

1 General

1.1 RELATED SECTIONS

- .1 Section 01 10 10 - General Instructions.

1.2 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings; submit drawings stamped and signed by professional engineer registered or licensed in Province of Prince Edward Island, Canada.
- .3 Shop drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
- .4 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
- .5 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.
- .6 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
 - .2 Operation and maintenance manual approved by, and final copies deposited with, Consultant before final inspection.
 - .3 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Color coding chart.
 - .4 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
 - .5 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
 - .6 Approvals:
 - .1 Submit 2 copies of draft Operation and Maintenance Manual to Consultant for approval 4 weeks prior to Substantial Completion. Submission of individual data will not be accepted unless directed by Consultant.
 - .2 Make changes as required and re-submit as directed by Consultant.
 - .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
 - .8 Site records:

- .1 Consultant will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
- .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
- .3 Use different color waterproof ink for each service.
- .4 Make available for reference purposes and inspection.
- .9 As-built drawings:
 - .1 Prior to start of testing, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (date).
 - .3 Submit to Consultant for approval and make corrections as directed.
 - .4 Perform testing, adjusting and balancing using as-built drawings.
 - .5 Submit completed electronic and reproducible as-built drawings with Operating and Maintenance Manuals.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Testing and Quality Control.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.

1.4 MAINTENANCE

- .1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:
 - .1 One glass for each gauge glass.
 - .2 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
 - .3 One trap per 10 trap used each size.
- .2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.
- .3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse in accordance with Section 01 74 22 - Construction/Demolition Waste Management and Disposal.

1.6 DEFICIENCY LIST

- .1 Lists of work deficiencies will be issued at anytime. Rectify immediately work to satisfaction of Consultant.
- .2 Submit requests for takeover inspection in writing.

1.7 SITE SERVICES

- .1 Known Services:
 - .1 Drawings indicate known existing facilities.
 - .2 Locate all known services prior to initiating work.
 - .3 Consult with and follow Engineer's written instructions before commencing work.

- .4 Once location has been set out, assume responsibility for all damage during installation. Bear cost of repairs and replacements made necessary.
- .2 Unknown Services:
 - .1 Locate all services whose exact location is not known.
 - .2 Avoid damaging or displacing existing services where exact position is not known. Should any damage occur, advise Engineer in writing for remedial instructions.

1.8 CO-ORDINATION

- .1 Locate distribution systems, equipment and materials to provide minimum interference and maximum usable space.
- .2 Where interference occurs, Consultant shall approve location of equipment and materials regardless of installation sequence.

1.9 REGULATIONS

- .1 Comply with most stringent requirements of NBC, Provincial and Municipal regulations and by-laws, specified standards, codes and these specifications and plans. Practices contained in these standards or standards suggested or recommended by referenced organizations, are to be taken as minimum requirements.
- .2 Furnish certificates confirming work installed conforms to requirements of authorities having jurisdiction.

1.10 DRAWINGS

- .1 Drawings:
 - .1 Are not intended to show structural details or architectural features.
 - .2 Are not to be scaled.
 - .3 Except where dimensioned, the drawings indicate general mechanical layouts only.
- .2 Provide field drawings to indicate relative position of various services when required by Consultant. Obtain Consultant's approval before commencing work.
- .3 As-Built (Record) Drawings:
 - .1 Maintain as specified in Section 01 78 00 - Closeout Submittals.

1.11 EQUIPMENT LIST

- .1 Submit list of manufacturers named within 7 days after award of the contract. Do not order equipment until list is approved.

1.12 ENERGY CONSUMPTION

- .1 Consultant may reject equipment submitted for approval on basis of performance or energy consumed or demanded.

1.13 APPROVAL OF EQUIPMENT

- .1 When equipment list has been reviewed by Consultant, conform to Section 01 33 00 - Submittal Procedures for items shown on equipment list and all other materials and equipment necessary to complete requirements of mechanical systems. This includes equipment named under Standard of Acceptance.

1.14 BREAKDOWN OF COSTS

- .1 Price will be broken down at tender time as required by depository instructions.
- .2 Immediately upon notice of contract award, further break down tender price as per Par. 1.34.

