1.0 GENERAL

The indoor air-handling unit and mini-duct, high-velocity duct system shall be designed to deliver the minimum airflow required to meet the specified capacity of the equipment. The equipment and duct design shall comply with the written definition of a Small-Duct High-Velocity system per ARI 210/240.

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of such products, which are of similar material, design and workmanship.

The manufacturer shall warrant against defects in materials and workmanship for a period of one year on all parts.

The system model number shall be _____.

2.0 DESIGN REQUIREMENTS

2.1 General

Each system shall be designed to deliver at least the minimum airflow required to produce the required capacity for heating or cooling, whichever is greater. There shall be some means of adjusting the airflow, either by changing fan speeds, or adding restriction to the duct system by means of a restricter plate or balancing orifices.

The system shall have a total cooling capacity of _____ BTU/HR (kW) with a sensible heat ratio less than 0.65 based on the entering air condition of 80°F (26.7°C) dry bulb, and 67°F (19.4°C) wet bulb.

The system shall have a total heating capacity of _____ BTU/HR (kW), based on the entering air condition of 70°F (21.1°C) dry bulb.

2.2 Special Requirements

2.2.1 Refrigerant Systems

Each system shall be capable of delivering at least 250 CFM per nominal ton of capacity (33 L/s per nominal kW).

The system shall conform to ARI 210/240 and be rated for a minimum Seasonal Energy Efficiency (SEER) of 10.0. Heat pump models shall be rated with minimum Heating Seasonal Performance Factor (HSPF) of 6.8.

2.2.2 Hydronic Systems

The capacity of the chilled water and hot water coil shall include any temperature rise across the blower and motor.

The chilled water coil cooling capacity shall be based on entering water of _____ °F (°C) at _____ GPM (l/s).

The hot water coil heating capacity shall be based on entering water of _____ °F (°C) at _____ GPM (l/s).

3.0 MECHANICAL EQUIPMENT

The air-handling unit shall be in accordance with UL 1995 (CAN/CSA-C22.2 No. 236). The unit shall include a blower, motor, controls, and heat exchanger. If the total weight of the unit is greater than 100 pounds (45 kg), the unit shall be modular in construction such that the sections are easily joined without special tools.

3.1 Cabinet

The cabinet shall be constructed of 22 gauge galvanized steel and be designed for easy installation and service.

3.2 Blower and Motor

The unit shall be designed for 208-230 volt, 1 phase, and 60 Hz power. The blower motor shall be a permanent split capacitor type with Class B insulation. It shall have permanently lubricated ball bearings and automatic reset thermal overload protection.

The blower shall be direct driven centrifugal type designed for high-pressure applications. The minimum external static pressure shall be 1.2 inches of water (298 Pa). The motor shall mount directly to the blower housing and inlet ring by means of a heavy gauge spider mount that is easily removed for service using a twist-and-lock design.

3.3 Controls

All controls shall be designed for 24 volt. The control panel shall include a 48VA class 2, 24V/208-230V transformer inherently or internally fused. All refrigerant coils shall be protected by a temperature limit control to protect the coil from freeze up. Heat pump coils shall additionally provide a bypass relay to jumper out the anti-frost control during defrost mode. The blower control shall include a low-speed ventilation mode to circulate air without heating or cooling.

A third party low ambient head pressure control shall be installed to maximize system capacity as the outdoor temperature drops. This control shall maintain head pressure by controlling the condenser fan. It shall be compatible with the condenser fan motor.

A Mild Weather Kit Control, Model UPC-65, shall be installed on each heat pump to limit head pressure, preventing nuisance tripping of the compressor high pressure switch when heating is required during warm ambient conditions.

OPTIONAL. The controls shall include a soft-start soft-stop feature; relays for a humidifier, ERV, hot water coil, and chilled water coil; the ventilation mode shall be half speed operate using less than 30% of the full speed power.

3.4 Heat Exchangers

3.4.1 Refrigerant Coil

Refrigerant coils shall have 3/8-inch (9.5-mm) minimum diameter copper tubes with mechanically bonded or soldered aluminum fins. Each coil shall be dehydrated and sealed after testing and prior to evacuation and charging. Each coil shall contain a small nitrogen holding charge less than 10 psig(.70 kg/sq cm).

The coils shall be designed for R22 and R410A refrigerant. Refrigerant metering shall be accomplished with an externally equalized TX valve with threaded connections of either Chatleff or flare type. Heat pump coils shall include an internal or external bypass check valve. Liquid line connection shall be 3/8 inch (9.5-mm) ODF. Suction line connection for 2 to 5 ton systems shall be 7/8 inch (22.2-mm) ODF and 5/8 inch (15.9-mm) ODF for 1 to 1.5 ton systems.

3.4.2 Hydronic Coil

Hydronic coils shall be designed for 150 psig (10.5 kg/sq. cm)at 200°F (93°C). Each coil shall include a vent and a drain plug. The vent plug shall

be at the highest practical point of the coil. The drain plug shall be at the lowest practical point of the coil. Hot water coils shall be installed by sliding into the cabinet for easy installation and service. All water coil connections shall be 7/8 inch (22.2-mm) OD except for the M1218 hot water coil which shall be 5/8 inch (15.9 mm) OD.

