Thermal Insulation, Mineral Fibre, for Buildings
 - .4 CAN/ULC-S702.2-10, Mineral Fibre Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

1.3 DEFINITIONS

- .1 For purposes of this section:
 - .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "EXPOSED" - will mean "not concealed" as specified.
- .2 TIAC ss:
 - .1 CRF: Code Rectangular Finish.
 - .2 CPF: Code Piping Finish.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .4 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.

1.5 QUALITY ASSURANCE

- .1 Qualifications:
- .2 Installer: specialist in performing work of this Section, and have at least 3 years successful experience in this size and type of project.
- .3 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Storage and Protection:
 - .1 Protect from weather, construction traffic.
 - .2 Protect against damage.
 - .3 Store at temperatures and conditions required by manufacturer.

Part 2 Products

2.1 FIRE AND SMOKE RATING

- .1 In accordance with CAN/ULC-S102.
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.2 INSULATION

- .1 Mineral fibre specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/ULC-S702 and ASTM C547.
 - .2 Maximum "k" factor: to CAN/ULC-S702.
- .4 TIAC Code 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.

2.3 INSULATION SECUREMENT

- .1 Tape: self-adhesive, aluminum, plain, 50 mm wide minimum.
- .2 Contact adhesive: quick setting.
- .3 Canvas adhesive: washable.
- .4 Tie wire: 1.5 mm diameter stainless steel.
- .5 Bands: stainless steel, 19 mm wide, 0.5 mm thick.

2.4 CEMENT

- .1 Thermal insulating and finishing cement:
 - .1 Air drying on mineral wool, to ASTM C449/C449M.

2.5 VAPOUR RETARDER LAP ADHESIVE

- .1 Water based, fire retardant type, compatible with insulation.

2.6 INDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 JACKETS

- .1 Polyvinyl Chloride (PVC):
 - .1 One-piece moulded type and sheet to CAN/CGSB-51.53 with pre-formed shapes as required.
 - .2 Colours: to match adjacent finish paint.
 - .3 Minimum service temperatures: -20 degrees C.
 - .4 Maximum service temperature: 65 degrees C.
 - .5 Moisture vapour transmission: 0.02 perm.
 - .6 Fastenings:
 - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
 - .2 Tacks.
 - .3 Pressure sensitive vinyl tape of matching colour.

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 manufacturers 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 PIPING INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 TIAC Code: A-1.
 - .1 Securements: bands at 300 mm on centre.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code 1501-H.
- .3 TIAC Code: C-2 with vapour retarder jacket.
 - .1 Insulation securements: bands.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
- .4 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.

| Applica- tion | Temp degrees C | TIAC code | Pipe sizes (NPS) and insulation thickness (mm) | | | | | | | | | | |
|--|----------------------|---------------|--|--------|----|--------------|-----|----|----|----|----|----|----|
| Run out | to 1 | 1 1/4 to 2 | 2 1/2 to 4 | 5 to 6 | 8 | up to 175 | A-1 | 38 | 50 | 65 | 75 | 90 | 90 |
| Domestic HWS and recirc. | A-1 | 25 | 25 | 25 | 38 | 38 | 38 | | | | | | |
| Domestic CWS with vapour retarder | C-2] | 25 | 25 | 25 | 25 | 25 | 25 | | | | | | |

- .5 Finishes:
 - .1 Exposed indoors: ABS jacket.
 - .2 Exposed in mechanical rooms: ABS jacket.
 - .3 Concealed, indoors: ABS jacket.
 - .4 Finish attachments: bands, at 150 mm on centre. Seals: closed.
 - .5 Installation: to appropriate TIAC code CRF/1 through CPF/5.

3.5 FIELD QUALITY CONTROL

- .1 Verification requirements 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.

