

PART 1 - GENERAL

1.1 Protection of Openings

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

1.2 Painting

- .1 Prime and touch up marred finished paintwork to match original.
- .2 Restore to new condition, finishes which have been damaged too extensively to be merely primed and touched up.

1.3 Demonstration and Operating and Maintenance Instructions

- .1 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.
- .2 Where specified elsewhere in Divisions 21 and 23, manufacturers to provide demonstrations and instructions.
- .3 Use operation and maintenance manual, record drawings, audio visual aids, etc. as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.
- .5 Where deemed necessary, the Consultant and/or Owner may record these demonstrations on video tape for future reference.

1.4 Closeout Submittals

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 21 05 01 - Mechanical General Requirements.
- .2 Operation and maintenance manual to be approved by, and final copies deposited with, Consultant before final inspection.
- .3 Operation data to include:
 - .1 Control schematics for each system including environmental controls.
 - .2 Description of system and its controls.
 - .3 Description of actions to be taken in event of equipment failure.

- .4 Maintenance data shall include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each piece of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .5 Approvals:
 - .1 Submit one (1) electronic copy (PDF format) on memory stick for review.
 - .1 Submit three (3) copies of draft Operation and Maintenance Manual to Consultant for approval.
 - .2 Make changes as required and re-submit as directed by Consultant.
- .6 Additional data:
 - .1 Prepare and insert into operation and maintenance manual when need for same becomes apparent during demonstrations and instructions specified above.
 - .2 MSDS for all hazardous material installed and left stored on site or with the Owner.
 - .3 Analysis of hydronic systems water after cleaning and treatment of piping.

1.5 Shop Drawings and Product Data

- .1 Submit shop drawings and product data in accordance with Section 21 05 01-Mechanical General Requirements.
- .2 Shop drawings and product data shall show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
 - .3 Wiring diagrams showing field wiring connections and field wiring between related components.
- .3 Shop drawings and product data shall be 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 as to current model production.
 - .5 Certification of compliance to applicable codes.
- .4 In addition to transmittal letter referred to in Section 21 05 01 - Mechanical General Requirements. Use the "Shop Drawing Submittal Form" included within this specification section. Identify section and paragraph number.
- .5 Provide one electronic (PDF format) copy of shop drawings for all equipment specified and/or indicated including but not limited to the following items:
 - .1 General:
 - .1 Firestopping Materials (by this Contractor).

- .2 Drain Valves.
- .2 Insulation:
 - .1 Pipe insulation.
 - .2 Duct insulation.
 - .3 Equipment insulation.
 - .4 Insulation covers.
- .3 Hydronic Piping Systems:
 - .1 Horizontal unit heaters.
 - .2 Valves (all types).
 - .3 Automatic air vents.
 - .4 Circuit balancing valves.
- .4 Ventilation and Air Conditioning:
 - .1 Flexible Duct Connections.
 - .2 Duct Access Doors.
 - .3 Motorized Dampers and Actuators.
 - .4 Louvers and Intake/Exhaust Hoods.
- .5 Fire Protection:
 - .1 Sprinkler Heads (all types).

1.6 Cleaning

- .1 Clean interior and exterior of all systems. Vacuum interior of plenums, etc. Ductwork shall be shipped to the construction site with open ends of ducts covered with plastic. Ductwork not capped or covered over with plastic during construction shall be vacuumed also.
- .2 Clean the job site daily. If the site is not cleaned to the Owner's satisfaction, then the Owner shall make arrangements for cleaning and charge the cost against the Contract.

1.7 Record Drawings

- .1 One (1) set of white prints will be provided for record purposes. Maintain project "as-built" record drawings and accurately record significant deviations from the Contract Documents, caused by site condition or Contract change. Mark changes on white prints in "RED".
 - .1 Prior to regularly scheduled site meetings this contractor shall have record drawings available for review by the consultant team.
- .2 Identify each drawing in the lower right hand corner in letters at least 13mm high as follows:
 - .1 "RECORD DRAWINGS"
 - .2 This drawing has been revised to show Mechanical systems as installed.
 - .3 Signature of Contractor.
 - .4 Date.

