



SECTION 23 81 06 - PACKAGED ROOFTOP AIR CONDITIONING UNITS - CUSTOM

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes equipment types that contain all the components of the refrigeration process within a single package.
 - 1. Packaged rooftop air conditioning unit (larger than 5 tons).
 - 2. Roof curb.

1.2 REFERENCES

- A. AMCA Standard 99: Standards Handbook
- B. AMCA /ANSI Standard 204: Balance Quality and Vibration Levels for Fans
- C. AMCA Standard 210: Laboratory Methods of Testing Fans for Ratings
- D. AMCA Standard 300: Reverberant Room Method for Sound Testing of Fans
- E. AMCA Standard 500: Test Methods for Louvers, Dampers and Shutters
- F. ARI Standards: 210/240, 270, 410, and 435
- G. ASHRAE Standard 52: Gravimetric and Dust Spot Procedures for Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter
- H. Unit shall be designed to conform to ANSI/ASHRAE 15, latest revision.
- I. Unit shall be certified in accordance with ANSI Z21.47 Standards.
- J. ASHRAE/ANSI Standard 111: Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems
- K. UL Standard 1995: Heating and Cooling Equipment
- L. ASTM A-525: Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
- M. Equipment shall be UL or ETL listed.
- N. Roof curb shall be designed to conform to NRCA Standards.

1.3 SUBMITTALS

- A. Product Data: Submit data indicating:
 - 1. Cooling and heating capacities.



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2. Dimensions.
 3. Weights.
 4. Rough-in connections and connection requirements.
 5. Duct connections.
 6. Electrical requirements with electrical characteristics and connection requirements.
 7. Controls.
 8. Accessories.
- B. Test Reports: Submit results of factory test at time of unit shipment.
- C. Manufacturer's Installation Instructions: Submit assembly, support details, connection requirements, and include start-up instructions.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 TESTING

- A. Equipment shall be factory run tested for a minimum of eight hours to ensure proper operation.
- B. Factory test shall be witnessed by the Owner's representative (2 people) prior to shipping to the project site.

1.5 WARRANTY

- A. Provide 5 years parts and labor warranty for compressors, VFD, motors and Ultraviolet Disinfection System.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Packaged Rooftop Cooling Unit. Provide outdoor rooftop mounted electrically controlled cooling unit utilizing multiple compressors as specified herein for cooling.
- B. Manufacturers
1. **Mammoth**
 2. **Energy Labs**

2.2 EQUIPMENT

- A. Cabinet and Frame
1. The unit base frame shall be fabricated with 6-inch, 10.2 lb. per foot, structural steel C-channel.
 2. Structural cross members shall be placed at critical locations to support internal components.



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3. Vertical frame members shall be fabricated from formed 11-gauge channels.
4. The unit base frame shall be furnished with lifting lugs capable of accepting cable or chain hooks for rigging.
5. Prior to unit assembly, the entire frame shall be covered with a minimum one-mil coat of air-dried sandstone rust inhibiting coating for maximum corrosion protection.
6. Internal floor liners shall be fabricated from 14-gauge galvanized steel welded to the base frame and sealed to prevent air leakage.
7. The entire unit length shall include an underliner constructed of 20-gauge galvanized steel to contain insulation and provide additional structural support.
8. The air handler cabinet casing shall utilize double wall sandwich construction.
9. The exterior surfaces of the wall shall form the air seal and shall be fabricated from 20-gauge galvanized steel.
10. The interior shall be lined with 20-gauge galvanized steel.
11. The exterior panels shall be galvanized steel, pre-coated with 6 mils of phenolic baked coating which will withstand 5,000 hours of salt spray per ASTM B-117 over 4 mils epoxy primer for a total of 10 mils for marine environments.
12. The unit base shall be insulated with 4-inch, 1-pound density of fiberglass insulation with a minimum R-value of 13.
13. Wall and roof panels shall be insulated with 2-inch, 1-pound density fiberglass with a minimum R-value of 6.9. Compressing 2" insulation between 1" panels is not acceptable.
14. A 4-inch space shall be provided between the air handler top liner and the roof panels to accommodate refrigerant piping and electrical runs.
15. Electrical wiring shall be run in a full-length electrical raceway above the air handler top liner.
16. Exterior roof panels shall be crowned for drainage and easily removable for service access.