3.6 CLEANING

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

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Provide and install **Domestic Hot Water system monitoring** utilizing existing Direct Digital Control (DDC) technology as shown on drawings and described in these specifications.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/The Instrumentation, Systems and Automation Society (ISA).
 - .1 ANSI/ISA 5.5-1985, Graphic Symbols for Process Displays.
- .2 American National Standards Institute (ANSI)/ Institute of Electrical and Electronics Engineers (IEEE).
 - .1 ANSI/IEEE 260.1-2004, American National Standard Letter Symbols Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units).
- .3 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
 - .1 ASHRAE STD 135-R2010, BACNET - Data Communication Protocol for Building Automation and Control Network.
- .4 Institute of Electrical and Electronics Engineers (IEEE)/Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements.
 - .1 IEEE 802.3-2012, Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications.

1.3 ACRONYMS AND ABBREVIATIONS

- .1 Acronyms used in EMCS:
 - .1 AEL - Average Effectiveness Level.
 - .2 AI - Analog Input.
 - .3 AO - Analog Output.
 - .4 BACnet - Building Automation and Control Network.
 - .5 BC(s) - Building Controller(s).
 - .6 BECC - Building Environmental Control Center.
 - .7 CAD - Computer Aided Design.
 - .8 CDL - Control Description Logic.
 - .9 CDS - Control Design Schematic.
 - .10 COSV - Change of State or Value.
 - .11 CPU - Central Processing Unit.
 - .12 DI - Digital Input.
 - .13 DO - Digital Output.

- .14 DP - Differential Pressure.
- .15 EMCS - Energy Monitoring and Control System.
- .16 GUI – Graphical User Interface.
- .17 HVAC - Heating, Ventilation, Air Conditioning.
- .18 IDE - Interface Device Equipment.
- .19 I/O - Input/Output.
- .20 LAN - Local Area Network.
- .21 LCU - Local Control Unit.
- .22 MCU - Master Control Unit.
- .23 NC - Normally Closed.
- .24 NO - Normally Open.
- .25 OS - Operating System.
- .26 O&M - Operation and Maintenance.
- .27 OWS - Operator Work Station.
- .28 PC - Personal Computer.
- .29 PCI - Peripheral Control Interface.
- .30 PCMCIA - Personal Computer Micro-Card Interface Adapter.
- .31 PID - Proportional, Integral and Derivative.
- .32 RAM - Random Access Memory.
- .33 SP - Static Pressure.
- .34 ROM - Read Only Memory.
- .35 TCU - Terminal Control Unit.
- .36 USB - Universal Serial Bus.
- .37 UPS - Uninterruptible Power Supply.
- .38 VAV - Variable Air Volume.

1.4 DEFINITIONS

- .1 Point: may be logical or physical.
 - .1 Logical points: values calculated by system such as setpoints, totals, counts, derived corrections and may include, but not limited to result of and statements in CDL's.
 - .2 Physical points: inputs or outputs which have hardware wired to controllers to measure physical properties, to provide status conditions of contacts or relays or to provide interaction with related equipment (system start/stop, modulation control, etc.)
- .2 Point Name: composed of two parts, point identifier and point expansion.
 - .1 Point identifier: comprised of three descriptors, "area" descriptor, "system" descriptor and "point" descriptor.
 - .1 Area descriptor: building or part of building where point is located.
 - .2 System descriptor: system that point is located on.
 - .3 Point descriptor: physical or logical point description. For point identifier "area", "system" and "point" will be short forms or acronyms.

- .2 Point expansion: comprised of three fields, one for each descriptor. Expanded form of short form or acronym used in "area", "system" and "point" descriptors is placed into appropriate point expansion field.
- .3 Point Object Type: points fall into following object types:
 - .1 AI (analog input).
 - .2 AO (analog output).
 - .3 DI (digital input).
 - .4 DO (digital output).
 - .5 Pulse inputs.
- .4 Symbols and engineering unit abbreviations utilized in displays: to ANSI/ISA S5.5.
 - .1 Printouts: to ANSI/IEEE 260.1.
 - .2 Refer also to Section 25 05 54- EMCS: Identification.