- .3 Submit record drawings to Engineer for approval. Make all corrections as directed.
- .4 Turn over the record drawings to the Owner at the completion of the project.

1.8 **Definitions**

- .1 The word "provide" shall mean "supply and install" unless otherwise indicated.
- .2 Provide new materials, equipment and plant of proven design and quality and of current models with published ratings for which replacement parts are readily available.
- .3 Conform to requirements of "General Conditions" and "Division 1".

1.9 **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 The Mechanical Trade Contractor shall check the content of the drawings, specifications and dimensions, and before proceeding, report to the Engineer any error or omission between Mechanical or Electrical and Architectural plans.
- .4 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 Engineer shall be final, if interpretation is required.
- .5 Misinterpretation of drawings and specifications shall not relieve the Mechanical Trade Contractor of responsibility.
- .6 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.

1.10 **Site Visits**

- .1 Before commencing work, visit site and verify that requirements of Plans and Specifications are consistent with site conditions.

- .2 Advise Engineer, 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.

1.11 Guarantees

- .1 This Mechanical Trade Contractor shall guarantee all his work free from defects for a period of one year, unless specifically noted otherwise, after final acceptance of such work by the Owner 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 Consultant for review.
- .3 Bind guarantees in hard cover report binder suitable for 216mm x 279mm sheets. Label cover "Guarantees" and show project name. Provide title sheet and table of contents.
- .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.

1.12 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
 - Provincial Department of Health
- .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.

1.13 Reference Standards

- .1 Use following latest editions and amendments in effect on date of Tender call:
- | | |
|--------|---|
| AABC | Associated Air Balance Council |
| ADC | Air Diffusion Council |
| AMCA | Air Moving and Conditioning Association |
| API | American Petroleum Institute |
| ASHRAE | American Society of Heating, Refrigeration and Air Conditioning Engineers |
| ASME | American Society of Mechanical Engineers |
| ASTM | American Society for Testing and Materials |
| CEMA | Canadian Electrical Manufacturers Association |
| CFUA | Canadian Fire Underwriters' Association |
| CGSB | Canadian Government Specification Board |
| CHVAC | Canadian Heating, Ventilation and Air Conditioning Code (NRC) |
| CSA | Canadian Standards Association |
| CUA | Canadian Underwriters' Association |
| NACE | National Association of Corrosion Engineers |
| NBC | National Building Code of Canada |
| NBFU | National Board of Fire Underwriters' |
| NBS | National Bureau of Standards |
| NFPA | National Fire Protection Association |
| NSC | National Standards of Canada |
| SMACNA | Sheet Metal and Air Conditioning Contractors National Association Inc. |
| TIMA | Thermal Insulation Manufacturers Association |
| UL | Underwriters' Laboratories |
| ULC | Underwriters' Laboratories of Canada |

1.14 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.

1.15 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 unless the Consultant's approval for an alternative is secured in writing.

- .2 Should the Mechanical Trade Contractor desire to substitute another material for one or more specified by name, he shall apply in writing for such permission at least ten (10) calendar days before closing date of the Tender package. He shall also provide data and/or samples for the Engineer's consideration. The Contractor shall be fully responsible for any additional costs that might result due to equipment substitution.
- .3 Equipment submitted as alternate to that specified on the drawings or in the specifications by model number or catalogue reference must be capable of meeting the full range of operating parameters as the specified equipment. It must also be configured and set to meet the specific design point parameters as called for on the plans or in the specifications.
- .4 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 Consultants to require installation of the equipment used preparing the layout.
- .5 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. Alternates, other than those specified, must be submitted for approval prior to Tender closing.
 - .2 Standard of Acceptance - Only the product mentioned may be used unless alternate products are approved in the Addenda.