B. Access Doors

1. A full-size hinged access door shall be provided for any section requiring service access. Removable casing panels shall not be allowed. Door frame shall be of rigid extruded aluminum. Adhesive-backed gasket applied to the frame shall not be allowed. Access doors shall be thermally broken and provided to the following components at a minimum: supply and return fan motors, supply and return fan inlets, filters, dampers, cooling/heating coils and any other serviceable component. Hinged access doors shall be complete with stainless steel hinges and multiple-point, single-handle compression-type latches to provide quick access and a positive air seal. Latch shall include integral keyed lock. Interior latch allows door closure during inclement weather. Doors shall include locking type door retainers to protect doors against wind damage when open. Doors shall be nominal 18- or 24-inch or 36-inch width. Actual opening widths shall be 17.25 inches and 29.25 inches respectively.
2. Door safety restraints provide a 2-turn secondary latch which shall prevent unwanted rapid door opening against high interior pressures.



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3. Each fan section access door shall include a secondary door. This door shall be constructed of expanded metal in a rigid frame which shall allow visual inspection of the fan, motor, and drive components. To gain access to the fan through this door requires the use of a tool.
4. Each door shall include a view port to allow visual inspection of interior components.

2.3 FANS

- A. Type: Double inlet, centrifugal type fan.
- B. Performance Ratings: Conform to AMCA 210 and label with AMCA Certified Rating Seal.
- C. Sound Ratings: AMCA 301, tested to AMCA 300 and label with AMCA Certified Sound Rating Seal.
- D. Bearings: Self-aligning, grease lubricated, ball or roller bearings with lubrication fittings extended to exterior of casing with copper tube and grease fitting rigidly attached to casing.
- E. Mounting: Locate fan and motor internally on welded steel base coated with corrosion resistant paint. Factory mount motor on slide rails. Furnish access to motor, drive, and bearings through removable casing panels or hinged access doors. Mount base on spring vibration isolators.
- F. Flexible Connection: Separate unit from connecting ductwork.

2.4 VARIABLE FREQUENCY DRIVES

- A. VFDs for supply fans and return fans and condenser fans shall be mounted and wired by the unit manufacturer inside of ventilated NEMA 3R enclosures. See Section on VARIABLE FREQUENCY DRIVES.

2.5 REFRIGERANT COILS

- A. Air-Cooled Condensing Section: Condenser coils shall be constructed of seamless copper tubes, mechanically expanded into copper fins. Each coil shall include an integral 10 degree F sub-cooling circuit. The mechanical refrigerant system shall be capable of operating at ambient conditions down to 0 degree F and shall include ASME receivers on all circuits and ASME relief valve on all circuits. Condenser fans shall be direct drive, propeller type. Fans shall be VFD controlled to vary the speed to maintain a minimum head pressure. Condenser deck shall be insulated.
- B. Compressors: The compressor shall be scroll or screw type. Compressors shall be high efficiency, suction-gas cooled, single speed, hermetic type, with three Teflon bearings and a cast iron motor frame. Compressors shall be mounted on rubber-in-shear isolators. The compressor circuit shall include high and low pressure taps, a discharge service valve, and a check valve at the discharge outlet to prevent reverse rotation. Compressors shall have internal motor protection for over-temperature and over-current conditions. Other safety devices include a crankcase heater, high-pressure cutout, and low pressure freeze protection. Capacity reduction shall be performed with compressor staging and hot gas bypass on tandem



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- compressor models. Capacity reduction shall be performed with hot gas bypass on non-tandem compressor models.
- C. **Mechanical Pressure-Controlled Hot Gas Bypass:** A pressure-controlled modulating hot gas bypass valve will trim the #1 compressor's effective capacity. The valve shall be controlled between each and every compressor control stage. The valve follows the cooling demand and must be commanded fully closed before a compressor stage is enabled and commanded to its maximum open position (adjustable) before a stage is disabled.
 - D. **Refrigeration Circuit Specialties:** Each independent refrigerant circuit shall be completely piped, tested, dehydrated, and fully charged with oil and refrigerant R410A or R407C. Each refrigerant circuit includes compressor, condenser with integral liquid sub-cooler, liquid line service and charging valve, filter drier, sight glass, fusible plug, and thermostatic expansion valve.
 - E. **Evaporator Coil:** Direct expansion coil shall be constructed of seamless coated copper tubes expanded into copper fins and shall not be less than three rows in depth, nor have more than 12 fins per inch. Coil casing shall be constructed of type 201 stainless steel. Headers shall be copper. Evaporator coil shall be provided with adjustable superheat controls and external equalizers. Coils shall be tested to be leak-free with nitrogen at 500 PSIG under water. The entire refrigerant piping circuit shall be leak tested at 150 PSIG air pressure.
 - F. The evaporator coil shall be provided with a drain pan which shall be fabricated of 14-gauge 201 stainless steel and sloped for positive drainage of condensate. A 1-1/4-inch diameter condensate drain connection shall be provided on one side of the unit for slab coils and on both sides of the unit for V-bank coils and shall be field trapped by others.
 - G. All coils (evaporator and condenser) shall be coated with minimum 1.0 mil. aluminum impregnated polyurethane coating by Blygold PoluAl XT or approved equal. Coating shall withstand 4,000 hours in both salt spray test per ASTM B117 and acid salt spray test per ASTM D5339. Finned-tube coils applied coating shall have 5 year warranty.

