

SECTION 15730

DECENTRALIZED UNITARY AIR CONDITIONING EQUIPMENT

**PART 1 –GENERAL**

1.1 SUMMARY

- A. Section includes packaged roof top unit, unit controls, remote panel, roof mounting curb and base, maintenance service, unitary air conditioners and controls. Packaged terminal air conditioning units, packaged terminal heat pump units, wall sleeves and louvers and controls.

1.2 REFERENCES

- A. ARI 210 (Air-Conditioning and Refrigeration Institute) - Unitary Air-Conditioning Equipment.
- B. ARI 240 (Air-Conditioning and Refrigeration Institute) - Air Source Unitary Heat Pump Equipment.
- C. ARI 270 (Air-Conditioning and Refrigeration Institute) - Sound Rating of Outdoor Unitary Equipment.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide at least the following data for each piece of equipment:
  - 1. Gas Heating:
    - a. Input (Btu/hr)
    - b. Output: (Btu/hr)
  - 2. Heat Pump Heating:
    - a. Heating capacity (Btu/hr)
    - b. Rated outdoor air temperature (°F db / °F wb)
    - c. Rated air temperature entering indoor coil (°F)
    - d. Co-efficient of performance (COP)
  - 3. Hydronic Heating:
    - a. Heating capacity (Btu/hr)
    - b. Water flow (gpm)
    - c. Water entering (°F)
    - d. Water leaving: (°F)
  - 4. Cooling:
    - a. Rated cooling output (Btu/hr)
    - b. Air entering evaporator (°F db / °F wb)
    - c. Air leaving evaporator (°F db / °F wb)
    - d. Water entering condenser (°F) (water cooled)

- e. Water leaving condenser (°F) (water cooled)
- f. Condenser ambient air (°F) (air cooled)
- g. Condenser airflow (cfm) (air cooled)
- h. Air entering condenser (°F) (air cooled)
- i. Evaporator fan motor (hp, volts, single or three phase, 60 Hz)
- j. Condenser fan motor (hp, volts, single or three phase, 60 Hz) (air cooled)
- k. Energy efficiency ratio (EER)
- 5. Supply Air:
  - a. Air flow (cfm)
  - b. External static pressure (inch wg)
- 6. Return and/or Exhaust Air:
  - a. Air flow (cfm)
  - b. External static pressure (inch wg)
- 7. Unit Sound Rating (dB each octave band)

#### 1.4 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate capacity and dimensions of manufactured products and assemblies. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.
- C. Product Data: Submit data indicating dimensions, rough-in connections, and electrical characteristics and connection requirements. Provide capacity and dimensions of manufactured products and assemblies required for this Project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections. Provide data for manufactured products and assemblies. Indicate water, drain, thermostatic valves, and electrical rough-in connections with electrical characteristics and connection requirements.
- D. Manufacturer's Installation Instructions: Submit assembly, support details, connection requirements, and include start-up instructions.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Section 01770 - Execution Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of controls that are separate from units.

C. Provide Operation and Maintenance Data and Manuals.

1.6 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes and laws as well as the School of Medicine Guidelines, the Stanford University Facilities Design Guidelines and all Stanford University Contract documents.

B. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.8 PRE-INSTALLATION MEETING

A. Section 01330 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Accept equipment on site in factory packaging. Inspect for damage.

B. Protect equipment from damage by providing temporary covers until construction is complete in adjacent space. Protect rooftop units from damage by storing off the roof until the roof mounting curbs are in place.

1.10 WARRANTY

A. Section 01770 - Execution Requirements: Product warranties and product bonds.

B. Provide five year manufacturers warranty for compressors and heat exchangers and 20 years for gas.

## **PART 2 –PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Trane
- B. Carrier
- C. McQuay
- D. Mammoth
- E. Mitsubishi
- F. Or approved equal

### **2.2 ROOFTOP AIR CONDITIONING UNITS**

- A. General: Roof mounted units having natural gas burner, electric heating elements, and/or electric refrigeration.
- B. Description: Self-contained, packaged, factory assembled and pre-wired, consisting of a combination of the following items; cabinet and frame, supply fan, return fan, heat exchanger and burner, heat recovery coil, reversing valve controls, air filters, refrigerant cooling coil and compressor, condenser coil and condenser fan.