1.16 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.

1.17 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 Consultant's 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 Consultant.
- .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.

1.18 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. Sleeve shall be supplied by the Mechanical Sub-Contractor and built-in by the appropriate trade.
 - .2 Unless otherwise specified, construct sleeve of galvanized sheet steel with lock seam joints of minimum 22 gauge.
 - .3 Use cast iron or galvanized steel pipe sleeves with perimeter fin continuously welded at mid point.
 - .1 Where sleeve extends above finished floor.
 - .4 In equipment rooms and other wet areas where water from spills or leaks may penetrate the floor slab, extend sleeves 6.4mm 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 13mm clearance, all around, between sleeve and pipes or between sleeve and insulation.
 - .2 Unless otherwise specified, terminate sleeves flush with walls.
 - .3 Sleeves shall be sized to accommodate the insulated pipe diameter.
- .3 Caulking:
 - .1 Caulk sleeves below grade floors with oakum and lead between sleeve and pipe.
 - .2 Ensure no contact between copper tube or pipe and ferrous sleeve.
- .4 Escutcheons and Plates:
 - .1 Provide on pipes passing through finished walls and floors.
 - .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.

- .5 Penetrations of Fire Separations:
 - .1 Where pipes or ducts 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 Engineer 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 Provide shop drawings in accordance with specification Section 21 05 01 - Mechanical General Requirements. Each trade Contractor shall be responsible for his/her own firestopping.
 - .4 Acceptable Materials:
 - .1 Dow Corning Fire Stop System.
 - .2 3M Fire Barrier Penetration Sealing System.
 - .3 Hilti Fire Stop System.
 - .4 Royal Quickstop.

1.19 Di-electric Unions

- .1 All connections between steel and copper or brass for pipe 50mm and smaller shall be made of di-electric unions, except on all closed systems.

1.20 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.

1.21

Appendix A

14-301

SHOP DRAWINGS

MECHANICAL CONTRACTOR'S REVIEW CONFIRMATION

<p>The Shop Drawings Have Been Reviewed by the Mechanical Contractor and All Items Are In Conformance with the Plans and Specifications? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Are Specified Model Numbers and/or Options Indicated? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>If No, Explain: _____</p> <p>Confirmed by Contractor: _____ <small>Print Name</small></p> <p>Contractor's Signature: _____</p> <p>Date: _____</p> <p>Item: _____</p> <p>Specification Section and Item Number: _____</p> <p>Drawing Reference: _____</p>
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General Contractor: _____

Mechanical Contractor: _____

Mechanical Contractor's Project Representative: _____

Phone Number: _____ Fax Number: _____ E-mail: _____

PART 1 - GENERAL

1.1 References

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE):
 - .1 ASHRAE Standard 90.1-latest edition.
- .2 American Society for Testing and Materials (ASTM):
 - .1 ASTM B 209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate.
 - .2 ASTM C 335, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .3 ASTM C 449M, Standard Specification for Mineral Fibre-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .4 ASTM C 921, Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-51.9, Mineral Fibre Thermal Insulation for Piping and Round Ducting.
 - .2 CAN/CGSB-51.11, Mineral Fibre Thermal Insulation Blanket.
 - .3 CAN/CGSB-51.12, Cement, Thermal Insulating and Finishing.
 - .4 CAN/CGSB-51.40, Thermal Insulation, Flexible, Elastomeric, Unicellular, Sheet and Pipe Covering.
 - .5 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
 - .6 CGSB 51-GP-53M, Jacketing, Polyvinyl, Chloride Sheet, for Insulating Pipes, Vessels and Round Ducts.
- .4 Underwriters' Laboratories of Canada (ULC):
 - .1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.
- .5 National Building Code of Canada - 2010.
- .6 National Plumbing Code of Canada - 2010.
- .7 National Energy Code of Canada for Buildings - 2011.
- .8 Manufacturer's Trade Associations:
 - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.

