SECTION 23 81 32

ROOFTOP AIR CONDITIONING UNITS (GAS - ELECTRIC)

(BELOW 3 TONS)

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Comply with General Requirements in Division 1 - General Requirements, and all referenced documents.

B. Comply with all other Division 23 Sections as applicable. Refer to other Divisions for coordination of work with other trades as required.

1.2 SYSTEM DESCRIPTION

A. The work shall include installing new electric cooling, gas heating, roof mounted air conditioning units to meet scheduled capacities.

B. The units specified herein are intended to cycle on and off to meet thermostatic control, and are not intended to introduce outside air continuously or to control space relative humidity.

C. Contractor shall connect all ductwork, condensate drain piping, roof curbs, controls, factory furnished field installed accessories, appurtenances, insulation, supports, flashing, etc. to make a complete and operational system.

1.3 QUALITY ASSURANCE

A. All equipment and materials shall be new and of the best quality complying with all standards specified herein.

B. All equipment and materials shall be installed in a workmanlike manner by trained and experienced mechanics as recommended by the equipment manufacturer and as detailed on the Drawings.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's descriptive literature and installation instructions and method for the configuration of equipment proposed, including wiring diagrams, piping connections, ductwork connections, capacities at scheduled conditions, fan capacity curves, accessories furnished, and other descriptive literature necessary to fully evaluate the Submittals for full compliance with these specifications.

B. Shop Drawings: Submit in accordance with Section 23 05 00.

1.5 PRODUCT HANDLING

A. Deliver all equipment to the site where it shall be covered and protected. Material not properly protected and stored and which is damaged or defaced during construction shall be replaced at no cost to the Owner.

B. Storage and protection of materials shall be in accordance with Section 23 05 00.

1.6 INSTALLATION, OPERATION, AND MAINTENANCE BROCHURES

A. Furnish all installation manuals required by a trained and experienced mechanical technician for proper installation of equipment. Manuals shall be provided with equipment and be attached thereto.

B. Furnish three (3) complete bound Operating and Maintenance Brochures with spare parts lists, which shall be submitted at "Substantial Completion".

C. Furnish extended four (4) year compressor and fourteen (14) year heat exchanger warranty certificates to begin at the end of the first year warranty. Indicate specific model and serial numbers for all items of equipment furnished.

PART 2 - PRODUCTS

2.1 ROOFTOP PACKAGED A/C UNITS

A. Units shall be a one-piece, air cooled, electric cooling, gas heating unit, and shall be mounted on a full perimeter roof curb.

B. Total and sensible cooling capacities shall meet or exceed scheduled requirements.

C. Unit compressors shall be serviceable semi-hermetic or welded fully hermetic type with crank case heaters and suitable spring vibration isolators. Refrigerant type shall be R-410A. Compressors shall be of the same manufacture as unit and shall have a 5 year warranty. Scroll type compressors shall have electric power phase reversal protection, or equivalent feature, to prevent sustained reverse rotation of the compressor to prevent burn out of, or damage to, the compressor. Include an insulated panel under compressor section to prevent condensation forming on the bottom.

D. Coils: Indoor and outdoor coils shall be of non-ferrous construction with aluminum plate fins mechanically bonded to seamless copper tubes with all joints brazed.

E. Fans and Motors: Indoor blowers shall be either double inlet forward curved, centrifugal, direct driven type with multi-speed drives (5 speed or ECM) or belt drive double inlet, forward curve fans with adjustable sheaves. Motor shall have permanently

lubricated bearings. Outdoor fans shall be of the propeller type, with direct driven permanently lubricated motor. Outdoor fans shall discharge upward. Furnish high efficiency (premium) evaporator fan motors for motors one (1) horsepower and larger in size. Premium motors that are furnished as a standard option by the manufacturer will be accepted. Refer to Section 23 05 13 for general motor requirements.

F. Unit cabinets shall be constructed of galvanized steel, bonderized and coated with a baked enamel finish. Cabinet interior shall be insulated with one inch (1") thick neoprene coated fiberglass. Cabinet panels shall be easily removable for service to all operating components. A condensate drain sloped for continuous positive drainage, to prevent standing condensate, for the indoor evaporator coil shall be provided.

G. Controls: The cooling system shall be protected with high pressurestat, low pressurestat, loss-of-charge protection, and current and temperature sensitive overload devices. Each of these devices shall be wired to prevent compressor restart until reset at the thermostat (or unit circuit breaker). All control devices specified herein shall be factory installed.

H. Heat Exchanger shall be tubular in design and constructed of corrosion resistant type 409 or 316 stainless steel. Heat exchanger shall carry a fifteen (15) year warranty. Burners shall be constructed of aluminum painted cold rolled steel and be of the in-shot type.