### **2.3 FABRICATION**

- A. Cabinet: Galvanized Steel with baked enamel finish, access doors or removable access panels with quick fasteners and locking door handle type with piano hinges. Structural members shall be minimum 18 gage with access doors or removable panels of minimum 20 gage.
- B. Insulation: 2 inch thick neoprene coated glass fiber with edges protected from erosion.
- C. Heat Exchangers: Aluminized or stainless steel, of welded construction.
- D. Supply and Return and Exhaust Fan: Forward curved centrifugal type, resiliently mounted with V-belt drive, adjustable variable pitch motor pulley for fans without a VFD, fixed pitch motor pulley for fans with a VFD, and rubber isolated hinge mounted high efficiency motor or direct drive. Isolate complete fan assembly.
- E. Air Filters: 2 inch thick MERV-9 glass fiber disposable media in sealed metal frames.
- F. Roof Mounting Curb: galvanized steel, channel frame with gaskets, nailer strips. Provide vibration isolation.

## 2.4 BURNER

- A. Gas Burner: Atmospheric, induced or forced draft type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shut-off, intermittent spark or glow coil ignition, flame sensing device, and automatic 100 percent shut-off pilot.
- B. Gas Burner Safety Controls: Energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, energize blower motor, and after air flow proven and slight delay, allow gas valve to open
- C. High Limit Control: Temperature sensor with fixed stop at maximum permissible setting, de-energize burner on excessive bonnet temperature and energize burner when temperature drops to lower safe value.
- D. Supply Fan Control: Temperature sensor sensing bonnet temperatures and independent of burner controls, with provisions for continuous fan operation.

## 2.5 EVAPORATOR COIL

- A. Provide copper tube aluminum fin coil assembly with galvanized or stainless steel drain pan and connection.
- B. Provide capillary tubes or thermostatic expansion valves for units of 10 tons capacity and less, and thermostatic expansion valves and alternate row circuiting for units 12 tons cooling capacity and larger.
- C. Use refrigerants with low ozone depletion potential (ODP) and global warming potential (GWP) according to the USGBC's LEED-NC system.

## 2.6 COMPRESSOR

- A. Provide hermetic or semi-hermetic compressors, 3600 rpm maximum, resiliently mounted with positive lubrication, high and low pressure safety controls, motor overload protection, and gage ports.
- B. Five-minute timed off circuit to delay compressor start.
- C. Provide step capacity control by hot gas by-pass, cycling compressors, cylinder unloading, or cycling multi-speed compressors.

## 2.7 CONDENSER

- A. Provide copper tube aluminum fin coil assembly with sub-cooling rows and coil guard.
- B. Provide direct drive propeller fans, motor overload protection, wired to operate with compressor. Provide high efficiency sealed bearing fan motors.
- C. Include pressure switch for operation with low ambient temperatures on all larger units.
- D. Provide refrigerant pressure switches or outdoor thermostat to cycle condenser fans.

## 2.8 MIXED AIR CASING

- A. Dampers: Provide outside, return and relief dampers with damper operator and control package to automatically vary outside air quantity based on an air-side economizer sequence. Outside air damper to fail to closed position. Relief dampers may be barometric.
- B. Gaskets: Provide tight fitting dampers with edge gaskets maximum leakage 5 percent at 2 inches pressure differential.
- C. Damper Operator: 24 volt with gear train sealed in oil with spring return on units 7.5 ton cooling capacity and larger.
- D. Damper Operator: Pneumatic piston or gear driven type with spring return and pilot positioner.
- E. Mixed Air Controls: Maintain selected supply air temperature with outside air damper to minimum position when ambient air temperature exceeds return air temperature.

## 2.9 OPERATING CONTROLS

- A. Provide low voltage, 365 day digital programmable and adjustable room thermostat(s) to control burner operation, heater stages in sequence with delay between stages, compressor and condenser fan, and supply fan to maintain temperature setting.
- B. Include system selector switch (off-heat-auto-cool) and fan control switch (autoon).
- C. Provide double acting thermostat with multi-stage heating and multi-stage cooling.

- D. Locate thermostat in room as shown.
- E. Provide terminal strip on unit for connection of operating controls to remote panel. Provide control for at least two stages of heating and two stages cooling.
- F. Provide remote mounted fan control switch (on-auto).
- G. Provide low limit thermostat in supply air to close outside air damper and stop supply fan.
- H. Provide night control energized by central time clock to lock out refrigeration and stop supply air fan for night and unoccupied operation.
- I. Provide remote readout panels containing signal lights indicating system status, heating system failure, cooling system failure, and dirty filters; check switches proving signal light operations; system on-off switch and cooling system on-off switch.
- J. Provide in panel a 7 day time clock for energizing night control, remote damper control, low limit manual reset, and remote thermostat temperature set point.