1.2 Definitions

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

1.3 Shop Drawings

- .1 Submit shop drawings in accordance with Section 21 05 01 Mechanical General Requirements.
- .2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for pipe, fittings, valves, and jointing recommendations.

1.4 Manufacturer's Instructions

- .1 Manufacturer's installation instructions to be submitted to Engineer upon request.
- .2 Installation instructions to include procedures to be used and installation standards to be achieved.

1.5 Qualifications

- .1 Installer to be specialist in performing work of this section, and have at least three years successful experience in this size and type of project.
- .2 Approved Contractors: Guilfords (2000) Inc., Scotia Insulations Ltd., Twin City Insulation, Zink's Mechanical Insulation, Pro-Insul Ltd., Parker Kaefer Inc..

1.6 Delivery, Storage and Handling

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Protect from weather, construction traffic, and against damage from any source.
- .3 Store at temperatures and conditions required by manufacturer.

PART 2 - PRODUCTS

2.1 Fire and Smoke Rating

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

2.2 Mineral Fibre Insulation

- .1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.
- .2 Ceramic Fibre Insulation shall be rated for a maximum service temperature of 1480°C and have a linear shrinkage no greater than 2% after a 24 hour period at temperature.
- .3 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C 335.
- .4 TIAC Code A-1: Rigid moulded mineral fibre without factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/CGSB-51.9.
 - .2 Maximum "k" factor: to CAN/CGSB-51.9.

2.3 Glass Fibre Board

- .1 To have a maximum operating temperature of 232°C and ULC flame spread rating of 15.

2.4 Jackets

- .1 Aluminum:
 - .1 Corrugated aluminum sheets, 0.41mm thick.
 - .2 Joining: Longitudinal and circumferential slip joints with 50mm laps.
 - .3 Fittings: 0.51mm thick die-shaped fitting covers with factory-attached protective liner.
 - .4 Metal jacket banding and mechanical seals: stainless steel, 19mm wide, 0.51mm thick at 305mm spacing.
 - .1 Seal joints and make watertight.

2.5 Accessories

- .1 Stainless steel wire, 18 gauge, Type 304, dead soft annealed.
- .2 Galvanized wire, 15 gauge, annealed.

- .3 Stainless steel mesh, hexagonal mesh, 20 gauge, Type 304.
- .4 Galvanized mesh, hexagonal mesh, 15 gauge, galvanized annealed.
- .5 Aluminum straps, will be 13mm x 0.51mm.
- .6 Stainless steel straps, will be 13mm x 0.51mm, Type 304, dead soft.
- .7 Lagging adhesive, will be Permastik 2001 or Sealfast 30.36.
- .8 Vapour barrier mastic, will be Benjamine Foster 82-07 or Flintkote 230-04.

2.6 Vapour Retarder Lap Adhesive

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

2.7 Indoor Vapour Retarder Finish

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

2.8 Standard of Acceptance

- .1 Products of the following manufacturers are acceptable:
Bakor, Fibreglass Canada, Knauf Fibre Glass, Manson, Johns Manville.

PART 3 - EXECUTION

3.1 Pre-Installation Requirements

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

3.2 Installation

- .1 Apply materials in accordance with insulation and equipment manufacturers instructions and this specification.
- .2 Use two layers with staggered joints when required nominal wall thickness exceeds 75mm.

- .3 Supports, Hangers:
 - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.
- .4 On curved surfaces secure the insulation with galvanized steel wire or with aluminum straps.
- .5 Finish the insulation by applying 25mm hexagonal mesh, 15 gauge, galvanized annealed wire, with metal corner beads applied after the blocks are wired in place. Wire mesh will be tightly stretched in place and secured with galvanized wire. Overlap mesh at joints and bind with galvanized wire. Apply one coat, not less than 6.35mm thick of hydraulic setting cement and trowel to a smooth finish. Cover with 8 oz. canvas neatly fitted and secured with lagging adhesive. Lap seams at least 50mm.
- .6 Insulation shall be extended not less than 4 times specified equipment insulation thickness in each direction over supporting structural members.
- .7 Install in accordance with TIAC National Standards
 - .1 Hot equipment: To TIAC code 1503-H.