I. Heating controls shall consist of a redundant gas valve, electronic spark ignition, remote pilot flame sensor, time-delay relay, limit switches, and centrifugal switch. Burner shall be power draft type.

J. Unit Electrical Connections: Cabinet shall contain suitable openings for routing of all utility connections. The base unit shall contain a terminal strip in the control compartment to allow for terminal-to-terminal connection of room thermostat and field installed accessories. This shall include a Conventional Thermostat Interface (CTI) to allow for an energy management system to control the unit fan and all cooling and heating stages.

K. Accessories and Options: The following factory-installed options (FIOP) or field-installed accessories shall be provided:

1. Roof curb shall generally be supplied by the same supplier as unit. Alternately, a custom curb manufacturer meeting the specified requirements shall be used if the equipment manufacturer cannot comply with the specified requirements. Dimensions shall be provided to allow for easy duct location and connection to roof curb prior to unit placement. Curb design shall comply with National Roofing Contractors Association (NRCA) requirements. This, typically, requires a curb extending a minimum of eight inches (8") above the top surface of the roof which results in a minimum 18" tall curb. However, due to planned roofing projects, all

new curbs are required to be a minimum of 184” in height. Curbs shall be made from minimum 18 gauge G-90 galvanized steel, have a treated 2" x 4" wood nailer, have hinged corners and be pitched to match the roof slope, from 1/4" to 12", such that the curb top and unit sit level. Custom adapter curbs are not allowed, except where specifically specified and noted on the contract documents. This is only shown at Big Springs Elementary School on the Gym RTU. These adaptor curbs shall be minimum height required to have no greater than a 45 degree offset to existing curb and be constructed of minimum 18 gauge G-90 galvanized steel. Custom adapter curbs shall be fully welded with no seams and fully sloped so that there are no flat portions of the curb in the horizontal (Refer to Drawings for curb type). Curbs shall be fully gasketed between the curb top and unit bottom with the curb providing full perimeter support, cross structure support and air seal for the unit. Curbs shall provide for the full support for both the supply and return air ducts. For custom adapter curbs provide shop fabricated curb sized for existing curb dimensions. Provide for a separate thru utility vertical entry point within the footprint of the inside of the curb; no penetrations allowed in the side (vertical portions) of curbs. Curbs shall be fully perimeter insulated with minimum one inch (1") thick neoprene coated rigid fiberglass insulation, minimum 1.5 pcf density, either factory or field insulated.

2. Outside air shall be controlled by an optimized dry-bulb type economizer with multi-stage integrated economizer and compressor operation for optimum benefit:
    a. The economizer shall consist of motor operated fully modulating type outdoor and return air dampers, both sequenced and fully adjustable, constructed from low leakage dampers that utilize metal blades with rubber edge seals and aluminum or stainless steel end seals. Damper blades shall be gear driven and be designed to have no more than 25 CFM of leakage per square foot of damper area when subjected to 2" W.G. air pressure differential across the damper, or less than 2% at a total static pressure of 0.5 Inches W.G., with a negative return air static pressure of 0.05 Inches W.G.
    b. Damper motors shall be the spring return type to insure the tight closing of the outdoor air damper during periods of unit shut down or power failure. The outside air damper and actuator shall be capable of opening to a pre-set minimum when the unit is operated in the normal occupied mode. Provide a field adjustable end switch, or equivalent control feature such as a potentiometer or SCR, to allow minimum outside air adjustment to that as scheduled.
    c. The economizer shall be completely factory installed, wired and run tested.
    d. Damper actuators shall be compatible with standard 0-10 Vdc Energy Management System output signal to allow modulating control of the minimum outside air flow rate for return air carbon dioxide level control, whether utilized or not. Actuators shall be a “Belimo MFT” type actuator.
    e. Provide weather protected hoods over each outside air intake and relief air outlet. Provide protection from birds on all hoods, using galvanized steel bird screen (1/ 2" x 1/2" wire mesh) or other approved method.
    f. Provide an automatic barometric relief damper to relieve positive building pressure on all units capable of introducing over 25% outside air through the

unit. Relief dampers shall be sized and capable of relieving 75% of total design air at 0.03 inches water gauge static pressure at the relief damper location. Provide oversized damper and hood system as required to comply. Submit data to confirm compliance with this requirement.

