METROLINX

Capital Projects Group

Split Type Air to Air Heat Pumps Specification

Specification 23 81 26

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Amendment Record Sheet

Amendment in Clause No.	Date of Amendment	Description of Changes
Various	Sept. 20, 2018	Revised to coordinate with corresponding specifications.

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1. GENERAL

1.1. SCOPE OF WORK

1.1.1. Provide split type air to air heat pumps as detailed on drawings and as specified herein.

1.2. DESIGN REQUIREMENTS

1.2.1. Air-source type heat pump system allowing simultaneous cooling and heating with a minimum system efficiency of 13 SEER.

1.2.2. System components

a) Outdoor condensing unit(s).

b) Indoor evaporator unit(s).

c) Controller to be integrable with DRM BAS system.

d) Interconnecting refrigerant piping.

e) Condensate drainage to drain by built-in condensate drain pump.

1.2.3. Design requirements are based on Part 2 specified requirements of products.

1.3. RELATED WORKS

1.3.1. Section 20 05 05 - Mechanical Work General Instructions.

1.3.2. Section 20 05 10 - Basic Mechanical Materials and Methods.

1.3.3. Section 20 05 40 – Mechanical Work Commissioning.

1.3.4. Section 23 23 00 – Refrigerant Piping, Valves and Accessories.

1.4. REFERENCE STANDARDS

1.4.1. Standards and codes to be latest editions adopted by and enforced by local governing authorities.

1.4.2. The units shall be listed by Electrical Testing Laboratories (ETL) and bear the ETL label.

1.4.3. The units shall conform to ANSI/UL STD. 1995 and certified to CAN/CSA C22.2 No. 236- 05.

1.4.4. The units shall be rated in accordance with ARI Standard 210/240 and bear the ARI label.

1.4.5. ANSI B16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

1.4.6. ASME B16.29-2017 Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings – DWV.

1.4.7. ARI 760 Performance Rating of Solenoid Valves for Use with Volatile Refrigerants.

1.4.8. ASHRAE Standard 15 Safety Standard for Refrigeration Systems.

1.4.9. ASHRAE Standard 17 Method of Testing Capacity of Thermostatic Refrigerant Expansion Valves.

1.4.10. ASHRAE Standard 63 Method of Testing Liquid-Line Filter Drier Filtration Capability.

1.4.11. ASHRAE Standard 69 Methods of Testing Discharge Line Refrigerant-Oil Separators.

1.4.12. ASHRAE Standard 90.1 Energy Standard for Buildings Except Low-Rise Residential Buildings.

1.4.13. ASTM A126 Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

1.4.14. ANSI B16.18 Cast Copper Alloy Solder Joint Pressure Fittings.

1.4.15. ANSI B16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

1.4.16. ASTM B32 Standard Specification for Solder Metal.

1.4.17. ASTM B88 Standard Specification for Seamless Copper Water Tube.

1.4.18. ASTM B280 Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

1.4.19. ASTM B306 Standard Specification for Copper Drainage Tube (DWV).

1.4.20. AWS A5.8 Filler Metals for Brazing & Braze Welding.

1.4.21. CSA B158.1 Cast Brass Solder Joint Drainage, Waste and Vent Fittings.

1.4.22. MSS SP-72 Ball Valves with Flanged or Buttwelding Ends.

1.5. TRAINING

1.5.1. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

1.5.2. Include for 3 training sessions of maximum 7 hours duration per session for 10 Metrolinx people per session.

1.5.3. Refer to Section 20 05 05 for additional general requirements.

1.6. WARRANTY

1.6.1. Products to be guaranteed by manufacturer, for a minimum of 2 years after acceptance by Metrolinx.

1.7. DELIVERY, STORAGE AND HANDLING

1.7.1. Handle and store products in accordance with manufacturer's instructions, in locations approved by Metrolinx. Include one copy of these instructions with product at time of shipment.

1.8. SUBMITTALS

1.8.1. Refer to submittal requirements in Section 20 05 05.

1.8.2. Product Data

a) Submit manufacturer's Product data indicating:

1) technical data, supplemented by bulletins, component illustrations, detailed views, technical descriptions of items, and parts lists;

2) performance criteria, compliance with appropriate reference standards; characteristics, limitations, and troubleshooting protocol;

3) product transportation, storage, handling, and installation requirements;

4) product identification in accordance with Metrolinx requirements.