3.3 Accessories

- .1 Where no vapour barrier is required wire, and wire mesh will be galvanized steel. Straps may be galvanized steel or aluminum.

3.4 Workmanship

- .1 Install insulation in first class manner with smooth and even surfaces. Outline of insulation shall be true shape. Outline of fitting insulation shall be shaped to blend with adjacent covering. Do not use scrap pieces of insulation where full size sections will fit.

3.5 Equipment Insulation Schedule

Equipment	Insulation	Thickness
Generator Muffler	Mineral Wool	50 mm

END OF SECTION

PART 1 - GENERAL

1.1 References

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE):
 - .1 ASHRAE Standard 90.1-latest edition.
- .2 American Society for Testing and Materials (ASTM):
 - .1 ASTM B 209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate.
 - .2 ASTM C 335, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .3 ASTM C 411, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C 449M, Standard Specification for Mineral Fibre-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C 795, Specification for Thermal Insulation for Use with Austenitic Stainless Steel.
 - .6 ASTM C 921, Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-51.2, Thermal Insulation, Calcium Silicate, for Piping, Machinery and Boilers.
 - .2 CAN/CGSB-51.9, Mineral Fibre Thermal Insulation for Piping and Round Ducting.
 - .3 CAN/CGSB-51.11, Mineral Fibre Thermal Insulation Blanket.
 - .4 CAN/CGSB-51.12, Cement, Thermal Insulating and Finishing.
 - .5 CAN/CGSB-51.40, Thermal Insulation, Flexible, Elastomeric, Unicellular, Sheet and Pipe Covering.
 - .6 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
 - .7 CGSB 51-GP-53M, Jacketing, Polyvinyl, Chloride Sheet, for Insulating Pipes, Vessels and Round Ducts.
- .4 Manufacturer's Trade Associations:
 - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.
- .5 Underwriters' Laboratories of Canada (ULC):
 - .1 CAN/ULC-S102-M88, Surface Burning Characteristics of Building Materials and Assemblies.
- .6 National Building Code of Canada - 2010.

- .7 National Plumbing Code of Canada - 2010.
- .8 National Energy Code of Canada for Buildings - 2011.

1.2 Definitions

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

1.3 Shop Drawings

- .1 Submit shop drawings in accordance with Section 21 05 01 - Mechanical General Requirements, item on Shop Drawings and Product Data.
- .2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for pipe, fittings, valves and jointing recommendations.
- .3 Submit shop drawings for pipe insulation, covering.

1.4 Manufacturer's Instructions

- .1 Submit manufacturer's installation instructions in Maintenance Manuals.

1.5 Qualifications

- .1 Installer to be specialist in performing work of this section, and have at least three years successful experience in this size and type of project.
- .2 Approved Contractor: Guildfords Inc., Scotia Insulators Ltd., Twin City Insulation, Pro-Insul Ltd., Zink's Mechanical Insulation, Parker Kaefer Inc.

1.6 Delivery, Storage and Handling

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Protect from weather, construction traffic.
- .3 Protect against damage from any source.

- .4 Store at temperatures and conditions required by manufacturer.

PART 2 - PRODUCTS

2.1 Fire and Smoke Rating

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

2.2 Fibreglass Insulation

- .1 Pipe insulation will be preformed glass fibre having a nominal density of 56 kg/m³.

2.3 Mineral Fibre Insulation

- .1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.