1.15 ACCEPTABLE PRODUCT

- .1 Means that item named and specified by catalogue number meets specification in all respects regarding performance, quality of material and workmanship, and is acceptable to Consultant.
- .2 Equipment proposed shall meet same standards.
- .3 Owner and Consultant reserve the right to make final decision on proposed equipment usage, if different from that specified or accepted as an approved equal.

1.16 AS INDICATED

- .1 Means that the item or items specified are shown or noted on the drawings.

1.17 EQUIPMENT REQUIREMENTS & INSTALLATION

- .1 Permit equipment maintenance and disassembly by use of unions or flanges to minimize disturbance to connecting piping without interference from building structure or other equipment.
- .2 Provide accessible means for lubricating equipment including permanent lubricated "lifetime" bearings.
- .3 Mount base mounted equipment on chamfered edge housekeeping pads a minimum of 100mm high and 50mm larger than equipment dimension all around. Pads provided by this Contractor. Coordinate sizes with equipment provider.
- .4 Pipe drain lines to drains in a manner to avoid disruption of surrounding space.
- .5 Line-up equipment, rectangular cleanouts and similar items with building walls wherever possible.
- .6 Contractor to provide metal caps and counter flashing for all roof penetrations provided under this section. Installation by this Contractor. This Contractor responsible for all membrane flashing.

1.18 RESPONSIBILITY FOR TEMPORARY TRIAL USAGE

- .1 Protect work against damage or loss until accepted by the Consultant.
- .2 Obtain written permission to start and test permanent equipment and systems prior to acceptance by Consultant.
- .3 Consultant may use equipment and systems for test purposes prior to acceptance. Supply labour, material and instruments required for testing.
- .4 See Division 21 for temporary usage. Guarantee period and commencement date shall not be affected.
- .5 Clean and renew equipment and system used prior to acceptance. Restore to original, new and full working condition.
- .6 Temporary usage includes steam blow.

1.19 ANCHOR BOLTS & TEMPLATES

- .1 Supplied and installed by Contractor responsible.

1.20 PROTECTION OF OPENINGS

- .1 Protect equipment, system openings including rough-in plumbing from dirt, dust and other foreign materials with materials compatible to the system.

1.21 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Electric equipment shall bear CSA label.
- .2 Conform to requirements of Canadian Electrical Code, Local Provincial and Municipal Authorities and specified standards.
- .3 Division 21, 22 and 23 responsible for their respective conduit, wiring and connections below 50 V which are related to control systems specified in Division 15 and shown on mechanical drawings. Refer to Electrical section for quality of materials and workmanship for wiring and conduit.
- .4 Motors.
 - .1 Provide motors for mechanical equipment.

- .2 If delivery of specified motor will delay delivery or installation of any equipment, install a motor for temporary use. Final acceptance of equipment will not occur until specified motor is installed.
- .5 Motors under 372 W: Speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 115V or 208V, unless otherwise specified.
- .6 Motors 372 W and larger: EEMAC Class B, squirrel cage induction, continuous duty, drip proof, ball bearing, maximum temperature rise 40EC, three phase, 208V in building, unless otherwise specified.
- .7 Provide motors, low voltage 50 V and less, wiring from transformers, and temperature pressure, humidity control devices.
- .8 Furnish composite wiring diagrams with remote interlocks for control systems, including performance and sequence of operation description of mechanical systems. Submit for approval by Consultant.

1.22 SLEEVES

- .1 Provide pipe sleeves at points where pipes pass through masonry or concrete walls or floors.
- .2 Provide acoustical pipe penetration seals where pipes pass through equipment room walls or floors.
 - .1 Seals to consist of two bolted pipe halves with minimum 19mm neoprene sponge bonded to inner face.
 - .2 Seal shall be tightened around the pipe to eliminate clearance between the inner sponge face and the piping.
- .3 Use cast iron or steel pipe sleeves with annular fin continuously welded at midpoint:
 - .1 Through foundation walls.
 - .2 Where sleeve extends above finished floor.
- .4 Sizes:
 - .1 Provide 6mm clearance all around, between sleeve and pipes or between sleeve and insulation.
 - .2 Where piping passes below footings, provide minimum clearance of 50mm between sleeve and pipe. Backfill up to underside of footing with concrete of same strength as footing.
- .5 Terminate sleeves flush with surface of concrete and masonry and 50mm above floors in mechanical or fan rooms or rooms susceptible to leaks. Not applicable to concrete floors on grade.
- .6 For pipes passing through roofs, use cast iron sleeves with caulking recess and flashing clamp device. Provide flashing and counter flashing as necessary for installation by Division 21, 22 or 23 contractor responsible. Anchor sleeves in roof construction; caulk between sleeve recess and pipe; fasten roof flashing to clamp device; make water-tight durable joint.
- .7 Fill voids around pipes. Remove plastic sleeves.
 - .1 Caulk between sleeve and pipe in foundation walls and below grade floors with waterproof pre-retardant non-hardening mastic.
 - .2 Where sleeves pass through walls or floors, caulk space between insulation and sleeve or between pipe and sleeve with waterproof fire retardant non-hardening mastic. Seal space at each end also with same.
 - .3 Ensure no contact between copper tube or pipe and ferrous sleeve.
 - .4 Fill future-use sleeves with lime plaster.
 - .5 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint to CGSB 1-GP-181M + Amdt - Mar-78.
- .8 Temporarily plug all openings during construction.

