

Part 1 General

1.1 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .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 Section 01 33 00 - Submittal Procedures: use 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 01 78 10 - Closeout Submittals.
 - .2 Operation and maintenance manual approved 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 troubleshooting 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 Approvals:
 - .1 Submit 2 copies of draft Operation and Maintenance Manual to Contract Administrator for approval. 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 Contract Administrator 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.
 - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
- .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 approval and make corrections as directed.
 - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
 - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.

1.2 MAINTENANCE

- .1 Furnish spare parts in accordance with Section 01 78 10 - Closeout Submittals as follows:
 - .1 One set of packing for each pump.
 - .2 One casing joint gasket for each size pump.
 - .3 One head gasket set for each heat exchanger.
 - .4 One glass for each gauge glass.
 - .5 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
- .2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 10 - Closeout Submittals.

- .3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.3 DELIVERY, STORAGE, AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Construction Waste Management and Disposal: in accordance with Section 01 74 00.

1.4 MATERIALS

- .1 Following Appendix of Manufacturers lists manufacturers of equipment and materials acceptable to Contract Administrator, subject to individual clauses under the various sub-sections of Mechanical Work Specifications. See item 'Materials' under this section of specification.
- .2 Product noted in individual specification clauses is an item that meets specification in all respects regarding performance, quality of material and workmanship, and is acceptable to Contract Administrator without qualification. Equipment proposed from other manufacturers listed as 'Approved Manufacturers' and alternates shall meet same standards.
- .3 Contractor to submit within forty-eight hours of notification from Contract Administrator, one (1) copy of fully and properly completed Appendix of Manufacturers listing thereon names of manufacturers of products which shall be used to execute work of Contract. If list is not submitted within 48 hours, Contractor must use product named in each individual clause.
- .4 Submit shop drawings for all items marked with asterisk(*).
- .5 Request for equals must be received in Contract Administrator's office as per the City of Winnipeg's requirements.

1.5 EQUIPMENT OR MATERIAL & APPROVED MANUFACTURERS

- .1 ELECTRIC MOTORS
 - .1 G.E.; Siemens; Tamper; Reliance; Leland; Lincoln; U.S. Electric; Century; Baldor; WEG; Toshiba
- .2 INSULATION
 - .1 Pipe Insulation Manville; Owens Corning; Knauf; Pabco; Fibreglas
 - .2 External Duct Insulation Manville; Fibreglas; Knauf
 - .3 Fire Retardant Canvas Fattal; Radley
 - .4 Lagging Adhesive/Coating Bakor; Childers; Fosters
 - .5 Refrigerant piping Armstrong; Rubatex
 - .6 Aluminum pipe jacket Childers; Permaclad; Pabco
 - .7 PVC pipe jacket Sure-Fit
- .3 VIBRATION CONTROL