2.4 Insulation Securement

- .1 Tape: Self-adhesive, aluminum, reinforced, 50mm wide minimum.
.2 Contact adhesive: Quick setting.
.3 Canvas adhesive: Washable.
.4 Tie wire: 1.5 mm diameter stainless steel.
.5 Bands: Stainless steel, 19mm wide, 0.50 mm thick.

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 11 oz.

2.8 Jackets

- .1 Polyvinyl Chloride (PVC):
 - .1 One-piece moulded type to CGSB 51-GP-53M with pre-formed shapes as required.
 - .2 Colours: White.
 - .3 Minimum service temperatures: -20°C.
 - .4 Maximum service temperature: 65.6°C.
 - .5 Moisture vapour transmission: 0.02 perm.
 - .6 Thickness: 0.50 mm
 - .7 Fastenings:
 - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
 - .2 Tacks.
 - .8 Use PVC jackets for all insulated fittings.
- .2 All-Service Jacket (ASJ):
 - .1 The fiberglass pipe insulation jacket is a high density, white kraft bonded to an aluminum foil reinforced with fiberglass yarn. The longitudinal lap of the jacket has a pressure sensitive tape lap sealing system. Butt ends are sealed with pressure sensitivetape butt strips.
 - .2 Lagging adhesive: Compatible with insulation.
 - .3 Use for all straight sections of piping.

2.9 Acceptable Products

- .1 Products of the following manufacturers are acceptable:
 - Bakor
 - Fibreglass Canada
 - Knauf Fibre Glass
 - Manson
 - Johns Manville

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 to be clean, dry, free from foreign material.

3.2 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 50 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Hangers, supports to be 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.

3.3 Removable, Pre-fabricated Insulation and Enclosures

- .1 Application: At balancing valves and unions at equipment.
- .2 Insulation:
 - .1 Insulation, fastenings and finishes: same as system.
 - .2 Jacket: Canvas.

3.4 Piping Insulation Schedules

- .1 Includes valves and fittings unless otherwise specified.
- .2 Thickness of insulation to be as listed in following table.

Application	Temperature °C	Type	Pipe Sizes and Insulation Thickness (mm)				
			to 25	32 to 50	63 to 100	150	200 & Over
Interior Piping Only							
Condensate Drains	All temperatures	Fibreglass	25	25	25	25	25
Hot Water Heating (Perimeter)	Up to 88	Fibreglass	25	25	38	38	38

- .3 Finishes:
 - .1 Exposed indoors: Canvas, PVC jacket.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

- .1 The General Conditions outlined in Section 21 05 01 Mechanical General Requirements apply to work performed under this section.
- .2 Scope of Work:
 - .1 Modify the existing wet pipe sprinkler system as per the drawings.
 - .2 A significant portion of the building is in use by the Owner. All work in areas occupied by the Owner to be coordinated and scheduled in advance with the Owner.
- .3 Related Sections:
 - .1 21 05 01 - Mechanical General Requirements.
 - .2 23 05 53 - Mechanical Identification.

1.2 References

- .1 American National Standards Institute/National Fire Prevention Association (ANSI/NFPA):
 - .1 ANSI/NFPA 13-2007, Installation of Sprinkler Systems.
 - .2 ANSI/NFPA 25-2008, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
- .2 National Building Code of Canada - 2010.
- .3 Authority having Jurisdiction:
 - .1 Conform to the requirements of the Authority having Jurisdiction.
- .4 Approvals:
 - .1 Obtain approval from the Authority Having Jurisdiction before beginning installation.
 - .2 Contractor to provide shop drawings and piping layout drawings to the Authority Having Jurisdiction.
 - .3 Pay all costs associated with such approvals and checking.

1.3 Submittals

- .1 Submit manufacturer's printed product literature, specifications and datasheets.
- .2 Record drawings of each system.
 - .1 After completion, but before final acceptance, submit complete set of Record drawings of each system, showing deviation from the contract drawings clearly marked in red.