1.23 ESCUTCHEONS AND PLATES

- .1 Provide on pipes passing through finished walls, partitions, floors and ceilings.
- .2 Use chrome or nickel plated brass, solid type, with set screws for ceiling or wall mounting. Use cast iron type in equipment room.
- .3 Inside diameter shall fit around finished pipe. Outside diameter shall cover opening or sleeve.
- .4 Where sleeve extends above finished floor, escutcheons or plates shall clear sleeve extension.
- .5 Secure to pipe or finished surface but not insulation.

1.24 TESTS

- .1 Provide the following supplementary requirements to tests specified:
 - .1 Give written 24 hours notice of date when tests will be made.
 - .2 Do not insulate or conceal work until tested and approved. Follow construction schedule and arrange for tests.
 - .3 Conduct tests in presence of Engineer.
 - .4 Bear costs including retesting and making good.
 - .5 Pipe pressure:
 - .1 Hydraulically test all water supply and steam supply systems at 12 times system operating pressure or minimum 860 kPa.
 - .2 Maintain test pressures without loss for 4 hours unless otherwise specified.
 - .3 Test drainage, waste and vent piping to code.
 - .4 Prior to test isolate all equipment or other parts which are incomplete or not designed to withstand test pressures.
 - .5 All piping of the drainage and venting systems shall be tested by means of filling the system with water after all outlets have been plugged. All joints shall be checked and the water level must hold without dropping for a period of one hour before the work is to be backfilled or otherwise built-in. Sections of the system may be tested separately provided they are at least 3000mm high and include at least 1500mm of the section below, where applicable. Any leaks observed must be corrected by additional caulking of joints or if necessary by removal of any section of pipe required.
 - .6 Testing shall be done before pipe covering is installed. Leaks must be located, corrected and test reapplied before acceptance of building.
 - .7 Provide test certification for all tests signed by Engineer or designated representative.

1.25 PAINTING

- .1 Apply at least one coat of corrosion resistant primer paint to supports, and equipment fabricated from ferrous metals.
- .2 Prime and touch up marred finished paintwork to match original.

1.26 SPECIAL TOOLS AND SPARE PARTS

- .1 Furnish spare parts as follows:
 - .1 One set of mechanical seals for pump.
 - .2 One casing joint gasket for pump.
 - .3 One set of gaskets for each heat exchanger.
 - .4 One glass for each gauge glass installed.
- .2 Identify spare parts containers as to contents and replacement parts numbers.
- .3 Provide one set of special tools required to service equipment as recommended by manufacturers.
- .4 Furnish one grease gun and adapters to suit different types of grease and grease fittings complete with 2 tubes of each kind of grease.

1.27 DIELECTRIC COUPLINGS

- .1 Provide wherever pipes of dissimilar metals are jointed.
- .2 Provide insulating unions for pipe sizes NPS 2 and under and insulating flanges for pipe sizes over NPS 2.
- .3 Cast brass adapters may be used where approved by Engineer.
- .4 Provide felt or rubber gaskets to prevent dissimilar metals contact.

1.28 DRAIN VALVES

- .1 Minimum NPS 19mm unless otherwise specified: straight pattern bronze with hose end male thread and complete with cap and chain.
- .2 Locate at all low points and section isolating valves unless otherwise specified.