1.5 SCOPE OF WORK

- .1 Work covered by sections of Division 25 consists of all work to add to the existing EMCS, including, but not limited to, the following:
 - .1 Complete electrical installation including conduits, cables, junction boxes, etc. required for control systems, automation and EMCS, as shown on drawings and described in these specifications, as well as all electrical connections required to motor control centers and starters, interlocks for fans, pumps or other controls.
 - .2 Programming and complete database required for DDC controls and the centralized management system, including generation of new graphic.
 - .3 Software/Hardware complete with full documentation.
 - .4 Start-up, testing, calibration and technical support during commissioning, full documentation.
 - .5 Complete update of identification system and as-built documentation for EMCS.

1.6 ELECTRICAL INSTALLATION

- .1 EMCS contractor is responsible for the hiring of a qualified and licensed Electrical contractor for the following work:
 - .1 Complete electrical installation including all conduits, cables, junction box, etc. required for control systems.
 - .2 All connections to motor control centers or starters, interlocks for fans, pumps and other control components.
- .2 Quality Assurance:
 - .1 The electrical subcontractor to be fully competent in the type of work described in Division 25 and to be familiar with the electrical and grounding requirements of this type of installation.

1.7 DESIGNATED CONTRACTOR

- .1 Hire the services of Siemens Canada or its authorized representative to complete the work related in all EMCS sections.

Part 2 Products

2.1 EQUIPMENT

- .1 There is an existing SIEMENS APOGEE system presently installed in the building. All materials must be selected to ensure full compatibility with the existing SIEMENS APOGEE system.

Part 3 Execution

3.1 GENERAL

- .1 All controls shall be installed and adjusted by specialized technicians, regularly employed by the manufacturer or its authorized distributor. All costs related to adjustments form part of this contract.
- .2 All controls components must be easily accessible for maintenance.

3.2 MANUFACTURER'S RECOMMENDATIONS

- .1 Installation: to manufacturer's recommendations.

3.3 ELECTRICAL INSTALLATION

- .1 Complete installation in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.
- .3 Provide grounding for the controls and EMCS installation in accordance with Division 26.
- .4 Wiring:
 - .1 Wiring must be continuous without joints.
 - .2 All wiring for EMCS shall be run in EMT conduit unless specified otherwise.
 - .3 Maximum conduit fill not to exceed 50%.
 - .4 Do not run exposed conduits in normally occupied spaces unless otherwise indicated or unless impossible to do otherwise. Consultant to review before starting Work.
 - .5 Wiring in mechanical rooms, wiring in service rooms and exposed wiring must be in conduit.
 - .6 Wiring sizes:
 - .1 120 V: #12AWG minimum.
 - .2 24 V: #18AWG minimum.
 - .3 Power loss through conductor shall not exceed 5%.

3.4 PAINTING

- .1 Clean and touch up marred or scratched surfaces of factory finished equipment to match original finish.
- .2 Restore to new condition, finished surfaces too extensively damaged to be primed and touched up to make good.

- .3 Clean and prime exposed hangers, racks, fastenings, and other support components.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

- .1 Acronyms and definitions: refer to Section 25 05 01 - EMCS: General Requirements.

1.2 SUBMITTALS

- .1 Shop Drawings to consist of three (3) hard copies and one (1) soft copy of design documents, shop drawings, product data and software.
- .2 Hard copy to be completely indexed and coordinated package to assure compliance with contract requirements and arranged in same sequence as specification and cross-referenced to specification section and paragraph number.
- .3 Soft copy to be in PDF - latest version, structured using menu format for easy loading and retrieval on OWS.

1.3 DETAIL SHOP DRAWING REVIEW

- .1 Submit shop drawings and include following:
 - .1 Complete bill of materials indicating quantity, manufacturer and model number of equipment to be used and the associated equipment ID.
 - .2 Specification sheets for each item, including all pertinent information such as:
 - .1 To include manufacturer's descriptive literature.
 - .2 Sensor type and location.
 - .3 Transmitter type and range.
 - .4 Wiring schematics, wiring and connections lists.
 - .5 Points addresses.
 - .6 Software and programming details for each point.
 - .7 Manufacturer's instructions for installation, including his recommended methods.
 - .8 Input and output levels and pressures where new system is connected to the existing one.
 - .3 Wiring schematics for each controlled point. Label control elements and terminals. Where a control element is also shown on control schematic use the same name.

