

**CITY OF HOUSTON FIRE DEPARTMENT
INTERIOR RENOVATION OF FIRE STATION NO. 62**

DIVISION 15 — MECHANICAL

Section 15730 — SINGLE PACKAGE DX UNIT WITH GAS HEAT

PART 1 – RELATED DOCUMENTS

1.01 RELATED DOCUMENTS

- A. The General Provisions for Mechanical Work form a part of this Section of the Specifications and shall govern the Work under this heading.

1.02 WORK INCLUDED

- A. Section Includes: Unit is an outdoor rooftop mounted, electrically controlled heating and cooling unit utilizing fully hermetic scroll compressors with on demand crankcase heaters for cooling duty and induced draft gas combustion for heating duty. Supply air shall be discharged horizontally, as shown on contract drawings. Units shall be of ultra high cooling efficiency and utilize environmentally friendly R-410A refrigerant.

1.03 SUBMITTALS

- A. Submit for approval as described under Section 15010, Shop Drawings and product data for work included in this Section.
- B. Submit manufacturer's installation, operation and maintenance instructions.

1.04 WARRANTY

- A. Provide extended 5 year parts and labor compressor warranty.

1.05 QUALITY ASSURANCE

- A. Unit shall well exceed ASHRAE 90.1-2001 Energy Efficiency Standards. All units shall be ENERGY STAR qualified.
- B. Unit shall be rated in accordance with ARI Standards 210 (03-12) and 360 on all others. All units shall be designed in accordance with UL Standard 1995. Unit shall be rated in accordance with ARI sound standards 270 or 370.
- C. Unit shall be designed to conform to ASHRAE 15.
- D. Unit shall be UL and UL, Canada, tested and certified in accordance with ANSI Z21.47 Standards as a total package.
- E. Roof curb shall be designed to conform to NRCA Standards.
- F. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
- G. Unit casing shall be capable of withstanding 500-hour salt spray exposure per ASTM B117 (scribed specimen).

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- H. Unit shall be manufactured in a facility registered to ISO 9001:2000.
- I. Each unit shall be subjected to a completely automated run testing on the assembly line.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Unit shall be stored and handled per manufacturer's recommendations.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

- A. Carrier
- B. Lennox
- C. Trane

2.02 EQUIPMENT (STANDARD)

- A. General:
Unit shall be a fully factory assembled, pre-tested, single-piece heating and cooling unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, Refrigerant charge (R-410A), and special features required prior to field start-up. Outdoor sound ratings on sizes 03-06 shall be as low as 72 dB, on sizes 08 to 16 as low as 80 dB and on sizes 20 to 28 as low as 82 dB.
- B. Unit Cabinet:
Unit shall be a fully factory assembled, pre-tested, single-piece heating and cooling unit
 1. Constructed of galvanized steel, bonderized and coated with a pre-painted baked enamel finish on all externally exposed surfaces. Internal surfaces shall be of a primer coated finish.
 2. All airstream interior surfaces shall be insulated with a minimum 1/2-in. thick, 1 lb density foil-faced cleanable insulation. Insulation shall be bonded with a thermosetting resin (8 to 12% by weight nominal, phenol formaldehyde typical), and coated with an acrylic or other material that meets the NFPA 90 flame retardance requirements and has an "R" value of 3.70. Insulation shall also be encapsulated with panel design or tape edges ensuring secure fit.
 3. Cabinet panels shall be hinged with integrated non-corrosive hinges. Large area hinged access panels for the filter, compressors, evaporator fan, and control box and heat section areas. Each panel shall use multiple quarter-turn latches and handles. Each major external hinged access panel shall be double-wall construction and permanently attached to the rooftop unit. Panels shall also include tiebacks.
 4. Return air filters shall be accessible through a dedicated hinged access panel and be on a slide-out track using standard size filters. Filter shall be

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standard off the shelve sizes and be the size per cabinet. Capability for 2 or 4 inch filters shall be on all sizes.