1.29 INSTRUCTION OF OPERATING STAFF

- .1 Provide certified personnel to instruct operating staff on operation of mechanical equipment. Provide maintenance specialist personnel to instruct operating staff on maintenance and adjustment of mechanical equipment and any changes or modification in equipment made under terms of guarantee.
- .2 Provide instruction during regular work hours prior to acceptance and turn-over to operating staff for regular operation.
- .3 Use operation and maintenance data manual for instruction purposes. On completion of instruction, turn one manual over to Owner and the balance to Engineer.
- .4 This Contractor to ensure mechanical systems are complete and fully operational as per the requirements of these documents and the applicable codes. Premature failure of any mechanical system(s) and/or related accessories deemed to be the result of poor workmanship shall be the financial responsibility of the Contractor responsible.

1.30 OPERATING AND MAINTENANCE MANUAL

- .1 Provide operation and maintenance data for incorporation into manual specified in the Section 01 78 00 - Closeout Submittals.
- .2 Definition: detailed information and records of individual products provided by manufacturer of supplier as part of project requirements, and of systems, describing operation and maintenance of each item.
- .3 Operating data to include:
 - .1 Environmental and other control schematics for each system.
 - .2 Description of each system and its controls.
 - .3 Description of operation of each system at various loads together with reset schedules and seasonal variances.
 - .4 Operating instruction for each system and each component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Color coding chart.
- .4 Maintenance data shall include:
 - .1 Servicing, maintenance, operating and trouble-shooting instructions for each item of equipment.
 - .2 Equipment manufacturer's performance data sheets.
 - .3 Equipment performance verification test results.
- .5 Approvals:
 - .1 Submit 1 draft of Operating and Maintenance Manual to Engineer for approval one month prior to estimated substantial completion date. Submission of individual data will not be accepted unless so directed by Engineer.

- .2 Make any changes in submission as may be required and re-submit as directed.
- .3 Failure to do so will result in delay of progress payment.
- .6 Provide two (2) bound final copies of operating and maintenance manuals to Owner and one (1) bound final copy to Engineer.

1.31 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures. Provide all shop drawings within 30 days after contract has been awarded. Failure to do so will delay progress payments. Photocopies of fax sheets or poor quality photocopies will not be acceptable for shop drawings.
- .2 Shop drawings and product data shall show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances, access door swing spaces.
 - .3 Internal wiring diagrams if applicable.
- .3 Shop drawings and product data shall be accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify as to current production.
 - .5 Certification of compliance to applicable codes.
- .4 Keep 1 copy of shop drawings and product data on site, available for reference purposes at all times.

1.32 CLEANING AND FINAL ADJUSTMENT

- .1 Clean interior and exterior of all systems including strainers.
- .2 Clean and refurbish all equipment and leave in first class operating condition including replacement of all filters in all piping systems.
- .3 Balance and adjust all systems and each piece of equipment to operate efficiently.

1.33 AS-BUILT RECORD DRAWINGS BY CONTRACTOR

- .1 General: to be read in conjunction with Section 01 78 00 - Closeout Submittals.
- .2 Site records:
 - .1 Mark thereon all changes as work progresses and as changes occur.
 - .2 Transfer information to show all work as actually installed.
 - .3 Make these drawings available for reference purposes and to inspection at all times.
- .3 As-built drawings:
 - .1 Prior to start of testing, balancing and adjusting, finalize production of ACAD as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: "AS BUILT DRAWINGS". Signature of contractor and date to be included.
 - .3 Submit to Engineer for approval and make all corrections as directed.
 - .4 Testing, balancing and adjusting to be performed using as-built drawings.
 - .5 Hand over completed reproducible as-built drawings with Operating and Maintenance Manuals.

1.34 CUTTING & PATCHING

- .1 All cutting and patching required to properly accommodate the work of this Division shall be the financial responsibility of respective Division 21, 22 or 23 and carried out by trades to the applicable Specifications provided in this document. The General Contractor for this contract will be liable and financially responsible for the work required for the installation of the new roof top units, including but not limited to, demolition to cut the holes in the roof, structural support for the roof curbs and modified roofing to the new curbs. The roofing Sub-Contractor and General

Contractor will carry the Warrantee for roofing in areas affected by new construction. Roof areas unaffected by such work will be carried by the original contractor involved with the base-build contract.

