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List of Drawings
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H0 - Boiler Room Heating Layout H1 - Level One Heating Layout H2 - Level Two Heating Layout H3 - Level Three Heating Layout H4 - Level Four Heating Layout H5 - Level Five Heating Layout
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**END OF SECTION**

## **Part 1 General**

### **1.1 WORK COVERED BY CONTRACT DOCUMENTS**

- .1 Work of this Contract comprises the replacement of heating system piping, fittings, valves, etc. as indicated in the contract document. The project work occurs at the Polaris Building located at the Bedford Institute of Oceanography, Dartmouth, N.S..

### **1.2 CONTRACT METHOD**

- .1 Construct Work under single stipulated price contract.

### **1.3 WORK BY OTHERS**

- .1 Co-operate with other Contractors in carrying out their respective works and carry out instructions from Departmental Representative.
- .2 Co-ordinate work with that of other Contractors. If any part of work under this Contract depends for its proper execution or result upon work of another Contractor, report promptly to Departmental Representative, in writing, any defects which may interfere with proper execution of Work.

### **1.4 WORK SEQUENCE**

- .1 Co-ordinate Progress Schedule and co-ordinate with Owner Occupancy during construction.
- .2 Maintain fire access/control.

### **1.5 CONTRACTOR USE OF PREMISES**

- .1 Limit use of premises for Work, for storage and for access, to allow:
  - .1 Owner occupancy.
  - .2 Work by other contractors.
- .2 Co-ordinate use of premises under direction of Departmental Representative.
- .3 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
- .4 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.
- .5 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Departmental Representative.
- .6 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

## **1.6 OWNER OCCUPANCY**

- .1 Owner will fully occupy all floors during occupied hours. Co-operate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.

## **1.7 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING**

- .1 Execute work with least possible interference or disturbance to building operations, occupants and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.
- .2 Use only service elevator, existing in building, for moving workers and material.
  - .1 Obtain approval of Departmental Representative prior to use of passenger elevators. Protect walls of passenger elevators during use.
  - .2 Accept liability for damage, safety of equipment and overloading of existing equipment.
- .3 Where necessary for access to mechanical systems, contractor to identify systems furniture that must be temporarily relocated. Removal and re-installation of the furniture will be the responsibility of PWGSC. Contractor to provide Departmental Representative three (3) working days notice of furniture to be removed.
- .4 Unless preauthorized by Departmental Representative, maintain full functionality of all areas of occupied space during occupied hours (i.e. Monday to Friday 06:00 to 18:00 hrs).

## **1.8 EXISTING SERVICES**

- .1 Notify Public Works and Government Services Canada of intended interruption of services and obtain required permission prior to interruption.
- .2 Where Work involves breaking into or connecting to existing services, give Departmental Representative 48 hours notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to tenant operations.
- .3 Provide alternative routes for personnel.
- .4 Establish location and extent of service lines in area of work before starting Work. Notify Departmental Representative of findings.
- .5 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.
- .6 Provide temporary services to maintain critical building and tenant systems.
- .7 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.

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

### **1.9 DOCUMENTS REQUIRED**

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

### **Part 2 Products**

#### **2.1 NOT USED**

- .1 Not used.

### **Part 3 Execution**

#### **3.1 NOT USED**

- .1 Not used.

**END OF SECTION**

## **Part 1 General**

### **1.1 ACCESS AND EGRESS**

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

### **1.2 USE OF SITE AND FACILITIES**

- .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.
- .2 Maintain existing services to building and provide for personnel and vehicle access.
- .3 The General Contractor and Sub-contractors are to be escorted by Commissionaires at all times when accessing the facility and/or working in the facility.
- .4 Departmental Representative will assign sanitary facilities for use by Contractor's personnel. Keep facilities clean.
- .5 Use only service elevator, existing in building, for moving workers and material.
  - .1 Obtain approval of Departmental Representative prior to use of passenger elevators. Protect walls of passenger elevators during use.
  - .2 Accept liability for damage, safety of equipment and overloading of existing equipment.
- .6 Closures: protect work temporarily until permanent enclosures are completed.

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

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

### **1.4 EXISTING SERVICES**

- .1 Notify Public Works and Government Services Canada of intended interruption of services and obtain required permission prior to the interruption.
- .2 Where Work involves breaking into or connecting to existing services, give Departmental Representative 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum. Carry out interruptions at times with minimum disturbance to tenant operations.

- .3 Provide for alternative routes for personnel.
- .4 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

### **1.5 SPECIAL REQUIREMENTS**

- .1 Except for the Boiler Room, work in all areas and on all floors is to be done during unoccupied hours on Monday to Friday from 18:00 to 05:00 hours and on Saturdays, Sundays, and statutory holidays.
- .2 Work on each Washroom is to be completed prior to starting work on the next washroom.
- .3 Carry out noise generating Work Monday to Friday from 18:00 to 05:00 hours and on Saturdays, Sundays, and statutory holidays.
- .4 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic, and security regulations.
- .5 Keep within limits of work and avenues of ingress and egress.

### **1.6 SECURITY CLEARANCES**

- .1 Personnel employed on this project will be subject to security check. Obtain clearance, as instructed, for each individual who will be required to enter the premises.
- .2 Personnel will be checked daily at start of work shift and provided with pass which must be worn at all times. Pass must be returned at end of work shift and personnel checked out.
- .3 As Contractor security clearances are obtained, contractors will be escorted at all times by designated commissionaires, working within the facility and accessing the facility. The costs of designated commissionaires escorts will not be the responsibility of the 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 RELATED REQUIREMENTS**

- .1 Section 01 45 00 – Quality Control.
- .2 Section 01 78 00 – Closeout Submittals.

### **1.2 ADMINISTRATIVE**

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

### **1.3 SHOP DRAWINGS AND PRODUCT DATA**

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures, and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 Submit drawings stamped and signed by a qualified professional engineer registered or licensed in the Province of Nova Scotia, Canada.

- .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .4 Allow 15 calendar days for Departmental Representative's review of each submission.
- .5 Adjustments or corrections made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When re-submitting, notify Departmental Representative in writing of revisions other than those requested.
- .7 Accompany submissions with transmittal letter, in duplicate, containing:
  - .1 Date.
  - .2 Project title and number.
  - .3 Contractor's name and address.
  - .4 Identification and quantity of each shop drawing, product data and sample.
  - .5 Other pertinent data.
- .8 Submissions include:
  - .1 Date and revision dates.
  - .2 Project title and number.
  - .3 Name and address of:
    - .1 Subcontractor.
    - .2 Supplier.
    - .3 Manufacturer.
  - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
  - .5 Cross reference to particular details of contract drawings and specifications section number for which shop drawing submission addresses.
  - .6 Details of appropriate portions of Work as applicable:
    - .1 Fabrication.
    - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
    - .3 Setting or erection details.

- .4 Capacities.
  - .5 Performance characteristics.
  - .6 Standards.
  - .7 Operating weight.
  - .8 Wiring diagrams.
  - .9 Single line and schematic diagrams.
  - .10 Relationship to adjacent work.
- .9 After Departmental Representative's review, distribute copies.
  - .10 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
  - .11 Submit electronic copy of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
  - .12 Submit electronic copy of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
    - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
    - .2 Testing must have been within 3 years of date of contract award for project.
  - .13 Submit electronic copy of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
    - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
    - .2 Certificates must be dated after award of project contract complete with project name.
  - .14 Submit electronic copy of manufacturers instructions for requirements requested in specification Sections and as requested by Departmental Representative.
    - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
  - .15 Submit electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.

- .16 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .17 Submit electronic copy of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
- .18 Delete information not applicable to project.
- .19 Supplement standard information to provide details applicable to project.
- .20 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and re-submission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .21 The review of shop drawings by Public Works and Government Services Canada (PWGSC) is for sole purpose of ascertaining conformance with general concept.
  - .1 This review shall not mean that PWGSC 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.

#### 1.4 SAMPLES

- .1 Submit for review samples in [duplicate] [triplicate] as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to PWGSC Project Manager's office or other address as directed by Departmental Representative's. Do not drop off samples at construction site except for special circumstances previously approved by Departmental Representative.
- .3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .4 Where colour, pattern or texture is criterion, submit full range of samples.
- .5 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.

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

## **1.5 MOCK-UPS**

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

## **1.6 CERTIFICATES AND TRANSCRIPTS**

- .1 Immediately after award of Contract, submit copies of permits, notices, compliance certificates received by Regulatory Agencies having jurisdiction and as applicable to the work.
- .2 Submission of above documents to be in accordance with Submittal – General Requirements procedures specified in this section.

## **Part 2 Products**

### **2.1 NOT USED**

- .1 Not Used.

## **Part 3 Execution**

### **3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

## **Part 1 General**

### **1.1 SECTION INCLUDES**

- .1 Health and safety consideration required to ensure that PWGSC shows due diligence towards health and safety on construction sites, and meets the requirements laid out in PWGSC/RPB Departmental Policy DP 073 – Occupational Health and Safety – Construction.

### **1.2 RELATED SECTIONS**

- .1 Section 01 33 00 – Submittal Procedures.

### **1.3 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 Nova Scotia
  - .1 Occupational Health and Safety Act, S.N.S. - Updated 2013.

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

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and 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 3 copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative weekly.
- .4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .5 Submit copies of incident and accident reports.
- .6 Submit WHMIS MSDS - Material Safety Data Sheets.
- .7 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 7 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental

Representative within 7 days after receipt of comments from Departmental Representative.

- .8 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .9 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 Departmental Representative.
- .10 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

### **1.5 FILING OF NOTICE**

- .1 File Notice of Project with Provincial authorities prior to beginning of Work.

### **1.6 SAFETY ASSESSMENT**

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

### **1.7 MEETINGS**

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

### **1.8 GENERAL REQUIREMENTS**

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.
- .2 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

### **1.9 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.

### **1.10 COMPLIANCE REQUIREMENTS**

- .1 Comply with Occupational Health and Safety Act, General Safety Regulation, N.S. Reg..

- .2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

### **1.11 UNFORSEEN HAZARDS**

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

### **1.12 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 demolition and renovation of buildings.
  - .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.

### **1.13 POSTING OF DOCUMENTS**

- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction, and in consultation with Departmental Representative.

### **1.14 CORRECTION OF NON-COMPLIANCE**

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

### **1.15 BLASTING**

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

### **1.16 POWDER ACTUATED DEVICES**

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



**1.17 WORK STOPPAGE**

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

**Part 2 Products**

**2.1 NOT USED**

- .1 Not used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not used.

**END OF SECTION**

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## **Part 1 General**

### **1.1 FIRE DEPARTMENT BRIEFING**

- .1 Departmental Representative will co-ordinate arrangements for contractor for briefing on Fire Safety at pre-work conference before work is commenced.

### **1.2 REPORTING FIRES**

- .1 Know location of nearest fire alarm box and telephone, including emergency phone number.
- .2 Report immediately fire incidents to Fire Department as follows:
  - .1 Activate nearest fire alarm box; or
  - .2 Telephone.
- .3 Person activating fire alarm box will remain at box to direct Fire Department to scene of fire.
- .4 When reporting fire by telephone, give location of fire, name or number of building and be prepared to verify location.

### **1.3 INTERIOR AND EXTERIOR FIRE PROTECTION AND ALARM SYSTEMS**

- .1 Fire protection and alarm system will not be:
  - .1 Obstructed;
  - .2 Shut-off, unless approved by Departmental Representative; and
  - .3 Left inactive at end of working day or shift.
- .2 Fire hydrants, standpipes and hose systems will not be used for other than fire-fighting.
- .3 Costs incurred, from the fire department and facility owner, resulting from negligently setting off false alarms will be charged to the Contractor in the form of financial progress payment reductions and holdback assessments against the Contract.

### **1.4 FIRE EXTINGUISHERS**

- .1 Supply fire extinguishers necessary to protect work in progress and contractor's physical plant on site.

### **1.5 BLOCKAGE OF ROADWAYS**

- .1 Advise Departmental Representative of work that would impede fire apparatus response. This includes violation of minimum overhead clearance, erecting of barricades and digging of trenches.

## **1.6 SMOKING PRECAUTIONS**

- .1 Observe smoking regulations.

## **1.7 RUBBISH AND WASTE MATERIALS**

- .1 Keep rubbish and waste materials at minimum quantities.
- .2 Burning of rubbish is prohibited.
- .3 Removal:
  - .1 Remove rubbish from work site at end of work day or shift or as directed.
- .4 Storage:
  - .1 Store oily waste in approved receptacles to ensure maximum cleanliness and safety.
  - .2 Deposit greasy or oily rags and materials subject to spontaneous combustion in approved receptacles and remove specified.

## **1.8 FLAMMABLE AND COMBUSTIBLE LIQUIDS**

- .1 Handling, storage and use of flammable and combustible liquids governed by current National Fire Code of Canada.
- .2 Keep flammable and combustible liquids such as gasoline, kerosene and naphtha for ready use in quantities not exceeding 45 litres provided they are stored in approved safety cans bearing Underwriters' Laboratory of Canada or Factory Mutual seal of approval. Storage of quantities of flammable and combustible liquids exceeding 45 litres for work purposes requires permission.
- .3 Transfer of flammable and combustible liquids is prohibited within buildings or jetties.
- .4 Transfer of flammable and combustible liquids will not be carried out in vicinity of open flames or any type of heat-producing devices.
- .5 Do not use flammable liquids having flash point below 38 degrees C such as naphtha or gasoline as solvents or cleaning agents.
- .6 Store flammable and combustible waste liquids, for disposal, in approved containers located in safe ventilated area. Keep quantities minimum and Fire Department is to be notified when disposal is required.

## **1.9 HAZARDOUS SUBSTANCES**

- .1 Work entailing use of toxic or hazardous materials, chemicals and/or explosives, or otherwise creating hazard to life, safety or health, in accordance with National Fire Code of Canada.
- .2 Obtain from Departmental Representative a "Hot Work" permit for work involving welding, burning or use of blowtorches and salamanders, in buildings or facilities.

- .3 When Work is carried out in dangerous or hazardous areas involving use of heat, provide fire watchers equipped with sufficient fire extinguishers. Determination of dangerous or hazardous areas along with level of protection necessary for Fire Watch is at discretion of Departmental Representative. Contractors are responsible for providing fire watch service for work on scale established at pre-work conference.
- .4 Provide ventilation where flammable liquids, such as lacquers or urethanes are used, eliminate sources of ignition. Inform Departmental Representative prior to and at cessation of such work.

### **1.10 FIRE SAFETY AND HOT WORK REQUIREMENTS**

- .1 Implement and follow fire safety measures during work. Comply with the following:
  - .1 National Fire Code, 2010.
  - .2 Fire Protection Standards PCC 301, Standard for Construction Operations and FCC 302, Standard for Welding and Cutting as issued by the Fire Protection Services of Human Resources Development Canada.
  - .3 Federal and Provincial Occupational Health and Safety Acts and Regulations as specified in Section 01 35 30 – Health and Safety Requirements.
- .2 In event of conflict between any provisions of above authorities, the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, Departmental Representative will advise on the course of action to be followed.
- .3 Hot Work Requirements:
  - .1 Obtain Departmental Representative's written Authorization to Proceed for the performance of Hot Work on site as may be required in the course of work.
  - .2 To obtain authorization submit to Departmental Representative for review:
    - .1 Contractor's Hot Work Procedures to be followed on site in accordance with clause 1.12 below.
    - .2 Type of work and frequency of situations which will require Hot Work.
  - .3 Upon confirmation that effective fire safety measures will be implemented for hot work, Departmental Representative will grant authorization covering the entire construction project and duration of work. However in some cases, depending upon the nature of phasing of work, the quantity of various trades needing to perform welding and cutting on site, or other deemed situation, Departmental Representative might designate certain portions of the work as separate entities, each entity requiring individual written authorization to proceed. Following Departmental Representative's directives in this regard.

- .4 Do not perform and Hot Work until receipt of Departmental Representative's written Authorization to Proceed.
- .5 In occupied areas of facility, co-ordinate performance of Hot Work with Facility Manager through the Departmental Representative. When directed perform Hot Work during non-operative hours facility is vacant of employees. Follow Departmental Representative's directives in this regard.

### 1.11 CONFORMANCE

- .1 Ensure that Hot Work procedures, as established for project and agreed upon with Departmental Representative, are stringently followed. Enforce use and compliance by all workers.
- .2 Brief all workers and sub-contractors on Hot Work Procedures and Permit system.
- .3 Failure to comply with the established hot work procedures may result in disciplinary measures.

### 1.12 HOT WORK PROCEDURES

- .1 Develop Hot Work Procedures, to be followed when Hot Work is required as part of the work.
- .2 Describe safe work practices and sequence of activities to be followed on site by Contractor and workers to minimize the potential occurrence of a fire resulting from Hot Work.
- .3 Hot Work Procedures to include:
  - .1 Requirement to perform hazard assessment of the site and immediate work area, based on type and extent of Hot Work required, in accordance with Hazard Assessment and Safety Plan requirements. Carry out hazard assessment for each hot work event.
  - .2 Use of a Hot Work Permit system, issued by authorized contractor, for each event when Hot Work is required, granting permission to carry out hot work.
  - .3 Provision of a designated persons to carry out a Fire Safety Watch for a minimum of 30 minutes immediately upon completion of the hot work.
- .4 Procedures to comply with fire safety codes and standards specified herein and occupational health and safety regulations.
- .5 Generic procedures, if used, must be edited, supplemented with pertinent information and tailored to reflect specific project conditions. Clearly label as being the Hot Work Procedures applicable to this contract.
- .6 Include within procedures the step by step process on how to prepare and issue the Hot Work Permit.
- .7 Hot Work Procedures to be in typewritten format, listing step by step procedures and worker instructions, clearly establishing and allocating responsibilities of:

- .1 Worker(s).
- .2 Designated person authorized to issue the Hot Work Permit.
- .3 Fire Safety Watcher.
- .4 Sub-contractors and Contractor.

