**HVAC Guide Specifications — Section 23**

**PR Packaged Rooftop Cooling Unit with Heat**

Size Range:

**3 to 140 Tons Nominal (Cooling)**

Addison Models:

**PRMA, PROA, PRRA, PRMH, PROH, PRRH, PRMW, PROW, PRRW**

**Part 1 — General**

1.01 SYSTEM DESCRIPTION:

Outdoor roof curb or slab mounted, electronically controlled, cooling or cooling/heating unit utilizing hermetic scroll compressors with crankcase heaters for cooling duty and gas combustion or electric resistance heaters for heating duty. Units shall discharge supply air vertically or horizontally as shown on contract drawings.

1.02 QUALITY ASSURANCE

A. Unit shall be designed to conform to the latest adopted editions of ANSI/ASHRAE 15, ASHRAE 62, and UL Standard 1995.

B. Unit shall be listed as a total package by ETL and ETL, Canada.

C. Gas heat equipped units shall be designed to conform to ANSI Standard Z21.47 (U.S.A.) / CSA Standard 2.3 (Canada), Gas-Fired Central Furnaces.

D. Roof curb shall be designed to NRCA criteria per Bulletin B-1986.

E. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.

1.03 DELIVERY, STORAGE AND HANDLING

Unit shall be stored and handled per manufacturer’s recommendations.

1.04 WARRANTY and QUALITY CONTROL

 A. Complete unit includes a 1st year warranty, parts only.

 B. An extended warranty 2nd-5th years for the compressor, parts only, shall be included.

 C. An extended warranty 2nd-10th years for the gas heat exchanger , parts only, shall be included.

 D. Quality Control – A Complete Functional & Sequential Factory Run Test in Every Mode:  Cooling,

 De-humidification, Heating, Economizer, Heat Recovery Mode, Heat Pump, as

 configured shall be performed with test results available. This includes refrigerant

 operating pressure and temperature, refrigerant high pressure cut out and low pressure cut out

 safeties to insure proper operation, measured subcooling and superheat for proper refrigerant

 charge, compressor(s) and fan motor(s) amperage draw. The completed functional test report

 shall be available and turned over to the end user.

**Part 2 — Products**

2.01 EQUIPMENT

A. General:

The unit shall be a packaged factory assembled heating and/or cooling system. The unit shall include all factory wiring with a single point power connection, phase and voltage monitor, refrigerant piping and charge (R-410A), operating oil charge. Single refrigerant circuit (sizes 036–096) or dual refrigerant circuits (sizes 120–840), shall include a microprocessor based control system. The unit shall, based on project requirements, include all special features necessary to provide fully conditioned ventilation air at neutral conditions to the building.

B. Unit Cabinet:

1. Double wall design, constructed of G-90 galvanized steel, bonderized primed on exterior and interior and pre-coated with a polyester pre-coat finish on exterior.

a. Top cover shall be a minimum 20-gage sheet metal with 2.0-in. thick, closed cell polyisocyanurate foam insulation with a 24-gage sheet metal interior liner.

b. Access panels shall be a minimum of 20-gage sheet metal with 2.0-in. thick, closed cell polyisocyanurate foam insulation with a 24-gage sheet metal interior liner. Fastening screws shall be Magniguard coated for corrosion resistance.

d. Base pans shall be 16 gage galvanized steel insulated with 0.375-in. thick closed cell foam insulation to provide a thermal barrier and seal against the roof curb. All openings through the base pan shall have upturned flanges at least 1.5 inches in height with sealed corners.

e. Condensate pan shall be double sloped, single wall 20-gage stainless steel with welded corners and insulated with 1 inch closed cell neoprene insulation.

f. Base rail shall be 6” C channel 12-gage galvanized steel G-90 and bolted ( A,B and C cabinet) or 6” tubular welded closed section structural steel tubing ( D and E cabinet) .

g. Roof sections shall be sloped for proper drainage and include drip edge.

2. Unit casing shall be capable of withstanding up to 2,500-hour salt spray exposure per ASTM B117.

3. Unit shall have insulated access doors, for easy access to the controls compartment and all other areas requiring servicing. Each door shall seal against a triple edge co-extruded EPDM gasket to help prevent air and water leakage. Door stays shall be provided for ease and safety during servicing.