.1	Vibration Control Products*	Vibro-Acoustics; Airmaster; Vibron; Kinetics; SVC Ind.; Mason Industries; VAW
.4	PLUMBING	
.1	Grooved copper piping system*	Gruvlok; Victaulic
.2	Drainage of Waste	
.1	Cast iron soil pipe	Bibby-Ste-Croix
.3	Valves (gate & globe)*	Crane; Toyo; Kitz; Nibco
.4	Valves (butterfly)*	Keystone; Center Line; Kurimoto; Victaulic; Gruvlok
.5	Valves (ball)*	Toyo; Kitz; Nibco; Anvil
.6	Check valves to 2" diam.*	
.1	Horizontal piping	Crane; Toyo; Kitz; Nibco
.2	Vertical piping	Val-Matic
.7	Hangers and Supports	Anvil; Crane; Myatt
.8	Alignment Guides	Adsc0; Flexon; Fulton; Yarway
.9	Drainage specialties* (floor drains, roof drains, cleanouts, chair carriers, etc.)	Watts; Zurn; J.R. Smith; Mifab
.10	Dielectric	Watts
.11	Shock absorbers*	Zurn; Watts; J.R. Smith; Mifab
.12	Strainers*	Spirax-Sarco; Muessco; Toyo; Crane; Colton
.13	Expansion joints*	Fulton; Flexonics; Hyspan; Flextech
.14	Pressure gauges*	Ashcroft; Kunkle; Morrison; Winters; Marshalltown; Ametek; Trerice; Weiss
.15	Thermometers*	Ashcroft; Trerice; Taylor; Weiss; Marshalltown; Winters
.16	Hose bibbs & compression stops*	Powers Crane; Brass Craft
.17	Wall hydrants*	Zurn; Watts; J.R. Smith; Mifab
.18	Wall hydrants*	Brass Craft; Crane
.19	Gas cocks*	Toyo; Neuman-Milliken; Anvil
.20	Gas regulators*	Fisher
.21	Plumbing fixtures*	Crane; American-Standard; Kohler;Toro
.22	Plumbing brass*	American Standard; Crane; Cambridge
.23	Flush valves*	Crane; Teck; Sloan; Zurn
.24	Stainless steel sinks*	American-Standard; K.I.L.; Briggs & Wessan; Kindred Industries; Architectural Metals Industries; Aristaline
.25	Toilet seats*	Olsonite; Moldex; Centoco; Bemis
.26	Sump pumps*	Monarch; Barnes; Armstrong; Gorman Rupp; Marlow
.27	Hot water tank*	Turbomax
.28	Hot water recirc. pumps*	Armstrong; B & G; Grundfos

.29	Shower controls*	Symmons; Powers; Bradley
.30	Shower heads*	Symmons; Powers; Bradley
.31	Thermostatic mixing valves*	Symmons; Powers
.32	Refrigerated drinking fountains*	Haws; Aquarius Elkay
.33	Drinking fountains*	Crane; American-Standard; Kohler
.34	Backflow preventers*	Watts; Conbraco; Ames
.35	Expansion tanks*	Amtrol; Expanflex; H & G
.36	Eyewash*	Haws; Bradley; Guardian Equipment

.5 FIRE PROTECTION

.1	Automatic sprinkler equipment*	Reliable; Viking; Victaulic; Tyco Fire Products (Gem, Star, Central)
.2	Gate valves*	Kennedy; McAvity; Mueller; Watts; Nibco
.3	Ball Valves*	Milwaukee; Global
.4	Check valves*	Crane; Check-Rite; Val-matic; Victaulic; Gruvlok
.5	Butterfly valves*	Crane; Victaulic; Mueller; Watts; Gruvlok; Global; Nibco
.6	Pressure gauges*	Dresser; Morrison; Marshalltown; H.O. Trerice; Ametek; Kunkle; Winters; Tyco
.7	Fire extinguishers*	Pyrene; Diamond; LynCar; Flag; Badger; Kidd; Ansul
.8	Jockey pumps*	Burks
.9	Mechanical joints*	Victaulic; Gruvlok
.10	Pre-action control valves*	Reliable; Griswold; Claval; Tyco Fire Products (Gem, Star, Central)
.11	Backflow preventers*	Watts; Conbraco; Ames
.12	Valve monitor & flow switches*	Potter; Tectra; Edson; Canswiss

.6 HYDRONICS

.1	Welding fittings	Anvil; Crane; Tube Turn
.2	Malleable iron fittings, flange, flange gaskets	Crane; Gourd; Anvil; International Malleable
.1	Mechanical joints	Victaulic; Gruvlok
.3	Pipe hangers	Anvil; Crane; Myatt
.4	Floor plates	Crane
.5	Gate, globe valves*	Crane; Toyo; Kitz; Nibco
.6	Check valves (up to 2" diam.)	
.1	Horizontal piping*	Crane; Toyo; Kitz; Nibco
.2	Vertical piping*	Durabla; Nibco
.7	Check valves (2-1/2" diam. & up)	
.8	Butterfly valves*	Keystone; Center Line; Nibco; Victaulic; Jenkins; Gruvlok