### **1.13 HOT WORK PERMIT**

- .1 Develop "Hot Work Permit" form in typewritten format.
- .2 Hot Work Permit to include, as a minimum, the following data:
  - .1 Project name and project number.
  - .2 Building name, address and specific floor, room or area where hot work will be performed.
  - .3 Date when permit issued.
  - .4 Description on type of hot work to be carried out.
  - .5 Special precautions required, including type of fire extinguisher needed.
  - .6 Name and signature authorized person, designated by Contractor, to issue the permit.
  - .7 Name of worker(s) clearly printed, to which the permit is being issued.
  - .8 Time duration of permit (not to exceed 8 hours) indicating "Start" time and date and "Completion" time and date when Hot Work permit will be in effect.
  - .9 Worker signature with date and time when hot work terminated.
  - .10 Specified period of time requiring Safety Watch.
  - .11 Name and signature of person designated as Fire Safety Watcher, complete with time and date when safety watch terminated, certifying that the surrounding area was under his continual watch and inspection for the minimum time period specified in Permit and commenced immediately upon the completion of Hot Work.
- .3 Industry standard forms shall only be used if all data specified above is included on form.
- .4 Each Hot Work Permit to be completed in full and signed as follows:
  - .1 Authorized person issuing Permit before Hot Work commences.
  - .2 Worker's upon completion of Hot Work.
  - .3 Fire Safety Watcher upon termination of safety watch.
  - .4 Returned to Contractor's site superintendent for safe keeping.

### **1.14 DOCUMENTS ON SITE**

- .1 Keep work permits and hazard assessment documentation on site for duration of work.

- .2 Upon request, make available to Departmental Representative or to authorized safety representative for inspection.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

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## **Part 1 General**

### **1.1 RELATED REQUIREMENTS**

- .1 Section 01 22 00 – Submittal Procedures.
- .2 Section 01 78 00 – Closeout Submittals.

### **1.2 INSPECTION**

- .1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.
- .3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .4 Departmental Representative may 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.

### **1.3 INDEPENDENT INSPECTION AGENCIES**

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

### **1.4 ACCESS TO WORK**

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



## **1.5 PROCEDURES**

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

## **1.6 REJECTED WORK**

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

## **1.7 REPORTS**

- .1 Submit 4 copies of inspection and test reports to Departmental Representative.

## **1.8 TESTS AND MIX DESIGNS**

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

## **1.9 MOCK-UPS**

- .1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of Sections required to provide mock-ups.
- .2 Construct in locations acceptable to Departmental Representative.
- .3 Prepare mock-ups for Departmental Representative's review with reasonable promptness and in orderly sequence, to not cause delays in Work.
- .4 Failure to prepare mock-ups in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .5 If requested, Departmental Representative will assist in preparing schedule fixing dates for preparation.
- .6 Remove mock-up at conclusion of Work or when acceptable to Departmental Representative.

## **1.10 MILL TESTS**

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

**1.11 EQUIPMENT AND SYSTEMS**

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

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

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## **Part 1 General**

### **1.1 SUBMITTALS**

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

### **1.2 INSTALLATION AND REMOVAL**

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

### **1.3 TEMPORARY HEATING AND VENTILATION**

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

#### **1.4 FIRE PROTECTION**

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

#### **Part 2 Products**

##### **2.1 NOT USED**

- .1 Not Used.

#### **Part 3 Execution**

##### **3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

## **Part 1 General**

### **1.1 RELATED SECTIONS**

- .1 Section 01 51 00 – Temporary Utilities.

### **1.2 REFERENCES**

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

### **1.3 INSTALLATION AND REMOVAL**

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

### **1.4 GUARD RAILS AND BARRICADES**

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

### **1.5 WEATHER ENCLOSURES**

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

### **1.6 DUST TIGHT SCREENS**

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

### **1.7 ACCESS TO SITE**

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

## **1.8 PUBLIC TRAFFIC FLOW**

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

## **1.9 FIRE ROUTES**

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

## **1.10 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY**

- .1 Protect surrounding private and public property from damage during performance of Work.
- .2 Be responsible for damage incurred.

## **1.11 PROTECTION OF BUILDING FINISHES**

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

## **1.12 WASTE MANAGEMENT AND DISPOSAL**

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

## **Part 2 Products**

### **2.1 NOT USED**

- .1 Not Used.

## **Part 3 Execution**

### **3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

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## **Part 1 General**

### **1.1 REFERENCES**

- .1 Within text of each specifications section, reference may be made to reference standards
- .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, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.
- .4 Cost for such testing will be born by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.

### **1.2 QUALITY**

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

### **1.3 AVAILABILITY**

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are

foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

- .2 In event of failure to notify Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Departmental Representative reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

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

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

#### **1.5 TRANSPORTATION**

- .1 Pay costs of transportation of products required in performance of Work.

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

- .1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.



- .2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative will establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.

### **1.7 QUALITY OF WORK**

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.

### **1.8 CO-ORDINATION**

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

### **1.9 CONCEALMENT**

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

### **1.10 REMEDIAL WORK**

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

### **1.11 LOCATION OF FIXTURES**

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

## **1.12 FASTENINGS**

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

## **1.13 FASTENINGS - EQUIPMENT**

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hexagon heads, semi-finished unless otherwise specified
- .3 Bolts may not project more than one diameter beyond nuts.
- .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

## **1.14 PROTECTION OF WORK IN PROGRESS**

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

## **1.15 EXISTING UTILITIES**

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

## **Part 2 Products**

### **2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

.1 Not Used.

**END OF SECTION**

## **Part 1 General**

### **1.1 REFERENCES**

- .1 Public Works Government and Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC-ID: R0202D, Title: General Conditions "C", In Effect as of: Oct. 8, 2014.

### **1.2 PROJECT CLEANLINESS**

- .1 Maintain the work site and building entrances, corridors, stairwells, etc. designated for use by construction work force in tidy condition, free from accumulation of waste products and debris. Clean areas on a daily basis.
- .2 Daily and/or nightly clean up is required after work shift which includes sweeping dirt and debris, light mopping or work area and a wipe down of affected work station work surfaces and window sills.
- .3 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5 Provide on-site containers for collection of waste materials and debris.
- .6 Use separate collection bins, clearly marked as to purpose for recycling. Refer to Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .7 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.
- .8 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .9 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .10 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .11 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.
- .12 Employ dust barriers, dividers, seal doors with tape and provide other means required, and as approved by Departmental Representative, to ensure dust and dirt generated by construction operations are not transmitted to occupied areas of the building. Should duct accidentally migrate to occupied areas of the building, employ such means as may be necessary to immediately clean the area(s) to the satisfaction of the Departmental Representative.

- .13 Be responsible to immediately clean construction dust and dirt transferred by foot traffic, or by other means, into lobbies, corridors, stairwells, and office areas in use by facility employees. Carry out cleaning operations, including floor washing as necessary to thoroughly clean all soiled surfaces.

### 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.
- .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured items.
- .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 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .12 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .13 Remove dirt and other disfiguration from exterior surfaces.
- .14 Clean and sweep roofs, gutters, areaways, and sunken wells.
- .15 Sweep and wash clean paved areas.
- .16 Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.
- .17 Clean roofs, downspouts, and drainage systems.
- .18 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

**1.4 WASTE MANAGEMENT AND DISPOSAL**

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

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

## **Part 1 General**

### **1.1 WASTE MANAGEMENT GOALS**

- .1 Prior to start of Work conduct meeting with Departmental Representative to review and discuss PWGSC's waste management plan and goals.
- .2 PWGSC's waste management goal: to divert 80 percent of total Project Waste from landfill sites. Provide Departmental Representative documentation certifying that waste management, recycling, reuse of recyclable and reusable materials have been extensively practiced.
- .3 Accomplish maximum control of solid construction waste.
- .4 Preserve environment and prevent pollution and environment damage.

### **1.2 RELATED SECTIONS**

- .1 Section 01 33 00 – Submittal Procedures.

### **1.3 MATERIALS SOURCE SEPARATION PROGRAM (MSSP)**

- .1 Prepare MSSP and have ready for use prior to project start-up.
- .2 Implement MSSP for waste generated on project in compliance with approved methods and as reviewed by Departmental Representative.
- .3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.
- .4 Provide containers to deposit reusable and recyclable materials.
- .5 Locate containers in locations to facilitate deposit of materials without hindering daily operations.
- .6 Locate separated materials in areas which minimizes material damage.
- .7 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition.
  - .1 Transport to approved and authorized recycling facility to users of material for recycling.
- .8 Collect, handle, store on-site, and transport off-site, salvaged materials in combined condition.
  - .1 Ship materials to site operating under Certificate of Approval premises of Owner.
  - .2 Materials must be immediately separated into required categories for reuse or recycling.

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

- .1 Store materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.
- .2 Unless specified otherwise, materials for removal become Contractor's property.
- .3 Protect, stockpile, store, and catalogue salvaged items.
- .4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
- .5 Protect structural components not removed for demolition from movement or damage.
- .6 Support affected structures. If safety of building is endangered, cease operations and immediately notify Departmental Representative.
- .7 Protect surface drainage, mechanical and electrical from damage and blockage.
- .8 Separate and store materials produced during dismantling of structure in designated areas.
- .9 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.
  - .1 On-site source separation is recommended.
  - .2 Remove co-mingled materials to off-site processing facility for separation.
  - .3 Provide waybills for separated materials.

#### **1.5 DISPOSAL OF WASTES**

- .1 Do not bury rubbish or waste materials.
- .2 Do not dispose of waste, volatile materials, mineral spirits, oil or paint thinner into waterways, storm, or sanitary sewers.
- .3 Keep records of construction waste including:
  - .1 Number and size of bins.
  - .2 Waste type of each bin.
  - .3 Total tonnage generated.
  - .4 Tonnage reused or recycled.
  - .5 Reused or recycled waste destination.
- .4 Remove materials from deconstruction as deconstruction/disassembly work progresses.
- .5 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in pre-demolition material audit.



## **1.6 USE OF SITE AND FACILITIES**

- .1 Execute Work with least possible interference or disturbance to normal use of premises.
- .2 Maintain security measures established by existing facility.

## **1.7 SCHEDULING**

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

## **Part 2 Products**

### **2.1 NOT USED**

- .1 Not Used.

## **Part 3 Execution**

### **3.1 APPLICATION**

- .1 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

### **3.2 CLEANING**

- .1 Remove tools and waste materials on completion of work, and leave work area in clean and orderly condition.
- .2 Clean up work areas as work progresses.
- .3 Source separate materials to be reused/recycled into specified sort areas.

**END OF SECTION**

## Part 1 General

### 1.1 RELATED SECTIONS

- .1 Section 01 78 00 – Closeout Submittals.

### 1.2 INSPECTION AND DECLARATION

- .1 Contractor's Inspection: Contractor and Sub-contractors: conduct inspection of work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
  - .1 Notify Departmental Representative in writing of satisfactory completion of Contractor's Inspection and that corrections have been made and deficiencies rectified.
  - .2 Request Departmental Representative's Inspection.
- .2 Departmental Representative's Inspection: Departmental Representative and Contractor will perform inspection of work to identify obvious defects or deficiencies. Contractor to correct work accordingly.
- .3 Completion: submit written certificate that following have been performed:
  - .1 Work has been completed and inspected for compliance with Contract Documents.
  - .2 Defects have been corrected and deficiencies have been completed.
  - .3 Equipment and systems have been tested, adjusted and balanced and are fully operational.
  - .4 Certificates required by Boiler Inspection Branch Fire Commissioner and/or Utility companies have been submitted.
  - .5 Operation of systems have been demonstrated to Departmental Representative.
  - .6 Work is complete and ready for final inspection.
- .4 Final Inspection: When items noted above are completed, request final inspection of work by Departmental Representative. If work is deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection.
- .5 Notwithstanding the General Conditions, the Contractor's attention is drawn to the fact that the Departmental Representative will not issued an Interim Certificate of completion until such time that Contractor performs following work and/or turns over to Departmental Representative specified documents.
  - .1 Project record as-built documents.
  - .2 Final operations and maintenance manuals.
  - .3 Maintenance materials, parts and tools.

- .4 Certificates of test and test results.
- .5 Training complete with related manuals.
- .6 Manufacturer's Guarantee Certificates.
- .7 Commissioning and support documents.

### **1.3 CLEANING**

- .1 In accordance with Section 01 74 11 - Cleaning.
- .2 Remove waste and surplus materials, rubbish and construction facilities from the site in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **Part 2 Products**

#### **2.1 NOT USED**

- .1 Not Used.

### **Part 3 Execution**

#### **3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

## **Part 1 General**

### **1.1 RELATED SECTIONS**

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 79 00 – Demonstration and Training.

### **1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .3 Copy will be returned with Departmental Representative's comments.
- .4 Revise content of documents as required prior to final submittal.
- .5 Three weeks prior to application for Interim Certificate of Completion of project, submit to Departmental Representative, four final copies of operating and maintenance manuals in English.
- .6 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.
- .7 Furnish evidence, if requested, for type, source and quality of products provided.
- .8 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .9 Pay costs of transportation.

### **1.3 FORMAT**

- .1 Organize data as instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf sized 215 x 280 mm paper, with spine and face pockets.
- .3 When multiple binders are used, correlate data into related consistent groupings.
  - .1 Identify contents of each binder on spine.
- .4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by systems, process flow, under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: manufacturer's printed data, or typewritten data.

- .8 Drawings: provide with reinforced punched binder tab.
  - .1 Bind in with text; fold larger drawings to size of text pages.
- .9 Provide 1:1 scaled CAD files in dwg format on CD.

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

- .1 Table of Contents for Each Volume: provide full table of contents in each binder, clearly indicate which contents are in each binder.
- .2 Cover sheet containing:
  - .1 Date of submission.
  - .2 Project title, location and project number.
  - .3 Names, addresses and telephone numbers of Contractor and all sub-contractors.
  - .4 Schedule of products and systems, indexed to content of volume.
- .3 For each product or system:
  - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .4 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .5 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .6 Typewritten Text: as required to supplement product data.
  - .1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.
- .7 Training: refer to Section 01 79 00 - Demonstration and Training.

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

- .1 Maintain, at site for Departmental Representative one record copy of:
  - .1 Contract Drawings.
  - .2 Specifications.
  - .3 Addenda.
  - .4 Change Orders and other modifications to Contract.
  - .5 Reviewed shop drawings, product data, and samples.
  - .6 Field test records.
  - .7 Inspection certificates.
  - .8 Manufacturer's certificates.

- .2 Store record documents and samples in field office apart from documents used for construction.
  - .1 Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.
  - .1 Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition.
  - .1 Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Departmental Representative.

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

- .1 Record information on set of drawings, and in copy of Project Manual, provided by Departmental Representative.
- .2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress.
  - .1 Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: mark each item to record actual construction, including:
  - .1 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
  - .2 Field changes of dimension and detail.
  - .3 Changes made by change orders.
  - .4 Details not on original Contract Drawings.
  - .5 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.

## **1.7 EQUIPMENT AND SYSTEMS**

- .1 For each item of equipment and each system include description of unit or system, and component parts.

- .1 Give function, normal operation characteristics and limiting conditions.
- .2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.
  - .1 Include regulation, control, stopping, shut-down, and emergency instructions.
  - .2 Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports.
- .15 Additional requirements: as specified in individual specification sections.

## **1.8 MATERIALS AND FINISHES**

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

detrimental agents and methods, and recommended schedule for cleaning and maintenance.

- .4 Additional requirements: as specified in individual specifications sections.

## 1.9 MAINTENANCE MATERIALS

### .1 Spare Parts:

- .1 Provide spare parts, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to site, store in location as directed by Departmental Representative.
- .4 Receive and catalogue items. Prepare and submit inventory listing indicating the following:
  - .1 Part number.
  - .2 Identification of equipment or system for which parts are applicable
  - .3 Installation instruction as applicable.
  - .4 Name, address and telephone number of nearest supplier.
- .5 Obtain receipt for delivered products and submit prior to final payment.

### .2 Extra Stock Materials:

- .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to site. Store in location as directed by Department Representative.
- .4 Receive and catalogue items.
  - .1 Submit inventory listing to Departmental Representative.
  - .2 Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

### .3 Special Tools:

- .1 Provide special tools, in quantities specified in individual specification section.
- .2 Provide items with tags identifying their associated function and equipment.
- .3 Provide instructions on intended use of tool.
- .4 Deliver to site. Store in location as directed by Departmental Representative.
- .5 Receive and catalogue items.
  - .1 Submit inventory listing to Departmental Representative.



- .2 Include approved listings in Maintenance Manual.

#### **1.10 DELIVERY, STORAGE AND HANDLING**

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Clearly mark on each container or packaging as to content and quantity.
- .4 Store components subject to damage from weather in weatherproof enclosures.
- .5 Store paints and freezable materials in a heated and ventilated room.
- .6 Remove and replace damaged products during handling or delivery at own expense to satisfaction of Departmental Representative.