1.8.3. Shop Drawings

a) Submit shop drawings/product data sheets for products. Include following:

1) capacity and ratings;

2) dimensions;

3) mounting details to suit locations shown, indicating methods and hardware to be used;

4) control components and control wiring schematic.

1.8.4. Commissioning Package

a) Submit the following in accordance with Sections 20 05 05 and 20 05 40:

1) Commissioning Plan;

2) Commissioning Procedures;

3) Certificate of Readiness;

4) complete test sheets specified in Section 20 05 40 and attach them to the Certificate of Readiness;

5) Source Quality Control inspection and test results and attach to the Certificate of Readiness.

1.8.5. Commissioning Closeout Package

a) Submit the following in accordance with Section 20 05 05:

1) Deficiency Report;

2) Commissioning Closeout Report;

3) submit the following for each Product for incorporation into the Operation and Maintenance Manuals in accordance with Section 20 05 05:

i) Identification: manufacturer's name, type, year, serial number, number of units, capacity, and identification to related systems;

ii) functional description detailing operation and control of components;

iii) performance criteria and maintenance data;

iv) safety precautions;

v) operating instructions and precautions;

vi) component parts availability, including names and addresses of spare part suppliers;

vii) maintenance and troubleshooting guidelines/protocol;

viii) product storage, preparation, handling, and installation requirements;

IX) Commissioning Report.

1.9. QUALITY ASSURANCE

1.9.1. Manufacturers Qualifications

a) Manufacturer shall be ISO 9000, 9001 or 9002 certified. Manufacturer of product shall have produced similar product for a minimum period of five years. When requested by Consultant, an acceptable list of installations with similar product shall be provided demonstrating compliance with this requirement.

b) Manufacturers are to be current members of Air-Conditioning, Heating and Refrigeration Institute (AHRI), and products are to be in accordance with requirements of standards listed previously.

c) Where manufacturers provide after installation onsite inspection of product installations, include for manufacturer's authorized representative to perform onsite inspection and certificate of approvals.

1.9.2. Installers Qualifications

a) Installers for work to be performed by or work under licensed Mechanical Contractor.

b) Installers of equipment, systems and associated work are to be fully qualified and experienced installers of respective products and work in which they are installing.

c) Where manufacturers provide training sessions to installers and certificates upon successful completion, installers to have obtained such certificates and submit copies with shop drawings.

1.9.3. Regulatory Requirements

a) Products and work to comply with applicable local governing authority regulations, bylaws and directives.

b) Include for required inspections and certificate of approvals of installation work from local governing authorities.

2. PRODUCTS

2.1. OUTDOOR CONDENSING UNIT

2.1.1. Refrigerant flash technology enables providing up to 100% of rated heating capacity at -18 °C (0 °F) in standard mode.

2.1.2. Operating Temperature Range

a) Cooling (Outdoor): -5 °C to 46 °C (23°F to 115 °F) DB.

b) Heating (Outdoor): -25 °C to 15 °C (-13 °C to 60 °F) DB.

2.1.3. Modular design allowing multiple smaller capacity units to be piped together to form a large capacity system.

2.1.4. Minimum outdoor temperature for simultaneous cooling and heating operation is -20 °C (-4 °F).

2.1.5. Cabinet

a) The casing shall be constructed from galvanized steel plate and finished with ivory colour (Munsell 3Y 7.8/1.1) acrylic paint.

b) The fan grille shall be of polypropylene (PP) plastic.

c) Built-in base pan heater to prevent ice in drain pan.

2.1.6. Compressor

a) The compressor shall be hermetic scroll type with variable compressor speed inverter technology.

b) The compressor crankcase shall be heated by intermittent low speed compressor motor rotation.

c) The outdoor unit shall have high pressure and over current protective device.

d) The compressor shall have two phase flash injection technology.

2.1.7. Fan

a) The unit shall be furnished with DC fan motors for direct drive propeller fan.

b) The motor bearings shall be permanently lubricated.

c) The fan shall be mounted in front of the coil, pulling air across it from the rear and dispelling it through the front.

2.1.8. Coil

a) The condenser coil shall be of copper tubing with flat aluminum fins.

b) The coil shall be protected with an integral metal guard.