 Access doors shall include a thermal break. Access doors shall be equipped with stainless steel piano hinges and quarter turn, adjustable, lockable by tool, draw tight cam-action latches.

4. Unit shall have provisions in frame rails to facilitate overhead rigging.

7. Filters shall be accessible through a hinged access panel.

8. The outdoor air opening shall have a factory provided hood with bird screen. Exhaust hoods shall be included with the economizer and/or exhaust options.

OPTIONS:

1. Outside air aluminum mesh filter

C. Fans:

1. Indoor Supply, Return/Exhaust Fans:
	1. Direct-drive plenum fan(s) shall be provided and both axial and radial clearances must be equal to or greater than fan manufacturer’s recommendations for full rated fan performance and efficiency. The inlet cone, impeller with backward curved or airfoil blades is manufactured of steel with a painted finish. Fan assembly shall be statically and dynamically balanced at the factory as a single rotating assembly to a quality level of G=2.5 in accordance with DIN ISO 1940-1. Provide ODP or TEFC premium efficiency motors with VFD. Fan motor assembly is rigid mounted for optimal performance.

OPTIONS:

* + - 1. Rubber pad isolation mount
			2. 1-inch spring isolation mount

b. ECM type assembly is base mounted and external rotor fan with backward curved blades of high performance composite material. Fan assembly shall be statically and dynamically balanced at the factory as a single rotating assembly to a quality level of G=6.3 in accordance with DIN ISO 1940-1.

2. Condenser Fan and motor fully assembled by manufacturer:

1. Fans shall be external rotor direct driven axial fans with a minimum 5-1/2” powder coated spun venturi for high efficiency and low noise, with powder coated sickle shaped blades.
2. The fan motor TEAO, totally enclosed air over, assembly shall be end mounted to a structurally powder coated rigid welded finger guard.
3. Fans shall be VFD driven for controlling head pressure. Low ambient operation is 0°F.

d. Fans shall discharge air vertically upward and the finger guard shall be powder coated.

e. Fans shall be statically and dynamically balanced as an assembly to a quality level of G=6.3 in accordance with DIN ISO 1940-1.

f. Fan Sound Power Levels as shown and scheduled:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  Tag | 63hz | 125hz | 250hz | 500hz | 1000hz | 2000hz | 4000hz | 8000hz | Total dBA |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |

OPTIONS:

* + - 1. Flooded head pressure control for minus 20°F ambient operation
			2. Low noise EC fan motors with serrated owlet fan blades

D. Compressors:

1. Fully hermetic, scroll type compressors with overload protection and short cycle protection with minimum on and off timers. Time delay relay 5 minute minimum ON run time for proper oil level and compressor operation
2. Compressor shall be installed in an insulated compartment accessible through hinged access doors for sound mitigation. Exposed compressors must be applied with sound blankets for sound mitigation.
3. Line voltage, low voltage operating controls, refrigerant circuit access points, refrigerant flow control devices and compressors shall be accessible from a single location behind stainless steel piano hinged access doors for ease of service.
4. Compressors shall be mounted on rubber in shear isolators and refrigerant lines to include reaction torque loops.
5. Reverse rotation protection shall be provided for all compressors and all 3 phase motors in the unit.
6. Crankcase heaters shall only be activated during compressor off mode.

OPTIONS: Variable Capacity Compressor(s):

1. On circuits up to eight (8) tons a digital compressor shall be available on the lead refrigeration circuit. The control system shall be capable of unloading the compressor in an unlimited number of steps for capacity control. For units without ALC DDC controllers a Digital Control Module (DCM) shall be included.
2. On circuits from ten (10) tons and larger a variable capacity compressor with a variable speed drive shall be available on the lead refrigeration circuit. The control system shall be capable of unloading the compressor in an unlimited number of steps for capacity control. Unit sizes 480 and larger have tandem type compressors. The lead compressor shall include a variable speed drive and staging control for remaining compressors for capacity control.

 E. Refrigerant Components:

1. Unit shall be equipped with single refrigerant circuit (sizes 036–096) or dual refrigerant circuits (sizes 120 and up) with each circuit containing:

a. Solid core filter drier.

b. Field adjustable externally equalized thermostatic expansion valve.

c. Service access ports

2. Unit shall be equipped with VFD-controlled variable condenser fan speed operation for head pressure control to allow low ambient operation down to 0F.