#### **1.11 WARRANTIES AND BONDS**

- .1 Develop warranty management plan to contain information relevant to Warranties.
- .2 Submit warranty management plan, 30 days before planned pre-warranty conference, to Departmental Representative approval.
- .3 Warranty management plan to include required actions and documents to assure that Departmental Representative receives warranties to which it is entitled.
- .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
- .5 Submit, warranty information made available during construction phase, to Departmental Representative for approval prior to each monthly pay estimate.
- .6 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
  - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
  - .2 List sub-contractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
  - .3 Obtain warranties and bonds, executed in duplicate by sub-contractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
  - .4 Verify that documents are in proper form, contain full information, and are notarized.
  - .5 Co-execute submittals when required.
  - .6 Retain warranties and bonds until time specified for submittal.

- .7 Except for items put into use with Departmental Representative's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.
- .8 Conduct joint 4 month and 9 month warranty inspection, measured from time of acceptance, by Departmental Representative.
- .9 Include information contained in warranty management plan as follows:
  - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, sub-contractors, manufacturers or suppliers involved.
  - .2 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.
  - .3 Procedure and status of tagging of equipment covered by extended warranties.
  - .4 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
- .10 Respond in timely manner to oral or written notification of required construction warranty repair work.
- .11 Written verification to follow oral instructions.
  - .1 Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.

### **1.12 WARRANTY TAGS**

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

### **Part 2 Products**

#### **2.1 NOT USED**

- .1 Not Used.

### **Part 3 Execution**

#### **3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

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**Part 1      General**

**1.1          SUMMARY**

- .1 Section Includes:
  - .1 General requirements relating to commissioning of project's components and systems, specifying general requirements to PV of components, equipment, sub-systems, systems, and integrated systems.
- .2 Acronyms:
  - .1 BMM - Building Management Manual.
  - .2 Cx - Commissioning.
  - .3 EMCS - Energy Monitoring and Control Systems.
  - .4 O&M - Operation and Maintenance.
  - .5 PI - Product Information.
  - .6 PV - Performance Verification.
  - .7 TAB - Testing, Adjusting and Balancing.

**1.2          REFERENCES**

- .1 American Water Works Association (AWWA)
- .2 Public Works and Government Services Canada (PWGSC)
  - .1 PWGSC - Commissioning Manual (CP.1) -4th edition-[06].
- .3 Underwriters' Laboratories of Canada (ULC)

**1.3          GENERAL**

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

- .2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.
- .3 Design Criteria: as per client's requirements or determined by designer to meet Project functional and operational requirements.

#### 1.4 COMMISSIONING OVERVIEW

- .1 Departmental Representative to maintain overall responsibility for project and is sole point of contact between members of commissioning team.
- .2 Project Manager will select Cx Team consisting of following members:
  - .1 PWGSC Design Quality Review Team: during construction, will conduct periodic site reviews to observe general progress.
  - .2 PWGSC Quality Assurance Commissioning Manager: ensures Cx activities are carried out to ensure delivery of a fully operational project including:
    - .1 Review of Cx documentation from operational perspective.
    - .2 Review for performance, reliability, durability of operation, accessibility, maintainability, operational efficiency under conditions of operation.
    - .3 Protection of health, safety and comfort of occupants and O&M personnel.
    - .4 Monitoring of Cx activities, training, development of Cx documentation.
    - .5 Work closely with members of Cx Team.
  - .3 Departmental Representative is responsible for:
    - .1 Organizing Cx.
    - .2 Monitoring operations Cx activities.
    - .3 Witnessing, certifying accuracy of reported results.
    - .4 Witnessing and certifying TAB and other tests.
    - .5 Developing BMM.
    - .6 Ensuring implementation of final Cx Plan.
    - .7 Performing verification of performance of installed systems and equipment.
    - .8 Implementation of Training Plan.
  - .4 Construction Team: contractor, sub-contractors, suppliers and support disciplines, is responsible for construction/installation in accordance with contract documents, including:
    - .1 Testing.
    - .2 TAB.
    - .3 Performance of Cx activities.
    - .4 Delivery of training and Cx documentation.
    - .5 Assigning one person as point of contact with Departmental Representative and PWGSC Cx Manager for administrative and coordination purposes.

- .5 Contractor's Cx agent implements specified Cx activities including:
  - .1 Demonstrations.
  - .2 Training.
  - .3 Testing.
  - .4 Preparation, submission of test reports.
- .6 Property Manager: represents lead role in Operation Phase and onwards and is responsible for:
  - .1 Receiving facility.
  - .2 Day-To-Day operation and maintenance of facility.
- .3 Cx to be a line item of Contractor's cost breakdown.
- .4 Cx activities supplement field quality and testing procedures described in relevant technical sections.
- .5 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction and Cx stages to ensure the Facility is proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities includes transfer of critical knowledge to facility operational personnel.
- .6 Departmental Representative will issue Interim Acceptance Certificate when:
  - .1 Completed Cx documentation has been received, reviewed for suitability and approved by Departmental Representative.
  - .2 Equipment, components and systems have been commissioned.
  - .3 O&M training has been completed.

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

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

#### **1.6 PRE-CX REVIEW**

- .1 Before Construction:
  - .1 Review contract documents, confirm by writing to Departmental Representative.
    - .1 Adequacy of provisions for Cx.
    - .2 Aspects of design and installation pertinent to success of Cx.

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

## 1.7 CONFLICTS

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

## 1.8 SUBMITTALS

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

## 1.9 COMMISSIONING DOCUMENTATION

- .1 Departmental Representative to review and approve Cx documentation.

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

#### **1.10 COMMISSIONING SCHEDULE**

- .1 Provide detailed Cx schedule as part of construction schedule in accordance with Sections 01 11 00 – Summary of Work and 01 14 00 – Work Restrictions.
- .2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:
  - .1 Approval of Cx reports.
  - .2 Verification of reported results.
  - .3 Repairs, retesting, re-commissioning, re-verification.
  - .4 Training.

#### **1.11 COMMISSIONING MEETINGS**

- .1 Convene Cx meetings following project meetings as specified herein.
- .2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.
- .3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.
- .4 At 60% construction completion stage. Departmental Representative to call a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:
  - .1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.
  - .2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.
- .5 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.
- .6 Meeting will be chaired by Departmental Representative, who will record and distribute minutes.
- .7 Ensure subcontractors and relevant manufacturer representatives are present at 60% and subsequent Cx meetings and as required.

#### **1.12 STARTING AND TESTING**

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

#### **1.13 WITNESSING OF STARTING AND TESTING**

- .1 Provide fourteen (14) day notice prior to commencement.



- .2 Departmental Representative to witness of start-up and testing.
- .3 Contractor's Cx Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

#### **1.14 MANUFACTURER'S INVOLVEMENT**

- .1 Factory testing: manufacturer to:
  - .1 Coordinate time and location of testing.
  - .2 Provide testing documentation for approval by Departmental Representative.
  - .3 Arrange for Departmental Representative to witness tests.
  - .4 Obtain written approval of test results and documentation from Departmental Representative before delivery to site.
- .2 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Departmental Representative.
  - .1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.
  - .2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.
- .3 Integrity of warranties:
  - .1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.
  - .2 Verify with manufacturer that testing as specified will not void warranties.
- .4 Qualifications of manufacturer's personnel:
  - .1 Experienced in design, installation and operation of equipment and systems.
  - .2 Ability to interpret test results accurately.
  - .3 To report results in clear, concise, logical manner.

#### **1.15 PROCEDURES**

- .1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.
- .2 Conduct start-up and testing in following distinct phases:
  - .1 Included in delivery and installation:
    - .1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.
    - .2 Visual inspection of quality of installation.
  - .2 Start-up: follow accepted start-up procedures.
  - .3 Operational testing: document equipment performance.

- .4 System PV: include repetition of tests after correcting deficiencies.
- .5 Post-substantial performance verification: to include fine-tuning.
- .3 Correct deficiencies and obtain approval from Departmental Representative after distinct phases have been completed and before commencing next phase.
- .4 Document require tests on approved PV forms.
- .5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Departmental Representative. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:
  - .1 Minor equipment/systems: implement corrective measures approved by Departmental Representative.
  - .2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Departmental Representative.
  - .3 If evaluation report concludes that major damage has occurred, Departmental Representative shall reject equipment.
    - .1 Rejected equipment to be remove from site and replace with new.
    - .2 Subject new equipment/systems to specified start-up procedures.

#### **1.16 START-UP DOCUMENTATION**

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

#### **1.17 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS**

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

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**1.18 TEST RESULTS**

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

**1.19 START OF COMMISSIONING**

- .1 Notify Departmental Representative at least twenty-one (21) days prior to start of Cx.
- .2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

**1.20 INSTRUMENTS / EQUIPMENT**

- .1 Submit to Departmental Representative for review and approval:
  - .1 Complete list of instruments proposed to be used.
  - .2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.
- .2 Provide the following equipment as required:
  - .1 2-way radios.
  - .2 Ladders.
  - .3 Equipment as required to complete work.

**1.21 COMMISSIONING PERFORMANCE VERIFICATION**

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

**1.22 WITNESSING COMMISSIONING**

- .1 Departmental Representative to witness activities and verify results.

**1.23 AUTHORITIES HAVING JURISDICTION**

- .1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to

witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.

- .2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.
- .3 Provide copies to Departmental Representative within five (5) days of test and with Cx report.

#### **1.24 COMMISSIONING CONSTRAINTS**

- .1 It is necessary to complete Cx of occupancy, weather, and seasonal sensitive equipment and systems before issuance of the Interim Certificate, using, if necessary, simulated thermal loads.

#### **1.25 EXTRAPOLATION OF RESULTS**

- .1 Where Cx of weather, occupancy, or seasonal-sensitive equipment or systems cannot be conducted under near-rated or near-design conditions, extrapolate part-load results to design conditions when approved by Departmental Representative in accordance with equipment manufacturer's instructions, using manufacturer's data, with manufacturer's assistance and using approved formulae.

#### **1.26 EXTENT OF VERIFICATION**

- .1 Provide manpower and instrumentation to verify up to 30% of reported results, unless specified otherwise in other sections.
- .2 Number and location to be at discretion of Departmental Representative.
- .3 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.
- .4 Review and repeat commissioning of systems if inconsistencies found in more than 20% of reported results.
- .5 Perform additional commissioning until results are acceptable to Departmental Representative.

#### **1.27 REPEAT VERIFICATIONS**

- .1 Assume costs incurred by Departmental Representative for third and subsequent verifications where:
  - .1 Verification of reported results fail to receive Departmental Representative's approval.
  - .2 Repetition of second verification again fails to receive approval.
  - .3 Departmental Representative deems Contractor's request for second verification was premature.

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**1.28 SUNDRY CHECKS AND ADJUSTMENTS**

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

**1.29 DEFICIENCIES, FAULTS, DEFECTS**

- .1 Correct deficiencies found during start-up and Cx to satisfaction of Departmental Representative. Provide 'signed off' copy of Cx deficiency list upon request.
- .2 Report problems, faults or defects affecting Cx to Departmental Representative in writing. Stop Cx until problems are rectified. Proceed with written approval from Departmental Representative.

**1.30 COMPLETION OF COMMISSIONING**

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

**1.31 ACTIVITIES UPON COMPLETION OF COMMISSIONING**

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

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

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

**1.33 OCCUPANCY**

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

**1.34 INSTALLED INSTRUMENTATION**

- .1 Use instruments installed under Contract for TAB and PV if:
  - .1 Accuracy complies with these specifications.
  - .2 Calibration certificates have been deposited with Departmental Representative.
- .2 Calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted.

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**1.35 PERFORMANCE VERIFICATION TOLERANCES**

- .1 Application tolerances:
  - .1 Specified range of acceptable deviations of measured values from specified values or specified design criteria to be within +/- 10% of specified values, except for special areas.
- .2 Instrument accuracy tolerances:
  - .1 To be of higher order of magnitude than equipment or system being tested.
- .3 Measurement tolerances during verification:
  - .1 Unless otherwise specified actual values to be within +/- 2% of recorded values.

**1.36 OWNER'S PERFORMANCE TESTING**

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

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

## **Part 1 General**

### **1.1 REFERENCES**

- .1 Canadian Standards Association (CSA International):
  - .1 CSA S350-M1980(R0003), Code of Practice for Safety in Demolition of Structures.

### **1.2 SUBMITTALS**

- .1 Submit shop drawings in accordance with Section 0 33 00 – Submittal Procedures.
- .2 Before proceeding with demolition of load bearing walls of other walls and where required by authority having jurisdiction, submit for review by Departmental Representative shoring and underpinning drawings prepared by qualified professional engineer registered or licensed in the Province of Nova Scotia, showing proposed method.
- .3 Prior to beginning of Work on site submit detailed Waste Reduction Workplan in Accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal and indicate:
  - .1 Descriptions of and anticipated quantities in percentages of materials to be salvaged reused, recycled and landfilled.
  - .2 Schedule of selective demolition.
  - .3 Number and location of dumpsters.
  - .4 Anticipated frequency of tipping.
  - .5 Name and address of haulers, waste facilities and waste receiving organizations.

### **1.3 WASTE MANAGEMENT AND DISPOSAL**

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

### **1.4 SITE CONDITIONS**

- .1 Review “Designated Substance Report” and take precautions to protect environment.

## **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 Underwriter's Laboratories of Canada (ULC)
  - .1 ULC-S115-11, Standard Method of 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; (ref: NBC Part 3.1.9.1.1 and 9.10.9.6.1): 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 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets.
- .3 Shop Drawings:
  - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings and method of installation.
  - .3 Construction details should accurately reflect actual job conditions.
- .4 Samples:
  - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

- .2 Submit duplicate 300 x 300 mm samples showing actual fire stop material proposed for project.
- .5 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.
  - .1 Test reports: in accordance with CAN-ULC-S101 for fire endurance and CAN-ULC-S102 for surface burning characteristics.
    - .1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.
  - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.
  - .4 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

#### 1.4 QUALITY ASSURANCE

- .1 Qualifications:
  - .1 Installer: company and person specializing in fire stopping installations experience approved by manufacturer.
- .2 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section, with contractor's representative and Departmental Representative to:
  - .1 Verify project requirements.
  - .2 Review installation and substrate conditions.
  - .3 Co-ordination with other building subtrades.
  - .4 Review installation instructions and warranty requirements.
- .3 Site Meetings: as part of Manufacturer's Services described in PART 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.
  - .1 After delivery and storage of products, and when preparatory Work is complete, but before installation begins.
  - .2 Twice during progress of Work at 25% and 60% complete.
  - .3 Upon completion of Work, after cleaning is carried out.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements.
  - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

- .3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer and ULC markings.
- .2 Storage and Protection:
  - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.
- .3 Waste Management and Disposal:
  - .1 Separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- .1 Fire stopping and smoke seal systems: in accordance with CAN-ULC-S115.
  - .1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of CAN-ULC-S115 and not to exceed opening sizes for which they are intended.
  - .2 Fire stop system rating to match the applicable floor or wall rating.
- .2 Service penetration assemblies: certified by ULC in accordance with ULC-S115 and listed in ULC Guide No. 40 U19.
- .3 Service penetration fire stop components: certified by ULC in accordance with CAN-ULC-S115 and listed in ULC Guide No. 40 U19.13 and ULC Guide No. 40 U19.15 under the Label of Service of ULC.
- .4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.
- .5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.
- .6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.
- .7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .8 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.

- .9 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- .10 Sealants for vertical joints: non-sagging.

## **PART 3 - EXECUTION**

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

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

### **3.2 PREPARATION**

- .1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.
  - .1 Ensure that substrates and surfaces are clean, dry and frost free.
- .2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.
- .3 Maintain insulation around pipes and ducts penetrating fire separation.
- .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 ULC certification and manufacturer's instructions.
- .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 Departmental Representative.

- .2 Install floor fire stopping before interior partition erections.
- .3 Metal deck bonding: fire stopping to precede spray applied fireproofing to ensure required bonding.
- .4 Mechanical pipe insulation: certified fire stop system component.
  - .1 Ensure pipe insulation installation precedes fire stopping.

### **3.5 FIELD QUALITY CONTROL**

- .1 Inspections: notify Departmental Representative when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.
- .2 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
  - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

### **3.6 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- .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 masonry, concrete, and gypsum board partitions and walls.
  - .2 Edge of floor slabs at curtain wall and precast concrete panels.
  - .3 Top of fire-resistance rated masonry and gypsum board partitions.
  - .4 Intersection of fire-resistance rated masonry and gypsum board partitions.
  - .5 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
  - .6 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
  - .7 Openings and sleeves installed for future use through fire separations.
  - .8 Around mechanical and electrical assemblies penetrating fire separations.

- .9 Rigid ducts: greater than 129 cm<sup>2</sup>: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

END OF SECTION

## **1 General**

### **1.1 GENERAL**

- .1 Provide new materials and equipment of proven design and quality and of current models with published ratings for which replacement parts are readily available.

### **1.2 RELATED SECTIONS**

- .1 Section 01 32 16.06 - Construction Progress Schedule - Critical Path Method (CPM).
- .2 Section 01 32 16.07 - Construction Progress Schedules - Bar (GANNTT) Chart.
- .3 Section 01 33 00 - Submittal Procedures.
- .4 Section 01 35 29.06 - Health and Safety Requirements.
- .5 Section 01 45 00 - Quality Control.
- .6 Section 01 47 15 - Sustainable Requirements: Construction.
- .7 Section 01 74 11 - Cleaning
- .8 Section 01 47 17 - Sustainable Requirements: Contractor's Verification.
- .9 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .10 Section 01 78 00 - Closeout Submittals.
- .11 Section 01 91 13 - General Commissioning (Cx) Requirements.
- .12 Section 02 81 01 - Hazardous Materials.