1.35 FIRESTOPPING AND SMOKE SEALS

- .1 All firestopping and smoke seals required to properly accommodate the work of this Division shall be the financial responsibility of the respective Division 21, 22 or 23 and carried out by trades to the applicable Specifications provided in this document.
- .2 Work must be performed by a company with experience in the application of firestopping and smoke seals to ULC requirements.

2 Products

2.1 MATERIALS

- .1 Materials and products in accordance with Section 01 74 22 - Construction/Demolition Waste Management and Disposal (Short Form).

3 Execution

3.1 REPAIRS/ RESTORATION

- .1 To Section 09 91 00 - Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged extensively for priming and touch-up.

3.2 CLEANING

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

3.3 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Testing and Quality Control and submit report as described in PART 1 - SUBMITTALS.
 - .1 Radiographic testing.
 - .2 Pressure test.
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.4 DEMONSTRATION

- .1 Consultant will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Trial usage to apply to following equipment and systems:
 - .1 Steam and condensate lines and appurtenance.
- .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 Where specified elsewhere in Division 22 or 23 manufacturers to provide demonstrations and instructions.
- .5 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .6 Instruction duration time requirements as specified in appropriate sections.
- .7 Consultant will record these demonstrations on video tape for future reference.

3.5 PROTECTION

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

End of Section

1 General

1.1 SUMMARY

.1 Section Includes:

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

1.2 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ASHRAE Standard 90.1-01, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM B209M-04, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.
 - .2 ASTM C335-04, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .3 ASTM C411-04, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C533-2004, Calcium Silicate Block and Pipe Thermal Insulation.
 - .6 ASTM C547-2003, Mineral Fiber Pipe Insulation.
 - .7 ASTM C795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - .8 ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
 - .2 CAN/CGSB-51.53-95, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts
- .4 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
 - .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
 - .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .6 Manufacturer's Trade Associations
 - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2004).
- .7 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-03, Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S701-01, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .3 CAN/ULC-S702-1997, Thermal Insulation, Mineral Fibre, for Buildings
 - .4 CAN/ULC-S702.2-03, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

1.3 DEFINITIONS

.1 For purposes of this section:

- .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible

- chases and furred-in spaces.
- .2 "EXPOSED" - will mean "not concealed" as specified.
- .2 TIAC ss:
 - .1 CRF: Code Rectangular Finish.
 - .2 CPF: Code Piping Finish.

1.4 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Prince Edward Island, Canada.
- .4 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix label beneath sample indicating service.
- .5 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
 - .1 Consultant will make available 1 copy of systems supplier's installation instructions.

1.5 QUALITY ASSURANCE

- .1 Qualifications:
- .2 Installer: specialist in performing work of this Section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.
- .3 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.

1.6 DELIVERY, STORAGE AND HANDLING

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

- reuse in accordance with Section 01 74 22 - Construction/Demolition Waste Management and Disposal.
- .2 Place excess or unused insulation and insulation accessory materials in designated containers.
- .3 Divert unused metal materials from landfill to metal recycling facility approved by Consultant.
- .4 Dispose of unused adhesive material at official hazardous material collections site approved by Consultant.

2 Products

2.1 FIRE AND SMOKE RATING

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

2.2 INSULATION

- .1 Mineral fibre specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/ULC-S702.
 - .2 Maximum "k" factor: to CAN/ULC-S702.
- .4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/ULC-S702.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to CAN/ULC-S702.
- .5 TIAC Code C-2: mineral fibre blanket faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
 - .1 Mineral fibre: to CAN/ULC-S702.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to CAN/ULC-S702.
- .6 TIAC Code A-6: flexible unicellular tubular elastomer.
 - .1 Insulation: with vapour retarder jacket.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to CAN/ULC-S702.
 - .4 Certified by manufacturer: free of potential stress corrosion cracking corrodants.
- .7 TIAC Code A-2: rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.
 - .1 Insulation: to ASTM C533.
 - .2 Maximum "k" factor: to CAN/ULC-S702.
 - .3 Design to permit periodic removal and re-installation.

2.3 INSULATION SECUREMENT

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

2.4 CEMENT

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

2.5 VAPOUR RETARDER LAP ADHESIVE

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

2.6 INDOOR VAPOUR RETARDER FINISH

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

2.7 OUTDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.
- .2 Reinforcing fabric: fibrous glass, untreated 305 g/m².