- .2 Submit drawings on reproducible bond paper with title block similar to full size contract drawings.
- .3 Provide certificate indicating that sprinklers meet requirements of the authority having jurisdiction.
- .4 Submit maintenance and engineering data for incorporation into manual.

1.4 Delivery, Storage and Handling

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions. Store materials indoors and protect materials from exposure to harmful weather conditions.

1.5 Protection

- .1 Fire safety protection in accordance with NBC requirements during construction to be provided by the Sprinkler Contractor.
- .2 Interruption of Sprinkler service to existing portion of the building to be kept to as short of time as possible and to be coordinated with the Owner in advance.

PART 2 - PRODUCTS

2.1 Pipe, Fittings and Valves

- .1 Aboveground Pipe:
 - .1 Pipe - Roll Grooved: To ASTM A795, Steel, Schedule 10 for sizes up to 4".
 - .2 Pipe - Welded, Threaded or Cut Grooved: Sch. 40.
- .2 Aboveground Fittings and joints:
 - .1 Fittings: 862 kPa cast iron screwed or 862 kPa cast iron flanged.
 - .2 Bolts: Square or hex head to ASTM A307-00.
 - .3 Flange Gaskets: 1.6mm thick cloth inserted red rubber.
 - .4 Grooved Products:
 - .1 Rubber gasketted grooved-end pipe and fittings with mechanical couplings are permitted in pipe sizes 32mm and larger.
 - .2 All grooved products for systems to be ULC listed.
 - .3 All grooved couplings to be complete with angle bolt pads to provide a rigid joint, equal to Victaulic Style 005 Firelock, Anvilstar G-4 or Gruvlok 7400.
 - .4 All grooved products provided for this work and work covered under related sections to be provided by only one manufacturer.
 - .5 Side outlet tees using rubber gasketted fittings are not permitted.

- .6 Fittings to ASTM A47-99 and A536-84.
- .7 Acceptable Manufacturers: Anvilstart, Gruvlok, Shurjoint, Victaulic.
- .3 Rubber Gasket for Pipe Connection:
 - .1 Gaskets shall be moulded SBR rubber per ANSI/AWWA C111/A21.11.
- .4 Pipe Hangers:
 - .1 ULC listed for fire protection services in accordance with NFPA.

2.2 Sprinkler Heads

- .1 General: to ANSI/NFPA 13 and ULC listed for fire services.
- .2 Provide nominal 13mm orifice sprinkler heads.
 - .1 Release element of each head to be of ordinary rated temperature rating or higher as suitable for specific application and as required by ANSI/NFPA 13.
 - .2 Sprinklers in light hazard occupancies shall be the quick response type.

PART 3 - EXECUTION

3.1 Installation

- .1 All installation work to be in accordance with the rules and regulations of the Authority Having Jurisdiction and the Owners Insurer.
- .2 All piping to be kept as high and neat as possible. Pipe to run parallel to building lines unless noted otherwise
- .3 All piping shall be securely hung from the building structure using approved hangers.
- .4 Exposed piping passing through walls to be supplied with wall plates on both sides.
- .5 Exposed piping passing through floor and ceilings to be supplied with floor and ceiling plates.
- .6 Install system in accordance with approved shop drawings and manufacturers' recommendations.
- .7 Arrange drains as indicated or as required so that all parts of the system can be drained.
- .8 Identify system components as per specification Section 23 05 53 - Mechanical Identification.

- .9 Keep interior and ends of new piping and existing piping thoroughly cleaned of water and foreign matter.
- .10 Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter.
- .11 Inspect piping before placing into position.
- .12 Protect exposed steel pipe and fittings.
- .13 Provide red wire guards for sprinkler heads in mechanical, electrical, and communications rooms, other areas where heads are subject to damage, and where shown on the drawings.
- .14 At all times during construction protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system..

3.2 Cleaning

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

END OF SECTION