### **1.3 REFERENCED CODES and STANDARDS**

- .1 Use following latest editions and amendments in effect at time of Tender Call:

AABC	Associated Air Balance Council
API	American Petroleum Institute
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
CEMA	Canadian Electrical Manufacturers Association
CFUA	Canadian Fire Underwriters' Association
CGSB	Canadian General Standards Board
CHVAC	Canadian Heating, Ventilation and Air Conditioning Code (NRC)
CSA	Canadian Standards Association
CUA	Canadian Underwriters' Association
HRA	Heating, Refrigeration and Air Conditioning Institute of Canada
NACE	National Association of Corrosion Engineers
NBC	National Building Code of Canada
NBFU	National Board of Fire Underwriters'
NBS	National Bureau of Standards
NECC	National Energy Code of Canada for Buildings
NFC	National Fire Code of Canada
NS DOL	Nova Scotia Department of Labour

NSC	National Standards of Canada
SAE	Society of Automotive Engineers
TIAC	Thermal Insulation Association of Canada
TIMA	Thermal Insulation Manufacturers Association
UL	Underwriters' Laboratories
ULC	Underwriters' Laboratories of Canada

#### 1.4 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submittals shall be in the metric system and use the same unit as shown in the contract documents.
- .3 Shop Drawings
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Nova Scotia where noted.
  - .2 Submit shop drawings for all equipment listed and for all equipment the contractor wishes to substitute for provided such alternative equipment has prior approval.
  - .3 Work is not to commence until shop drawings have been reviewed by the Departmental Representative.
  - .4 The Departmental Representative's review of these drawings is general. It is not intended to release the Contractor from necessity of furnishing materials and performing the work as required by the plans and specifications.
  - .5 All shop drawings must be checked against the requirements of the plans and specifications by this Contractor prior to submitting them. Drawings not checked will be returned without approval.
  - .6 All shop drawings must be first quality reproductions with all details, lettering, etc. distinct and legible.
  - .7 Shop drawings to show:
    - a) Mounting arrangements.
    - b) Operating and maintenance clearances.
  - .8 Shop drawings and product data accompanied by:
    - a) Detailed drawings of bases, supports, and anchor bolts.
    - b) Acoustical sound power data, where applicable.
    - c) Points of operation on performance curves. ( provide complete family of curves)
    - d) Manufacturer to certify current model production.
    - e) Certification of compliance to applicable codes.
  - .9 Upon receipt of product shop drawings by the mechanical contractor he shall review them to ensure that they meet the requirements of the specification in all respects, that they are clear and legible, all options being provided are clearly indicated and that dimensions, weights, power requirements, quantities and capacities are consistent with the requirements of the plans and specifications. The contractor shall complete Appendix A at the end of this section verifying that he has completed these tasks. The contractor shall then forward the shop drawings through the appropriate channels for final review by the



- Departmental Representative. Shop drawings that are not accompanied by Appendix A clearly indicating that the contractor has completed this review will not be reviewed by the Departmental Representative and will be returned to the contractor.
- .10 Equipment of each specification section to be submitted separately
  - .11 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.
- .4 Operation and Maintenance Manuals:
- .1 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
  - .2 Provide three (3) copies to the Owner of the Maintenance manual. Each copy to be suitable bound, three ring binders containing letter sized pages. Larger pages, suitably folded, or folded in pockets may be used where necessary.
  - .3 Binders shall be no more than 2/3 full leaving room to add material in the future. Where necessary additional binders shall be provided.
  - .4 The Maintenance Manuals shall include the following:
    - .1 Have a title sheet, or sheets, preceding data on which shall be recorded Project name, date, list of contents, and Trade Contractor's name.
    - .2 Be organized into applicable Sections of work with each Section separated by hard paper dividers with plastic covered tabs marked by Section.
    - .3 Contain a list of local (or nearest) representative of each piece of equipment including mail address, e-mail address, web site, and phone number.
    - .4 One (1) copy of each final approved shop drawing on which have been recorded changes made during fabrication and installation.
    - .5 Typed or printed information and notes, and neatly drafted drawings.
    - .6 Maintenance and operating instructions on all building equipment supplied by the Trade Contract.
    - .7 General and specific instructions for the maintenance and operation of automatic and adjustable controls. (see section 25 05 03)
    - .8 Brochures and parts list for all equipment.
    - .9 Sources of supply for all proprietary products used in the work.
    - .10 Lists of supply sources for maintenance of all equipment in the project of which more detailed information is not included above.
    - .11 Lists of recommended spare parts.
    - .12 A Preventive Maintenance schedule.
  - .5 Additional data:
    - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
    - .2 Provide separate tab for MSDS for all hazardous material installed and left stored on site or with the Owner. First page of tab to be an index of MSDS included.

- .3 Provide separate tab for all equipment startup reports. First page of tab to be an index of reports included.
- .4 Provide separate tab for copies of all equipment manufacturers warranties. A copy of the warrantee to also be included with the equipment O & M data. First page of tab to be an index of warrantees included.
- .5 Provide separate tab for copies of all reports used to obtain variances from codes. First page of tab to be an index of variances.
- .6 Provide an analysis of hydronic systems water after cleaning and treatment of piping.
- .7 Include serial number of equipment furnished with serial numbers.

.5 Shop Drawing and Maintenance Manual Submittal Summary

	Shop Drawings						Maintenance Manuals						
	Model No.	Dimension	Service Requirements	Weight	Electrical	Performance Data	Shop Drawing	O & M Data	Start Up Report	As-Built Drawing	Spare Parts List	MSDS	Serial No.
<b>Common Items</b>													
Drain Valves	•	•					•						
Fire Stopping	•					•	•					•	
Flexible Pipe Connection	•	•					•						
Fittings and Valves	•	•		•			•	•					
Pipe Guides and Anchors	•	•					•						
Pipe Hangers and Supports	•	•		•			•						
Pipe Identification	•	•											
Pipe Unions	•						•						
Pipe Insulation		•				•	•						
<b>Heating</b>													
Heating Specialties AAV, Flexible Pipe Connections, Manual Air Vent, Strainer	•	•		•		•	•						
Valves (all Services) – Balancing, Check, Mixing, Shut-off	•	•		•			•	•		1			
<b>Control</b>													
See Section 25 05 02													

- .6 As-Built Drawings:
  - .1 The Departmental Representative will provide one set of reproducible mechanical drawings for As-Built Drawing purposes. The Contractor shall mark thereon all significant changes and deviations from contract documents as work progresses and as changes occur.
  - .2 On a weekly basis, transfer information to reproducibles, revising reproducibles to show all work as actually installed.

- .3 Mark changes on white prints in 'Red'.
- .4 Make available for reference purposes and inspection at all times.
- .5 Prior to start of Testing, Adjusting and Balancing (TAB), finalize production of as-built/record drawings.
- .6 Identify each drawing in lower right hand corner in letters at least 1/2" high as follows: "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (date).
- .7 Submit to Departmental Representative for approval and make corrections as directed.
- .8 TAB to be performed using as-built drawings.
- .9 Submit completed reproducible as-built/record drawings to Departmental Representative for review.

#### **1.5 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Health and Safety Requirements: do construction and occupational health and safety in accordance with Section 01 35 30 – Health and Safety Requirements.

#### **1.6 MAINTENANCE MATERIAL**

- .1 Furnish one (1) set of special or proprietary tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.

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

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Store materials in a clean, dry location protected from damage. Protect equipment from dirt and dust.
- .4 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

#### **1.8 TEMPORARY HEAT**

- .1 Temporary Heat for new Construction shall be the responsibility of the General Contractor.
- .2 All costs for temporary heat shall be the responsibility of the General Contractor.

## **1.9 PROTECTION OF OPENINGS**

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

## **1.10 PAINTING**

- .1 Finish painting by others unless specifically noted. Where finish painting is required, prime painting by the appropriate trade contractor.
- .2 Piping is the responsibility of the appropriate trade contractor.
- .3 Apply to hangers, supports and equipment fabricated from ferrous metals at least one (1) coat of corrosion resistant paint before shipment to job site.
- .4 Prime and touch up marred finished paintwork to match original.
- .5 Restore to new condition, finishes which have been damaged too extensively to be merely primed and touched up. Do not paint over nameplates.
- .6 Patch cuts and paint to match existing conditions.

## **1.11 DEMONSTRATION OF COMPLETE SYSTEM**

- .1 At the conclusion of the job, the Contractor shall review and demonstrate to the Departmental Representative all equipment and their respective functions, operation, and maintenance. Such demonstration shall be provided for such reasonable periods of time as the complexity of the job warrants, and as approved by the Departmental Representative. Such review and demonstration shall be made by an authorized representative of the Contractor, fully knowledgeable of the project, its installation, and operation.
- .2 Provide the Departmental Representative with a schedule of system demonstration at least two (2) weeks prior demonstration
- .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/record drawings, audio visual aids, etc. as part of instruction materials.
- .5 Instruction duration time requirements as specified in appropriate sections.
- .6 Where deemed necessary, the Departmental Representative may record these demonstrations for future reference.

## **1.12 CLEANING**

- .1 Clean the job site daily. If the site is not cleaned to the Departmental Representative's satisfaction, then the Departmental Representative shall make arrangements for cleaning and charge the cost against the Contract.
- .2 At conclusion of project remove surplus material, rubbish, tools, and equipment.

### **1.13 DEFINITIONS**

- .1 Acceptable Materials - Any product mentioned may be used provided it meets or exceeds the quality, performance capability, and space requirements of the equipment shown and called for on the plans and in the specifications.
- .2 Provide - "supply and install" unless otherwise indicated.
- .3 Standard of Acceptance – Only the product listed may be used unless alternate products are included in an addendum.

### **1.14 DRAWINGS AND SPECIFICATIONS**

- .1 Not intended to show structural details or architectural features.
- .2 Except where dimensioned, indicates general mechanical layouts only. Do not scale.
- .3 If required by the Departmental Representative, provide field drawings to show the relative position of various services. Obtain Departmental Representative review before beginning work.
- .4 The Mechanical Trade Contractor shall check the content of the drawings, specifications and dimensions, and before proceeding, report to the Departmental Representative any error or omission between Mechanical or Electrical and Architectural plans.
- .5 These specifications are to be considered as an integral part of the drawings which accompany them, neither the drawings nor the specifications shall be used alone. Any item which is omitted in one but which is reasonably implied in the other, shall be considered properly and sufficiently specified and must, therefore, be provided under the Contract. The decision of the Departmental Representative shall be final, if interpretation is required.
- .6 Misinterpretation of drawings and specifications shall not relieve the Mechanical Trade Contractor of responsibility.
- .7 All Mechanical Trade Contractors shall make themselves familiar with the overall intended operation of the mechanical systems prior to installation so that all necessary accessories such as dampers, vents, valves, controls, etc., can be installed during the normal progress of the work. Failure to do so will result in the Mechanical Trade Contractor's responsibility in providing such devices, at his expense when the need of such devices becomes apparent during start-up.

### 1.15 SITE VISITS

- .1 Before commencing work, visit site and verify that requirements of Plans and Specifications are consistent with site conditions.
- .2 Advise Departmental Representative, in writing, of any discrepancies or conflicts.
- .3 No allowance shall be made for failure to include items which a thorough investigation would have shown to be required.

### 1.16 GUARANTEES

- .1 This Mechanical Trade Contractor shall guarantee all his work free from defects for a period of one (1) year, unless specifically noted otherwise, after final acceptance of such work by the Departmental Representative and shall make good all defects other than normal wear and tear during the life of the guarantee. This Mechanical Trade Contractor shall guarantee all work and equipment supplied by him to work quietly and satisfactorily and to accomplish the work for which it was installed during the life of the above guarantee. At any time during this period, he shall make any necessary changes and adjustments or replacements, to accomplish this at his own expense.
- .2 Submit manufacturers' written guarantees to the Departmental Representative for review.
- .3 Provide copies of all guarantees in a separate tab of the O & M manual.
- .4 Each guarantee shall include:
  - .1 Project name and address.
  - .2 Guarantee time period (commencement date shall be as date shown on Project Final Certificate of Completion unless otherwise indicated).
  - .3 Clear and concise definition of what is guaranteed and remedial action provided.
  - .4 Signatures of Mechanical Trade Contractor and a company officer of the manufacturing firm.
  - .5 Include all extended guarantees (and service contracts) as specified in individual sections.

### 1.17 PERMITS AND REGULATIONS

- .1 All Mechanical Trade Contractors shall comply with all regulations of authorities having jurisdiction, where applicable, including but not limited to the following:
  - Provincial Department of Labour
  - Provincial Fire Marshal
  - Municipal Plumbing Inspector
  - Provincial Board of Insurance Underwriters

- .2 The Mechanical Trade Contractor shall obtain and pay for any permits required by Local Codes and Regulations and arrange for inspections.
- .3 Any additional materials or labour required to conform to any of these rules and regulations will be furnished under the Contract with no additional cost to the Owner.

#### **1.18 CO-ORDINATION**

- .1 Co-ordinate work with other trades to avoid conflict.
- .2 Locate distribution systems, equipment and materials to provide minimum interference and maximum useable space.
- .3 Co-ordinate location of pipe drops / risers with trades erecting walls and ceilings to ensure that all pipes are concealed in walls or ceilings spaces. If space is not available in walls or ceilings, locate pipes so that they can be easily boxed in by the relevant trades. Where pipes are shown rising in concrete block walls, placement of the pipe shall be done in conjunction with the erection of the wall.
- .4 The Mechanical Contractor shall meet regularly with the structural and other relevant trades during the production of coordination drawings to obtain physical dimension, access requirements and preferred location for the services.
- .5 In the event that conflicts arise, the Mechanical Contractor shall work with all other relevant Contractor(s) to ensure that the necessary adjustments are made so that all components fit in the space available with adequate clearance for servicing and removal. If after a thorough effort to fit equipment in a space and provide adequate space for servicing and removal, the Departmental Representative determines that additional space is required, he may request assistance to resolve the issue through the Construction Manager.
- .6 All adjustments or re-routing of the mechanical, electrical and sprinkler systems required to avoid conflict and provide adequate space for servicing and removal of equipment shall be made at the expense of the relevant trade contractor.
- .7 Prepare coordination drawings showing the routing of main ducts, piping mains. Main sprinkler pipe, electrical conduit runs, and sprinkler piping in critical areas shall be shown.
- .8 Rerouting of pipes and ducts to be reviewed by the Departmental Representative.

#### **1.19 ALTERNATES**

- .1 Wherever an item or class of material is specified exclusively by trade name of maker or by catalogue reference or under "Acceptable Materials", only such item shall be used.
- .2 The Mechanical Trade Contractor shall note that all layouts on the mechanical drawings are based on the specified equipment and any changes necessitated in

service connections, etc., will be done at the Mechanical Trade Contractor's expense. Furthermore, if it is found that the provisions made regarding space conditions are not met, the right is reserved by the Departmental Representative to require installation of the equipment used preparing the layout.

## 1.20 CUTTING AND PATCHING

- .1 Make every effort to minimize cutting and patching and provide dimensions, locations and other data for bases, sleeves, boxes, etc., to be built in as construction proceeds. Set sleeves and make openings in concrete forms and masonry before placing concrete and masonry.

## 1.21 PIPE TESTS

- .1 Notice of Tests: Give written notice for a minimum of four (4) working days prior to date when tests will be made.
- .2 Prior Tests: Concealed or insulated work shall remain uncovered until completely tested and approved, but if construction schedule requires, arrange for prior tests on parts of system as approved.
- .3 Acceptance Tests: Conduct in presence of the Departmental representative or representative of the Authorities Having Jurisdiction.
- .4 Costs: Bear all costs in connection with tests conducted.
- .5 Certificates: Obtain acceptance certificates from the authorities having jurisdiction. Work is not considered complete until certificates have been delivered to the Departmental Representative.
- .6 Water Systems: Fill with water and hydraulically test at 1½ times system operating pressure or at 689 kPa, whichever is greatest. Unless otherwise noted maintain test pressures without loss for a four (4) hour period. Use valves to isolate equipment not rated for this pressure. An air test is acceptable for metal piping systems.

## 1.22 SLEEVES AND ESCUTCHEONS

- .1 Sleeves:
  - .1 Unless otherwise specified, supply pipe sleeves for all points where pipe passes through masonry or concrete walls or floors, fire rated assemblies, and elsewhere as indicated. Sleeve shall be supplied by the Mechanical Sub-Contractor and built-in by the appropriate trade.
  - .2 Where concrete walls or floors are core drilled to accommodate pipe, sleeves are not required except where indicated in sub-paragraph 5 below.
  - .3 Unless otherwise specified, construct sleeve of galvanized sheet steel with lock seam joints of minimum 22 gauge.
  - .4 Use galvanized sch 10 steel pipe sleeves with perimeter fin continuously welded at mid point.
    - .1 Where sleeve extends above finished floor.



