Part 1 General

1.1 REFERENCES

.1 Unless otherwise noted, refer to the latest references and standards listed herein adopted by the local authority having jurisdiction.

1.2 SUBMITTALS

.1 Submittals: in accordance with Specification E3 – Shop Drawings.

.2 Shop drawings to show:

- .1 Mounting arrangements.
- .2 Operating and maintenance clearances.

.3 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.

.4 In addition to transmittal letter referred to in Specification E3 – Shop Drawings: use the Mechanical Contractors Association of Canada (MCAC) "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

.5 Closeout Submittals:

- .1 Provide operation and maintenance data for incorporation into manual specified in Section E4.
- .2 Operation and maintenance manual reviewed by, and final copies deposited with, Contract Administrator before final inspection.
- .3 Operation data to include:
  - .1 Control schematics for systems including environmental controls.
  - .2 Description of systems and their controls.
  - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
  - .4 Operation instruction for systems and component.
  - .5 Description of actions to be taken in event of equipment failure.
  - .6 Valves schedule and flow diagram.
  - .7 Colour coding chart.
- .4 Maintenance data to include: servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
  - .1 Data to include schedules of tasks, frequency, tools required and task time.

.5 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.6 Reviews:

.1 Submit two (2) copies of draft Operation and Maintenance Manual to Contract Administrator for review. Submission of individual data will not be accepted unless directed by Contract Administrator.

.2 Make changes as required and re-submit as directed by Contract Administrator.

.7 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.8 Site records:

.1 Departmental Representative will provide white prints of the mechanical drawings. 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 white prints, revising white prints to show work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection.

.9 As-built drawings:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.3 Submit to Contract Administrator for review and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.10 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section C11.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: in accordance with Specification D13 – Environmental Protection Plan.

Part 2 Products

2.1 NOT USED

.1 Not Used

Part 3 Execution

3.1 DEMOLITION

.1 Preparation

.1 Coordinate utility service outages with utility company and schedule utility to locate exterior services.

.2 Provide temporary connections to maintain existing system in service during construction. When Contractor elects to perform work on energized equipment, use personnel experienced in such operations.

.3 Beginning of demolition means installer accepts existing conditions.

.2 Demolition

.1 Connect equipment which is existing and is to remain to the new system as required to maintain its proper operation.

.2 Maintain access to existing mechanical installations which remain active. Modify installation or provide access as appropriate.

.3 Scheduling and Phasing

.1 Prior to the start of any demolition work within the building, provide the Contract Administrator a schedule of phased selective demolition for all mechanical demolition at the site.

.2 Provide the following information for the schedule:

.1 Number of phases of demolition.

.2 Limits of each phase.

.3 Dates of start/finish demolition by phase.

.3 Coordinate the mechanical demolition schedule with all aspects of demolition under other Divisions of the specifications.

3.2 PAINTING REPAIRS AND RESTORATION

.1 Painting in accordance with Section 09 91 00 – Painting and Protective Coatings.

3.3 CLEANING

.1 Clean interior and exterior of all systems including strainers.

3.4 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Section C11 and submit report as described in PART 1 - SUBMITTALS.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.5 DEMONSTRATION

.1 Departmental Representative, Contract Administrator will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

.4 Instruction duration time requirements as specified in appropriate sections.

3.6 PROTECTION

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

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Thermal insulation for piping and piping accessories.

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.

.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 Manufacturer's Trade Associations

.1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2004).

.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 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:

.1 CRF: Code Rectangular Finish.

.2 CPF: Code Piping Finish.

1.4 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: specialist in performing work of this Section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with manufacturer's written instructions and Section E4.

.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.

.4 Place excess or unused insulation and insulation accessory materials in designated containers.

.5 Divert unused metal materials from landfill to metal recycling facility.

.6 Dispose of unused adhesive material at official hazardous material collections site.

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102.

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre specified includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335.

.3 Hot Piping: Formed fine fibrous glass or mineral fibre pipe insulation, with factory applied general purpose jacket, factory moulded to conform to piping, "K" value maximum 0.035 W/m°C. Service temperature up to 150°C

.4 Cold Piping: Foamed plastic of closed cell structure or closed cell elastomer, "K" value maximum 0.04 W/m°C. The water vapour transmission rate not to exceed 0.1 perms.

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 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 Aluminum:

.1 To ASTM B209.
.2 Thickness: 0.50 mm sheet.
.3 Finish: smooth or stucco embossed.
.4 Joining: longitudinal and circumferential slip joints with 50 mm laps.
.5 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5mm thick at 300 mm spacing.

.2 Canvas:

.1 220 gm/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
.2 Lagging adhesive: compatible with insulation.

Part 3 Execution

3.1 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.

3.2 INSTALLATION

.1 Install in accordance with National Plumbing Code of Canada and authority having jurisdiction.

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

.3 Ensure insulation is continuous through inside walls. Pack around pipes with fire proof self-supporting insulation material, properly sealed.

.4 Insulate piping, fittings and valves. Do not insulate unions, flanges (except on flanged valves), strainers, flexible connections and expansion joints. Terminate insulation neatly with plastic material trowelled on a bevel.

.5 Finish insulation neatly on hangers, supports and other protrusions.

.6 Locate insulation or cover seams in least visible locations. Locate seams on piping in ceiling spaces on the underside of the pipe.

.7 Provide recovering jackets on exposed insulation throughout, including equipment rooms. Make smooth uneven insulated surfaces before recovering.

.8 Cold Piping: Seal lap joints with 100% coverage of vapour barrier adhesive. Seal butt joints with 50 mm^2 in wide strips of vapour barrier sealed with vapour barrier adhesive. For fittings and valves, apply hydraulic insulating cement; or apply factory fabricated insulation half shells, seal all laps and joints.

.9 Flare out staples may be used to secure jacket laps on hot systems. Staples are to be applied on 100 mm^4 in centres.

.10 Hot Piping: For fittings and valves, apply hydraulic insulating cement; or apply factory fabricated insulation half shells.

3.3 INSTALLATION OF ELASTOMERIC INSULATION

.1 Insulation to remain dry. Overlaps to manufacturer’s instructions. Ensure tight joints.

.2 Provide vapour retarder as recommended by manufacturer.

3.4 PIPING INSULATION SCHEDULES

	Piping or Equipment	Pipe Sizes NPS	Insulation Thickness mm	Recovery Jacket
.1	Domestic Cold Water	All sizes	25	Canvas
.2	Domestic Hot Water	13mm to 51mm	25.4	Canvas
.3	Domestic Hot Water	64mm to 127mm	38.1	Canvas

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute/National Fire Prevention Association (ANSI/NFPA)

.1 ANSI/NFPA 10, Standard for Portable Fire Extinguishers

1.2 SUBMITTALS

.1 Submit shop drawings in accordance with Specification E3 – Shop Drawings.

.2 Provide ULC listed maintenance data for incorporation into manual specified in Section E4.

Part 2 Products

2.1 COMPONENTS

.1 Provide ULC listed portable, wall mounted 2-A, 10-B., C dry chemical fire extinguishers as indicated.

.2 Fire extinguishers to meet ANSI/NFPA 10 for ordinary hazard and occupancy fire protection.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with ANSI/NFPA 10.

3.2 SITE TESTS

.1 Test to acceptance in accordance with ANSI/NFPA 10.

.2 Testing to be witnessed by authority having jurisdiction.

END OF SECTION