1.4 CLOSEOUT DOCUMENTATION

- .1 Final "Operations and Maintenance" manual to include all as-built data related to the completed EMCS installation, including:
 - .1 Corrected and updated version of all information requested in the shop drawings reviews, in accordance with the as-built system.
 - .2 Specifications sheet for each input/output point, sensors, transmitters, showing information associated with each particular point including:
 - .1 Sensing element type and location.
 - .2 Transmitter type and range.

-
- .3 Associated field wiring schematics, schedules and terminations.
 - .4 Manufacturer's recommended installation instructions and procedures.

.3 Control schematics.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CSA C22.1-12, The Canadian Electrical Code, Part I (22nd Edition), Safety Standard for Electrical Installations.

1.2 DEFINITIONS

- .1 For acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

1.3 SUBMITTALS

- .1 Submit to Project Manager for approval samples of nameplates, identification tags and list of proposed wording.

Part 2 Products

2.1 NAMEPLATES FOR FIELD DEVICES

- .1 Identify by plastic encased cards attached by plastic tie.
- .2 Sizes: 25 x 50 mm minimum.
- .3 Lettering: minimum 5 mm high produced from laser printer in black.
- .4 Data to include: point name and point address.

2.2 WIRING

- .1 Power wiring:
 - .1 Supply and install numbered tape markings on wiring at panels, junction boxes, splitters, cabinets and outlet boxes.
 - .2 Colour coding: to CSA C22.1.
 - .3 Power wiring: identify circuit breaker panel/circuit breaker number inside each EMCS panel.
- .2 EMCS:
 - .1 Identify field device and network wiring end-to-end with plastic rings printed with indelible number markings.
 - .2 Inside control panels, label terminals of terminal blocks with the same identification used on wiring schematics.

2.3 CONDUIT

- .1 Colour code EMCS conduit.
- .2 Pre-paint box covers and conduit fittings.

- .3 Coding: use fluorescent orange paint or tape of 25 mm wide; confirm colour with Project Manager during "Preliminary Design Review".

Part 3 Execution

3.1 NAMEPLATES AND LABELS

- .1 Ensure that manufacturer's nameplates, CSA labels and identification nameplates are visible and legible at all times.

3.2 CONTROL PANELS

- .1 Provide updated Points List of each modified controller located inside a control panel. Install Points List on the door inside the panel enclosure.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 National Electrical Manufacturer's Association (NEMA).
 - .1 NEMA 250-08, Enclosures for Electrical Equipment (1000 Volts Maximum).
- .2 Canadian Standards Association (CSA International).
 - .1 CSA-C22.1-12, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.

1.2 DEFINITIONS

- .1 Acronyms and Definitions: refer to Section 25 05 01 - EMCS: General Requirements.

1.3 SUBMITTALS

- .1 Submit shop drawings, technical sheets and manufacturer's installation instructions in accordance with Section 25 05 02 - EMCS: Submittals and Review Process.

1.4 EXISTING CONDITIONS

- .1 Repair surfaces damaged during execution of Work.
- .2 Turn over to Project Manager existing materials removed from Work not identified for re-use.

Part 2 Products

2.1 GENERAL

- .1 Control devices of each category to be of same type and manufacturer.
- .2 Operating conditions: 0 – 70 degrees C with 0 – 95 % RH (non-condensing) unless otherwise specified.
- .3 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.
- .4 Transmitters and sensors to be unaffected by external transmitters including walkie talkies.
- .5 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.
- .6 Outdoor installations: use weatherproof construction in NEMA 4 enclosures.
- .7 Control devices to satisfy the following requirements:
 - .1 Controls must react to changing conditions.
 - .2 Linearity: relationship between control device measurement (temperature, humidity, pressure, etc.) and output signal to be linear type.

- .3 Control limits: control devices to maintain their controlled variable within the following set point limits:
 - .1 Temperature:
 - .1 $\pm 0.3^{\circ}\text{C}$ (0.5°F) for chilled water and hot water systems.
 - .2 $\pm 0.8^{\circ}\text{C}$ (1.5°F) in all other applications.
 - .2 Humidity:
 - .1 $\pm 5\%$ in all cases.
- .4 For the domestic hot water temperature and pressure monitoring, two remote location are required. Please verify locations on mechanical drawings.