.9	Ball Valves*	Toyo; Kitz; Nibco; Victaulic; Newman Hattersley; Jenkins; Anvil
.10	Balancing valves (up to 2")*	Toyo; Kitz; Anvil; Newman Hattersley
.11	Balancing valves (2½" dia & up)*	Keystone; Center Line; Nibco; Victaulic; Jenkins; Gruvlok
.12	Circuit balancing valves*	Armstrong; Tour & Andersson; Gruvlok
.13	Triple duty valves*	Armstrong; B&G; Gruvlok; Victaulic
.14	Suction guides*	Armstrong; B&G
.15	Expansion joints*	Fulton; Flexonics; Hyspan
.16	Alignment guides*	Adsko; Flexon; Fulton; Flexonics; Hyspan
.17	Air vents*	Dole; Hoffman; Maid-O-Mist
.18	Air purgers*	Hamlet & Garneau
.19	Strainers*	Spirax-Sarco; Mueller; Victaulic; Gruvlok;
.20	Thermometers*	Ashcroft; H.O. Terrice; Winters; Taylor; Weiss; Marshalltown
.21	Pressure gauges*	Kunkle; Winters; Ametek; Ashcroft; Terrice; Weiss; Marshalltown
.22	Water pressure reducing valves*	B & G; Braukmann
.23	Water pressure reducing valve; chilled/hot water systems*	Fisher 95-R; Braukmann
.24	Expansion tanks*	Amtrol; Expanflex; Wessels; B & G; Taco; John Wood
.25	Tank gauges*	Morrison
.26	Relief valves (water)*	Conbraco; Spence; Farris
.27	Wall fin, convectors*	Rosemex; Engineered Air; Rittling
.28	Forced flow, unit heaters*	Rosemex; Engineered Air; McQuay
.29	Radiant panels*	Airtex; Frenger; TWA; Rosemex
.30	Fan coil units*	Carrier; McQuay; York; Engineered Air
.31	Boilers*	
	.1 Condensing*	Aerco; Viessmann; Camus; Buderus
.32	Vertical in-line pumps*	Armstrong; B & G
.33	In-Line pumps*	Armstrong; B & G; Duro; Thrush
.34	Flexible pipe connectors*	Flexonics; Hydro-Flex; United Flexible
.35	Chemical treatment*	GE Betz
.36	Glycol fill system*	Hamlet & Garneau; Axiom
.37	Glycol	Union Carbide; Dow
.38	Steam humidifier*	NEP (cleanable cylinder); Nortec
.7	AIR DISTRIBUTION	
	.1 Ducturns, damper hardware, fan connections*	Duro-Dyne
	.2 Duct Sealer	Duro-Dyne; 3M; Flexa-Duct; United; Bakelite