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F. Coils:

1. Standard evaporator coil shall have enhanced surface aluminum sine wave fins mechanically bonded to seamless internally grooved 3/8” diameter (ABC cabinets) 1/2” diameter (D,E cabinets) copper tubes, .012” tube wall thickness with brazed tube joints.

 Evaporator coils shall be minimum six (6) row with intertwined circuiting. Stacked coils shall be intertwined circuiting for the full face area to be active and prevent any stratified air temperatures from occurring.

1. Air Cooled Condensing Coil, Cooling only duty: microchannel floating microchannel

 condenser coil mounting design with rubber isolation and glide path for coil expansion and

 contraction.  Rigid mounted microchannel condenser coils are not acceptable.

* 1. Air Source Heat Pump duty: Standard air-over condenser coils shall have enhanced

surface aluminum plate fins mechanically bonded to seamless internally grooved copper tubes with brazed tube joints.

* 1. FrostShield™, Frost Free Air Source Heat Pump Operation. Factory installed sensors, controls and refrigerant valve(s) shall allow continuous heat pump operation down to an ambient of X° F without reverse-cycle defrost.
1. Design point: The unit shall produce xxx MBH at an ambient of X ° F dry bulb and a minimum COP of XX
2. Additional operating point: The unit shall produce xxx MBH at an ambient of  X ° F dry bulb and a minimum COP of XX

Selection Methods:

* Units sized to achieve scheduled capacity with mechanical refrigeration circuit (system) only. The scheduled MCA/MOCP is not to be exceeded.
* Units sized to achieve scheduled capacity with mechanical refrigeration circuit ( system) and supplemental heat. The scheduled MCA/MOCP is not to be exceeded.

Units requiring defrost shall submit performance profile during defrost operation and specify the supplemental heat required to maintain LAT setpoint during defrost. Any increase to MCA/MOCP will be the responsibility of the installing mechanical contractor to upgrade the electrical service.

3. Water source units sizes 036-840 Coaxial water-to-refrigerant heat exchanger coils, water side inner

 tube of copper and refrigerant side outer tube of steel. Coils and water piping are insulated.

a. Coils shall be rated for refrigerant side working pressure of 650 psig and water side working pressure of 400 psig. Hydrogen test gas shall be used for leak testing.

b. Factory installed and piped are heat exchanger, thermal dispersion water flow switch, and independent modulating head pressure control valves **per refrigeration circuit**.

4. Water source units Sizes 960-1680 use use a single dual circuited High-efficiency 316 Stainless Steel

 brazed plate heat exchangers with asymmetric refrigerant and water channels to provide enhanced

 efficiency & performance in both full and partial-load conditions with the most compact design.

 Asymmetric brazed plate heat exchangers also reduce the refrigerant charge requirement and provide

 lower water pressure drop for reduced system pumping horsepower. The equipment incorporates

 integral extended surface 3” basket with 60 Mesh stainless steel strainers with isolation valves for ease

 of maintenance and reduced equipment downtime. Factory installed and piped thermal dispersion

 flow switch, and head pressure control valve.

* 1. Brazed plate heat exchanger shall be rated for refrigerant side working pressure of 650 psig and water side working pressure of 400 psig. Hydrogen test gas shall be used for leak testing.

G. **COIL OPTIONS:**

1. Optional: Air cooled units, flooded condenser for head pressure control for operation down to a low ambient of minus 20 F during cooling operation
2. Optional Modulating Hot Gas Reheat: A factory-installed hot gas reheat (HGRH) coil shall be available. The HGRH coil shall be an available option on the lead circuit only or with a dual circuit coil for reheat both refrigerant circuits. Precise leaving DX coil air temperature sensor and control prior to reheat coil, for verification of proper de-humidification operation, as well as ease of troubleshooting and diagnostics.  Saturated Suction Temperature control is inadequate and not acceptable.
3. Optional :Liquid Subcooling Coil: The unit could be equipped with a factory-installed liquid sub-cooling coil on all circuits. The coil shall be located immediately downstream of the evaporator coil. Coil circuit(s) shall be switchable. Operation of sub-cooling coil shall increase the total cooling capacity and offer first stage of reheat. Refer to the equipment schedule for increase in capacity MBH and resultant improvement in EER .