5. Holes shall be provided in the base rails (minimum 16 gage) for rigging shackles and level travel and movement during overhead rigging operations.
6. Fork lift slots shall be available from three sides of the unit (end and 2 sides) for sizes 03-14 and two sides of the unit (end and side) for other sizes.
7. Unit shall have a factory-installed internally sloped condensate drain pan, providing a minimum 3/4-in.-14 NPT connection to prevent standing water from accumulating. Pan shall be fabricated of high impact polycarbonate material and shall slide out for cleaning and or maintenance on 03-16 sizes. An alternate vertical drain (3/4-in. NPT) connection is also available. Pan shall be fabricated of epoxy powder coated steel for other sizes. All drain pans conform to ASHRAE 62 self-draining provisions.
8. Unit shall have standard thru-the-bottom power and control wiring connection capability.

C. Fans:

1. Indoor blower (evaporator fan):
 - a. Centrifugal supply air blower shall have rubber-isolated, cartridge type ball bearings (03-16) or pillow-block ball bearings (20-28) and adjustable belt drive.
 - b. Fan wheel shall be made from steel with a corrosion resistant finish. It shall be a dynamically balanced, double-inlet type with forward-curved blades.
 - c. The indoor fan system (blower wheels, motors, belts, and both bearings) shall slide out for easy access.
 - d. Evaporator-fan motors shall be continuous operation, open drip-proof. Bearings shall be sealed, permanently lubricated ball-bearing type for longer life and lower maintenance.
 - e. On sizes 03 to 16, fan belt shall be located on opposite side of evaporator coil to prevent damage from broken fan belts. On 20 to 28 sizes a fan belt catch system shall be used.
2. Condenser fans shall be of the direct-driven propeller type, with corrosion-resistant aluminum blades riveted to corrosion-resistant steel supports. They shall be dynamically balanced and discharge air upwards. Condenser-fan motors shall be totally enclosed, thermally protected, and be of a shaft down design to protect from direct contact from harsh environments.
3. Induced-draft blower shall be of the direct-driven, single inlet, forward-curved, centrifugal type. It shall be made from aluminized steel with a corrosion-resistant finish and shall be dynamically balanced.

D. Compressor(s):

1. Fully hermetic, scroll type with on demand crankcase heaters, internal high-pressure and temperature protection.
2. Factory mounted on rubber grommets and internally spring mounted for vibration isolation.
3. Be mounted on dedicated mounting plate to ensure secure design and reduced sound levels.

E. Coils:

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1. Standard evaporator and condenser coils shall have aluminum lanced plate fins mechanically bonded to seamless internally grooved copper tubes with all joints brazed.
2. Dual circuit models (08-28) shall have face-split type evaporator coil.
3. Condenser and evaporator coils shall be single slab, single pass design to facilitate easy coil cleaning. Composite coils or coils that require unit top panels removed shall be unacceptable.
4. Coils shall be leak tested at 170 psig and pressure tested at 1875 psig.

F. Heating Section:

1. Induced-draft combustion type with energy saving direct-spark ignition system and redundant main gas valve with 2-stage capability on all 3-phase units.
2. Heat Exchanger:
 - a. The stainless steel heat exchanger shall be of the tubular-section type, constructed of a minimum of 20-gage type 409 stainless steel, including stainless steel tubes, vestibule plate, and collector box.
3. Burners shall be of the in-shot type constructed of aluminum-coated steel.
4. All gas piping shall enter the unit at a single location. Gas entry shall be capable through side or bottom for unit.
5. All factory-installed orifices are for operation up to 2,000 feet of altitude. For altitudes between 2,000 ft and 7,000 ft, a factory certified kit shall be furnished for field installation.
6. The integrated gas controller (IGC) board shall include gas heat operation fault notification using an LED (light-emitting diode).
7. Unit shall be equipped with anti-cycle protection with one short cycle on unit flame rollout switch or 4 continuous short cycles on the high-temperature limit switch. Fault indication shall be made using an LED.
8. The IGC board shall contain algorithms that modify evaporator-fan operation to prevent future cycling on high-temperature limit switch.
9. The LED shall be visible without removal of control box access panel.
10. Gas burner tray, when disconnected, shall easily slide out for maintenance.

G. Refrigerant Components: Each refrigerant circuit shall include:

1. Balanced port thermostatic expansion valve (TXV) with removable power element.
2. Solid core refrigerant filter driers with pressure ports.
3. Refrigerant pressure gage ports and connections on suction, discharge, and liquid lines.

H. Filter Section:

1. Standard filter section shall consist of factory-installed 2-in. thick disposable fiberglass filters and shall be on a dedicated slide out track to easily facilitate access and replacement.
2. Filter section shall use standard size filters and be of common sizes within cabinet sizes.

I. Controls and Safeties:

1. Unit *ComfortLink*[™] Controls:

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- a. Scrolling Marquee display.
 - b. CCN (Carrier Comfort Network®) capable.
 - c. Unit control with standard suction pressure transducers and condensing temperature thermistors.
 - d. Shall provide a 5° F temperature difference between cooling and heating set points to meet ASHRAE 90.1 Energy Standard.
 - e. Shall provide and display a current alarm list and an alarm history list.
 - f. Automatic compressor redundancy on units without Humidi-MiZer™ system.
 - g. Service run test capability.
 - h. Shall accept input from a CO2 sensor (both indoor and outdoor).
 - i. Configurable alarm light shall be provided which activates when certain types of alarms occur.
 - j. Compressor minimum run time (3 minutes) and minimum off time (5 minutes) are provided.
 - k. Service diagnostic mode.
 - l. Economizer control (optional).
 - m. Multiple capacity stages (on size 08-28 units).
 - n. Unit shall be complete with self-contained low-voltage control circuit.
 - o. Unit shall have 0° F low ambient cooling operation.
2. Safeties:
- a. Unit shall incorporate a solid-state compressor lockout that provides optional reset capability at the space thermostat, should any of the following safety devices trip and shut off compressor:
 - 1) Compressor lockout protection provided for either internal or external overload.
 - 2) Low-pressure protection.
 - 3) Freeze protection (evaporator coil).
 - 4) High-pressure protection (high pressure switch or internal).
 - 5) Compressor reverse rotation protection (*ComfortLink*™ units only).
 - 6) Loss of charge protection.
 - 7) Start assist on single-phase units.
 - b. Supply-air sensor shall be located in the unit and detect both heating and cooling operation.
 - c. Induced draft heating section shall be provided with the following minimum protections:
 - 1) High-temperature limit switch.
 - 2) Induced-draft motor speed sensor.
 - 3) Flame rollout switch.
 - 4) Flame proving controls.
 - 5) Redundant gas valve.
- J. Operating Characteristics:
- 1. Unit shall be capable of starting and running at 125 F ambient outdoor temperature per maximum load criteria of ARI Standard 210 (03-12 sizes) and 360 (16-28 sizes).
 - 2. Unit with *ComfortLink* controls will operate in cooling down to an outdoor ambient temperature of 0° F. Electro-mechanical shall operate down to 40 F.
 - 3. Unit shall be provided with fan time delay to prevent cold air delivery in Heating mode.

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- K. Electrical Requirements:
All unit power wiring shall enter unit cabinet at a single location — side or bottom.
- L. Motors:
1. Compressor motors shall be cooled by refrigerant gas passing through motor windings and shall have line break thermal and current overload protection.
 2. Evaporator fan motor shall have permanently lubricated, sealed bearings and inherent automatic-reset thermal overload protection or manual reset calibrated circuit breakers. Evaporator motors are designed specifically for Carrier and do *not* have conventional horsepower (hp) ratings listed on the motor nameplate. Motors are designed and qualified in the “air-over” location downstream of the cooling coil and carry a maximum continuous bhp rating that is the maximum application bhp rating for the motor; no “safety factors” above that rating may be applied.
 3. All evaporator fan motors 5 hp and larger shall meet the minimum efficiency requirements as established by the Energy Policy Act of 1992 (EPACT), effective October 24, 1997.
 4. Totally enclosed condenser-fan motor shall have permanently lubricated, sealed bearings, and inherent automatic-reset thermal overload protection.
 5. Induced-draft motor shall have permanently lubricated sealed bearings and inherent automatic-reset thermal overload protection.
- M. Special Features:
1. Two-Position Motorized Outdoor Air Damper:
 - a. The damper shall admit up to 50% outdoor air. Spring return damper closes when unit is off.
 - b. The package shall include a multiple-blade damper and motors.
 - c. Shall be available as factory-installed option and field-installed accessory most economical level.
 2. Convenience Outlet:
 - a. Factory-installed powered convenience outlet shall be internally mounted with an externally accessible 115-v, 2-plug female receptacle with hinged cover. Shall include 15 amp GFI with independent fuse protection and service receptacle disconnect. The convenience outlet is powered from the line side of the disconnect or circuit breaker with a factory-installed step down transformer, therefore it will not be affected by the position of the disconnect or circuit breaker.
 3. Return Air Smoke Detector:
The smoke detector shall send input to the controller to shut down the unit in case smoke is detected. The smoke detector shall be factory installed in the return air section or shall be available as a field-installed accessory.
 4. Filter Status:
The filter status switch shall be a pressure switch and will indicate a dirty filter. The switch shall be available as field or factory-installed.
 5. Fan Status:
The fan status switch shall be a pressure switch and will indicate indoor fan operation. The switch shall be available as field or factory-installed.
 6. High Fan Performance Motor/Drive:

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This motor/drive offering shall provide high range motor and drive capability to enhance evaporator fan performance.

7. Horizontal Kit:
 - a. Horizontal kit shall contain all the necessary hardware to convert a vertical airflow unit to a horizontal airflow unit (16-28 sizes).
 - b. The unit shall also be available as a horizontal airflow unit directly from the factory.
8. Phase Loss Protection (3-phase units only):
Shall provide unit shutdown when an electrical phase loss is detected – automatic reset type.
9. Electronic Programmable Thermostat:
Capable of using deluxe full-featured electronic thermostat.
10. Thermostats and Subbases:
To provide staged heating and cooling in addition to automatic (or manual) changeover and fan control.
11. Humidi-MiZer™ Adaptive Dehumidification System:
 - a. The Humidi-MiZer dehumidification system shall be factory-installed, and shall provide greater dehumidification of the occupied space by two modes of dehumidification operations beside its normal design cooling mode:
 - 1) Subcooling mode further subcools the hot liquid refrigerant leaving the condenser coil when both temperature and humidity in the space are not satisfied.
 - 2) Hot gas reheat mode shall mix a portion of the hot gas from the discharge of the compressor with the hot liquid refrigerant leaving the condenser coil to create a two-phase heat transfer in the system, resulting in a neutral leaving-air temperature when only humidity in the space is not satisfied.
 - b. The system shall consist of a subcooling/reheat dehumidification coil located downstream of the standard evaporator coil.
 - c. The system shall include crankcase heater(s) for the scroll compressor(s).
 - d. The system shall include a low outdoor air temperature switch to lock out both subcooling and hot gas reheat mode when the outdoor-air temperature is below 40 F.
 - e. The system shall include a Motormaster® low ambient control to ensure the normal design cooling mode capable of down to 0° F low ambient operation.
 - f. The system shall include a low-pressure switch on the suction line to ensure low pressure start-up of hot gas reheat mode at lower outdoor temperature condition.
 - g. The system operation may be controlled by a field-installed, wall-mounted humidistat. The dehumidification circuit will then operate only when needed. Field connections for the humidistat are made in the low-voltage compartment of the unit control box. The sensor can be set for any level between 55% and 80% relative humidity.
 - h. The system shall include a thermostatic expansion valve (TXV) to ensure a positive superheat condition.
 - i. For units with two or three compressors (sizes 08-28), depending on the conditions required to maintain the space set points, one or all the compressors can operate in subcooling mode, one compressor could operate in subcooling mode while the other(s) operate in hot gas

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reheat mode, or one or all the compressors can operate in hot gas reheat mode.

PART 3 – EXECUTION

3.01 INSTALLERS

- A. Installers shall be manufacturer trained

3.02 EXAMINATION

- A. Site shall be examined and deemed acceptable to receive the rooftop units prior to installation.

3.03 INSTALLATION

- A. Unit shall be installed per manufacturer's instructions

3.04 CONSTRUCTION

- A. Interface with Other Work:
 - 1. Unit shall be compatible with building automation system described in Section 15910.

3.05 FIELD QUALITY CONTROL

- A. Site Tests, Inspection:
 - 1. Equipment Operation Test shall be conducted by manufacturer trained contractor to verify proper operation.

END OF SECTION