.3	Fire Damper*	Controlled Air; Penn; Air Balance; C.A.A.; Hart & Cooley; Ruskin; Nailor; Cesco
.4	Pitot tube enclosures*	Lawson Taylor
.5	Manometers*	Dwyer
.6	Filters*	A.A.F.; Camfill-Farr; Continental; Airguard
.7	Electronic Air Filtration	Strion-Aire
.8	Louvres*	Airolite; Carnes; Penn; Air-O Vent; Canadian Advanced Air; H & C; Westvent; Ventex
.9	Air supply units*	McQuay; Carrier; York
.10	Tube / vane axial fans*	CML Northern Blower; Twin City; Barry Blower; Hartzell; Loren Cook; Greenheck
.11	Belt driven vent fans*	CML Northern Blower; Loren Cook; Twin City; Barry Blower; Greenheck
.12	Roof exhausters*	Delhi; Airmaster; Torin; Greenheck; Penn; Philips-Lau; Airdex
.13	Ceiling exhaust fans*	Penn; Tradewind; Greenheck; Loren Cook
.14	Down Draft fans*	SMC; Union; Canarm; Banvil; Leading Edge
.15	Air cooled condensing units*	Carrier; McQuay; Keeprite; Engineered Air; York; Lennox
.16	Diffusers, registers & grilles*	E.H. Price
.17	Acoustic duct insulation*	Manville; Fibreglas; Ultralite; Knauf
.18	Variable volume air valves*	E.H. Price; Nailor; Titus;
.19	Duct silencers*	Vibro-Acoustics; Commercial Acoustics; Vibron; Kinetics; VAW; Ruskin
.20	Ductless split air conditioner*	Carrier; Mitsubishi
.21	Refrigerant piping & accessories*	Henry; Mueller
.22	Spiral ductwork*	AMS; Basar; United; Vent Air; Pellaers
.23	Heat recovery units*	Regen-Air; BKM
.24	Direct drive centrifugal exhauster*	Delhi
.25	Backdraft damper*	Penn; Greenheck; Ventex
.8	CONTROLS/INSTRUMENTATION	
.1	Temperature control system*	Base Bid: Johnson
.2	Gas detection sensor*	Q.E.L.; M.S.A.; Vulcain
.3	I.A.Q. sensor*	Greystone; Vulcain; Comag
.4	Level switch (Sump Pits, ENH-10 etc.)*	Flygt
.5	Flow switch*	
.1	(Fluid)	McDonnell & Miller
.2	(Air)	Cleveland Controls AFS-222
.6	Flow sensors*	
.1	(Fluid)	Engineering Measurements Co.

- .2 (Compressed Air and/or medical gas)* TMP-600 Hastings Series STH
- .7 Air flow measuring stations* Air Monitor
- .9 H.V.A.C. BALANCE AND TESTING
 - .1 H.V.A.C. Balance & Testing Agency Airdronics Inc.; DFC; AHS; Air Movement

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 CLEANING

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

3.2 DEMONSTRATION

- .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 Use operation and maintenance manual, as-built drawings, and audio-visual aids as part of instruction materials.
- .3 Instruction duration time requirements as specified in appropriate sections.
- .4 Contractor will record these demonstrations on video tape for future reference.

3.3 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 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 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-S102-03, 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 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

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.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 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 Waste Management and Disposal: in accordance with Section 01 74 00
 - .2 .

Part 2 Products

2.1 FIRE AND SMOKE RATING

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

2.2 INSULATION

- .1 Mineral fibre specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/ULC-S702 ASTM C547.
 - .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 ASTM C547.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to CAN/ULC-S702 ASTM C547.
- .5 TIAC Code C-2: mineral fibre blanket faced with without factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
 - .1 Mineral fibre: to CAN/ULC-S702 ASTM C547.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to CAN/ULC-S702 ASTM C547.
- .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:.
 - .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.
 - .3 Design to permit periodic removal and re-installation.

2.3 INSULATION SECUREMENT

- .1 Tape: self-adhesive, aluminum, reinforced, 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 to CAN/CGSB-51.53 with pre-formed shapes as required.
 - .2 Colours: to match adjacent finish paint.
 - .3 Minimum service temperatures: -20 degrees C.
 - .4 Maximum service temperature: 65 degrees C.
 - .5 Moisture vapour transmission: 0.02 perm.
 - .6 Fastenings:
 - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
 - .2 Tacks.
 - .3 Pressure sensitive vinyl tape of matching colour.
 - .7 Special requirements:
 - .1 Indoor: None.
 - .2 Outdoor: UV rated material at least 0.5 mm thick.
- .2 ABS Plastic:
 - .1 One-piece moulded type 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, 0.5 mm thick at 300 mm spacing.

2.9 WEATHERPROOF CAULKING FOR JACKETS INSTALLED OUTDOORS

- .1 Caulking to: Section 07 92 10 - Joint Sealing.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PRE-INSTALLATION REQUIREMENT

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

3.3 INSTALLATION

- .1 Install in accordance with TIAC National Standards.

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

3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

- .1 Application: at valves, primary flow measuring elements flanges and unions at equipment.
- .2 Design: to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.
- .3 Insulation:
 - .1 Insulation, fastenings and finishes: same as system.
 - .2 Jacket: aluminum PVC ABS.