H. Filter Section:

 1. Standard filter section shall have 2 in. filter racks of 20 gage G-90 construction. 2-in. thick

 MERV-8 pleated media filters as standard.

OPTIONS:

1. Optional filter section shall be supplied with 4-in. thick MERV-8, 11, or 13 pleated media filters.
2. Optional filter section shall be supplied with 2” MERV-8 pre-filter plus 4” MERV 8, 11, or 13 type filters.
3. Optional filter section shall be supplied with 2” metal mesh pre-filter plus 4” MERV 8, 11, or 13 type filters.
4. Dirty Filter Status Switch: shall be a pressure differential switch and will indicate a dirty filter. The switch shall be factory installed.

I. Controls and Safeties:

1. Microprocessor Controls:

1. Shall include application logic to control unit in several standalone modes:
	* 1. Supply Fan control,
		2. DX Cooling control
		3. Heating control (DX Heat Pump and/or Electric/Gas)
		4. Dehumidification
		5. ERV/Desiccant wheel operation and bypass damper operation
		6. Outdoor Damper control for Outdoor air economization/energy efficiency
2. Unit operation shall include terminal control for:
	* 1. Supply Air Temperature
		2. Supply Air Dewpoint/Relative Humidity
		3. Zone Air Temperature
		4. Zone Air Dewpoint/Relative Humidity
		5. Airflow CFM, based on Duct Pressure or Air Monitoring
3. Can include a field-installed space temperature sensor for zone control
4. Shall support BACnet IP, BACnet Ethernet, BACnet MS/TP and BACnet ARCNET.
5. Shall support Modbus RTU and Modbus TCP
6. Can provide a 5° F temperature difference between cooling and heating set points to meet ASHRAE 90.1, energy standard.
7. Shall include a color HMI touchscreen (Equipment Touch).
8. HMI shall include user access differentiation via passcodes.
9. Shall provide at least 28 configurable inputs and 16 configurable outputs for unit control
10. Can provide field configurable Input/Outputs via HMI
11. Shall provide and display a current alarm list and an alarm history list.
12. Compressor minimum run time (3 minutes) and minimum off time (5 minutes) shall be provided.
13. Shall have service run test capability
14. Shall support Hand/Off/Auto switches on controller inputs and outputs for troubleshooting.
15. Unit controls shall be in electrically isolated low voltage control section.

J. Commissioning User Interface: The commissioning HMI shall be a color touchscreen with

 access to all available modes, applicable setpoints and statuses, unit networking information

 and the like.

 a. Safeties:

1) Compressor lockout protection provided for either internal or external overload.

2) Low-pressure protection.

3) Freeze protection (evaporator coil).

4) High-pressure protection.

5) Loss of charge protection.

b. Supply-air sensor shall be located in the unit and shall be used for compressor stage control.

c. Unit shall be equipped with a supply fan status switch to protect the system in the event of a fan drive failure.

d. Induced draft heating section shall be provided with the following minimum protections:

1) High-temperature limit switch.

2) Differential pressure switch for proof of induced draft.

3) Flame rollout switch.

4) Flame proving controls.

5) Redundant style gas valve.

K. Operating Characteristics:

1. Unit shall be capable of operating upwards of 115° F. outdoor ambient air temperature per maximum load criteria of AHRI Standard 920 and AHRI Standard 340/360.

2. Unit with standard controls will operate in cooling down to an outdoor ambient temperature of 0 o F.

3. Units shall be equipped with an enthalpy control economizer with modulating outdoor and return air dampers.

4. Unit shall be provided with fan time delay to prevent cold air delivery (gas heat only).

L. Electrical Requirements:

1. All unit power wiring shall enter unit cabinet at a single location with a single power

 point connection.

2. Control panel shall incorporate “Touch-safe” design.

3. Phase/Voltage Monitor: A factory-installed over / under-voltage and phase loss sensor shall stop the unit whenever voltage exceeds allowable range, phases are out of sequence, or a phase is dropped. The unit will restart automatically after a delay of five (5) minutes after the correct power is supplied. Display shall be capable of archiving and display of last four (4) faults modes.