2.8 JACKETS

- .1 Polyvinyl Chloride (PVC):
 - .1 One-piece moulded type and sheet to CAN/CGSB-51.53 with pre-formed shapes as required.
 - .2 Colours: to match adjacent finish paint.
 - .3 Minimum service temperatures: -20 degrees C.
 - .4 Maximum service temperature: 65 degrees C.
 - .5 Moisture vapour transmission: 0.02 perm.
 - .6 Thickness: 0.55 mm.
 - .7 Fastenings:
 - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
 - .2 Tacks.
 - .3 Pressure sensitive vinyl tape of matching colour.
 - .8 Special requirements:
 - .1 Indoor: Flame Spread Rating 25 Smoke Developed 50
 - .2 Outdoor: UV rated material at least 0.5 mm thick.
- .2 ABS Plastic:
 - .1 One-piece moulded type and sheet with pre-formed shapes as required.
 - .2 Colours: to match adjacent finish paint.
 - .3 Minimum service temperatures: -40 degrees C.
 - .4 Maximum service temperature: 82 degrees C.
 - .5 Moisture vapour transmission: 0.012 perm.
 - .6 Thickness: 0.75 mm.
 - .7 Fastenings:
 - .1 Solvent weld adhesive compatible with insulation to seal laps and joints.
 - .2 Tacks.
 - .3 Pressure sensitive vinyl tape of matching colour.
 - .8 Locations:
 - .1 For outdoor use ONLY.
- .3 Canvas:
 - .1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
 - .2 Lagging adhesive: compatible with insulation.
- .4 Aluminum:
 - .1 To ASTM B209.
 - .2 Thickness: 0.50 mm sheet.
 - .3 Finish: smooth.
 - .4 Joining: longitudinal and circumferential slip joints with 50 mm laps.

- .5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
- .6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5mm thick at 300 mm spacing.
- .5 Stainless steel:
 - .1 Type: 304.
 - .2 Thickness: 0.25 mm.
 - .3 Finish: smooth.
 - .4 Joining: longitudinal and circumferential slip joints with 50 mm laps.
 - .5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
 - .6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5mm thick at 300 mm spacing.

2.9 WEATHERPROOF CAULKING FOR JACKETS INSTALLED OUTDOORS

- .1 Caulking to: Section

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PRE-INSTALLATION REQUIREMENT

- .1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.
- .2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers instructions and this specification.
- .3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Install hangers, supports outside vapour retarder jacket.
- .5 Supports, Hangers:
 - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

- .1 Application: at expansion joints, valves, primary flow measuring elements.
- .2 Design: to permit movement of expansion joint without damage to adjacent insulation.
- .3 Insulation:
 - .1 Insulation, fastenings and finishes: same as system.
 - .2 Jacket: aluminum.

3.5 INSTALLATION OF ELASTOMERIC INSULATION

- .1 Insulation to remain dry. Overlaps to manufacturers instructions. Ensure tight joints.
- .2 Provide vapour retarder as recommended by manufacturer.