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: Tape 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: Tape 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: Tape.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code.

- .5 TIAC Code: C-2 with vapour retarder jacket.
 - .1 Insulation securements: Tape.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
- .6 TIAC Code: A-2.
 - .1 Insulation securements: Staples and adhesive.
 - .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, unless required for protection of residence occupants and barrier free installation.

Application	Temp degrees C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)					
			Run out	to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over
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
Domestic HWS		A-1	25	25	25	38	38	38
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 liquid suction	4 - 13	A-6	25	25	25	25	25	25
Refrigerant hot gas liquid suction	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: PVC jacket.
 - .2 Exposed in mechanical rooms: canvas PVC jacket.
 - .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 ABS jacket.
 - .6 Finish attachments: SS screws bands, at 300 mm on centre. Seals: closed.
 - .7 Installation: to appropriate TIAC code CRF/1 through CPF/5.

3.7 CLEANING

- .1 Proceed in accordance with Section 01 74 00 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation for wet pipe fire protection and sprinkler systems for heated areas.

1.2 REFERENCES

- .1 American National Standards Institute/National Fire Prevention Association (ANSI/NFPA)ANSI/NFPA 13-2002, Installation of Sprinkler Systems.
 - .1 ANSI/NFPA 24-2002, Installation of Private Fire Service Mains and Their Appurtenances.
 - .2 ANSI/NFPA 25-2002, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
- .2 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN4 S543-M984, Standard for Internal Lug Quick Connect Couplings for Fire Hose.

1.3 SAMPLES

- .1 Submit samples of following:
 - .1 Each type of sprinkler head.
 - .2 Signs.

1.4 DESIGN REQUIREMENTS

- .1 Design automatic wet pipe fire suppression sprinkler systems in accordance with required and advisory provisions of NFPA 13, by hydraulic calculations for uniform distribution of water over design area.
- .2 Include with each system materials, accessories, and equipment inside and outside building to provide each system complete and ready for use.
- .3 Design and provide each system to give full consideration to blind spaces, piping, electrical equipment, ducts, and other construction and equipment in accordance with detailed shop drawings. Locate sprinkler heads in consistent pattern with ceiling grid, lights, and air supply diffusers.
- .4 Devices and equipment for fire protection service: ULC approved for use in wet pipe sprinkler systems.
- .5 Location of Sprinkler Heads:
 - .1 Locate heads in relation to ceiling and spacing of sprinkler heads not to exceed that permitted by NFPA 13 for ordinary hazard occupancy.
 - .2 Uniformly space sprinklers on branch.

- .6 Water Distribution:
 - .1 Make distribution uniform throughout the area in which sprinkler heads will open.
 - .2 Discharge from individual heads in hydraulically most remote area to be 100 % of specified density.
- .7 Density of Application of Water:
 - .1 Size pipe to provide specified density when system is discharging specified total maximum required flow.
- .8 Sprinkler Discharge Area:
 - .1 Area: hydraulically most remote area as defined in NFPA 13.
- .9 Outside Hose Allowances:
 - .1 Include allowance in hydraulic calculations for outside hose streams as defined in NFPA-13.
- .10 Friction Losses:
 - .1 Calculate losses in piping in accordance with Hazen-Williams formula with 'C' value of 120 for steel piping, 150 for copper tubing, and 140 for cement-lined ductile-iron piping.
- .11 Water Supply:
 - .1 Base hydraulic calculations on residual pressure obtained from water distribution piping system flow test. Conduct actual flow test for site at multiple hydrants.

1.5 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures.
 - .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.
- .2 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 Manitoba, Canada.
 - .2 Indicate:
 - .1 Materials.
 - .2 Finishes.
 - .3 Method of anchorage
 - .4 Number of anchors.
 - .5 Supports.
 - .6 Reinforcement.