3. Alternate motor and/or drive assembly to produce added cfm and static pressure capability where required based on scheduled requirements.
4. Time Guard Circuit to prevent compressor short cycling as a result of a rapid change in thermostat setting. Also, automatically prevents restart for at least 5 minutes, or other minimum time per the unit manufacturer, after shut-down.
5. Provide filter rack to accept standard 2" thick filters. Ship units to job site with 2" thick throwaway filters for coil and heat exchanger protection. All return and outside air shall be filtered by the same single common set of filters.
6. Condenser fin hail and vandal guards. Guards shall be made of hot dip galvanized steel; or UV inhibited, PVC coated steel; or factory enamel or epoxy painted steel; or other approved corrosion resistant material. Flat expanded metal, field made devices, and screen or fencing materials are not acceptable.
7. Condensate drain and electrical connections shall be routed within the roof curb such that no roof penetrations exterior to the unit roof curb are required for either service.

L. All roof top A/C Units shall have a minimum EER and furnace efficiency as scheduled, both of which shall meet or exceed the 2018 International Energy Conservation Code.

M. Units shall be as manufactured by:

1. Trane.
2. Lennox.

2.2 TEMPERATURE CONTROLS

A. Under Specification Section 23 09 00, Controls and Instrumentation, space temperature sensors, as applicable, shall be provided for field installation along with factory mounted and wired terminal unit controllers to control units.

B. Each rooftop A/C unit shall have wiring terminals to receive signals from the Terminal Unit controller to receive 4-20 ma, or 0-10 volt D.C. as applicable, signals to stage on and off heat, energize compressor(s), as applicable, modulate the outside and return air dampers. Provide contacts to energize and de-energize the unit.

PART 3 - EXECUTION

3.1 DELIVERY AND PROTECTION

A. Deliver all equipment to each site. All equipment shall be handled carefully to avoid damage and be protected from exposure to the weather and dirt.

B. All equipment shall be examined upon delivery to the site and evidence of abuse, damage, or exposure to weather and dirt shall be grounds for refusal to accept individual pieces of equipment. Rejected items shall be replaced promptly at no cost.

C. During construction, take all steps necessary to protect equipment from damage or vandalism. All damage or vandalism shall be repaired at no cost to the Owner.

3.2 ROOFTOP A/C UNITS

A. Install manufactured roof curbs on the roof square and level to receive the units. Provide and install additional steel framing as required to provide safe, noiseless, operating systems.

B. Coordinate the electrical services and control wiring with the Electrical Systems Installer. Coordinate the condensate drainage system with the Plumbing Systems Installer.

C. Coordinate the exact unit locations with the structural systems and the ceiling systems as actually installed.

D. Make all sheet metal supply and return duct connections with flexible duct connections.

E. Install sound and vibration isolation devices as detailed and specified elsewhere herein and on the Drawings.

F. Provide for one (1) additional set of fan sheaves for each belt drive unit, as required by the Testing and Balancing Firm, to obtain design air flows. For bidding purposes provide one (1) set sheaves, and belts where required, as follows:

# of Units	Minimum # Sets of Belts & Sheaves
1 - 5	3
6 - 10	5
11 - 15	7
16 - 20	9
21 - 30	14
31 or more	33%

G. Gas furnaces shall be jumpered to operate at full fire, with the supply fan operating, for a minimum of thirty (30), but not more than sixty (60), minutes to burn off dust, lint,

and factory produced oil films. Remove jumper after this process is completed. Perform this work in such a fashion as not to void equipment warranties.

3.3 CLEANUP

A. Clean evaporator and condenser coils, condensate pans and condensate drain piping after installation of rooftop A/C units is complete.

B. Clean all debris from inside rooftop A/C unit casings

C. Replace air filters with new as specified in Section 23 30 00.

D. Tighten and align fan belts and lubricate all bearings. Verify proper rotation of moving parts.

E. Install all field installed accessories.

F. Make all power and control wiring connections.

G. Verify correct operation of equipment, accessories, and control devices.

3.4 OPERATING PROCEDURES AND REQUIREMENTS

A. Operating and service instructions in illustrated and bound form shall be furnished by the manufacturer, three (3) copies, at "Substantial Completion".

B. At startup, the equipment manufacturer shall furnish skilled personnel, separate from the installing contractor’s work force, to supervise, check out performance, make any required adjustments, place all units in service, and instruct the Owner's personnel for a full period of two (2) hours for each 15 units provided. Fill-out a manufacturer’s start-up report, to be typewritten, for each new unit installed which shall reflect the operating conditions of the electrical power supply, refrigeration system and gas furnace.

C. The manufacturer of each item of equipment shall provide complete wiring diagrams to the Electrical Systems Installer and shall provide drawings indicating all required external wiring and arrangements of connections.

3.5 WARRANTY

A. Transfer Warranty to Owner for a full one year period after "Substantial Completion".

B. Transfer any and all other warranties as applicable over to the Owner at "Substantial Completion", including extended 4-year compressor warranties, as applicable, on refrigeration equipment, and extended 14-year warranties, as applicable, on heating furnace sections.

END OF SECTION