2.6 DAMPERS, HOODS, AND LOUVERS

- A. **Low Leak Outside Air/Return Air (OA/RA) Dampers:** Outside air and return air (economizer) dampers shall be constructed of heavy gauge, aluminum airfoil-shaped blades and 14-gauge galvanized steel frames. The damper blades shall be mounted to plated square shafts which rotate in permanently-lubricated nylon bearings to insure smooth operation. Vinyl blade seals shall be locked into extruded aluminum blade slots. Side seals shall be constructed of flexible metal compression-type stainless steel. Damper blades operate without clatter or binding and damper linkage will be located out of the air stream. Actuator shall be direct-mounting type.
- B. **Outside Air Louvers - Economizer:** Outside air louvers shall be of a storm-proof design and provided with a 2-inch by 2-inch galvanized bird screen. A fully-insulated divider deck shall be provided to separate outside air from return air.

2.7 FILTERS

Provide MERV 8 pre-filter, carbon filter, bipolar ionization unit and MERV 13 final filter.



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- A. See Section on HVAC AIR CLEANING DEVICES.

2.8 ELECTRICAL

- A. General: All electrical wiring conforms to UL 1995. Where required, wiring will be run in EMT. The unit shall be equipped for single source power connection.
- B. Main Control Panel - Exterior: The main control panel will have access door(s) for direct access to the controls. The panel shall be equivalent to NEMA type 3R (rainproof) and contain a single externally-operated, molded case switch (non-automatic circuit breaker) suitable for copper wire up to and including 3-inch conduit. Low-voltage control panel wiring shall be enclosed in a wiring duct.
- C. Service Outlet and Lights: GFI-type service outlet(s) shall be provided. Power is provided from the main unit. Circuit shall remain energized regardless of main unit disconnect position.
- D. Lights not in the air stream shall be fluorescent with a wire guard. Lights in the air stream shall be vapor-proof screw-in type fluorescent with a cast alloy base with threaded hubs, gasketed glass cover, and wire guard. Lights are wired to a single switch. Power shall be on the same circuit as the Service Outlet. Light circuit shall remain energized regardless of main unit disconnect position.

2.9 CONTROLS

- A. A microprocessor controller shall be installed in the proximity to the air conditioning unit. The air conditioning unit will be provided with all necessary temperature, pressure sensors, filter switches and wiring for complete temperature controls and economizer operation as indicated on the control drawings.
- B. Unit controller shall have capability as standard for remote access and monitoring over the internet.
- C. Building BAS Interface. Provide an interface between the unit controls and the BMS and the FMCS.

2.10 ROOF CURB

- A. Factory assembled galvanized steel mounting curb designed and manufactured by unit manufacturer.
1. All roof top equipment including packaged rooftop air conditioning units are to be curb mounted.
 2. Perimeter type with support of air handling sections.
 3. Furnish supply and return opening duct frames as part of curb structure allowing duct connections to be made directly to curb.
 4. Minimum of 12 inches high.
 5. Furnish gaskets for field mounting.



PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install equipment in accordance with manufacturer's instructions.

3.2 TRAINING

- A. Furnish services of factory trained representative for minimum of one day to leak test, refrigerant pressure test, evacuate, dehydrate, charge, start-up, calibrate controls, and instruct LAWA on operation and maintenance.
- B. Provide minimum of 12 hours (3 shifts) of classroom and hands on training to LAWA Maintenance personnel.
- C. Training shall occur after the system is fully operational.

END OF SECTION 23 81 06