- .2 Pipe penetrations through concrete foundation walls shall be sealed using proprietary pre-manufactured, water-tight seals.
  - .1 Acceptable Products: Link-Seal, Metraflex.
- .5 In kitchens, washrooms, laboratories, and other wet areas where water from spills or leaks may penetrate the floor slab, extend sleeves 25 mm above the finished floor. This does not apply to concrete slabs on grade. In all other areas, sleeves shall be flush with the finished floor.
- .2 Sizes:
  - .1 Provide approximately 12 mm clearance, all around, between sleeve and pipes or between sleeve and insulation.
  - .2 Through footings, use sleeves large enough to accommodate hub of cast iron soil pipe (where applicable).
  - .3 Where piping passes below footings, provide minimum all round clearance of 50 mm between piping and sleeves. Backfill up to underside of footing with concrete of same strength as footing.
  - .4 Unless otherwise specified, terminate sleeves flush with walls and ceilings.
  - .5 Sleeves shall be sized to accommodate the insulated pipe diameter.
- .3 Unless otherwise indicated for pipes passing through roofs, use galvanized or cast iron sleeves with caulking recess and flashing clamp device. Anchor sleeves in roof construction; caulk between sleeve recess and pipe; fasten roof flashing to clamp device; make watertight durable joint.
- .4 Caulking:
  - .1 Where pipes pass through on grade concrete slab floors, caulk open spaces with non-hardening mastic.
  - .2 Ensure no contact between copper tube or pipe and ferrous sleeve.
- .5 Escutcheons and Plates:
  - .1 Provide on pipes passing through finished walls, partition floors and ceilings.
  - .2 Use chrome or nickel plated brass, either split or solid type, with set screws for ceiling or wall-mounted. For equipment room, use cast iron type.
  - .3 Inside diameter shall fit around finished pipe insulation or uninsulated pipe. Outside diameter shall cover sleeve.
  - .4 Where sleeve extends above finished floor, escutcheons or plates shall be bell shaped to cover the sleeve extension.
  - .5 Secure to pipe or sleeve but not to insulation.
- .6 Penetrations of Fire Separations:
  - .1 Where pipes pass through walls or floors which provide fire separations, seal around openings with ULC or cUL classified fire stop system. Material shall be installed to manufacturers' recommendations by factory trained installers and shall provide a fire rating equal to that of the separation which has been penetrated.

- .2 Departmental Representative reserves the opportunity for destructive testing of a sample of the installation in order to examine the thickness of sealant and installation of the backing material.
- .3 Refer to Section 07 84 00 - Fire Stopping.

### **1.23 DI-ELECTRIC UNIONS**

- .1 All connections between steel and copper or brass for pipe 2" and smaller shall be made of di-electric unions, except on all closed systems.

### **1.24 COMPLETION**

- .1 Nothing herein contained can be constructed to relieve the Trade from making good and perfect work in all usual details of construction and in accordance with best standard practice and in strict compliance with provisions of any and all laws and ordinances, and the rules and regulations of any duly constituted public body having jurisdiction over this work.
- .2 This Trade shall be held responsible to provide and furnish all necessary labour and to bear all expenses incidental to the satisfactory completion of the work.

### **1.25 RELATED WORK PERFORMED BY OTHERS**

- .1 Work of other trades not to be supported from mechanical equipment, pipes, ducts, conduits or their supports.

### **1.26 RELATED WORK PERFORMED BY THIS SECTION**

- .1 Work of each sub trade to be supported directly from structure independent of other sub trades unless prior approval obtained from Departmental Representative.

### **1.27 FIELD QUALITY CONTROL**

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in Submittal section above.
- .2 All work to be performed by qualified personal or with appropriate training and qualifications in the field in which they are engaged. Apprentices and labourers shall be under the continuous supervision of a qualified tradesperson.
- .3 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in Submittal section above.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

## **2 EXECUTION**

### **2.1 EXAMINATION**

- .1 Do not begin installation until substrates have been properly prepared.
- .2 Conduct tests according to manufacturer's written recommendations to verify that substrates are free of oil, grease, rolling compounds, incompatible primers, loose mill scale, dirt and other foreign substances capable of impairing bond of fire-stopping.
- .3 Verify that items penetrating fire rated assemblies are securely attached, including sleeves, supports, hangers, and clips.
- .4 Verify that openings and adjacent areas are not obstructed by construction that would interfere with installation of fire-stopping, including ducts, piping, equipment, and other suspended construction.
- .5 Verify that environmental conditions are safe and suitable for installation of fire-stopping.
- .6 If substrate preparation is the responsibility of another installer, notify Departmental Representative of unsatisfactory preparation before proceeding.

### **2.2 PREPARATION**

- .1 Prepare substrates in accordance with manufacturer's instructions and recommendations.
- .2 Install masking and temporary coverings as required to prevent contamination or defacement of adjacent surfaces due to fire-stopping installation.

### **2.3 INSTALLATION**

- .1 Install in strict accordance with manufacturer's detailed installation instructions and procedures.
- .2 Install so that openings are completely filled and material is securely adhered.
- .3 Where fire-stopping surface will be exposed to view, finish to a smooth, uniform surface flush with adjacent surfaces.
- .4 After installation is complete, remove combustible forming materials and accessories that are not part of the listed system.
- .5 Repair or replace defective installations in accordance with manufacturer's recommendations, listed systems details and applicable code requirements.

- .6 At each through penetration, attach identification labels on both sides in location where label will be visible to anyone seeking to remove penetrating items or fire-stopping.
- .7 Clean fire-stop materials off surfaces adjacent to openings as work progresses, using methods and cleaning materials approved in writing by fire-stop system manufacturer and which will not damage the surfaces being cleaned.
- .8 Notify Authority Having Jurisdiction (AHJ) when fire-stopping installation is ready for inspection; obtain advance approval of anticipated inspection dates and phasing, if any, required to allow subsequent construction to proceed.
- .9 Do not cover fire-stopping with other construction until approval of authority having jurisdiction has been received.

#### **2.4 FIELD QUALITY CONTROL**

- .1 Departmental Representative will engage an independent testing agency to inspect installed fire-stopping and to prepare reports indicating whether the installed work complies with the contract documents.
- .2 Notify testing agency at least 7 days prior to date when fire-stopping installation will be ready for inspection; obtain advance approval of general schedule and phasing, if any, required to allow subsequent construction to proceed.

#### **2.5 CLEANING AND PROTECTION**

- .1 Remove left over material and debris from Work area. Use necessary means to protect fire protection product(s) before, during, and after installation.
- .2 Touch-up, repair or replace damaged products before Substantial Completion.
- .3 Install identification Labels for Through Penetration: Pressure sensitive self-adhesive vinyl labels, preprinted with the following information:
  - .1 The words "Warning - Through Penetration Fire-stop System - Do not Disturb. Notify Building Management of Any Damage."
  - .2 Listing agency's system number or designation.
  - .3 System manufacturer's name, address, and phone number.
  - .4 Installer's name, address, and phone number.
  - .5 General contractor's name, address, and phone number (if applicable).
  - .6 Date of installation.

#### **2.6 FIRE-STOPPING**

- .1 The Contractor shall provide labeling for each through-the-wall or thru the floor penetration.
- .2 Installation shall be completed by qualified Tradesmen, properly trained by the manufacturer and in accordance with the product listing. In lieu of this, the Contractor shall engage the services of a qualified firm/company to complete the fire-stopping.

**3 PRODUCTS**

**3.1 NOT USED**

APPENDIX A

14-227

## SHOP DRAWINGS

### MECHANICAL CONTRACTOR'S REVIEW CONFIRMATION

The Shop Drawings Have Been Reviewed by the Mechanical Contractor and All  
Items Are In Conformance with the Plans and Specifications?  Yes  No

Are Specified Model Numbers and/or Options Indicated?  Yes  No

If No, Explain: \_\_\_\_\_

Confirmed by Contractor: \_\_\_\_\_

Print Name

Contractor's Signature: \_\_\_\_\_

Date: \_\_\_\_\_

Item: \_\_\_\_\_

Specification Section and Item Number: \_\_\_\_\_

Drawing Reference: \_\_\_\_\_

General Contractor: \_\_\_\_\_

Mechanical Contractor: \_\_\_\_\_

Mechanical Contractor's Project Representative: \_\_\_\_\_

Phone Number: \_\_\_\_\_ Fax Number: \_\_\_\_\_ E-mail: \_\_\_\_\_

**END OF SECTION**

## **1 General**

### **1.1 RELATED SECTIONS**

- .1 Section 21 05 01 – Common Work Results – Mechanical
- .2 Section 23 05 05 – Installation of Pipework
- .3 Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment
- .4 Section 23 05 53 – Mechanical Identification
- .5 Section 23 07 16 – Thermal Insulation for Piping
- .6 Section 23 08 02 – Cleaning and Startup of Mechanical Systems

### **1.2 REFERENCES**

- .1 Canadian Federal Legislation.
- .2 Canadian Environmental Protection Act (CEPA), 1988.
- .3 Canadian Environmental Assessment Act (CEAA), 1995.

### **1.3 EXISTING CONDITIONS AND DOCUMENTATION**

- .1 Demolition of spray or trowel-applied asbestos can be hazardous to health. Should material resembling spray or trowel-applied ASBESTOS be encountered in the course of demolition work, stop work and notify the Departmental Representative immediately. Do not proceed until written instructions have been received from the Departmental Representative.
- .2 Hazardous materials (if discovered) removal shall be treated as an additional expense; to be negotiated with the successful Contractor during the demolition phase of this project.
- .3 Drawings indicating the existing conditions are incomplete and have been provided for information and guidance purposes only. The actual extent and condition of components and systems shall be determined by the Contractor during the Tender period.

### **1.4 PROTECTION**

- .1 Protect all existing systems. Be responsible for any damage and make good.

### **1.5 SUMMARY OF WORK**

- .1 Remove, re-locate and/or reinstate existing Mechanical systems to facilitate the Mechanical scope of work described below.
- .2 Comply with the DFO's Waste Reduction Procedure.
- .3 Hazardous Materials shall be removed in accordance with Provincial and/or Federal regulations, standards and guidelines.

- .4 The Contractor is responsible to obtain and pay for all necessary permits and inspections as required by the specifications or local authorities to perform the Work.
- .5 The Contractor shall protect adjacent properties, vehicles and pedestrians. Provide all temporary works and protection for the complete scope including any associated fees.
- .6 The Contractor shall coordinate all work with the work of other trades on site.
- .7 The Contractor shall assume full responsibility for the protection and safe-keeping of all products that are stored on site.
- .8 Do all work in accordance with the requirements of the Halifax Regional Municipality (HRM) and the Province of Nova Scotia.
- .9 Do all work in accordance with the Fire Marshal's office.
- .10 Do all work in accordance with the Nova Scotia Department of Labour.
- .11 Do all work in accordance with the requirements set-forth by the local Nova Scotia Occupational Health & Safety.
- .12 All work must be coordinated with the requirements of the new construction which shall follow the completion of the demolition and disposal of redundant items. Work shall be completed as per Section 01 14 00 – Work Restrictions or as otherwise directed by the Departmental Representative.
- .13 Demolition and disposal shall consist of, but is not necessarily limited to, the items and systems identified in the Project scope of work.
- .14 In general, the Mechanical project scope of work involves the following:
  - .1 Demolition:
    - .1 Removal of all existing 'press-fit'® heating piping sizes 50 mm and smaller.
    - .2 Removal of all pipeline accessories, supports and/or hangers associated with the heating piping included in this work.
    - .3 Removal of all pneumatic control valves.
    - .4 Removal of all pneumatic tubing and associated controls components.
    - .5 Removal of all radiator and lockshield valves located in radiator cabinets.
  - .2 Installation:
    - .1 Installation of new Schedule 40 steel piping to match existing pipe sizes.
    - .2 Installation of new radiator and lockshief valves in radiator cabinets.



- .3 Installation of new pipeline accessories, supports and/or hangers in accordance with this specification and as indicated on mechanical drawings.
- .4 Installation of new DDC control valves to tie into existing building controls and room temperature sensors.
- .5 Provide system cleaning and start up as specified.
- .6 Provide water balancing services as specified.

## **2 PRODUCTS**

### **2.1 EQUIPMENT**

- .1 Equipment and heavy machinery used to meet or exceed all applicable emission requirements.
- .2 Leave machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.

## **3 EXECUTION**

### **3.1 PREPARATION**

- .1 Review and thoroughly inspect site with Departmental Representative to verify extent and location of items designated for removal and disposal, recycling and salvage.
- .2 Locate and protect utilities. Preserve active utilities traversing site in operating condition.
- .3 Notify and obtain approval of utility companies before starting demolition.

### **3.2 DEMOLITION – GENERAL**

- .1 Take care not to damage or alter existing services that are to remain.
- .2 At end of each day's work, leave work in safe and stable condition. Protect parts not to be demolished at all times.
- .3 Demolish to minimize dusting.
- .4 Remove and dispose of demolished materials except where noted otherwise and in accordance with the Authorities Having Jurisdiction (AHJ).
- .5 Workers shall have clean hands while working around existing finishes and where clean white cotton gloves when handling existing finishes and building components to prevent soiling or staining of existing finishes.

- .6 Protect flooring under the work with plastic sheeting. Damaged flooring to be patched and repaired to match existing conditions.
- .7 Materials cannot be left on the grounds or within the Buildings. All Contractors and their materials must be accounted for daily. Co-ordinate materials storage on-site. All materials shall be secured.
- .8 See also Section 21 05 01.

### **3.3 SEQUENCES OF OPERATION**

- .1 Schedule demolition to create the least amount of disturbance. Co-ordinate timing of work with the Departmental representative.
- .2 Any equipment, components, etc. deemed salvageable will be removed prior to the demolition.
- .3 Ensure that all debris is immediately taken away and all access and firefighting lanes and parking areas must be kept clear at all times.
- .4 Contractor to ensure all Mechanical systems, (i.e. ductwork, piping, etc.) are all disconnected, and that systems disconnected are not associated with the operational portion of the facility.
- .5 Remove the existing units made redundant by this work.
- .6 Disposal of Material:
  - .1 Dispose of materials not designated for salvage or reuse off site at authorized facilities and in accordance with the requirements of the Nova Scotia Department of Environment and Labour.
  - .2 Do not stockpile debris on site, remove from site immediately.

### **3.4 RESTORATION**

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

### **3.5 CLEANUP**

- .1 Upon completion of work, remove debris, trim surfaces and leave work site clean.
- .2 Use only cleaning solutions and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

### **3.6 EXISTING PIPING AND EQUIPMENT**

- .1 Remove all piping and equipment as indicated on the Drawings in accordance with the AHJ and Provincial Regulations.

**END OF SECTION**

**1 General**

**1.1 RELATED SECTIONS**

.1 Section 21 05 01 – Common Work Results – Mechanical.

**1.2 USE OF SYSTEMS**

.1 Use of new and or existing permanent heating and or ventilating systems for supplying temporary heat or ventilation is **not permitted**.

.2 Exhaust systems are not included in approvals for temporary heating ventilation.

**2 Products**

**2.1 NOT USED**

.1 Not Used.

**3 Execution**

**3.1 NOT USED**

.1 Not Used.

**END OF SECTION**

## 1 General

### 1.1 SCOPE OF WORK

- .1 Provide all piping to the building as shown on plans and described in the specification.
- .2 Trim pipe lengths left in previous contract as necessary to connect piping and equipment installed in this contract. Provide all flanges, welds, and/or material to make these connections.

### 1.2 RELATED SECTIONS

- .1 Section 21 05 01 – Common Work Results – Mechanical
- .2 Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment
- .3 Section 23 05 53 – Mechanical Identification
- .4 Section 23 07 15 – Thermal Insulation for Piping
- .5 Section 23 08 02 – Cleaning and Startup of Mechanical Systems

### 1.3 REFERENCES

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .2 Green Seal Environmental Standards (GSES)
  - .2 Standard GS-11-2008, 2nd Edition, Environmental Standard for Paints and Coatings.

## 2 Products

### 2.1 MATERIAL

- .1 Pipe material as per the following table

Service	Sizes	Material	Specification Section
Heating			
Above Ground Heating Water	under 200 mm	Steel - SCH 40	23 21 13

- .2 Sealants: in accordance with Section 07 92 00 - Joint Sealants.
  - .1 Sealants: maximum VOC limit to SCAQMD Rule 1168 and to GSES GS-36.
- .3 Sealants: maximum VOC limit to SCAQMD Rule 1168 and to GSES GS-36.

.4 Adhesives: maximum VOC limit to SCAQMD Rule 1168 and to GSES GS-36.

### **3 Execution**

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

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

#### **3.2 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 required by relevant codes.

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer and as indicated 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 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 at high points in piping systems.

.2 Install isolating valve at each automatic air valve.

#### **3.6 DIELECTRIC CONNECTIONS**

.1 General: compatible with system, to suit pressure rating of system.

.2 Use brass fittings (eg valves, strainers) to join dissimilar metals on closed systems.

- .3 Use dielectric unions to join dissimilar metals on open systems (ie domestic water) 50 mm and smaller.
- .4 Where dielectric connections are concealed, provide access through access doors or removable ceiling tiles.

### 3.7 PIPEWORK INSTALLATION

- .1 Screwed fittings jointed with Teflon tape.
- .2 Cover open ends of pipe to protect openings against entry of foreign material.
- .3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .4 Assemble piping using fittings manufactured to ANSI standards.
- .5 Install exposed piping, equipment, etc parallel or perpendicular to building lines.
- .6 Install concealed pipework to minimize furring space, maximize headroom, and conserve space.
- .7 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .8 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .9 Group piping wherever possible and as indicated.
- .10 Ream pipes and remove scale and other foreign material before assembly.
- .11 Use concentric reducers at pipe size changes unless shown differently on contract drawings.
- .12 Provide for thermal expansion as indicated.
- .13 Valves:
  - .1 Install in accessible locations.
  - .2 Remove interior parts before soldering.
  - .3 Install with stems above horizontal position unless indicated.
  - .4 Valves accessible for maintenance without removing adjacent piping.
  - .5 Install globe valves in bypass around control valves.
  - .6 Use gate or ball valves at branch take-offs for isolating purposes except where specified.
- .14 Check Valves:
  - .1 Install silent check valves on discharge of pumps and in vertical pipes with downward flow and as indicated.
  - .2 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 elsewhere as indicated.
- .2 Pipe sleeves shall be SCH 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, and 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, 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 Uninsulated unheated pipes not subject to movement: no special preparation.
- .3 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit pipe movement without damaging firestopping material or installation.



- .4 Insulated pipes and ducts: ensure integrity of insulation and vapour barriers.

### 3.11 FLUSHING OUT OF PIPING SYSTEMS

- .1 Flush system in accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.
- .2 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 11 - Cleaning supplemented as specified in relevant mechanical sections.
- .3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

### 3.12 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

- .1 Advise Departmental Representative 72 hours minimum prior to performance of pressure tests.
- .2 Pressure test pipework according to following table:

Service	Minimum Pressure	Test Length
Hot Water Heating	860 kPa or 150% of maximum system pressure	4 hours

- .3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant mechanical sections.
- .4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.
- .5 Conduct tests in presence of Departmental Representative or approved third party.
- .6 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.
- .7 Insulate or conceal work only after approval and certification of tests by Departmental Representative.
- .8 Record test results and provide copy to 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.

**END OF SECTION**

## **1 General**

### **1.1 RELATED SECTIONS**

- .1 Section 21 05 01 – Common Work Results – Mechanical
- .2 Section 23 05 05 – Installation of Pipework.
- .3 Section 23 05 53.01 – Mechanical Identification.

### **1.2 REFERENCES**

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

### **1.3 SUBMITTALS**

- .1 Provide Shop Drawing and Maintenance Manual submittals in accordance with Section 01 33 00 - Submittal Procedures and Section 21 05 01 – Common Work Results - Mechanical.

## **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 grooved 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 Globe Valves:
  - .1 Requirements common to globe valves, unless specified otherwise:
    - .1 Standard specification: MSS SP-80.
    - .2 Bonnet: union with hexagonal shoulders.
    - .3 Connections: screwed with hexagonal shoulders.
    - .4 Pressure testing: to MSS SP-80. Tests to be hydrostatic.
    - .5 Stuffing box: threaded to bonnet with gland follower, packing nut, high grade non-asbestos packing.
    - .6 Handwheel: non-ferrous.
    - .7 Handwheel Nut: bronze to ASTM B62.
  
  - .2 NPS 2 and under, composition disc, Class 150:
    - .1 Body and bonnet: union bonnet.
    - .2 Disc and seat: renewable rotating PTFE disc in easily removable disc holder, regrindable bronze seat, loosely secured to bronze stem to ASTM B505.
    - .3 Operator: handwheel or lockshield, as applicable.
  
  - .3 NPS 2 and under, plug disc, Class 150, screwed ends:
    - .1 Body and bonnet: union bonnet.
    - .2 Disc and seat ring: tapered plug type with disc stem ring of AISI S420 stainless steel to ASTM A276, loosely secured to stem.
    - .3 Operator: handwheel.
  
- .5 Ball Valves:
  - .1 NPS 2 and under:
    - .1 Body and cap: cast high tensile bronze to ASTM B62.
    - .2 Pressure rating: Class 125 4140-kPa CWP, 860 kPa steam.
    - .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 Acceptable Materials: Apollo, Crane, Jenkins, Nibco, Kitz, Victaulic, Milwaukee Valve Company.

### **3 Execution**

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

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

#### **3.2 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.

**END OF SECTION**

## **1 General**

### **1.1 RELATED SECTIONS**

- .1 Section 21 05 01 – Common Work Results - Mechanical.
- .2 Section 23 05 05 – Installation of Pipework.

### **1.2 REFERENCES**

- .1 American Society of Mechanical Engineers (ASME)
  - .1 ASME B31.1, Power Piping.
- .2 ASTM International
  - .1 ASTM A125, Standard Specification for Steel Springs, Helical, Heat-Treated.
  - .2 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .3 ASTM A563, Standard Specification for Carbon and Alloy Steel Nuts.
- .3 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
  - .1 MSS SP58, Pipe Hangers and Supports - Materials, Design and Manufacture.
  - .2 MSS SP69, Pipe Hangers and Supports - Selection and Application.
  - .3 MSS SP89, Pipe Hangers and Supports - Fabrication and Installation Practices.
- .4 Underwriter's Laboratories of Canada (ULC)

### **1.3 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures and Section 21 05 01 – Common Work Results - Mechanical

## **2 Products**

### **2.1 SYSTEM DESCRIPTION**

- .1 Design Requirements:
  - .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
  - .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 and MSS SP58.
  - .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
  - .4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

- .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.

## 2.2 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP58.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

## 2.3 PIPE HANGERS

- .1 Finishes:
  - .1 Pipe hangers and supports: galvanized painted with zinc-rich paint after manufacture but before installation.
  - .2 Ensure steel hangers in contact with copper piping are copper plated or epoxy coated.
  - .3 Apply to hangers, supports and equipment fabricated from ferrous metals at least one (1) coat of corrosion resistant paint before shipment to job site. Touch-up damaged finish surfaces to satisfaction of Departmental Representative.
- .2 Upper attachment structural: suspension from lower flange of I-Beam:
  - .1 Hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers,[UL listed FM approved to MSS-SP58 and MSS-SP69.
    - .1 Acceptable Materials: Myatt Fig. 514; Grinnell Fig. 131, Hunt.
- .3 Upper attachment structural: suspension from upper flange of I-Beam:
  - .1 Hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed FM approved.
    - .1 Acceptable Materials: Myatt Fig. 506; Grinnell Fig. 267, Hunt
- .4 Upper attachment to concrete:
  - .1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.
  - .2 Concrete inserts: wedge shaped body with knockout protector plate UL listed FM approved to MSS SP69.
- .5 Hanger rods: threaded rod material to MSS SP58:
  - .1 Ensure that hanger rods are subject to tensile loading only.
  - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
- .6 Pipe attachments: material to MSS SP58:
  - .1 Attachments for steel piping: carbon black steel
    - .1 Standard of Acceptance: Myatt Fig 12.

- .7 Adjustable clevis: material to MSS SP69 UL listed FM approved, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
- .8 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563.
  - .1 Finishes for steel pipework: (black) (galvanized).
  - .2 Finishes for copper, glass, brass or aluminum pipework: epoxy coated.
- .9 Wall brackets: carbon steel prime coated.
  - .1 Acceptable Materials: Myatt Fig. 321; Grinnell Fig. 195, Anvil, Taylor, Hunt, Cooper B-Line, Hunt; Anvil.
- .12 Acceptable Materials: Anvil, Bibby, Grinnell, Hunt, Myatt

## 2.4 RISER CLAMPS

- .1 Steel or cast iron pipe: galvanized carbon steel to MSS SP58, type 42, ULC listed.
  - .1 Acceptable Materials: Anvil Fig. 261, Hunt; Myatt; Grinnell
- .2 Copper pipe: carbon steel copper or epoxy plated to MSS SP58, type 42.
  - .1 Acceptable Materials: Anvil Fig. CT-121, Hunt; Myatt, Grinnell
- .3 Cold Water pipe: For pipes with liquids below 20 deg C use pre-insulated riser clamps.
  - .1 Acceptable Materials: Bergen, Pipe Shields Piping Technology and Products, Tolco Fig 6F
- .4 Bolts: to ASTM A307, Nuts: to ASTM A563.

## 3 Execution

### 3.1 MANUFACTURER'S INSTRUCTIONS

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

### 3.2 INSTALLATION

- .1 All pipes shall be hung securely from structure.
- .2 Clamps on riser piping:
  - .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
  - .2 Bolt-tightening torques to industry standards.
  - .3 Steel pipes: install below coupling or shear lugs welded to pipe.
  - .4 Cast iron pipes: install below joint.
- .3 Clevis plates:
  - .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.



- .4 Use approved constant support type hangers where:
  - .1 Vertical movement of pipework is 13 mm or more,
  - .2 Transfer of load to adjacent hangers or connected equipment is not permitted.
- .5 Use variable support spring hangers where:
  - .1 Transfer of load to adjacent piping or to connected equipment is not critical.
  - .2 Variation in supporting effect does not exceed 25 % of total load.

### 3.3 HANGER SPACING (HORIZONTAL)

- .1 Cast Iron pipe: At or adjacent to each hub or joint, at 3050 mm. and at 900 mm. if the pipe has mechanical joints and the length of pipe between adjacent fittings is 300 mm or less.
- .2 Provide support within 300 mm of each elbow
- .3 Flexible joint roll groove pipe: in accordance with table below for steel, but not less than one hanger at joints. Table listings for straight runs without concentrated loads and where full linear movement is not required.

Maximum Pipe Size (mm)	Hanger Rod Dia (mm)	Pipe Hanger Maximum Spacing (mm)	
		Steel	Copper
Up to 12	10	1800	1500
19 to 32	10	2100	1825
38	10	2750	2450
50	10	3050	2750

### 3.4 HANGER SPACING (VERTICAL)

- .1 Support metallic vertical piping at every other floor or 7600 mm intervals unless noted otherwise below.

### 3.5 HANGER INSTALLATION

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.
- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

### 3.6 HORIZONTAL MOVEMENT

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.
- .2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

### **3.7 FINAL ADJUSTMENT**

- .1 Adjust hangers and supports:
  - .1 Ensure that rod is vertical under operating conditions.
  - .2 Equalize loads.
- .2 Adjustable clevis:
  - .1 Tighten hanger load nut securely to ensure proper hanger performance.
  - .2 Tighten upper nut after adjustment.
- .3 C-clamps:
  - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps:
  - .1 Hammer jaw firmly against underside of beam.

**END OF SECTION**

## **1 General**

### **1.1 RELATED SECTIONS**

- .1 Section 21 05 01 – Common Work Results – Mechanical.
- .2 Section 25 05 54 – EMCS Identification.

### **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, Interior Alkyd Gloss Enamel.
  - .2 CAN/CGSB-24.3, Identification of Piping Systems.
- .3 Canadian Standards Association (CSA)
  - .1 CSA B128.1 – Non Potable Water Systems.

### **1.3 SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures and Section 21 05 01 Common Work Results – Mechanical.
- .2 Provide list of abbreviations for pipe and duct labeling in shop drawing submittal.
- .3 Provide pipe banding colour in shop drawing submittal.
- .4 Submit valve tag list for review prior to installing tags.

## **2 Products**

### **2.1 EXISTING IDENTIFICATION SYSTEMS**

- .1 Apply existing identification system to new work.
- .2 Before starting work, submit identification system for review.

### **2.2 NAMEPLATE CONSTRUCTION**

- .1 Lamicoid
  - .1 3 mm thick laminated plastic matte finish, with square corners, letters accurately aligned and machine engraved into core.
  - .2 Use maximum of 25 letters/numbers per line.
- .2 Brass Tags

- .1 Brass tags to be made of 18 ga brass.
- .2 Tags to be round or rectangular with rounded corners.
- .3 Attach to valves / equipment with chain.

## 2.3 PIPING SYSTEMS

- .1 Identify contents by background colour marking, stencils, and/or pictogram (as necessary) showing name and service including temperature and pressure and direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.
- .2 Where background colour marking does not cover full circumference of pipe provide full circumference banding at both ends of identifier.
- .3 Background colour to be full length of pipe identifier.
- .4 Identification of pipe to include Pictograms where required, to Workplace Hazardous Materials Information System (WHMIS) regulations.
- .5 Use block capital letters 50 mm high for pipes of 75 mm nominal and larger o.d. including insulation and not less than 19 mm high for smaller diameters..
- .6 Arrows showing direction of flow:
  - .1 OD of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.
  - .2 OD of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.
  - .3 Use double-headed arrows where flow is reversible.
  - .4 Pre-manufactured banding incorporating arrows is acceptable.
- .7 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.
  - .3 Waterproof and Heat Resistant Pressure Sensitive Plastic Marker Tags: for pipes and tubing 19 mm nominal and smaller.
  - .4 Acceptable Materials: SMS Coilmark, W.H. Brady Inc., Seton Name Plate Corp.,
- .8 Colours and Legends:
  - .1 All pipes to be identified. Where not listed, obtain direction from Departmental Representative.
  - .2 Colours for legends, arrows: to following table:

Background Colour	Text and Arrows
Yellow	Black

.3 Background colour marking and legends for piping systems:

Contents	Banding	Background colour marking	Legend
Heating			
Hot water heating supply	Black/Yellow	Yellow	HEATING SUPPLY
Hot water heating return	Black/Yellow	Yellow	HEATING RETURN

.9 Exposed Ceilings Painted Black

- .1 Pipe identification to be consist of a grey band at each end of the identification, grey directional arrows, and the service written in grey.

**2.4 VALVES**

- .1 Brass tags with 12 mm stamped identification data filled with black paint or coordinated with base colour to ensure strong contrast.
- .2 Valves to be identified using the same system as exists.
- .3 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.
- .4 Where new valves replace valves being removed the same identifier can be used.

**2.5 CONTROLS COMPONENTS IDENTIFICATION**

- .1 In addition to other identification specified in this section the following requirements apply.
- .1 Identify all control valves with plastic encased cards attached with a chain. Lettering on card to be a minimum of 4 mm high and to include the EMCS point name, point address and failsafe position (if applicable).
- .2 EMCS cabinet associated with these devices to include a list of all device point name and point address for each device.
- .3 Room temperature sensors to have identification specified above attached with adhesive.
- .2 Wiring
- .1 Provide numbered tape markings on wiring at panels, junction boxes, and devices.
- .2 Use colour coded wiring throughout.
- .3 Power wiring: identify circuit breaker panel/circuit breaker number inside each EMCS panel.
- .4 Control system wiring conduit to be identified by painting couplings White.

- .5 Pull and Junction Boxes
  - .1 Coloured inside and out white.
  - .2 Ensure a clearly defined diagonal line from corner to corner of box cover plate separated the two (2) colors.
  - .3 Apply coloring prior to installation.

## 2.6 CEILING MOUNTED EQUIPMENT

- .1 Where valves and control devices are installed above accessible ceilings, identification in accordance with the tables below. Underceiling identification shall be installed on the ceiling T-Bar spline or Access door frame directly below the access to the equipment. Vinyl adhesive discs shall be 19 mm diameter, white or black center disc (if necessary) to be 6 mm diameter. Letters on underceiling lamicooids to be 6 mm high unless noted otherwise. Letters on equipment lamicooids to be 12 mm high unless noted otherwise. In no case shall a valve or box be installed in a ceiling space that is not considered accessible unless a proper access hatch is provided by the appropriate Trade Contractor.
- .2 Where multiple similar devices are accessed through the same tile or access door only one (1) adhesive disc of each color is needed. If the device is identified with a lamicooid but no unique number only one (1) lamicooid is required stating the device and the quantity (ie 3 Fire Dampers)
- .3 Provide framed legend of colour coding used and mount in the main Mechanical Room. Include a copy of legend in each of the Operation and Maintenance Manuals.
- .4 Underceiling Identification Table

Service	Identification
Heating System Valves	Yellow Adhesive Disc with Black center
EMCS / Control Devices	Red Adhesive Disc with White center
EMCS System Transformers	White lamicooid, Black letters with unit identifier (eg EMCS Transformer)

- .5 Ceiling Mounted Equipment Identification Table

Service	Identification
Heating System Valves	Valve Tags
EMCS Devices	See Control System Identification Section above
EMCS System Transformer	White lamicooid, Black letters with unit identifier (eg EMCS Transformer ### V – ## V)

- .6 Lamicooid plates to be attached to splines, access door frames, and equipment with two (2) rivets each.

## 2.7 EQUIPMENT IN CABINETS and CONCEALED BEHIND WALLS

- .1 All EMCS panels to be identified on door.
- .2 Lamicoids to be mechanically fastened to access doors / panels. Tags to be attached to valves equipment with chains or rivets.
- .3 Access door / panel identification letters to be 6 mm high unless noted otherwise.
- .4 Equipment label letters to be 12 mm high unless noted otherwise.
- .5 Where multiple devices such as fire dampers or valves that do not require unique identification are behind an access door / panel a single identifier may be used on the access point. Each device, however, must be labeled.

- .6 Access door / Panel Identification

Service	Identification
EMCS Panels	White lamicoid, Black letters, 6 mm high

## 2.8 LANGUAGE

- 1. Identification to be in English.

## 3 Execution

### 3.1 MANUFACTURER'S INSTRUCTIONS

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

### 3.2 TIMING

- .1 Provide identification only after painting specified in 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 and/or CSA registration plates as required by the respective agency.
- .3 Identify all equipment and piping.

### 3.4 EXISTING PANELS and IDENTIFICATION

- .1 Correct existing nameplates and legends to reflect changes made during Work.

### 3.5 NAMEPLATES

- .1 Install in conspicuous location to facilitate easy reading and identification from operating floor.
- .2 Do not paint, insulate or cover.

### 3.6 LOCATION OF IDENTIFICATION ON PIPING

- .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.
- .10 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.
- .11 Maximum distance between non potable pipe identification to be 1500 mm.

### 3.7 VALVES, CONTROLLERS

- .1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.
- .2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by the Departmental Representative. Provide one copy (reduced in size if required) in each operating and maintenance manual.



.3 Number valves in each system consecutively.

**END OF SECTION**

## **1 General**

### **1.1 RELATED SECTIONS**

- .1 Section 21 05 01 – Common Work Results, Mechanical.

### **1.2 QUALIFICATIONS OF TAB PERSONNEL**

- .1 Submit names of TAB sub contractor to Departmental Representative within thirty (30) days of award of contract.
- .2 Provide documentation confirming qualifications, successful experience.
- .3 TAB Contractor shall submit list of projects completed within the last five (5) years.
- .4 TAB: performed in accordance with the requirements of industry standards, such as:
  - .1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2002.
  - .2 National Environmental Balancing Bureau (NEBB), TABB Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems.
  - .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing.
  - .4 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) – HVAC Applications: Testing, Adjusting and Balancing.
- .5 Recommendations and suggested practices contained in the TAB Standard: mandatory.
- .6 Quality assurance: Perform TAB under direction of supervisor qualified by AABC or NEBB
- .7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.
- .8 Acceptable Contractors: Scan Air, Scotia Air Balance 1996 Ltd., Griffin Air Balance, Systems Balance 2006 Ltd., Barrington Air Balance, Source Management Ltd..

### **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, where interlocked with other systems, in unison with those systems.

#### **1.6 PRE-TAB REVIEW**

- .1 Review contract documents before project construction is started and confirm in writing to Departmental Representative adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.
- .2 Review specified standards and report to Departmental Representative in writing proposed procedures which vary from standard.
- .3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

#### **1.7 START-UP**

- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
- .2 Follow special start-up procedures specified elsewhere in Division 23.

#### **1.8 OPERATION OF SYSTEMS DURING TAB**

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

#### **1.9 START OF TAB**

- .1 Notify Owner's Representative 7 days prior to start of TAB.
- .2 Start TAB when system is essentially completed including:

- .1 Pressure, leakage, other tests specified elsewhere Division 23.
- .2 Provisions for TAB installed and operational.
- .3 Start-up, verification for proper, normal / safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
  - .1 Liquid systems:
    - .1 Flushed, filled, vented.
    - .2 Correct pump rotation.
    - .3 Strainers in place, baskets clean.
    - .4 Isolating and balancing valves installed, open.
    - .5 Calibrated balancing valves installed, at factory settings.
    - .6 Chemical treatment systems complete, operational.

#### **1.10 APPLICATION TOLERANCES**

- .1 Do TAB to following tolerances of design values plus or minus 5%.

#### **1.11 ACCURACY TOLERANCES**

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

#### **1.12 INSTRUMENTS**

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

#### **1.13 SUBMITTALS**

- .1 Submit to Departmental Representative, prior to commencement of TAB:
  - .1 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 Format in accordance with AABC and/or NEBB.

- .2 TAB report to show results in SI units and include:
  - .1 Project record drawings.
  - .2 System schematics.
- .3 Submit three (3) copies of TAB Report to Departmental Representative for verification and approval, in \*.pdf format, in English, and be indexed.

#### **1.16 VERIFICATION**

- .1 Reported results subject to verification by Departmental Representative.
- .2 Provide manpower and instrumentation to verify up to 10 % of reported results.
- .3 Number and location of verified results to be at discretion of the Departmental Representative.
- .4 Bear 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.

#### **1.19 Hydronic Systems**

- .1 Definitions: for purposes of this section, to include low pressure and high pressure hot water heating, chilled water, condenser water, glycol systems.
- .2 Standard: TAB to be to most stringent of TAB standards of AABC, NEBB, SMACNA or ASHRAE.
- .3 TAB of all systems, equipment, components and controls specified.
- .4 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: Flow rate, static pressure, pressure drop (or loss), temperature, specific gravity, density, RPM, amps, electrical power and voltage.
- .5 Locations of equipment measurement: To include, but not be limited to, following as appropriate:

- .1 Inlet and outlet of each heat exchanger (primary and secondary sides), coils, humidifier, pumps, PRV, control valve, other equipment causing changes in conditions.
- .2 At each controller and controlled device.
- .6 Locations of systems measurements to include, but not be limited to, following as appropriate: Supply and return of each primary and secondary loop (main, main branch, branch, sub-branch of all hydronic systems, inlet connection of make-up water.
- .7 Voltage and current measurements for motors to be reported for each phase for three (3) phase systems.
- .8 Permanently mark the settings of all balancing valves with a permanent ink marker.

**1.20 POST-OCCUPANCY TAB**

- .1 Participate in systems checks twice during Warranty Period - #1 approximately three (3) months after acceptance and #2 within one (1) month of termination of Warranty Period.

**2 Products**

**2.1 NOT USED**

**3 Execution**

**3.1 NOT USED**

**END OF SECTION**

## **1 General**

### **1.1 RELATED SECTIONS**

- .1 Section 21 05 01 – Common Work Results – Mechanical.
- .2 Section 23 05 05 – Installation of Pipework.

### **1.2 REFERENCES**

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
  - .1 ASHRAE Standard 90.1, 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, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate.
  - .2 ASTM C335, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
  - .3 ASTM C411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
  - .4 ASTM C449/C449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
  - .5 ASTM C533, Calcium Silicate Block and Pipe Thermal Insulation.
  - .6 ASTM C547, Mineral Fiber Pipe Insulation.
  - .7 ASTM C795, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
  - .8 ASTM C921, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB)
  - .1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
  - .2 CAN/CGSB-51.53, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts
- .4 Thermal Insulation Association of Canada (TIAC) National Insulation Standards.
- .5 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.
  - .2 CAN/ULC-S701, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
  - .3 CAN/ULC-S702, Thermal Insulation, Mineral Fibre, for Buildings
  - .4 CAN/ULC-S702.2, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

### 1.3 SUBMITTALS

- .1 Provide Shop Drawing and Maintenance Manual submittals in accordance with Section 01 33 00 - Submittal Procedures and section 21 05 01 – Common Work Results – Mechanical.

### 1.4 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.
  - .3 RUN-OUT(s) – piping, not exceeding 4000 mm long, to individual equipment
- .2 TIAC codes:
  - .1 CRF: Code Rectangular Finish.
  - .2 CPF: Code Piping Finish..

### 1.5 ACCEPTABLE PIPE INSULATION CONTRACTORS

- .1 Guilfords (2000) Inc., Insul-Energy, Scotia Insulations Ltd, Twin City Insulation, Zink's Mechanical Insulation, Pro-Insul Ltd.; Insul-Energy Ltd.

## 2 Products

### 2.1 FIRE AND SMOKE RATING

- .1 Maximum flame spread rating: 25.
- .2 Maximum smoke developed rating: 50.

### 2.2 INSULATION

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



## **2.3 INSULATION SECUREMENT**

- .1 Tape: self-adhesive, aluminum, 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 Hydraulic setting or 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 Canvas:
  - .1 220 and 120 gm/m<sup>2</sup> cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
  - .2 Lagging adhesive: compatible with insulation.

## **2.8 MINERAL FIBRE INSULATION**

- .1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.
- .2 Pipe insulation will be preformed fibre with a nominal density of 5.5 lb/cu ft.

## **2.9 ACCEPTABLE MATERIALS**

- .1 Fiberglass Insulation supported by the following manufacturers are acceptable:
  - .1 Bakor; Owens Corning Canada LP; Johns Manville; Knauf Insulation

## **3 Execution**

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

- .1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.
- .2 Install in accordance with TIAC National Standards.

### **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 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES**

- .1 Application: at expansion joints, valves, primary flow measuring elements, strainers, flanges, and unions at equipment.
- .2 Design: to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.
- .3 Insulation:
  - .1 Insulation, fastenings and finishes: same as system.
  - .2 Jacket: high temperature fabric.
- .4 Finishes:
  - .1 Exposed indoors: PVC jacket.
  - .2 Exposed in mechanical rooms: PVC jacket where the temperature is less than 65°C.
  - .3 Concealed, indoors: insulation jacketed with PVC or removable blanket on valves, fittings. No further finish.
  - .4 Finish attachments: SS bands, at 150 mm.
  - .5 Installation: To appropriate TIAC code CRF/1 through CPF

### **3.4 CLEANING**

- .1 Insulation sub-contractor to remove all garbage relating to the installation of their product from site including, but not limited to insulation scraps, tape backing, scraps of jackets, material containers, etc.
- .2 Insulation sub-contractor to coordinate with the appropriate trade contractor to have splatter of lagging cleaned from other surfaces including but not limited to equipment, pipe, duct, walls, structure, and floor.
- .3 Insulation sub-contractor to coordinate with the appropriate trade contractor to repair or replace equipment damaged by splatter of lagging or the cleaning of the splatter.

- .4 The final cleanup described in this section shall constitute no less than 10% of the progress billing for this sub-contractor.

**3.5 PIPING INSULATION SCHEDULES**

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 TIAC Code: A-1.
  - .1 Securements: SS bands at 300 mm on centre.
  - .2 Seals: lap seal adhesive, lagging adhesive.
  - .3 Installation: TIAC Code 1501-H.
- .3 Thickness of insulation as listed in following table.

Application	Temp deg C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)					
			Run out	to 1	1 ¼ to 2	2 ½ to 4	5 to 6	8 & over
Hot Water Heating	60 - 94	A-1	25	38	38	38	38	38
Hot Water Heating	< 59	A-1	25	25	25	25	38	38

**END OF SECTION**

## **1 General**

### **1.1 RELATED SECTIONS**

- .1 Section 21 05 01 – Common Work Results – Mechanical
- .2 Section 21 05 01 – Common Work Results – Mechanical
- .3 Section 23 05 93 – Testing, Adjusting and Balancing for HVAC
- .4 Section 23 08 01 – Performance Verification – Mechanical Piping Systems

### **1.2 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM E202-00, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

## **2 Products**

### **2.1 CLEANING SOLUTIONS**

- .1 Tri-sodium phosphate: 0.40 kg per 100 L water in system.
- .2 Sodium carbonate: 0.40 kg per 100 L water in system.
- .3 Low-foaming detergent: 0.01 kg per 100 L water in system.

## **3 Execution**

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

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

### **3.2 CLEANING HYDRONIC SYSTEMS**

- .1 Timing: systems operational, hydrostatically tested and with safety devices functional, before cleaning is carried out.
- .2 Cleaning Agency:
  - .1 Retain qualified water treatment specialist to perform system cleaning.
- .3 Install instrumentation such as flow meters, orifice plates, pitot tubes, flow metering valves only after cleaning is certified as complete by water treatment specialist.
- .4 Cleaning procedures:

- .1 Provide detailed report outlining proposed cleaning procedures at least 4 weeks prior to proposed starting date. Report to include:
  - .1 Cleaning procedures, flow rates, elapsed time.
  - .2 Chemicals and concentrations used.
  - .3 Inhibitors and concentrations.
  - .4 Specific requirements for completion of work.
  - .5 Special precautions for protecting piping system materials and components.
  - .6 Complete analysis of water used to ensure water will not damage systems or equipment.
- .5 Conditions at time of cleaning of systems:
  - .1 Systems: free from construction debris, dirt and other foreign material.
  - .2 Control valves: operational, fully open to ensure that terminal units can be cleaned properly.
  - .3 Strainers: clean prior to initial fill.
  - .4 Install temporary filters on pumps not equipped with permanent filters.
  - .5 Install pressure gauges on strainers to detect plugging.
- .6 Report on Completion of Cleaning:
  - .1 When cleaning is completed, submit report, complete with certificate of compliance with specifications of cleaning component supplier.
- .7 Hydronic Systems:
  - .1 System shall be flushed with water to remove loose scale and dirt. Remove and clean strainers.
  - .2 Fill system with water, ensure air is vented from system.
  - .3 Fill expansion tanks 1/3 to 1/2 full, charge system with compressed air to at least 35 kPa (does not apply to diaphragm type expansion tanks).
  - .4 Use water metre to record volume of water in system to +/- 0.5%.
  - .5 Add chemicals under direct supervision of chemical treatment supplier.
  - .6 Closed loop systems: circulate system cleaner at 60 degrees C for at least 36 hours. Drain as quickly as possible. Ensure low points are drained Refill with water and inhibitors. Test concentrations and adjust to recommended levels.
  - .7 Completely drain the system again. Ensure low points are drained.
  - .8 Refill the system with water. Add corrosion inhibitor to system
  - .9 Add chemical solution to system.
  - .10 Establish circulation, raise temperature slowly to maximum design or eighty two degrees (82 °) C minimum. Circulate for 12 hours, ensuring flow in all circuits. Remove heat and continue to circulate until temperature is below thirty eight degrees (38 °) C. Drain as quickly as possible.
  - .11 Flush velocity in system mains and branches to be adequate so as to ensure removal of debris. System pumps may be used for circulating cleaning solution provided that velocities are adequate..

### 3.3 START-UP OF HYDRONIC SYSTEMS

- .1 After cleaning is completed and system is filled:
  - .1 Establish circulation and expansion tank level, set pressure controls.

- .2 Ensure air is removed.
- .3 Check pumps to be free from air, debris, possibility of cavitation when system is at design temperature.
- .4 Dismantle system pumps used for cleaning, inspect, replace worn parts, install new gaskets and new set of seals.
- .5 Clean out strainers repeatedly until system is clean.
- .6 Commission water treatment systems as specified in Section 23 25 00 - HVAC Water Treatment Systems.
- .7 Check water level in expansion tank with cold water with circulating pumps OFF and again with pumps ON.
- .8 Repeat with water at design temperature.
- .9 Check pressurization to ensure proper operation and to prevent water hammer, flashing, and cavitation. Eliminate water hammer and other noises.
- .10 Bring system up to design temperature and pressure slowly.
- .11 Perform TAB as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .12 Adjust pipe supports, hangers, springs as necessary.
- .13 Monitor pipe movement, performance of expansion joints, loops, guides, anchors.
- .14 Re-tighten bolts using torque wrench, to compensate for heat-caused relaxation. Repeat several times during commissioning.
- .15 Check operation of drain valves.
- .16 Adjust valve stem packings as systems settle down.
- .17 Fully open balancing valves (except those that are factory-set).
- .18 Check operation of over-temperature protection devices on circulating pumps.
- .19 Adjust alignment of piping at pumps to ensure flexibility, adequacy of pipe movement, absence of noise or vibration transmission.
- .20 Collect a sample of water, submit it to chemical supplier for analysis and include report in Maintenance Manuals.

**END OF SECTION**

## **1 General**

### **1.1 RELATED SECTIONS**

- .1 Section 21 05 01 – Common Work Results – Mechanical.
- .2 Section 23 05 05 – Installation of Pipework.
- .3 Section 23 05 53.01 – Mechanical Identification.
- .4 Section 23 08 02 – Cleaning and Start Up of Mechanical Piping Systems.

### **1.2 REFERENCES**

- .1 American National Standards Institute (ANSI)/American Welding Society (AWS)
  - .1 ANSI/AWS A5.8/A5.8M, Specification Filler Metals for Brazing and Bronze Welding.
- .2 American Society of Mechanical Engineers (ASME)
  - .1 ANSI/ASME B16.4, Gray-Iron Threaded Fittings.
  - .2 ANSI/ASME B16.15, Cast Bronze Threaded Fittings.
  - .3 ANSI B16.18, Cast Copper Alloy, Solder Joint Pressure Fittings.
  - .4 ANSI/ASME B16.22, Wrought Copper and Copper-Alloy Solder Joint Pressure Fittings.
- .3 American Society for Testing and Materials International (ASTM)
  - .1 ASTM B32, Standard Specification for Solder Metal.
  - .2 ASTM B61, Standard Specification for Steam or Valve Bronze Castings.
  - .3 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
  - .4 ASTM B88M, Standard Specification for Seamless Copper Water Tube Metric.
- .4 Manufacturers Standardization Society (MSS)
  - .1 MSS SP70, Cast Iron Gate Valves, Flanged and Threaded Ends.
  - .2 MSS SP71, Grey Iron Swing Check Valves, Flanged and Threaded Ends.
  - .3 MSS SP80, Bronze Gate, Globe, Angle and Check Valves.
  - .4 MSS SP85, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

### **1.3 SUBMITTALS**

- .1 Product Data:
  - .1 Provide Shop Drawing and Maintenance Manual submittals in accordance with Section 01 33 00 - Submittal Procedures and section 21 05 01 – Common Work Results - Mechanical.

## **2 Products**

### **2.1 PIPING**

- .1 Type "L" hard drawn copper tubing: to ASTM B88M.
- .2 Acceptable Materials: Victaulic, Gruvlock

## 2.2 FITTINGS

- .1 Cast bronze threaded fittings: to ANSI/ASME B16.15.
- .2 Wrought copper and copper alloy solder joint pressure fittings: to ANSI/ASME B16.22.
- .3 Cast iron threaded fittings: to ANSI/ASME B16.4.
- .4 Cast copper alloy solder joint pressure fittings: to ANSI B16.18.

## 2.3 FLANGES

- .1 Brass or bronze: threaded.
- .2 Cast iron: threaded.
- .3 Orifice flanges: slip-on, raised face, 2100 kPa.

## 2.4 JOINTS

- .1 Solder, tin-antimony, 95:5: to ASTM B32.
- .2 Silver solder BCUP: to ANSI/AWS A5.8.
- .3 Brazing: as indicated.

## 2.5 VALVES

- .1 Connections:
  - .1 NPS 2 and smaller: solder.
- .2 Globe valves: application: throttling, flow control, emergency bypass :
  - .1 NPS 2 and under:
    - .1 Mechanical Rooms: with PTFE disc, Bronze.
    - .2 Elsewhere: globe, with composition disc, Bronze.
    - .3 Acceptable Materials: Crane 5, Jenkins 106BP, Nibco S-211-Y, Toyo, Kitz, Milwaukee Valve Company, Hattersley A50M; Parker Kaefer Inc.
- .3 Drain valves:
  - .1 On radiation: Solid forged brass construction, solid brass body, forged brass cap, brass chain and hook, composition disc suitable for 250 °C, working pressure 200 psig at 250 °C.
    - .1 Acceptable Material: Dahl #21.616.



- .2 On Mains: Forged brass body, brass cap, steel handle, brass stem and ball, Teflon seat, hose end, 250 psig at 250 °C.
  - .1 Acceptable Material: Dahl #50.430.
- .4 Silent check valves:
  - .1 NPS 2 and under:
    - .1 Class 125, cast steel, wafer style, brass seat rings, brass inner valve, stainless steel spring.
    - .2 Acceptable Materials: Durabla GLC, Toyo, Kitz, Crane, Jenkins, Milwaukee Valve Company, Hattersley, Parker Kaefer Inc.
- .5 Ball valves:
  - .1 NPS 2 and under: Bronze.
  - .2 Acceptable Materials: Jenkins 901FJ and 902FJ, Crane, Toyo, Kitz, Hattersley, Milwaukee Valve Company.
- .6 Lift Check Valves
  - .1 50 mm and under:
    - .1 Class 125, swing check, Y-pattern, threaded ends, bronze disc with bronze hinge and stainless steel hinge pin, screw cap.
    - .2 Acceptable Materials:
      - .1 Crane Fig 37, Jenkins Fig. 4092J, Kitz Fig 22

## 2.6 GROOVED END VALVES

- .1 Where grooved piping concept is used in place of welded or threaded systems, Contractor shall incorporate grooved end valves of comparable construction.

## 3 Execution

### 3.1 MANUFACTURER'S INSTRUCTIONS

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

### 3.2 PIPING INSTALLATION

- .1 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.
- .2 Install concealed pipes close to building structure to keep furring space to minimum. Install to conserve headroom and space. Run exposed piping parallel to walls. Group piping where ever practical.
- .3 Slope piping in direction of drainage and for positive venting.
- .4 Use eccentric reducers at pipe size change installed to provide positive drainage or positive venting.

- .5 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.
- .6 Assemble piping using fittings manufactured to ANSI standards.
- .7 Saddle type branch fittings may be used on mains if branch line is no longer than half the size of main. Hole saw or drill and ream main to maintain full inside diameter of brance line prior to welding saddle.

### **3.3 VALVE INSTALLATION**

- .1 Install rising stem valves in upright position with stem above horizontal.
- .2 Install gate or ball at branch take-offs and to isolate each piece of equipment, and as indicated.
- .3 Install globe valves for balancing and in by-pass around control valves as indicated.
- .4 Install silent check valves on discharge of pumps and in vertical pipes with downward flow and as indicated.
- .5 Install swing check valves in horizontal lines on discharge of pumps and as indicated.
- .6 Install ball valves for glycol service.

### **3.4 CIRCUIT BALANCING VALVES**

- .1 Install and flow balancing valves as indicated.
- .2 Remove handwheel after installation and TAB is complete. Turn over handwheel to the Departmental Representative.

### **3.5 FLUSHING AND CLEANING**

- .1 Provide Departmental Representative with five (5) days notice of flushing and cleaning of system.
- .2 Flush in accordance with section 23 08 02 - Cleaning and Start Up of Mechanical Piping Systems
- .3 Re-install strainer screens/baskets.

**END OF SECTION**

## **1 General**

### **1.1 RELATED SECTIONS**

- .1 Section 21 05 01 – Common Work Results for Mechanical.
- .2 Section 23 05 05 – Installation of Pipework.
- .3 Section 23 05 53.01 – Mechanical Identification.
- .4 Section 23 08 02 – Cleaning and Start-up of Mechanical Piping Systems.

### **1.2 REFERENCES**

- .1 American Society of Mechanical Engineers (ASME).
  - .1 ASME B16.1, Cast Iron Pipe Flanges and Flanged Fittings.
  - .2 ASME B16.3, Malleable Iron Threaded Fittings.
  - .3 ASME B16.5, Pipe Flanges and Flanged Fittings.
  - .4 ASME B16.9, Factory-Made Wrought Buttwelding Fittings.
  - .5 ASME B18.2.1, Square and Hex Bolts and Screws (Inch Series).
  - .6 ASME B18.2.2, Square and Hex Nuts (Inch Series).
- .2 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM A47/A47M, Standard Specification for Ferritic Malleable Iron Castings.
  - .2 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
  - .3 ASTM A536, Standard Specification for Ductile Iron Castings.
  - .4 ASTM B61, Standard Specification for Steam or Valve Bronze Castings.
  - .5 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .3 American Water Works Association (AWWA).
  - .1 AWWA C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .4 Canadian Standards Association (CSA International).
  - .1 CSA B242-M, Groove and Shoulder Type Mechanical Pipe Couplings.
  - .2 CAN/CSA W48, Filler Metals and Allied Materials for Metal Arc Welding (Developed in cooperation with the Canadian Welding Bureau).
- .5 Manufacturer's Standardization of the Valve and Fittings Industry (MSS).
  - .1 MSS SP70, Cast Iron Gate Valves, Flanged and Threaded Ends.
  - .2 MSS SP71, Cast Iron Swing Check Valves Flanged and Threaded Ends.
  - .3 MSS SP80, Bronze Gate, Globe, Angle and Check Valves.
  - .4 MSS SP85, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

### **1.3 SUBMITTALS**

- .1 Provide Shop Drawing and Maintenance Manual submittals in accordance with Section 01 33 00 - Submittal Procedures and section 21 05 01 – Common Work Results - Mechanical.

## **2 Products**

### **2.1 PIPE**

- .1 Steel pipe: to ASTM A53/A53M, Grade B, Schedule 40:

### **2.2 PIPE JOINTS**

- .1 50 mm and under: screwed fittings with PTFE tape or lead-free pipe dope.
- .2 Pipe thread: taper.

### **2.3 FITTINGS**

- .1 Screwed fittings: malleable iron, to ASME B16.3, Class 150.
- .2 Unions: malleable iron, to ASTM A47/A47M and ASME B16.3.

### **2.4 VALVES**

- .1 Connections: 50 mm and smaller: screwed ends.
- .2 Globe valves: to MSS-SP-80 or MSS-SP-85 Application: Throttling, flow control, emergency bypass:
  - .1 50 mm and under:
    - .1 Mechanical Rooms: bronze with PTFE disc
    - .2 Elsewhere: bronze, with composition disc.
    - .3 Acceptable Product: Crane Fig.5TF, Kitz #03.
  - .3 Balancing, for TAB:
    - .1 50 mm and under shall be Y-pattern style design and all metal parts of non-ferrous pressure die cast, non-porous copper alloy. IPS connections unless otherwise noted. The valve shall have four 360 degrees adjustment turns of hand wheel for maximum setting.
    - .2 Acceptable Products: Armstrong, Taco, Bell & Gossett, Tour & Anderson, Danfoss Victaulic.
  - .4 Drain valves: Bronze gate valve, Class 125, non-rising stem, solid wedge disc.
    - .1 On radiation: Solid forged brass construction, solid brass body, forged brass cap, brass chain and hook, composition disc suitable for 480°F, working pressure 200 psi at 480°F.
      - .1 Acceptable Product: Dahl #21.616; Parker Kaefer Inc.
    - .2 On Mains: Forged brass body, brass cap, steel handle, brass stem and ball, Teflon seat, hose end, 250 psig at 480°F
      - .1 Acceptable Product: Dahl #50.430; Parker Kaefer Inc.

- .5 Ball valves:
  - .1 50 mm and under:
    - .1 Acceptable Product: Crane Fig 9202, Kitz #58.
  
- .6 Coil Connections:
  - .1 The Contractor may install in lieu of standard malleable iron or copper fittings the following component system consisting of the following:
    - .1 A complete three-component multi-functioned packaged.
    - .2 Rated for 120 degrees C up to 300 psi.
    - .3 Suitable for hot, cold, treated, and untreated water.
    - .4 UP union port fitting and STADK CBV to have unions sized to accommodate standard modulating valves.
  - .2 Acceptable Materials: Victaulic 78K Koil - Kit.

### **3 Execution**

#### **3.1 PIPING INSTALLATION**

- .1 Install pipework in accordance with Section 23 05 05 - Installation of Pipe Work.
- .2 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage, and installation instructions, and datasheets.

#### **3.2 CIRCUIT BALANCING VALVES**

- .1 Install flow measuring stations and flow balancing valves as indicated.
- .2 Remove handwheel after installation and when TAB is complete. Turn over handwheel to the Departmental Representative.

#### **3.3 CLEANING, FLUSHING AND START-UP**

- .1 In accordance with Section 23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems.

#### **3.4 TESTING**

- .1 Test system in accordance with Section 21 05 01 - Common Work Results for Mechanical.

#### **3.5 BALANCING**

- .1 Refer to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC for applicable procedures.

**END OF SECTION**

## **1 General**

### **1.1 RELATED REQUIREMENTS**

- .1 Specification 21 05 01 – Common Work Results – Mechanical.

### **1.2 REFERENCES**

- .1 American Society of Mechanical Engineers (ASME)
  - .1 ASME-04 (2007), Boiler and Pressure Vessel Code.
- .2 ASTM International Inc.
  - .1 ASTM A47/A47M-99 (2004), Standard Specification for Ferritic Malleable Iron Castings.
  - .2 ASTM A278/A278M-01 (2006), Standard Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 650 degrees F (350 degrees C).
  - .3 ASTM A516/A516M-06, Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate - and Lower - Temperature Service.
  - .4 ASTM A536-84(2004), Standard Specification for Ductile Iron Castings.
  - .5 ASTM B62-02, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .3 Canadian Standards Association (CSA International)
  - .1 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.

### **1.3 SUBMITTALS**

- .1 Provide Shop Drawing and Maintenance Manual submittals in accordance with Section 01 33 00 - Submittal Procedures and section 21 05 01 – Common Work Results - Mechanical.

## **2 Products**

### **2.1 AUTOMATIC AIR VENT**

- .1 Standard float vent: brass body and NPS 1/8.
- .2 Industrial float vent: cast iron body and NPS 1/2 connection and rated at 860 kPa working pressure.
- .3 Float: solid material suitable for 115 degrees C working temperature.
- .4 Acceptable Materials: Amtrol, Armstrong, Braukmann, Taco, ITT Bell & Gossett, Honeywell, Maidomist

### **2.2 PIPE LINE STRAINER**

- .1 NPS 1/2 to 2: bronze body to ASTM B62, (solder end) connections, Y pattern.
- .2 Screen: stainless steel or brass with 1.19 mm perforations.
- .3 Working pressure: 860 kPa.
- .4 Acceptable Materials: Mueller, Parker Kaefler Inc., Spriax/Sarco, Victaulic; Style 732

## **2.3 PRESSURE SAFETY RELIEF VALVES**

- .1 Safety valves of the correct rating for equipment to be protected.
- .2 Standard of Acceptance: Consolidated Fig. 1541 or Fig. 1511
- .3 Acceptable Materials: Armstrong, Faries 1855-OL and 1900 Series, ITT, Kunkle, Parker Kaefler Inc, Spirax-Sarco Fig. 6000 or Fig. 252, Watts Fig. 174A

## **2.4 PIPE PENETRATION SEALS**

- .1 Modular, thru-the-wall and thru-the-floor, core-drilled, pipe penetration seals:
  - .1 Rubber links to make water-tight/continuously fill the annular space between the pipe and the core-drilled wall opening.
  - .2 Size: NPS 6 (nominal 150 mm diam., Schedule 40 ductile iron piping).
  - .3 Rated at 14.1 m head (20 psig).
  - .4 Carbon steel nuts and bolts per ASTM B633 with 2 part zinc plated dichromate hardware c/w corrosion resistant organic coating.
  - .5 Black EPDM seal element.
  - .6 Temperature range: -40 to 121 deg.C.
  - .7 Tensile strength: 413.4 MPa (60,000 psig).
  - .8 Composite pressure plates molded of glass reinforced nylon.
  - .9 Tested in accordance with ASTM B-117 to pass a 1,500-hour salt spray test.
  - .10 Manufactured with materials conforming to ASTM D-256, ASTM D-297, ASTM S-395, ASTM D-412, ASTM D-638, ASTM D-790, ASTM D-792 and ASTM D-2240.
  - .11 Penetration/hole size: 254 mm (10" diam.).  
10 links per seal.
  - .12 Acceptable Materials: PSI-Thunderline/ Link-Seal® Modular Seal, Series "C", Model "LS-410-C", as manufactured by Pipeline Seal & Insulator, Inc, Houston, TX, or approved equivalent.

## **3 Execution**

### **3.1 GENERAL**



- .1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.
- .2 Run drain lines and blow off connections to terminate above nearest drain.
- .3 Maintain adequate clearance to permit service and maintenance.
- .4 Should deviations beyond allowable clearances arise, request and follow Departmental Representative's directive.
- .5 Check shop drawings for conformance of tappings for ancillaries and for equipment operating weights.

### **3.2 STRAINERS**

- .1 Install in horizontal or down flow lines.
- .2 Ensure clearance for removal of basket.
- .3 Install ahead of each automatic control valve larger than NPS 1, at radiation, and as indicated.

### **3.3 AIR VENTS**

- .1 Install at high points of systems.
- .2 Install stop cock on automatic air vent inlet. Run discharge to nearest drain or service sink.

**END OF SECTION**

## **1 General**

### **1.1 RELATED SECTIONS**

- .1 Section 21 05 01 – Common Work Results – Mechanical.
- .2 Section 23 05 05 – Installation of Pipework.
- .3 Section 23 08 02 – Cleaning and Start-up of Mechanical Piping Systems.

### **1.2 REFERENCES**

- .1 American Society of Mechanical Engineers (ASME)
  - .1 ASME Boiler and Pressure Vessel Code, Section VII-2004.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

### **1.3 SUBMITTALS**

- .1 Provide Shop Drawing and Maintenance Manual submittals in accordance with Section 01 33 00 - Submittal Procedures and section 21 05 01 – Common Work Results - Mechanical.

## **2 Products**

### **2.1 MANUFACTURER**

- .1 Equipment, chemicals, service provided by one supplier.

### **2.2 POT FEEDER**

- .1 There shall be no changes to the existing Pot Feeder.
- .2 Be responsible for damage to existing plant by this work.
- .3 Provide GE MD4100 corrosion inhibitor after system fill in equal proportion to existing to return system to original concentration levels.
- .4 Provide micron filter, capacity 2% of pump recirculating rate at operating pressure complete with six sets of filter cartridges.
- .5 Acceptable Materials: GE Water and Process Technologies

### **2.3 CHEMICAL FEED PUMPS**

- .1 There shall be no changes to the existing Chemical Feed Pumps.
- .2 Be responsible for damage to existing plant by this work.

## **2.4 SHIPPING/FEEDING CHEMICAL CONTAINERS**

- .1 High density molded polyethylene, with liquid level graduations, cover.

## **2.5 WATER TREATMENT FOR HYDRONIC SYSTEMS**

- .1 Hot water heating system: pot feeder, existing.
- .2 Micron filter for each pot feeder:
  - .1 Capacity 2% of pump recirculating rate at operating pressure.
  - .2 Six (6) sets of filter cartridges for each type, size of micron filter.

## **2.6 TEST EQUIPMENT**

- .1 Provide one set of test equipment for each system to verify performance.
- .2 Complete with carrying case, reagents for chemicals, specialized or supplementary equipment.

## **3 Execution**

### **3.1 INSTALLATION**

- .1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.
- .2 Install HVAC water treatment systems in accordance with ASME Boiler Code Section VII, and requirements and standards of authorities having jurisdiction, except where specified otherwise.
- .3 Ensure adequate clearances to permit performance of servicing and maintenance of equipment.

### **3.2 CLEANING OF MECHANICAL SYSTEMS**

- .1 Provide a copy of recommended cleaning procedures and chemicals for review by Departmental Representative.
- .2 Flush mechanical systems and equipment with approved cleaning chemicals designed to remove deposition from construction such as pipe dope, oils, loose mill scale and other extraneous materials. Use chemicals to inhibit corrosion of various system materials that are safe to handle and use.
- .3 Examine and clean filters and screens, periodically during circulation of cleaning solution, and monitor changes in pressure drop across equipment.

- .4 Drain and flush system until alkalinity of rinse water is equal to make-up water. Refill with clean water treated to prevent scale and corrosion during system operation.
- .5 Disposal of cleaning solutions approved by authority having jurisdiction.

### **3.3 FIELD QUALITY CONTROL**

- .1 Start-up:
  - .1 Start up water treatment systems in accordance with manufacturer's instructions.

**END OF SECTION**