OPTIONS:

1. Dual point power options available
2. Convenience Outlet: Shall be factory-installed and internally mounted with an externally accessible 115-v, 15 amp GFCI, female receptacle with hinged cover. The outlet shall require field-supplied 115-v power supply wiring. Disconnect provided ‘by others’
3. Convenience Outlet: Shall be factory-installed and internally mounted with an externally accessible 115-v, 15 amp GFCI, female receptacle with hinged cover. Factory-wired GFI with a step-down transformer and 15.0 Amp breaker.
4. NEMA 3R Non-Fused Disconect Switch: Shall be factory-installed, externally mounted, and UL approved. Non-fused switch shall provide unit power shutoff. Shall be accessible from outside the unit and shall provide power off lockout capability. Standard SCCR is 5 kVA.
5. Firestat: A factory-installed, manual-reset firestat shall be mounted in the return air opening of the unit. The firestat shall be set to open at 135 F.
6. Unit panel shall carry 65 KA SCCR rating. Unit sub wiring including contactors and motor starter protector rated at a minimum of 65KA. Over current protection devices for VFD's and ECM blowers are upgraded to fuses per manufacturers specs to increase the rating to a minimum of 65k.
7. NEMA 3R Fused Disconnect Switch: Shall be factory-installed, externally mounted and UL approved. Fused switch shall include appropriately sized fuse and provide unit power shutoff. Shall be accessible from outside the unit and shall provide power off lockout capability. Fused Disconnect rated for 100,000 AIC

M. Motors:

1. Compressor motors shall be cooled by refrigerant gas passing through motor windings and shall have either internal line break thermal and current overload protection or external current overload modules with compressor temperature sensors.

2. All condenser fan motors shall be totally enclosed air-over (IP54) with permanently lubricated ball bearings, class F insulation and manual reset overload protection.

3. Standard indoor fan motors shall be open drip proof design. Optional totally enclosed fan-cooled motors are available.

N. Unit Accessories and Options:

1. Energy Recovery:

a. The factory-installed enthalpy wheel shall be certified to meet the requirements of AHRI Standard 1060 and shall be AHRI listed.

b. The enthalpy wheel shall be constructed of corrugated synthetic fibrous media with a desiccant intimately bound and uniformly and permanently dispersed throughout the matrix structure of the media.

c. The desiccant material shall be molecular sieve, 4 angstrom or smaller.

d. The rotor shall be constructed of alternating layer of flat and corrugated media.

e. Wheel construction shall be fluted or formed honeycomb geometry so as to eliminate internal wheel bypass.

f. The wheel frames shall be evenly spaced steel spokes with a galvanized steel outer band and rigid center hub.

g. The wheel seals shall be full contact nylon brush type.

h. The wheel shall slide out of the cabinet side for service.

i. Wheel cassettes shall be constructed of galvanized steel. Cassettes shall have integral purge section.

j. The wheel bearings shall be inboard mounted permanently sealed roller bearings or externally flanged bearings.

k. The wheel shall be driven by a fractional horsepower AC motor via a multilink drive belt.

l. Energy wheel defrost control:

* + 1. On/off defrost
		2. Vfd defrost
		3. Electric preheat

 OPTIONS:

1. Aluminum substrate with 3A molecular sieve
2. Bypass dampers for economizer cycle ( air flow is through ECW wheel and dampers)
3. Wheel Rotation sensor

2. Gas Heating:

a. Gas heat shall be induced-draft combustion type with energy saving direct spark ignition systems and redundant main gas valves.

b. The heat exchanger shall be of the tubular section type constructed of a minimum of 20-gauge type 409 stainless steel.

c. Burners shall be of the in-shot type constructed of aluminum coated steel.

d. All gas piping shall be clearly identified on the unit cabinet.

e. Induced-Draft Fans:

1) Shall be direct-driven, single inlet, forward- curved centrifugal type.

2) Shall be statically and dynamically balanced.

3) Shall be made from steel with a corrosion- resistant finish.

f. High-corrosion areas such as flue gas collection and exhaust areas shall be lined with corrosion resistant material.

g. The unit shall have factory-installed gas heat with modulation options:

1. 2-stage heat control
2. Modulating control providing 20% to 100% burner modulation
3. Modulating control providing 10% to 100% burner modulation (except 75.0 MBH)

h. Furnace shall be accessed by a tool type latched and hinged service door as required by

 ANSI.