2.2. INDOOR EVAPORATOR UNIT(S)

2.2.1. One air source condensing unit supports up to 50 indoor units. The indoor unit shall be factory assembled, wired and tested.

2.2.2. Contained within the unit shall be all factory wiring, internal piping, internal diagnostic control circuit board and fan motor for maintenance.

2.2.3. Indoor unit shall have capabilities to be installed at a maximum height of 30 m (100 ft.) above or below the outdoor unit.

2.2.4. Total capacity of connected indoor units can be 50 - 150% of system capacity.

2.2.5. Return air shall be filtered by means of an easily removed washable filter with a MERV rating of 1-4.

2.2.6. The evaporator coil shall be of copper tubes construction with aluminum strake pre-coated fins on copper tubing. All tube joints shall be brazed with phoscopper and silver alloy.

2.2.7. A condensate pan and drain shall be provided under the coil. All units equipped with condensate drain pump capable of up to 550 mm (22") of lift.

2.2.8. Exposed Evaporators

a) Ceiling Cassette - 4 Way Air Flow (3/4 ton - 3 ton cooling capacity).

b) Ceiling Cassette - 2 Way Air Flow (1/2 ton - 2 ton cooling capacity).

c) Ceiling Cassette - 1 way Air Flow (1/2 ton - 2 ton cooling capacity).

d) Wall Hung (1/2 ton - 3 ton cooling capacity).

e) Floor Mounted (1/2 ton - 2 ton cooling capacity).

2.2.9. Concealed Evaporators

a) Low Static - up to 50 Pa (1/2 ton - 2 ton cooling capacity).

b) Medium Static - up to 130 Pa (1/2 ton - 4 ton cooling capacity).

c) High Static - up to 200 Pa (1 ton - 8 ton cooling capacity).

2.3. CONTROLLER

2.3.1. Controller allows monitoring and control of up to 50 indoor evaporator units.

2.3.2. The unit shall have a wired controller with microprocessor controls to perform input functions necessary to operate the system. There shall be a multi-language large DOT liquid crystal display wired controller.

2.3.3. The controller shall have a built in room temperature sensor.

2.3.4. The microprocessor control signal between the indoor and outdoor unit shall be incorporated with the indoor unit's electric supply requiring a minimum of 4 wire (3+gnd.) 12AWG cable.

2.3.5. The system shall be capable of automatic restart when power is restored after power interruption.

2.3.6. The wired controller shall provide 7 day programmable time schedule with temperature set back and system ON/OFF operation.

2.3.7. The controller shall have auto change over between heating and cooling modes.

2.3.8. The controller shall provide system error diagnostic code and operation historical data for troubleshooting.

2.3.9. The wired controller shall have built in lead lag control (operation rotation between two systems, backup operation on failure of working system) between two systems.

2.3.10. The system shall have the option to be integrated and controlled by BMS (LonWorks, BacNet).

2.3.11. The system shall provide status and error output signals.

2.3.12. The system shall have remote (control from remote location) ON/OFF control.

2.4. REFRIGERANT PIPING, VALVES AND ACCESSORIES

2.4.1. Refrigerant Piping

a) Copper refrigerant tube, ASTM B280, cleaned, dehydrated and sealed, marked ACR on hard temper straight lengths. Coils shall be tagged ASTM B280 by the manufacturer.

2.4.2. Soldering

a) Solder joints: Wrought copper fittings, ANSI B16.22.

b) Solder, refrigerant tubing: Cadmium free, AWS A5.8, 45 percent silver brazing alloy, Class Bag-5.

c) Solder, water and drain: 95-5 tin-antimony, ASTM B32 (95TA).

2.4.3. Refrigeration Valves

a) Stop Valves: Brass or bronze alloy, packless, or packed type with gas tight cap, frost proof, backseating.

b) Pressure Relief Valves: Forged brass with nonferrous, corrosion resistant internal working parts of high strength, cast iron bodies conforming to ASTM A126, Grade B. Set valves in accordance with ASHRAE Standard 15.

c) Solenoid Valves: ARI 760, UL-listed, two-position, direct acting or pilot-operated, moisture and vapor-proof type of corrosion resisting materials, designed for intended service, and solder-end connections. Fitted with suitable NEMA 250 enclosure of type required by location.

d) Thermostatic Expansion Valves: Brass body with stainless-steel or non-corrosive non- ferrous internal parts, diaphragm and spring-loaded (direct-operated) type with sensing bulb and distributor having side connection for hot-gas bypass and external equalizer. Size and operating characteristics as recommended by manufacturer of evaporator and factory set for superheat requirements. Solder-end connections. Testing and rating in accordance with ASHRAE Standard 17.

e) Check Valves: Brass or bronze alloy with swing or lift type, with tight closing resilient seals for silent operation; designed for low pressure drop, and with solder-end connections. Direction of flow shall be legibly and permanently indicated on the valve body.