## 2.10 OPERATING CONTROLS - SINGLE ZONE UNITS

- A. Electric solid state microcomputer based 365 day digital programmable room thermostat located as indicated
- B. Room thermostat shall incorporate:
  - 1. Automatic switching from heating to cooling.
  - 2. Preferential rate control to minimize overshoot and deviation from set point.
  - 3. Set-up for four separate temperatures per day.
  - 4. Instant override of set point for continuous or timed period from one hour to 31 days.
  - 5. Short cycle protection.
  - 6. Programming based on Weekdays, Saturday, Sunday, and Holidays.
  - 7. Switch selection features including imperial display, 12 or 24-hour clock, keyboard disable, remote sensor, battery back up power, and fan-on-auto.
- C. Room thermostat display shall include:
  - 1. Time of day.
  - 2. Actual room temperature.
  - 3. Programmed temperature.
  - 4. Programmed time.
  - 5. Duration of timed override.

6. Day of week.
7. System model indication: heating, cooling, auto, off, fan auto, fan on.
8. Stage (heating or cooling) operation.

D. Provide low limit thermostat in supply air to close outside air dampers and stop supply fan and provide freeze protection.

## 2.11 OPERATING CONTROLS - VARIABLE VOLUME UNITS

- A. Local temperature transmitter in supply air to signal electronic logic panel to control mixing dampers and cooling in sequence. Operate mixing section as first stage of cooling and revert to minimum outside air above approximately 75 degrees F as determined by temperature of return and outdoor air.
- B. Control cooling by cycling compressors, cylinder unloading, and hot gas bypass.
- C. Control logic to allow supply air reset under low load or airflow conditions.
- D. Provide 365 day time clock with spring carry over to control unit on occupied/unoccupied schedule. At night, unit shall be off. Locate clock in remote control panel with status lights.
- E. Provide two-stage morning warm-up thermostat to hold outdoor dampers closed and energize heat until return air temperature reaches set point.
- F. Utilize VFDs to control duct static pressures.

## 2.12 HEAT RECOVERY COIL

- A. Provide copper tube aluminum fin coil assembly with multiple circuits arranged to provide heat recovery.

## 2.13 PACKAGED AIR CONDITIONING UNITS

- A. Packaged, self-contained, factory assembled, pre-wired unit, consisting of cabinet, compressor, condensing coil, evaporator fan, evaporator coil, discharge plenum, outside air connection, heating coil, air filters, and controls; fully charged with refrigerant and filled with oil.
- B. Assembly: Up or horizontal flow air delivery as indicated, in draw-through configuration.



2.14 CABINET

- A. Frame and Panels: Galvanized steel with baked enamel finish, easily removed access-doors or panels.
- B. Insulation: Minimum 2 inch thick acoustic duct liner for lining cabinet interior.
- C. Drain Pan: Stainless steel with corrosion-resistant coating or molded corrosion resistant material.

2.15 EVAPORATOR FAN

- A. Fan: V-Belt driven, with permanently lubricated bearings or direct drive, double width, double inlet, forward curved centrifugal or propeller fan, statically and dynamically balanced, resiliently mounted, and premium efficiency for motors greater than 5 hp.
- B. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed. Variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.

2.16 COMPRESSOR

- A. Hermetically sealed, 3600 rpm maximum resiliently mounted with positive lubrication and internal motor protection.

2.17 EVAPORATOR COIL

- A. Direct expansion coiling coil of copper tubes expanded into aluminum fins.
- B. Refrigeration circuit with expansion device, filter-drier, and charging valves.

2.18 CONDENSER

- A. Co-Axial, copper tube in copper tube or shell and tube with finned copper tubes in steel shell with water temperature actuated water-regulating valve.
- B. Terminating suction and liquid refrigerant piping with service valves within unit.
- C. Fan: Statically and dynamically balanced, with permanently lubricated bearings.
- D. V-Belt Drive: Dynamically balanced, bored to fit shafts and keyed. Variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position as recommended by manufacturer or minimum 1.5 times

nameplate rating of the motor.

2.19 HEATING COIL

- A. Hot water or Steam heating coils will be copper tube coil with tubes expanded into aluminum fins.

2.20 AIR FILTERS

- A. Easily removed 2 inch thick MERV-9 disposable glass fiber panel filters.

2.21 CONTROLS

- A. Factory wired controls shall include contactor, high and low pressure cutouts, internal winding thermostat for compressor, control circuit transformer, noncycling reset relay.
- B. Provide thermostat to cycle cooling within unit with 'fan-off-cool' switch allowing continuous fan operation, or cycling fan on call for cooling.
- C. Provide room thermostat to control cooling with 'cool-off' selector switch and 'auto-on' fan control switch.
- D. Provide low voltage, adjustable room thermostat to control heater stages in sequence with delay between stages, compressor, condenser, and supply fan to maintain temperature setting. Include system selector switch (off-heat-auto-cool) and fan control switch (auto-on).