1. Heat exchanger is warranted for ten (10) years on a pro-rated basis.

Option:

* 1. Liquefied Propane (LP) furnaces: LP furnaces shall be factory-installed and do not require field conversion.

3. Electric Heat:

a. Electric resistance heaters shall be factory-installed, nichrome element type, open wire coils with 0.375 in. inside diameter, insulated with ceramic bushings, and include operating and safety controls. Coil ends shall be staked and welded to terminal screw slots.

b. Factory-installed electric heat shall have:

1) Staged heat control (1, 2 or 4 stages) or,

2) SCR (silicon controlled rectifier) control providing infinite capacity adjustment.

4. Hot Water Heat: Unit shall have a minimum 4-row hot water coil, 1/2” diameter copper tube and .016” tube wall thickness with aluminum fin construction, 8 fins per inch and .006” fin thickness, with air vents. Coil is installed downstream of the supply blower. Coil connection stubs will be located inside the unit cabinet. Hydronic control valves shall be field furnished.

5. Steam Heat: Unit shall have 1-row, non freeze steam distributing type, 5/8” diameter copper tube and .020” tube wall thickness with aluminum fin construction, 6-8 fins per inch and .0075” fin thickness. Coil installed downstream of the supply blower. Coil connection stubs will be located inside the unit cabinet. Control valves to be field furnished.

6. Chilled Water Coil (PROF ) : Unit shall have a minimum 6-row chilled water coil, 1/2” diameter

 copper tube and .016” tube wall thickness with aluminum fin construction, maximum 12 fins

 per inch, and .006” fin thickness, with air vents. Coil connection stubs will be located inside

 the unit cabinet. Hydronic control valves shall be field furnished.

7. Full Perimeter Roof Curb:

14” high flat un-insulated curb shall be formed of minimum 16-gage galvanized steel with wood nailer strip and shall be capable of supporting entire unit weight. Curb ships knocked down and requires filed assembly provided “by others”

8. Corrosion Protection

Unit shall be provided with a factory applied Corrosion Protection coatings designed to combat the corrosive effect of industrial and commercial atmospheric conditions including salt air, salt water, acid rain, chlorine and chlorides hydrochloric, nitric, hydrofluoric, sulfuric and uric acid fumes, hydrogen sulfide gas, lye, sulfur dioxide, chlorides, methane gas, hydrocarbons, chlorinated solvents and aromatic solvents. Coating is rated for 10,000 hr. Salt Spray. ASTM B117

Options:

1. Coated refrigerant to air condenser coil.
2. Coated refrigerant to air evaporator coil, hot gas reheat coil, sub-cooling coil and hot water (when selected)
3. All exterior and interior cabinet shall be coated. Includes refrigerant components and copper piping.

9. Dampers: Outside Air Damper, and Return Air Damper

Factory mounted AMCA Class 1A certified, low leakage airfoil control dampers. Frame shall be one-piece uniframe construction of 16 ga. (1.6) galvanized steel roll formed hat channel structurally equivalent to a minimum 13 ga. (2.4) frame. Blades shall be 14 ga. (2.0) equivalent galvanized steel, roll-formed airfoil type for low pressure drop and low noise generation.

Bearings shall be 304 stainless steel, oil impregnated, and self-lubricating sleeve type with a 450 pound (204 kg) minimum radial crush load.. Damper shall be tested and licensed in accordance with AMCA 511 for Air Performance and Air Leakage. Damper widths from 12" to 60" (305 to 1524) wide shall not leak any greater than 3 cfm/sq.ft. at 1" w.g. (15.2 l/s-m2 at .25 kPa).

Dampers: Exhaust Air Damper:

Standards: Frame shall be 20 gauge (1.0) roll-formed galvanized

steel. Blades shall be 28 gauge (.50) roll-formed galvanized

steel. Backdraft dampers shall be designed for maximum 3,000 fpm face velocities.

Optional: Motorized damper as specified above

**Part 3 — Execution**

3.01 INSTALLATION

 A. Install unit in accordance with manufacturers published instructions.

 B. A manufacturers’ trained service technician shall provide start-up supervision for each unit.

 C. Duct connections to units to allow for straight and smooth airflow. Connections to shall be to the roof cub prior to setting unit. Sleeve duct penetrations through roof.

 D. Drain lines to be trapped and run full size from condensate drain connection to appointed drain location.