

## **Part 1            General**

### **1.1    RELATED SECTIONS**

- .1    Section 01 33 00 - Submittal Procedures
- .2    Section 01 78 00 - Closeout Submittals
- .3    Section 07 92 00 - Sealants.

### **1.2    REFERENCES**

- .1    American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
  - .1    ASHRAE Standard 90.1-99, Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings (Including Addenda B, C, D, E, F, G, I and M) (includes supplements).
- .2    American Society for Testing and Materials (ASTM)
  - .1    ASTM C335-95, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
  - .2    ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
  - .3    ASTM C921-89/1996, 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 1999).
- .5    Underwriters' Laboratories of Canada (ULC)
  - .1    CAN/ULC-S102-M88 R2000, Surface Burning Characteristics of Building Materials and Assemblies.
  - .2    CAN/ULC-S702-1997, Thermal Insulation, Mineral Fibre, for Buildings

### **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 defined herein.

- .2 TIAC ss:
  - .1 CRF: Code Rectangular Finish.
  - .2 CPF: Code Piping Finish.

#### **1.4 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for pipe, fittings, valves and jointing recommendations.

#### **1.5 MANUFACTURERS' INSTRUCTIONS**

- .1 Submit manufacturers' installation instructions in accordance with Section 01 78 00 Closeout Submittals.
- .2 Installation instructions to include procedures to be used, installation standards to be achieved.

#### **1.6 QUALIFICATIONS**

- .1 Installer to be 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.

#### **1.7 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 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 TIAC Code A-6: Flexible unicellular tubular elastomer.
  - .1 Insulation: within vapour retarder jacket to ASTM C534
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Maximum "k" factor: 0.039 w/m<sup>2</sup>
  - .4 Certified by manufacturer to be free of stress cracking corrodants.

## **2.3 INSULATION SECUREMENT**

- .1 Tape: Self-adhesive, aluminum, plain reinforced, 50 mm wide minimum.
- .2 Contact adhesive: Quick setting.
- .3 Canvas adhesive: Washable.

## **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/m<sup>2</sup>.

## **2.8 JACKETS**

- .1 Aluminum
  - .1 To ASTM B208
  - .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.

### **Part 3 Execution**

#### **3.1 PRE-INSTALLATION REQUIREMENTS**

- .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 75 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 INSTALLATION OF ELASTOMERIC INSULATION**

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

#### **3.4 PIPING INSULATION SCHEDULES**

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 TIAC Code: A-6.
  - .1 Securements: as per manufactures recommendations.
  - .2 Seals: lap seal adhesive, lagging adhesive.
  - .3 Installation: TIAC Code 1501-CA.
- .3 Thickness of insulation to be as listed in following table.
  - .1 Run-outs to individual units and equipment not exceeding 4000 mm long.

- .2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp °C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)		
			Run out	to 1	1 1/4 to 2
Refrigerant, hot gas, liquid, suction		A-6	25	25	25
Condensate Drain		A-6	25	25	25

- .4 Finishes:
- .1 Exposed indoors: No further finish.
  - .2 Concealed, indoors: No further finish.
  - .3 Outdoors: Aluminum.
  - .4 Finish attachments: as per manufacturers installation.
  - .5 Installation: To appropriate TIAC code CRF/1 through CPF/5.

**END OF SECTION**

## **Part 1            General**

### **1.1      RELATED SECTIONS**

- .1      Section 01 78 00 - Closeout Submittals.

### **1.2      REFERENCES**

- .1      American Society of Mechanical Engineers (ASME)
  - .1      ASME B16.22-95, Wrought Copper Alloy Solder - Joint Pressure Fittings.
  - .2      ASME B16.24-91(R1998), Cast Copper Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500.
  - .3      ASME B16.26-88, Cast Copper Alloy Fittings for Flared Copper Tubes.
  - .4      ASME B31.5-00, Refrigeration Piping.
- .2      American Society for Testing and Materials (ASTM)
  - .1      ASTM A307-00, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .2      ASTM B280-08, Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
- .3      Canadian Standards Association (CSA)
  - .1      CSA B52-05, Mechanical Refrigeration Code.
- .4      Environment Canada (EC)

## **Part 2            Products**

### **2.1      TUBING**

- .1      Processed for refrigeration installation, deoxidized, dehydrated and sealed.
  - .1      Hard copper: to ASTM B280, type ACR.
  - .2      Annealed copper: to ASTM B280, with minimum wall thickness as per CSA B52 and ASME B31.5.

### **2.2      FITTINGS**

- .1      Service: design pressure 4.15 MPa and temperature 121 deg C. Coordinate requirements with cooling systems to be installed.
- .2      Brazed:
  - .1      Fittings: wrought copper to ASME B16.22.
  - .2      Joints: silver copper or copper-phosphorous, and non-corrosive flux.
- .3      Flanged:
  - .1      Bronze or steel Sch. 40, to ASME B16.24, Class 300.
  - .2      Gaskets: suitable for service.