- .7 Assembly details.
- .8 Accessories.
- .3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Test reports:
 - .1 Submit certified test reports for wet pipe fire protection sprinkler systems from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Instructions: submit manufacturer's installation instructions.
 - .2 Manufacturer's Field Reports: manufacturer's field reports specified.
- .4 Closeout Submittals:
 - .1 Submit maintenance and engineering data for incorporation into manual specified in Section 01 78 10 - Closeout Submittals in accordance with ANSI/NFPA 20.
 - .2 Manufacturer's Catalog Data, including specific model, type, and size for:
 - .1 Pipe and fittings.
 - .2 Alarm valves.
 - .3 Valves, including gate, check, and globe.
 - .4 Water motor alarms.
 - .5 Sprinkler heads.
 - .6 Pipe hangers and supports.
 - .7 Pressure or flow switch.
 - .8 Fire department connections.
 - .9 Excess pressure pump.
 - .10 Mechanical couplings.
 - .3 Drawings:
 - .1 Sprinkler heads and piping system layout.
 - .1 Prepare 760mm by 1050mm detail working drawings of system layout in accordance with NFPA 13, "Working Drawings (Plans)".
 - .2 Show data essential for proper installation of each system.
 - .3 Show details, plan view, elevations, and sections of systems supply and piping.
 - .4 Show piping schematic of systems supply, devices, valves, pipe, and fittings. Show point to point electrical wiring diagrams.
 - .2 Electrical wiring diagrams.
 - .4 Design Data:
 - .1 Calculations of sprinkler system design.

- .2 Indicate type and design of each system and certify that each system has performed satisfactorily in the manner intended for not less than 18 months.
- .5 Field Test Reports: Preliminary tests on piping system.
- .6 Records:
 - .1 As-built drawings of each system.
 - .1 After completion, but before final acceptance, submit complete set of as-built drawings of each system for record purposes.
 - .2 Submit 760 mm by 1050 mm drawings on reproducible Mylar film with title block similar to full size contract drawings.
- .7 Operation and Maintenance Manuals:
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 10 - Closeout Submittals.
 - .2 Provide detailed hydraulic calculations including summary sheet, and Contractors Material and Test Certificate for aboveground and underground piping and other documentation for incorporation into manual specified in Section 01 78 10 - Closeout Submittals in accordance with ANSI/NFPA 13.

1.6 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: company or person specializing in wet sprinkler systems with documented experience.

1.7 MAINTENANCE

- .1 Extra Materials: Provide maintenance materials in accordance with Section 01 78 10 - Closeout Submittals.
 - .1 Provide spare sprinklers and tools as required by ANSI/NFPA 13.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 00 - Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Storage and Protection:
 - .1 Store materials indoors in dry location.
 - .2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

Part 2 Products

2.1 ABOVE GROUND PIPING SYSTEMS

- .1 Provide fittings for changes in direction of piping and for connections.
 - .1 Make changes in piping sizes through tapered reducing pipe fittings, bushings will not be permitted.
- .2 Perform welding in shop; field welding will not be permitted.
- .3 Conceal piping in areas with suspended ceiling.

2.2 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 Provide welded, threaded, grooved-end type fittings into which sprinkler heads, sprinkler head riser nipples, or drop nipples are threaded.
 - .4 Plain-end fittings with mechanical couplings and fittings which use steel gripping devices to bite into pipe when pressure is applied will not be permitted.
 - .5 Rubber gasketed grooved-end pipe and fittings with mechanical couplings are permitted in pipe sizes 32 mm and larger.
 - .6 Fittings: ULC approved for use in wet pipe sprinkler systems.
 - .7 Ensure fittings, mechanical couplings, and rubber gaskets are supplied by same manufacturer.
 - .8 Side outlet tees using rubber gasketed fittings are not permitted.
 - .9 Sprinkler pipe and fittings: metal.
- .3 Valves:
 - .1 ULC listed for fire protection service.
 - .2 Gate valves: open by counterclockwise rotation.
 - .3 Check valves: flanged clear opening swing-check type with flanged inspection and access cover plate for sizes 10 cm and larger.
 - .4 Provide gate valve in piping protecting machine rooms, and machinery spaces.
- .4 Pipe hangers:
 - .1 ULC listed for fire protection services in accordance with NFPA.