3.5 Drain Pan

All cooling coils shall have a stainless steel primary drain pan. The primary drain connection shall be ½ inch (12.7-mm) FPT for units less than 2-ton capacity, and ¾ inch (19.1-mm) FPT for all larger units.

All primary drain pans shall be trapped with a 2.5 inch (64 mm) deep clear trap with removable cleanout caps.

For all installations where an overflow of condensate can cause damage, a secondary drain pan shall be installed under the entire unit with a separate non-trapped drain connection.

3.6 Electric Heater

The electric heater shall have its own separate control box with built-in circuit breakers and safety limits. It shall be _____ kW, 230 volt, 1 phase, 60 Hz. It shall be in its own cabinet and installed in the supply plenum at least 4 feet (122 cm) from any upstream equipment or fitting, and at least 2 feet (61 cm) from any downstream fitting.

The electric duct heater shall be built with ____ stages, with the first stage greater or equal to the other stages. The electric heaters shall be listed per UL 1995. Additionally, the electric heater will have a defrost circuit where one or more stages will be energized during the defrost mode if installed with a heat pump.

4.0 AIR DISTRIBUTION

The air distribution system shall be designed with a pressurized manifold (supply plenum) that feeds 2-inch (50.8-mm) ducts directly into the conditioned space. All ducts and connections shall be designed for 2 inches (50.8-mm) water column static pressure.

A minimum of 6 outlets per nominal ton (3.5 kW) shall be installed. The number and placement of the outlets shall be in accordance with the manufacturer's instructions, based on the room-by-room load analysis. Balancing is accomplished by matching the number of outlets in each room to the required load, using balancing orifices.

Duct insulation R-factor shall comply with the local building code and any BOCA or ICC engineering evaluation reports.

4.1 Plenum

The plenum may be insulated and sealed metal duct or fiberglass duct board. Fiberglass ductboard shall be ___ (1 or 1.5 inches) (25.4, 38 mm) thick. The plenum will be at least 7-inch (17.8-cm) I.D. for any airflow less than 700 CFM (329 L/s), at least 9-inch (22.9-cm) I.D. for any airflow less than 1000 CFM (470 L/s), or 10-inch (25.4 cm) I.D for airflow less than 1250 CFM (589 L/s). The number of elbows and tees shall be kept to a minimum.

4.2 Supply Tubing

The supply tubing shall be a flexible 2-inch (50.8-mm) inside diameter duct, wrapped with fiberglass insulation with an outer reinforced aluminized mylar vapor seal jacket. The inner core shall be two-ply corrugated aluminum. The supply tubing shall conform to UL 181 class 1 air ducts and be so labeled.

4.3 Sound Attenuator

Each duct run shall either terminate with at least 3 feet (0.9 m) of sound attenuator connected to at least 3 ft (0.9 m) of Supply Tubing, or the entire run shall be Sound Attenuator. The sound attenuator shall conform to UL Standard 181 as an Air Duct and be so labeled. It shall be constructed with helical wire and spun-bonded nylon or polyester, wrapped with fiberglass insulation with an outer reinforced aluminized mylar vapor seal jacket.

4.4 Connectors

All connectors shall be metal and have a tape ring or some means of allowing the outer jacket of the tubing to be sealed without compressing the insulation. The 2-inch (50.8-mm) ducting shall connect to metal plenum with a flanged stub using sheet metal screws, or shall connect to fiberglass plenum with a spin-in connection. All plenum connections shall be sealed with a gasket.

Tube-to-tube connectors (couplings) shall also include tape rings. The inner core shall be secured to the connector by means of a hose clamp or sheet metal screw. The outer jacket shall be secured and sealed to the connector tape ring with UL-181A-P aluminum tape or UL-181B duct tape.

4.5 Terminators

Each duct run shall terminate with a one-piece flanged outlet through a 2-inch (50-mm) diameter opening or through a 0.5 inch x 8 inch rectangular opening. All round outlets shall be free of obstructions or grille work unless located in the floor. The round outlets shall have some means of capping to prevent moisture migration during extended periods of non-use in cold weather. The outlets shall be either insulated metal or plastic conforming to a UL 94HB fire rating.

4.6 Balancing

Air balancing shall be accomplished primarily by providing the proper number of outlets in each space. For small rooms, balancing can be fine-tuned with orifices that are installed at the takeoff (plenum) connections.

4.7 Return Air Duct

The return air duct system, including filter, shall be designed for a maximum of 0.15 inches 3.8-mm) static pressure at the required airflow. The return duct must either be an acoustical dampening flex duct, made of fiberglass duct board, or lined with an acoustical or fiberglass lining. In addition, there shall be at least one 90° bend in the duct to prevent line-of-sight from the unit to the return opening. There can be multiple return openings.

5.0 INSTALLATION AND CHECK-OUT

The installation of the equipment shall be in accordance with the equipment manufacturer's instructions and all applicable local codes.

The airflow through the unit must be measured before the ductwork is boxed-in by recording the blower motor amps and voltage and comparing to the amperage charts for the blower. The system balance and total airflow must be verified by recording the airflow output of each outlet with a velocity meter that matches the outlet dimensions or is calibrated for the opening size.