.3 Bolts, nuts and washers: to ASTM A307, heavy series.

.4 Flared:

.1 Bronze or brass, for refrigeration, to ASME B16.26.

## **2.3 PIPE SLEEVES**

.1 Hard copper sized to provide 6 mm clearance around between sleeve and uninsulated pipe or between sleeve and insulation.

## **2.4 VALVES**

.1 22 mm and under: Max Working Pressure: 4.8 MPa, globe or angle non-directional type, diaphragm, packless type, with forged brass body and bonnet, moisture proof seal for below freezing applications, brazed connections.

.2 Over 22 mm: Max Working Pressure 4.8 MPa, globe or angle type, diaphragm, packless type, back-seating, cap seal, with cast bronze body and bonnet, moisture proof seal for below freezing applications, brazed connections.

## **Part 3 Execution**

### **3.1 GENERAL**

.1 Install in accordance with CSA B52 and ASME B31.5.

### **3.2 BRAZING PROCEDURES**

.1 Bleed inert gas into pipe during brazing.

.2 Remove valve internal parts, solenoid valve coils, sight glass.

.3 Do not apply heat near expansion valve and bulb.

### **3.3 PIPING INSTALLATION**

.1 General:

.1 Soft annealed copper tubing: bend without crimping or constriction. Hard drawn copper tubing: do not bend. Minimize use of fittings. Soft copper shall only be used near unit connections.

.2 Hot gas lines:

.1 Pitch at least 1:240 down in direction of low to prevent oil return to compressor during operation.

.2 Provide trap at base of risers greater than 2400 mm high and at each 7600 mm thereafter.

.3 Provide inverted deep trap at top of risers.

- .4 Provide double risers for compressors having capacity modulation.
  - .1 Large riser: install traps as specified above.
  - .2 Small riser: size for 5.1 m/s at minimum load. Connection upstream of traps on large riser.
- .3 Provide valves at all unit connections.

### **3.4 PRESSURE AND LEAK TESTING**

- .1 Close valves on factory charged equipment and other equipment not designed for test pressures.
- .2 Leak test to CSA B52 before evacuation to 2MPa and 1MPa on high and low sides respectively.
- .3 Test Procedure: Build pressure up to 35 kPa with refrigerant gas on high and low sides. Supplement with nitrogen to required test pressure. Test for leaks with electronic or halide detector. Repair leaks and repeat tests.

### **3.5 DEHYDRATION AND CHARGING**

- .1 Close service valves on factory charged equipment.
- .2 Ambient temperature to be at least 13 deg C for at least 12 hours before and during dehydration.
- .3 Use copper lines of largest practical size to reduce evacuation time.
- .4 Use two-stage vacuum pump with gas ballast on 2<sup>nd</sup> stage capable of pulling 5Pa absolute and filled with dehydrated oil.
- .5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.
- .6 Triple evacuate system components containing gases other than correct refrigerant or having lost holding charge as follows:
  - .1 Twice to 14Pa absolute and hold for 4h.
  - .2 Break vacuum with refrigerant to 14kPa.
  - .3 Final to 5Pa absolute and hold for at least 12 h.
  - .4 Isolate pump from system, record vacuum and time readings until stabilization of vacuum.
  - .5 Submit test results to Departmental Representative.
- .7 Charging:
  - .1 Charge system through filter-drier and charging valve on high side. Low side charging not permitted.
  - .2 With compressors off, charge only amount necessary for proper operation of system. If system pressures equalize before system is fully charged, close

charging valve and start up. With unit operating, add remainder of charge to system.

.3 Re-purge charging line if refrigerant container is changed during charging process.

.8 Checks:

.1 Make checks and measurements as per manufacturer's operation and maintenance instructions.

.2 Record and report measurements to Departmental Representative.

### **3.6 INSTRUCTIONS**

.1 Post instructions in frame with glass cover in accordance with Section 01 78 00 - Closeout Submittals.

**END OF SECTION**

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**Part 1            General**

**1.1    REFERENCES**

- .1    American National Standards Institute/National Fire Protection Association (ANSI/NFPA)
  - .1    ANSI/NFPA 90A- 1989 , Installation of Air Conditioning and Ventilating Systems.
- .2    Underwriters Laboratories of Canada (ULC)
  - .1    CAN4-S112- M82(R1987) , Fire Test of Fire Damper Assemblies.
  - .2    CAN4-S112.2- M84 , Fire Test of Ceiling Firestop Flap Assemblies.
  - .3    ULC-S505- 1974 , Fusible Links for Fire Protection Service.

**1.2    PRODUCT DATA**

- .1    Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Indicate the following:
  - .1    Fire dampers.
  - .2    Fusible links.
  - .3    Design details of break-away joints.

**1.3    CLOSEOUT SUBMITTALS**

- .1    Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

**1.4    CERTIFICATION OF RATINGS**

- .1    Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

**Part 2            Products**

**2.1    FIRE DAMPERS**

- .1    Fire dampers: listed and bear label of ULC and meet requirements of provincial fire authority and authorities having jurisdiction. Fire damper assemblies to be fire tested in accordance with CAN4-S112.

- .2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.
- .3 Type B (rectangular): for horizontal or vertical mounting, sized to maintain full duct cross sectional area.
- .4 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.
- .5 40 x 40 x 3 mm retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.

### **Part 3 Execution**

#### **3.1 INSTALLATION**

- .1 Install in accordance with ANSI/NFPA 90A and in accordance with conditions of ULC listing.
- .2 Maintain integrity of fire separation.
- .3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.
- .4 Install access door adjacent to each damper.
- .5 Coordinate with installer of firestopping.
- .6 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.
- .7 Install break-away joints of approved design on each side of fire separation.

**END OF SECTION**

**Part 1            General**

**1.1        RELATED SECTIONS**

- .1        Section 01 33 00 - Submittal Procedures.
- .2        Section 23 23 00 - Copper Tubing and Fittings Refrigerant.

**1.2        REFERENCES**

- .1        Air-Conditioning and Refrigeration Institute (ARI)
  - .1        ARI 210/240-84, Standard for Unitary Air Conditioning and Air-Source Heat Pump Equipment.
- .2        American National Standards Institute/National Fire Protection Association (ANSI/NFPA)
  - .1        ANSI/NFPA 90A-1989, Installation of Air Conditioning and Ventilating Systems.
- .3        American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
  - .1        ASHRAE Standard 15-1994, Safety Code for Mechanical Refrigeration.
- .4        Canadian Standards Association (CSA)
  - .1        CAN/CSA-C273.3-M91, Performance Standard for Split-System Central.

**1.3        SHOP DRAWINGS AND PRODUCT DATA**

- .1        Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Indicate:
  - .1        Capacities
  - .2        ARI Ratings
  - .3        Sound Power levels
  - .4        Installation instructions
  - .5        Start-up Instructions
  - .6        O&M, Instructions
  - .7        Wall bracket detail.

**1.4        WARRANTY**

- .1        Contractor hereby warrants heat pumps in accordance with GC 24, but for 5 years.

## **Part 2 Products**

### **2.1 GENERAL**

- .1 Heat pumps to be CSA approved and carry ARI or CSA certification seal.
- .2 System shall conform to NFPA-90A and ASHRAE Standards 15.

### **2.2 REFRIGERANTS**

- .1 Type of Refrigerant: R-410A or approved equal.
- .2 Sufficient refrigerant shall be provided to charge entire system as installed.

### **2.3 DRAIN PANS**

- .1 Design and construct condensate drain pans under indoor coils so that no water can accumulate and install to allow for easy cleaning.
- .2 Provide integral drain pumps with all indoor units.

### **2.4 INDIVIDUAL AIR-SOURCE SPLIT SYSTEM HEAT PUMPS**

- .1 Indoor Unit: (EVAP 1 - 5 )Wall mounted unit with cross flow fan 208-230V, single phase, 0.3A MCA. 2.3 Kw nominal capacity.
- .2 Outdoor Unit: (COND-1)Single compressor outdoor unit with inverter driven variable speed compressor. Propeller fan. Electronic expansion valve. 10.5 kW rated cooling capacity, 10.5 kW rated heating output. 12.5 EER cooling, 11.6 EER heating.

### **2.5 ACCESSORIES**

- .1 Provide aluminum wall bracket to mount outdoor unit from wall as indicated.

### **2.6 CONTROLS**

- .1 Remote Controller
  - .1 Remote controller with liquid crystal display, temperature sensor with adjustable temperature setpoint, weekly programmable timer, fan speed setting, operation mode . Provide with sufficient control wire between remote controller and heat pump indoor unit.
- .2 Auxiliary Heat Kit
  - .1 External heat kit adapter to control existing baseboard heat. External heat kit to allow remote controller to energize baseboard heat if heat pump cannot satisfy temperature demand.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install where indicated and in accordance with manufacturer's instructions.
- .2 Install outdoor units at ground level on shop fabricated steel housekeeping pad as indicated.
- .3 Provide concrete base as indicated.
- .4 Secure with hold-down bolts.
- .5 Make all duct connections through flexible connections.
- .6 Level unit with fans running. Align ductwork, flexible connections. Misalignment with fan stopped not to strain or damage flexible connection.
- .7 Make all piping connections.
- .8 Nothing to obstruct ready access to all components or to prevent removal of components for servicing.

**3.2 DRAIN PANS**

- .1 Install so that no water can accumulate and arrange so as to be easily accessible for cleaning.

**3.3 START-UP AND COMMISSIONING**

- .1 Manufacturer to certify installation.
- .2 Manufacturer to be present during start-up and certify performance.
- .3 Manufacturers to provide verbal, and written instructions to operating personnel. Instructions and material to be provided in English and French.
- .4 Submit written report to Departmental Representative.

**END OF SECTION**