3.6 PIPING INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 TIAC Code: A-1.
 - .1 Securements: SS wire at 300 mm on centre.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code 1501-H.
- .3 TIAC Code: A-3.
 - .1 Securements: SS wire at 300 mm on centre.
 - .2 Seals: VR lap seal adhesive, VR lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
- .4 TIAC Code: A-6.
 - .1 Insulation securements: as per manufacturers recommendation.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code: 1501-CA.
- .5 TIAC Code: C-2 vapour retarder jacket.
 - .1 Insulation securements: 18 GA SS wire or 12 mm x 0.5 mm SS bands at 300 mm on center.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
- .6 TIAC Code: A-2.
 - .1 Insulation securements: 18 GA SS wire or 12 mm x 0.5 mm SS bands at 300 mm on center.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code: 1501-H.
- .7 Thickness of insulation as listed in following table.
 - .1 Run-outs to individual units and equipment not exceeding 4000 mm long.
 - .2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp °C	TIAC Code	Pipe sizes (NPS) and insulation thickness (mm)					
			Run out	To 1	1¼ to 2	2½ to 4	5 to 6	8 & over
Steam	up to 175	A-1	38	50	65	75	90	90
Steam, Saturated and Super heated	over 175	A-1	38	65	65	75	90	90
Condensate Return	60 - 94	A-1	25	38	38	38	38	38
Pumped Condensate return	up to 94	A-1	25	38	38	38	38	38
Boiler Feed Water		A-1	25	25	25	25	25	25
Hot Water Heating	60 - 94	A-1	25	38	38	38	38	38
Hot Water Heating	up to 59	A-1	25	25	25	25	38	38
Glycol Heating	60 - 94	A-1	25	38	38	38	38	38
Glycol Heating	up to 59	A-1	25	25	25	25	38	38
Domestic HWS		A-1	25	25	25	38	38	38
Chilled Water	4 - 13	A-3	25	25	25	25	25	25
Chilled Water or Glycol	below 4	A-3	25	25	38	38	38	38
Dual Temp. Heating		A-3	—	—	—	—	—	—
Dual Temp. Cooling		A-3	—	—	—	—	—	—
Chilled Water Pump Casing		A-3	25	25	25	25	25	25
Condenser Water Outdoors		—	—	—	—	—	—	—
Condenser Water Indoors		—	—	—	—	—	—	—
Refrigerated Drinking Water		A-3	25	25	25	25	25	25
Domestic CWS		A-3	25	25	25	25	25	25
Domestic CWS with vapour retarder		C-2	25	25	25	25	25	25
Refrigerant hot gas	4 - 13	A-6	25	25	25	25	25	25
Refrigerant hot gas	below 4	A-6	25	25	38	38	38	38
RWL and RWP		C-2	25	25	25	25	25	25
Cooling Coil cond. drain		C-2	25	25	25	25	25	25
Diesel generator exhaust system		A-2	38	65	65	75	90	90

- .8 Finishes:
 - .1 Exposed indoors: canvas.
 - .2 Exposed in mechanical rooms: canvas.

- .3 Concealed, indoors: canvas on valves, fittings. No further finish.
- .4 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.
- .5 Outdoors: water-proof aluminum jacket.
- .6 Finish attachments: SS screws, at 150 mm on centre. Seals: wing.
- .7 Installation: to appropriate TIAC code CRF/1 through CPF/5.
- .8 No unjacketed insulation to be installed in manufacturing space.

3.7 FIELD QUALITY CONTROL

- .1 Verification requirements in accordance with Section 01 74 22 - Construction/Demolition Waste Management and Disposal (Short Form), include:
 - .1 Materials and resources.
 - .2 Storage and collection of recyclables.
 - .3 Construction waste management.
 - .4 Resource reuse.
 - .5 Recycled content.
 - .6 Local/regional materials.
 - .7 Certified wood.
 - .8 Low-emitting materials.

3.8 CLEANING

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

End of Section

1 General

1.1 REFERENCES

- .1 American National Standards Institute/National Fire Prevention Association (ANSI/NFPA)
 - .1 ANSI/NFPA 13- 1997 , Installation of Sprinkler Systems.
- .2 Underwriters Laboratories of Canada (ULC)
 - .1 ULC S543- 1984 , Internal Lug Quick Connect Couplings for Fire Hose.

1.2 RELATED SECTIONS

- .1 Section 23 05 21 - Thermometers and Pressure Gauges.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures and in accordance with ANSI/NFPA 13, working plans and design requirements.

1.4 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit samples of following:
 - .1 Each type of sprinkler head.
 - .2 Signs.

1.5 ENGINEERING DESIGN CRITERIA

- .1 Provide building with a complete, approved, operational sprinkler system in all areas.
- .2 Provide wet pipe sprinklers for all conditioned spaces.
- .3 Design documents are for information only. The Sprinkler Contractor shall be responsible for the actual layouts, routing of piping, and additional sprinkler heads to meet all requirements of the Authorities Having Jurisdiction, as well as the provision of a fire pump and specification of storage tank volume requirements and coordinating with general contractor as required.
- .4 Design system in accordance with ANSI/NFPA 13, using following parameters:
 - .1 Hazard:
 - .1 To suit occupancy as indicated.
 - .2 Pipe size and layout:
 - .1 Hydraulic design .
 - .2 Sprinkler head layout: to ANSI/NFPA 13 or as directed by authorities having jurisdiction .
 - .3 Water supply:
 - .1 Conduct flow and pressure test of water supply in vicinity of project to obtain criteria for bases of design in accordance with ANSI/NFPA 13 Work with general contractor in provision of cistern for water storage, fill control and all other requirements for the provision of a fire protection water supply meeting requirements of NFPA, NBC, NFC and Authorities Having Jurisdiction.
- .5 Wet piping shall not be routed through unheated areas, such as attics, etc.
- .6 The sprinkler layout shall be as required to meet the approval of all applicable codes and Local Authorities, which ever is more stringent.