2.2 TEMPERATURE SENSOR - T

- .1 General: resistance type to following requirements:
 - .1 RTD's: 1000 ohm or 10k ohm platinum element with strain minimizing construction. Coefficient of resistivity: 0.00385 ohms/ohm degrees C.
 - .2 Sensing element: hermetically sealed.
 - .3 Stem and tip construction: type 304 stainless steel.
 - .4 Time constant response: less than 3 seconds to temperature change of 10°C .
 - .5 Output signal: 4 – 20 mA.
 - .6 LCD Display.
 - .7 As per Greystone TE51xC Series.
- .2 Immersion Well:
 - .1 Stainless steel construction, with heat transfer compound compatible with sensor.

2.3 DIFFERENTIAL PRESSURE INTERFACE - DPI

- .1 General requirements:
 - .1 Wet-Wet pressure transmitter.
 - .2 Can accept ranges from 5 PSI to 500 PSI.
 - .3 Output signal: 4 - 20 mA proportional to operating range.
- .2 Differential pressure:
 - .1 Dual sensors.
 - .2 Accuracy: 1 % of span.
 - .3 LCD display.
 - .4 Zero and span adjustment.
 - .5 Sensor operating Range: -40°C to 85°C .
 - .6 As per Greystone WP-D Series.
 - .7 Must include VB Option.

2.4 PRESSURE INTERFACE - PI

- .1 General requirements:
 - .1 Gauge pressure transmitter.
 - .2 Can accept ranges from 5 PSI to 500 PSI.
 - .3 Output signal: 4 - 20 mA proportional to operating range.
- .2 Gauge pressure:
 - .1 Single sensors.
 - .2 Accuracy: 1 % of span.
 - .3 LCD display.
 - .4 Zero and span adjustment.
 - .5 Sensor operating Range: -40°C to 85°C.
 - .6 As per Greystone WP-G Series.

2.5 FLOW MEASURING STATION – FMS

- .1 Domestic cold water – Turbine flow meter:
 - .1 High performance turbine flow meter, model HP from Neptune, complete with local indicator (liters) and Tricon/E3 transmitter for measurement of domestic cold water consumption.
 - .2 Hydrodynamically-balanced, thrust compensated rotor.
 - .3 Listed for use on domestic water.
 - .4 Rugged, lead-free, high copper alloy main case, AWWA Class II turbine element and roll-sealed register. Flanged inlet/outlet connections. Interchangeable measuring element allowing in-line service.
 - .5 Maximum operating pressure: 175 psig (1206 kPa).
 - .6 Maximum operating temperature: 26.5°C (80°F).
 - .7 Transmitter: 4-20 mA, proportional to flow range of meter.
 - .8 Type HP from Neptune with Tricon/E3 transmitter or approved equivalent.
- .2 Domestic hot water:

2.6 CURRENT RELAYS - RC

- .1 Current Transmitter - Requirements:
 - .1 Suitable to detect belt loss or motor failure.
 - .2 Trip point adjustment, output status LED.
 - .3 Amperage range: 1 – 120 as per specific model.
 - .4 Transmitter range selected for specific application, in order to have proper reading.
 - .5 Isolation: 600 V AC rms.
 - .6 Split core for easy mounting.
 - .7 Induced sensor power.
 - .8 Output signal: 4 to 20 mA

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 equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.
- .2 Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.
- .3 Support field-mounted panels on pipe stands or channel brackets.
- .4 Fire stopping: provide space for fire stopping and maintain fire rating integrity.
- .5 Electrical:
 - .1 Complete installation in accordance with Section 25 05 01 – EMCS: General Requirements and Section 26 05 00 - Common Work Results for Electrical.
 - .2 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.