2.4.4. Refrigeration Accessories

a) Strainers: Designed to permit removing screen without removing strainer from piping system, and provided with screens 80 to 100 mesh in liquid lines up to 30 mm (1-1/8 inch), 60 mesh in liquid lines over 30 mm (1-1/8 inch), and 40 mesh in suction lines. Provide strainers in liquid line serving each thermostatic expansion valve, and in suction line serving each refrigerant compressor not equipped with integral strainer.

b) Refrigerant Moisture/Liquid Indicators: Double-ported type having heavy sight glasses sealed into forged bronze body and incorporating means of indicating refrigerant charge and moisture indication. Provide screwed brass seal caps.

c) Refrigerant Filter-Dryers: ULC listed, angle or in-line type, as shown on drawings. Conform to ASHRAE Standard 63. Heavy gage steel shell protected with corrosion-resistant paint; perforated baffle plates to prevent desiccant bypass. Size as recommended by manufacturer for service and capacity of system with connection not less than the line size in which installed. Filter driers with replaceable filters shall be furnished with one spare element of each type and size.

d) Flexible Metal Hose: Seamless bronze corrugated hose, covered with bronze wire braid, with standard copper tube ends.

e) Oil Separators: Provide for condensing units, where determined as necessary by the equipment manufacturer. All welded steel construction with capacity to eliminate a minimum of 95 percent of the oil from the hot gas flowing through it. Provide manufacturer's published ratings for minimum and maximum refrigeration tonnage corresponding to this oil separating efficiency. Conform to ASHRAE Standard 69. Separator shall be equipped with a float valve to prevent return of the hot gas to crankcase, and shall have isolating stop valves so it can be opened and services without pumping out any other part of the system. ASME construction or ULC listed.

2.4.5. Refer also to requirements of Section 23 23 00.

2.5. CONDENSATE DRAINAGE LOOP

2.5.1. Connect all evaporators to the condensate drainage loop. Direct drainage to open-gap funnel floor drain, in accordance with code requirements.

2.5.2. Insulate all horizontal sections of the condensate drainage loop.

2.5.3. Gravity Drainage Sections

a) Copper piping, Type DWV to:

1) ASTM B306-81 for copper tube;

2) CSA B158.1-1976 for cast brass fittings;

3) ANSI B16.29-1973 for wrought copper fittings;

4) Solder: tin-lead, 50:50, to ASTM B32-76, type 50A;

5) ASTM B88-83.

2.5.4. Pumped Drainage Sections

a) Pipe: Copper tube, ASTM B88, Type K or L, drawn.

2.5.5. Fittings for Copper Tube

a) Wrought copper or bronze castings conforming to ANSI B16.18 and B16.22. Unions shall be bronze, MSS SP-72, SP-110. Solder or braze joints.

b) Adapters: Provide adapters for joining screwed pipe to copper tubing.

C) Solder: ASTM B32 Composition Sb5. Provide non-corrosive flux.

3. EXECUTION

3.1. INSTALLATION

3.1.1. Provide split system equipment consisting of an exterior condensing unit and an indoor evaporator.

3.1.2. Secure condensing unit in place, level and plumb, on vibration isolation pads on a concrete housekeeping pad (on grade) or on pressure treated wooden sleepers (roof top).

3.1.3. Where applicable, anchor equipment in accordance applicable local governing codes requirements for seismic control and restraints. Provide flexible connections in all piping connections to equipment.

3.1.4. Install loose control components and perform required control wiring (except building automation system connections) between condensing unit and evaporator in conduit in accordance with manufacturer's control wiring schematic and wiring standards of electrical work.

3.1.5. Refer to Section 20 05 10 for equipment/system manufacturer certification requirements.

3.1.6. Refer to Section 20 05 10 for equipment/system start-up requirements.

END OF SECTION