1.6 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Provide detailed Hydraulic calculations including: Summary sheet for above ground and underground piping, as well as other deliverables for incorporation into Manual specified in Section 01 78 00 - Closeout Submittals, in accordance with ANSI/NFPA 13.

1.7 EXTRA MATERIALS

- .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide spare sprinklers and tools as required by ANSI/NFPA 13.

2 Products

2.1 PIPE, FITTINGS AND VALVES

- .1 Pipe:
 - .1 Ferrous: to ANSI/NFPA 13.
 - .2 Copper tube: to ANSI/NFPA 13.
- .2 Fittings and joints to ANSI/NFPA 13:
 - .1 Ferrous: screwed, welded, flanged or roll grooved.
 - .2 Copper tube: screwed, soldered, brazed.
- .3 Valves:
 - .1 ULC listed for fire protection service.
 - .2 Up to NPS 2: bronze, screwed ends, OS & Y; gate.
 - .3 NPS 2 1/2 and over: cast iron, flanged or roll grooved ends, indicating butterfly valve.
 - .4 Swing check valves.
 - .5 Ball drip.
- .4 Pipe hangers:
 - .1 ULC listed for fire protection services.

2.2 SPRINKLER HEADS

- .1 General: to ANSI/NFPA 13 and ULC listed for fire services.

2.3 SPRINKLER HEAD TYPE A

- .1 Upright bronze.

2.4 SPRINKLER HEAD TYPE B

- .1 Pendant chrome link and lever type.

2.5 SPRINKLER HEAD TYPE C

- .1 Pendant chrome glass bulb type.

2.6 SPRINKLER HEAD TYPE D

- .1 Recessed polished type with ring and cup.

2.7 SPRINKLER HEAD TYPE E

- .1 Flush polished link and lever type.

2.8 SPRINKLER HEAD TYPE F

- .1 Side wall polished link and lever type.

2.9 ALARM CHECK VALVE

- .1 Alarm check valve with retard chamber to ANSI/NFPA 13 and ULC listed for fire service.

2.10 SUPERVISORY SWITCHES

- .1 General: to ANSI/NFPA 13 and ULC listed for fire service.
- .2 Valves:
 - .1 Mechanically attached to valve body, with normally open and normally closed contacts and supervisory capability.
- .3 Flow switch type:
 - .1 With normally open and normally closed contacts and supervisory capability.
- .4 Pressure alarm switch:
 - .1 With normally open and normally closed contacts and supervisory capability.

2.11 WATER GONG

- .1 To ANSI/NFPA 13 and ULC listed for fire service. Location as indicated.

2.12 FIRE DEPARTMENT CONNECTION

- .1 To ANSI/NFPA 13 and ULC S543 listed, siamese type, location as indicated. Thread specifications to be compatible with local fire department.
- .2 Polished bronze. Threaded metal caps and chains.

2.13 PRESSURE GAUGES

- .1 ULC listed and to Section 23 05 21 - Thermometers and Pressure Gauges.
- .2 Shall have maximum limit of not less than twice normal working pressure at point where installed.

2.14 SIGNS

- .1 Bilingual Signs for control drain and test valves: to ANSI/NFPA 13.

2.15 ANTIFREEZE

- .1 Antifreeze loops to ANSI/NFPA 13, locations as indicated.

2.16 SPARE PARTS CABINET

- .1 For storage of maintenance materials, spare sprinkler heads and special tools.
- .2 Construct to sprinkler head manufacturers standard.

3 Execution

3.1 INSTALLATION

- .1 Install, inspect and test to acceptance in accordance with ANSI/NFPA 13.
- .2 Install excess pressure pump across alarm valve in accordance with manufacturers instructions.
- .3 Testing to be witnessed by Fire Commissioner of Canada .
- .4 Install water gong as indicated.

End of Section