3.3 TEMPERATURE SENSORS

- .1 Stabilize to ensure minimum field adjustments or calibrations.
- .2 Readily accessible and adaptable to each type of application to allow for quick easy replacement and servicing without special tools or skills.
- .3 Thermowells and strap-on: install for piping installations.
 - .1 When the pipe diameter is less than the thermowell length, install in an elbow.
 - .2 The obstruction created by the thermowell cannot restrict the flow more than 30%.
 - .3 Use thermal conducting paste inside wells.

3.4 IDENTIFICATION

- .1 Identify field devices in accordance with Section 25 05 54 - EMCS: Identification.

3.5 TESTING AND COMMISSIONING

- .1 Calibrate and test field devices for accuracy and performance.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-12, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.
 - .2 CSA C22.1-12, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations. ESA OESC-2012, Ontario Electrical Safety Code, 25th Edition, Electrical Safety Authority 2012.
 - .3 CAN/CSA-C22.3 No. 1-10, Overhead Systems.
 - .4 CAN3-C235-83(R2006), Preferred Voltage Levels for AC Systems, 0 to 50,000V.
- .2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
 - .1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.
- .3 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
 - .1 IEEE 100-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition. Institute of Electrical and Electronics Engineers.
 - .2 IEEE 1122-1998, IEEE Standard for Digital Recorders for Measurements in High Voltage Impulse Tests.

1.2 DEFINITIONS

- .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE 1122.

1.3 DESIGN REQUIREMENTS

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
 - .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification nameplates for control items in English and French.
- .4 Use one nameplate for each language.

1.4 SYSTEM START-UP

- .1 Instruct Departmental Representative and operating personnel 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.

1.5 OPERATING INSTRUCTIONS

- .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
- .2 Operating instructions to include following:
 - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
 - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
 - .3 Safety precautions.
 - .4 Procedures to be followed in event of equipment failure.
 - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

Part 2 Products

2.1 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

2.2 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of the Electrical Safety Authority.
- .2 Porcelain enamel signs, minimum size 175 x 250 mm.

2.3 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.4 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:
 - .1 Nameplates: lamicoïd 3 mm engraving sheet melamine, matt white finish face, black 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 |

NAMEPLATE SIZES

| | | | |
|--------|-------------|---------|--------------------|
| 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 nameplates and labels to be approved by Departmental Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO. ___" as directed by Departmental Representative.
- .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .8 Terminal cabinets and pull boxes: indicate system and voltage.
- .9 Transformers: indicate capacity, primary and secondary voltages.

2.5 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, numbered coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.6 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 and at five meter intervals.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

| | Prime | Auxiliary |
|-------------|--------|-----------|
| up to 250 V | Yellow | |
| up to 600 V | Yellow | Green |

2.7 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
 - .1 Paint distribution enclosures light gray to EEMAC 2Y-1.

Part 3 Execution

3.1 INSTALLATION

- .1 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.3 CONDUIT AND CABLE INSTALLATION

- .1 Cut openings in the building walls or floors as required to install new cables and conduits.
- .2 Prior to cutting, carry out x-ray inspection and locate sleeves.
- .3 Install new cables and conduits in openings provided in enclosure walls. Coordinate all installation with enclosure manufacturer.
- .4 Install steel sleeves through cut openings in floor slab. Sleeves to extend 150 mm above floor level. Secure sleeve with a suitable steel floor flange and clamp.
- .5 Seal openings and provide fire stopping in accordance with Section 07 84 00 - Firestopping.

3.4 CLEANING

- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 26 05 00 – Common Work Results for Electrical.
- .2 Section 26 05 21 – Wires and Cables (0-1000 V).

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.
 - .2 CAN/CSA C22.2 No.65-13, Wire Connectors.
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
- .3 National Electrical Manufacturers Association (NEMA)

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused wiring materials from landfill to metal recycling facility as approved by the Departmental Representative.