2.3 SPRINKLER HEADS

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

- .1 Type A: upright bronze.
 - .2 Type B: pendant chrome link and lever type.
 - .3 Type C: pendant chrome glass bulb type.
 - .4 Type D: recessed polished satin chrome glass bulb fusible link type with ring and cup.
 - .5 Type E: flush polished satin chrome link and lever type.
 - .6 Type F: side wall polished satin chrome link and lever type.
- .3 Provide nominal 1.2 cm orifice sprinkler heads.
- .1 Release element of each head to be of intermediate temperature rating or higher as suitable for specific application.
 - .2 Provide polished chromium-plated finish on copper alloy ceiling plates, and chromium-plated pendant sprinklers below suspended ceilings.
 - .3 Provide corrosion-resistant sprinkler heads and sprinkler head guards in accordance with NFPA 13.
 - .4 Provide sprinkler heads as indicated.
 - .5 Deflector: not more than 75 mm below suspended ceilings.
 - .6 Ceiling plates: not more than 25 mm deep.
 - .7 Ceiling cups: not permitted.

2.4 ALARM CHECK VALVE

- .1 Alarm check valve to ANSI/NFPA 13 and ULC listed for fire service.
- .2 Provide variable pressure type alarm valve complete with alarm test valve, alarm shutoff valve, drain valve, pressure gages, accessories, and appurtenances for proper operation of system.

2.5 WATER MOTOR ALARMS

- .1 Provide alarms approved weatherproof and guarded type, to sound locally on flow of water in each corresponding sprinkler system.
- .2 Mount alarms on outside of outer walls of each building at location as directed.
- .3 Provide separate drain piping directly to exterior of building.

2.6 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 Pressure or flow switch type:
 - .1 With normally open and normally closed contacts and supervisory capability.

- .2 Provide switch with circuit opener or closer for automatic transmittal of alarm over facility fire alarm system.
 - .3 Connect into building fire alarm system.
 - .4 Connection of switch: Section 28 31 01 - Fire Alarm Systems.
 - .5 Alarm actuating device: mechanical diaphragm controlled retard device adjustable from 10 to 60 seconds and instantly recycle.
- .4 Pressure alarm switch:
- .1 With normally open and normally closed contacts and supervisory capability.

2.7 WATER GONG

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

2.8 FIRE DEPARTMENT CONNECTION

- .1 Provide connections approximately 1.5 m above finish grade, location as indicated.
- .2 To ANSI/NFPA 13 and ULC S543 listed, Siamese type.
- .3 Polished chrome plated recessed of approved two-way type with 2.5 inch National Standard female hose threads with plug, chain, and identifying fire department connection escutcheon plate.
- .4 Thread specifications: compatible with local fire department.

2.9 EXCESS PRESSURE PUMP

- .1 Pump and motor unit:
 - .1 Pumps: positive displacement, gear type integrally mounted with motor.
 - .2 Approved for automatic wet pipe fire extinguishing sprinkler systems; complete with pilot light panel, differential motor control switch, high pressure switch, and low pressure switch.
 - .3 EEMAC Class B squirrel cage induction 1725 rpm, continuous duty, drip proof, ball bearing, maximum temperature rise 50 degrees C, 0.25 kW, 120/1/60.
 - .4 Capacity: 7.6 L/min.
- .2 Provide electrical power supply connections for pump and pilot light panel at supply side of building service panel. Provide separate fused safety-type switch with locked lever for each connection.
- .3 Pump operation switch: to operate excess pressure pump with pressure differential of 103 kPa.
- .4 Shut-off valve and strainer on pump inlet. Relief valve, check valve and shut-off valve on discharge connections.