2.22 ELECTRICAL CHARACTERISTICS AND COMPONENTS

- A. Disconnect Switch: Factory mount in control panel or on equipment

2.23 TERMINAL AIR CONDITIONING UNITS

- A. Description: Packaged, self-contained, through-the-wall are air or water cooled terminal air conditioning or heat pump units, with wall sleeve, room cabinet, electric refrigeration system, with hot water, steam or gas fired heating, outside air louvers, built-in or remote temperature controls; fully charged with “green” refrigerant, filled with oil, premium efficiency and digital controls.

2.24 CABINET

- A. Cabinet:
  - 1. Wall or floor mounted 18 gauge galvanized steel with epoxy coated or baked enamel finish, removable front panel with concealed latches.

B. Discharge Grille and Access Door:

1. Removable allowing 4-way discharge air pattern, with hinged door in top of cabinet for access to controls.
2. Integral allowing 4-way discharge air pattern, with hinged door in top of cabinet for access to controls.
3. Punched allowing 4-way discharge air pattern, with hinged door in top of cabinet for access to controls.
4. Louver extruded aluminum discharge grilles, allowing 4-way discharge air pattern, with hinged door in top of cabinet for access to controls.
5. Wall Cabinet: Matching cabinet in construction and finish, allowing diversion of unit air flow to adjoining room, with grille.

2.25 WALL SLEEVES AND LOUVERS

1. Wall Sleeves: 16 gauge galvanized steel with protective mastic coating or polyester finish.
2. Louvers: Flush
  - a. Companion flanged with enamel finish.
  - b. Anodized aluminum with enamel finish.

2.26 CHASSIS

A. Refrigeration System:

1. Green refrigerants as defined by the USGBCs LEED rating system.
2. High efficiency.
3. Low noise.
4. Direct expansion:
  - a. Cooling coil
  - b. Indoor coil.
5. Hermetically sealed compressor with internal spring isolation, external isolation, permanent split capacitor motor and overload protection.
6. Condenser or Outdoor coil and fan.
7. Coaxial tube-in-tube condenser with water- regulating valve.
8. Capillary restrictor and constant pressure expansion valve.

B. Air System: Centrifugal forward curved fans with two speed permanent split capacitor motor, permanent washable filters, positive pressure ventilation damper with concealed manual operator.

C. Heating Coil: Hot water

D. Condensate Drain: Drain pan to direct condensate to condenser coil for re-evaporation.

E. Condenser Fan: Centrifugal, forward curved or propeller type with separate permanent split capacitor motor.

## 2.27 CONTROLS

- A. Control Module: Unit or remote mounted adjustable digital thermostat, off-heatauto-cool switch, high-low fan switch.
- B. Low Ambient Lockout Control: Below 35 degrees F, outdoor thermostat shall prevent compressor operation.

## 2.28 ELECTRICAL CHARACTERISTICS AND COMPONENTS

- A. Disconnect Switch: Factory mount in control panel or on equipment.

# PART 3 –EXECUTION

## 3.1 EXAMINATION

- A. Section 01330 - Administrative Requirements: Coordination and project conditions.
- B. Verify that roof curbs are installed and dimensions are as shown on shop Drawings

## 3.2 INSTALLATION

- A. Install work in accordance with applicable codes and laws as well as the Stanford University Facilities Design Guidelines and all Stanford University Contract documents.
- B. Mount rooftop units on factory built roof-mounting curb providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.
- C. Locate remote panels where indicated.
- D. Connect controls to remote locations.
- E. Mount indoor units on vibration isolators.
- F. Connect indoor units to supply and return ductwork with flexible connections.
- G. Provide shut-off valves in condenser water inlet and outlet piping.
- H. Pipe refrigerant from unit to condenser.
- I. Pipe condensate from drain pan to drain system as directed by engineer and

approved by Project Manager.

- J. On water coils, provide shut-off valve on supply line and flow control and shutoff valve on return line. Provide manual or float operated automatic air vents at high points complete with stop valve.
- K. In steam coils, provide shut-off valve and vacuum breaker in steam line. Install steam traps with outlet below coil return connection.

### 3.3 MANUFACTURER'S FIELD SERVICES

- A. Provide initial start-up.

### 3.4 DEMONSTRATION AND TRAINING

- A. Demonstrate unit operation and maintenance.

END OF SECTION