Part 2 Products

2.1 MATERIALS

- .1 Pressure type wire connectors to: CAN/CSA C22.2No.65, with current carrying parts of copper alloy sized to fit copper conductors as required.
- .2 Copper long barrel compression connector as required by conductor size.
- .3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
 - .1 Connector body and stud clamp for stranded round copper conductors.
 - .2 Clamp for stranded round copper conductors.
 - .3 Stud clamp bolts.
 - .4 Bolts for copper conductors.
- .4 Insulation (tubing, boots and end caps)
 - .1 Heat shrink insulators:
 - .1 Moisture proof

- .2 Thermally stabilized cross-linked polyolefin
- .3 Self-sealing adhesive insulator with 3 to 1 expansion
- .4 Rated 1000 V, 90°C.
- .5 Clamps or connectors for armoured cable, flexible conduit as required to: CAN/CSA-C22.2 No.18.

Part 3 Execution

3.1 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and:
 - .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA C22.2 No.65.
 - .2 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 26 05 00 – Common Work Results for Electricity.
- .2 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.
- .3 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM B33-10, Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes.
 - .2 ASTM B172-10, Standard Specification for Rope-Lay-Stranded Copper Conductors Having Bunch-Stranded Members, for Electrical Conductors.
 - .3 ASTM B174-10, Standard Specification for Bunch-Stranded Copper Conductors for Electrical Conductors
- .2 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-12, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations
 - .2 CSA C22.2 No. 0.3-09, Test Methods for Electrical Wires and Cables.
 - .3 CAN/CSA-C22.2 No. 131-07 (R2012), Type TECK 90 Cable.

1.3 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 00 10 – General Instructions.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 00 10 – General Instructions.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal all packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Departmental Representative.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 BUILDING WIRES

- .1 Conductor material (wire in conduit): Annealed commercial grade, 98% conductivity,

copper. #12 to #10 AWG solid; #8 and larger - stranded.

- .2 Unless otherwise shown on the drawings or specified herein, provide conductors for circuits protected at 40 amperes and higher with insulation as follows:
 - .1 At 250 V and lower, RW90
 - .2 At greater than 250 V and less than 750 V in sizes up to #3 AWG = RW90
 - .3 For wiring systems at greater than 250 V and less than 750 V in sizes above #3 AWG, RWU 90 1000V.
 - .4 For circuits protected at less than 40 amperes Copper conductors: size as indicated, with thermoplastic insulation type TWU or TWH, as indicated, rated at 600 V.
 - .5 Colour Coding:
 - .1 Two (2) conductors, (1 phase): 1 black, 1 white
 - .2 Three (3) conductor, (1 phase): 1 black, 1 red, 1 white
 - .3 Three (3) conductor, 3 phase: 1 red (phase A), 1 black (phase B), 1 blue (phase C)
 - .4 Four (4) conductor, (3 phase): 1 red (phase A), 1 black (phase B), 1 blue (phase C), 1 white (neutral)
 - .5 Ground wire: green

2.2 ARMoured CABLES

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from galvanized steel strip.
- .4 Connectors: malleable steel

2.3 CONTROL CABLES

- .1 Low energy 300 V control cable: stranded annealed copper conductors sized as indicated, with PVC insulation type TW with shielding of tape coated with paramagnetic material over all conductors and overall covering of PVC jackets or interlocked armour of flat galvanized steel and overall PVC jacket.
- .2 600 V stranded annealed copper conductors, sizes as indicated with PVC insulation type TW, where indicated, with shielding of magnetic tape over all conductors and overall covering of thermoplastic jacket with sheath of interlocked armour and jacket over sheath of PVC.

Part 3 Execution

3.1 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

3.2 INSTALLATION OF CONDUCTORS IN CONDUIT

- .1 Conductors:
 - .1 Minimum wire size shall be #12 AWG unless otherwise specified.
 - .2 The current carrying capacity of the circuit conducts shall be equal to or better than shown on the drawings.
 - .3 Neutral Wire: full capacity continuous throughout its length.
 - .4 When load or breaker ratings are greater than 15A, the conditions shall be as indicated or of capacity equal to the load or breaker trip size as determined by the Canadian Electrical Code.
 - .5 Provide pigtails at all outlets for fixtures and wiring devices. All neutrals and branch circuits shall be connected in each outlet box to avoid a break in the neutral or the circuit wire when fixture or wiring device is disconnected.
 - .6 All branch circuit connections shall be made with an approved connector applied with a proper tool.
 - .7 Run a green insulated ground wire in all power and branch circuit EMT conduits. At each junction, pull and outlet box make a 360° loop of the stripped (insulation) uncut conductor under the ground screws.
- .2 Testing and Commissioning:
 - .1 Complete the following insulation resistance tests on the new feeders:
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500-V instrument.
 - .2 Megger 350-600-V circuits, feeders and equipment with a 1000-V instrument.
 - .3 Check resistance to ground before energizing.
 - .4 Carry out the tests in the presence of the Departmental Representative.
 - .5 Provide the instruments, meters, equipment and personnel required to conduct the tests during and at the conclusion of the project.
 - .6 Submit the typewritten test results for the Departmental Representative's review.

3.3 INSTALLATION OF CONTROL CABLES

- .1 Install control cables in conduit, underground ducts, as indicated.
- .2 Ground control cable shield.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 26 05 00 - Common Work Results for Electrical.
- .2 Section 26 05 20 - Wire and Box Connectors 0-1000V
- .3 Section 26 05 21 - Wire and Cables (0 - 1000 V).

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA C22.2 No.18-98 (R2003), Outlet Boxes, Conduit Boxes and Fittings.
 - .2 CSA C22.2 No. 56-04 (R2009), Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .3 CSA C22.2 No. 83-M1985 (R2013), Electrical Metallic Tubing.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 00 10 – General Instructions.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 00 10 – General Instructions.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal all packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Departmental Representative.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 CONDUITS

- .1 Electrical metallic tubing with couplings to CSA C22.2 No. 83.
- .2 Flexible and liquid-tight flexible metal conduit: to CSA C22.2 No.56.

2.2 CONDUIT FASTENINGS

- .1 One-hole galvanized steel straps to secure surface conduits 50 mm and smaller. Two-hole galvanized steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.

- .3 Channel type supports for two (2) or more conduits at 1500 mm OC.
- .4 12 mm diameter galvanized threaded rods to support suspended channels.

2.3 CONDUIT FITTINGS

- .1 Fittings for raceways: to CSA C22.2 No. 18.
- .2 Fitting manufactured for use with conduit specified.
- .3 Factory “ells” where 90° bends are required for 25 mm and larger conduits.
- .4 All couplings and connectors at the sprinkler-proof equipment shall be steel-compression type (binding collar). For all other applications, steel set screw-type couplings and connections shall be used. Set screw and cast types will not be acceptable.

Part 3 Execution

3.1 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in space through which they pass.
- .2 Conceal conduits except in mechanical and electrical service rooms.
- .3 In finished areas, run wiring concealed, except as otherwise specified or indicated on the drawings. Run exposed conduit neatly, parallel to building lines and maintain maximum headroom.
- .4 Use EMT conduit for all feeders and branch wiring within the building.
- .5 Use 600 mm liquid-tight flexible metal conduit for final connection to Load Bank .
- .6 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .7 Mechanically bend steel conduit over 20 mm diameter.
- .8 Install polypropylene fish cord in all empty conduits.
- .9 Where conduits become blocked, remove and replace blocked section.
- .10 Dry conduits out before installing wire.
- .11 Provide expansion fittings at all building and shield expansion joints.

3.2 SURFACE CONDUITS

- .1 Line up all exposed raceways, parallel and at right angles to the building walls. Set plumb and level equipment accurately and align hanger rods. Function and appearance shall be to the Departmental Representative's satisfaction.
- .2 Locate conduits behind infrared or gas-fired heaters with 1500 mm clearance.
- .3 Run conduits in flanged portion of structural steel.

- .4 Group conduits wherever possible on recessed channels. Surface or suspended channels may be used if unavoidable.
- .5 Do not pass conduits through structural members except as indicated and only with the Departmental Representative's permission for each case.

3.3 MINIMUM CONDUIT SIZE

- .1 The minimum conduit size shall be 20 mm.

3.4 EXPANSION FITTINGS

- .1 Conduit expansion fittings shall be provided on all conduits crossing structural expansion joints.
- .2 Install expansion fittings perpendicular to expansion joint.

3.5 CLEANING

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

END OF SECTION