2.10 PRESSURE GAUGES

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

2.11 PIPE SLEEVES

- .1 Provide pipe sleeves where piping passes through walls and floors.
- .2 Secure sleeves in position and location during construction.
- .3 Provide sleeves of sufficient length to pass through entire thickness of walls and floors.
- .4 Provide 2.5 cm minimum clearance between exterior of piping and interior of sleeve or core-drilled hole.
 - .1 Firmly pack space with mineral wool insulation.
 - .2 Seal space at both ends of sleeve or core-drilled hole with mechanically adjustable segmented elastomeric seal.
 - .3 In fire walls and fire floors, seal both ends of pipe sleeves or core-drilled holes with ULC listed fill, void, or cavity material.
- .5 Sleeves in Masonry and Concrete Walls, Floors, and Roofs:
 - .1 Provide hot-dip galvanized steel, ductile-iron, cast-iron sleeves.
 - .2 Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in core-drilled hole are completely grouted smooth.
- .6 Sleeves in Other Than Masonry and Concrete Walls, Floors, and Roofs:
 - .1 Provide 0.61 mm thick galvanized steel sheet.

2.12 ESCUTCHEON PLATES

- .1 Provide one piece type metal plates for piping passing through walls, floors, and ceilings in exposed spaces.
- .2 Provide polished chromium-plated finish on copper alloy plates in finished spaces.
- .3 Provide paint finish on metal plates in unfinished spaces.

2.13 INSPECTOR'S TEST CONNECTION

- .1 Locate inspector's test connection at hydraulically most remote part of each system, provide test connections approximately 3 m above floor for each sprinkler system or portion of each sprinkler system equipped with alarm device.
- .2 Provide test connection piping to location where discharge will be readily visible and where water may be discharged without property damage.
- .3 Provide discharge orifice of same size as corresponding sprinkler orifice.

2.14 SIGNS

- .1 Attach properly lettered Bilingual and approved metal signs to each valve and alarm device to ANSI/NFPA 13.
- .2 Permanently fix hydraulic design data nameplates to riser of each system.

2.15 SPARE PARTS CABINET

- .1 Provide metal cabinet with extra sprinkler heads and sprinkler head wrench adjacent to each alarm valve. Number and types of extra sprinkler heads as specified in NFPA 13.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install, inspect and test to acceptance in accordance with ANSI/NFPA 13 and ANSI/NFPA 25.

3.3 PIPE INSTALLATION

- .1 Install piping straight and true to bear evenly on hangers and supports. Do not hang piping from plaster ceilings.
- .2 Keep interior and ends of new piping and existing piping thoroughly cleaned of water and foreign matter.
- .3 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.
- .4 Inspect piping before placing into position.

3.4 FIELD QUALITY CONTROL

- .1 Site Test, Inspection:
 - .1 Perform test to determine compliance with specified requirements in presence of Departmental Representative.
 - .2 Test, inspect, and approve piping before covering or concealing.
 - .3 Preliminary Tests:
 - .1 Hydrostatically test each system at 200 psig for a 2 hour period with no leakage or reduction in pressure.
 - .2 Flush piping with potable water in accordance with NFPA 13.

- .3 Piping above suspended ceilings: tested, inspected, and approved before installation of ceilings.
- .4 Test alarms and other devices.
- .5 Test water flow alarms by flowing water through inspector's test connection. When tests have been completed and corrections made, submit signed and dated certificate in accordance with NFPA 13.
- .4 Formal Tests and Inspections:
 - .1 Do not submit request for formal test and inspection until preliminary test and corrections are completed and approved.
 - .2 Submit written request for formal inspection at least 15 days prior to inspection date.
 - .3 Repeat required tests as directed.
 - .4 Correct defects and make additional tests until systems comply with contract requirements.
 - .5 Furnish appliances, equipment, instruments, connecting devices, and personnel for tests.
- .2 Site Tests:
 - .1 Testing to be witnessed by authority having jurisdiction.
 - .2 Develop, with Contract Administrator assistance, detailed instructions for O & M of this installation.
- .3 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION