



TRANE

Guide Spec Summary

Date: 05/21/2001
Time: 08:53:15 AM
Job Name: EarthWise T-Series AHU – Full Spec
Location: Any Town, Earth
Prepared by:
Phone Number:
Prepared for:

Option List

Bid Type	Acceptable Manufacturers
Bid Type	Base Bid Trane
FILTERS - NUMBER	one set
FILTERS - TYPE	disposable
UNITS - TYPE	draw-thru
UNITS - FEATURES	fan sections
UNIT _ PAINT	manufacturer's standard color
INLET HOOD	Inlet Hood
CURB PROVIDED	by the unit manufacturer
DWDI FANS	DWDI FANS
FAN SECTION - TYPE	supply
FAN - TYPE	FC
ISOLATORS - TYPE	1 inch spring
ACCESS DOORS - PLACEMENT	drive side
FAN MOTOR - TYPE	high efficiency open drip-proof
FAN MOTOR - VOLTS	460 Volts, 60 Hz, 3-phase
DRIVE - PITCH	variable
DRIVE - RATING	1.2
COIL CASINGS - MATERIAL	galvanized steel
CONDENSER TUBES - TYPE	Condenser Tubes - Type
COPPER - THICKNESS	.016
TUBES - TYPE	Tubes - Type
FINS - MATERIAL	aluminum
DRAIN PAN	Insulated Drain Pan
INTERIOR PANS - MATERIAL	G90-U galvanized steel
FILTERS - TYPE	Filters - Type
FILTER SECTION - TYPE	2 inch flat , 4 inch flat
FILTERS - TYPE	throwaway
FILTERS - PLACEMENT	one
DAMPERS - TYPE	Dampers - Type
DAMPERS - TYPE	outside air
BLADE ACTION - TYPE	parallel
AIRFLOW MEASUREMENT SYSTEM	DAMPER_TRAQ

MOTOR_STARTER
MOTOR_VFD
VFD
DDC CONTROLS
CONTROLS
DDC_LCD
TCS

MOTOR_STARTER
MOTOR_VFD
VFD w/o Bypass
DDC CONTROLS
Factory controls
DDC_LCD
TCS

SECTION 15720

MODULAR ROOFTOP AIR HANDLING UNITS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Packaged Air Handling Units.
- B. Roof curbs.

1.02 RELATED WORK

- A. Section 01513 - Temporary Heating, Cooling, and Ventilating.
- B. Section 15121 - Expansion Compensation.
- C. Section 15290 - Duct Work Insulation.

1.03 REFERENCES

- A. ARI 430 - Standard for Central Station Air Handling Units.
- B. ARI 410 - Standard for Forced Circulation Air-Cooling and Air-Heating Coils.
- C. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
- D. UL 1995 - Heating and Cooling Equipment
- E. ANSI/AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- F. SMACNA - HVAC Duct Construction Standards.
- G. ANSI/UL 900 - Test Performance of Air Filter Units.
- H. AMCA 300 - Reverberant Method for Sound Testing of Fans.
- I. ARI 260 - Standard for Sound Rating of Ducted Air Moving and Conditioning Equipment

- J. AMCA 301 - Method for Publishing Sound Ratings for Air Moving Devices.
- K. ASHRAE 68 - Laboratory Method of Testing In-Duct Sound Power Measurement Procedure for Fans.

1.04 QUALITY ASSURANCE

- A. Air Handling Units: Product of manufacturer regularly engaged in production of components who issues complete catalog data on product offering.
- B. ISO 9001 Certification. The air handling manufacturer shall be ISO 9001 Certified by a third party registrar, such as HSB Registration Services, that is accredited by an accreditation body such as ANSI-RAB and / or RvC Dutch Council for Accrediation.
- C. Constant Volume Air Handling Units: Certify air volume, static pressure, fan speed, brake horsepower and selection procedures in accordance with ARI 430. If air handling units are not certified in accordance with ARI 430, contractor shall be responsible for expenses associated with testing of units after installation to verify performance of fan(s). Any costs incurred to adjust fans to meet scheduled capacities shall be the sole responsibility of the contractor.
- D. Variable Air Volume Air Handling Units with Variable Inlet Vanes: Certify air volume, static pressure, fan speed, brake horsepower and selection procedures in accordance with ARI 430. Certify units with inlet vanes in wide-open position. If air handling units are not certified in accordance with ARI 430, contractor shall be responsible for expenses associated with testing of units after installation to verify performance of fan(s). Any costs incurred to adjust fans to meet scheduled capacities shall be the sole responsibility of the contractor.
- E. Air Coils: Certify capacities, pressure drops and selection procedures in accordance with ARI 410-91.

1.05 SUBMITTALS

- A. Submit unit performance including: capacity, nominal and operating performance.
- B. Submit Mechanical Specifications for unit and accessories describing construction, components and options.
- C. Submit shop drawings indicating overall dimensions as well as installation, operation and service clearances. Indicate lift points and recommendations and center of gravity. Indicate unit shipping, installation and operating weights including dimensions.
- D. Provide fan curves with specified operating point clearly plotted.
- E. Submit data on electrical requirements and connection points. Include recommended wire and fuse sizes or MCA, sequence of operation, safety and start-up instructions.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Section [_____]. Units shall ship fully assembled up to practical shipping and rigging limitations. Units not shipped fully assembled shall have tags and airflow arrows on each section to indicate location and orientation in direction of airflow. Each section shall have lifting lugs to allow for field rigging and final placement of section.
- B. Deliver units to site with fan motors, sheaves, and belts completely assembled and mounted in units. Mount motors as specified in Article 2.06 Paragraph D, and Article 2.07 Paragraph A and B.
- C. Store and protect products under provisions of Section [_____].

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.08 EXTRA STOCK

- A. Provide one set of disposable filters.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Trane Company; Model: T-Series Climate Changer
- B. YORK; Model: Curbpak
- C. [_____]
- D. Substitutions: Under provisions of Section [_____]

**** OR ****

- A. Base bid shall be Trane with approved alternate being McQuay and York. Products as manufactured by McQuay and York, if they comply with this specification, may be acceptable. Alternate will be considered after the job is awarded.

2.02 GENERAL

- A. Manufacturer must clearly define any exceptions made to Plans and Specifications. Mechanical Contractor is responsible for expenses that occur due to exceptions made.
- B. Unit must be specifically designed for outdoor installation.
- C. Fabricate draw-thru type air handling units with fan sections.
- D. Factory fabricate air handling units of sizes, capacities, and configurations as scheduled on drawings.
- E. The unit shall be able to withstand up to 1.5 times design static pressure, or 8-inch wc whichever is less, with no more than 0.005 inch deflection per inch of panel span.

2.03 UNIT BASE

- A. Base shall be welded supporting the entire length and width of the unit. Units shipped in one piece shall have at a minimum six points of lift. These lift points shall be designed to accept standard rigging devices.
- B. The unit base design shall allow unit to rest on top of roofcurb when field installed. Entire length and width under base shall be sealed in the field with curb gasketing for weather tight seal.

2.04 CASING

- A. All panels shall be double wall construction. Interior and exterior panels shall be constructed of galvanized steel. Panel insulation system shall provide a minimum R value of 12. Insulation shall conform to NFPA 90 requirements.
- B. Panels shall be fully removable to allow for a proper way to thoroughly clean panels and to access internal parts. If panels are not removable, then manufacturer shall provide access sections with doors between all internal components to ensure access and cleanability of the air handler.
- C. Access doors shall be constructed with a double-wall of solid G90 galvanized steel interior panel. Gasketing around the full perimeter of the access door shall be used to prevent air and water leakage. Preferred door handle shall not penetrate door casing with single-handle latch.
- D. External surface of unit casing shall be prepared and factory coated with a minimum 1.5 mil enamel finish or equal. Unit casing exterior with factory coating shall be able to withstand a salt spray test in accordance with ASTM B117 for a minimum of 1500 consecutive hours. Unit casing will be provided with manufacturer's standard color.
- E. Unit roof shall be sloped a minimum .25 inch per foot either from one side of unit to other or from center to sides of the unit. Roof assembly shall

overhang all walls of units by 2 inch minimum.

- F. For units with outside air requirements, manufacturer shall provide inlet hood with high performance sine wave moisture eliminator to prevent water carryover into unit casing from outside air. Hoods shall be sized for 100% economizer cycle. If eliminator is not factory provided, contractor shall be responsible for field supplying and installing in manufacturers standard outside air inlet hood (s). If louvers are provided, then louvers shall be tested by an Independent AMCA approved laboratory for water carryover and air pressure drop in accordance with AMCA Standard 500, and testing reports shall be supplied with the submittal data.
- G. Galvanized steel roof mounting curb with wood nailing strip, and neoprene gasket shall be supplied by the unit manufacturer. If unit requires external piping cabinet, a separate curb shall be supplied for support of the external cabinet.

2.05 FANS SECTIONS

- A. Provide supply fan section(s) with FC double width, double inlet centrifugal fan designed and suitable for class of service indicated in the unit schedule. Fan shaft to be properly sized and protectively coated with lubricating oil. Fan shafts shall be solid and properly designed so that fan shaft does not pass through first critical speed as unit comes up to rated RPM. Fans shall be statically and dynamically tested as an assembly at the required RPM to meet design specifications. Key fan wheels to fan shaft to prevent slipping.
 - 1. Provide self-aligning, grease lubricated pillow-block ball bearings selected for L-50 200,000 hour average life per ANSI/AFBMA 9. Extend both grease lubrication fittings to drive side of unit with plastic tubes and zerk fittings rigidly attached to drive side bearing support.
- B. Mount fans on isolation bases. Internally mount motors on same isolation bases and internally isolate fans and motors with 1 inch spring isolators. Install flexible canvas ducts between

fan and casings to ensure complete isolation. Flexible canvas ducts shall comply with NFPA 90A. If no isolators or flexible canvas duct is provided, then the entire unit shall be externally isolated from the supply duct work and piping by contractor in order to avoid transmission of noise and vibration through the ductwork.

- C. Fan sections shall have full height, double wall, hinged doors on drive side for inspection and maintenance of internal components. Construct doors in accordance with Article 2.03 Paragraph E.
- D. Weigh fan and motor assembly at AHU manufacturer's factory for isolator selection. Statically and dynamically balance fan section assemblies. Fan section assemblies include fan wheels, shafts, bearings, drives, belts, isolation bases and isolators. Allow isolators to free float when performing fan balance. Measure vibration at each fan shaft bearing in horizontal, vertical and axial directions. Balance at design RPM as scheduled on drawings.

2.06 MOTORS AND DRIVES

- A. Factory install all motors on slide base to permit adjustment of belt tension.
- B. Fan Motors shall be heavy duty, high efficiency open drip-proof, operable at 460 Volts, 60 Hz, 3-phase.
- C. V-Belt Drive shall be variable pitch rated at 1.2 times the motor nameplate.

2.07 COILS SECTION

- A. Coils shall be manufactured by the same company as the supplier of the air handling unit. Install coils such that headers and return bends are enclosed by unit casings.
- B. The wet section of the unit, defined as the entering air side of the dehumidification coil to the leaving edge of the drain pan, shall be insulated. The insulation shall meet UL 181 requirements. The air stream surface of the insulation shall be

constructed or coated such that it is not biodegradable, repels water and it can be cleaned to prevent microbial growth. The manufacturer's maintenance instructions shall describe the proper cleaning procedure for the unit.

- C. Construct coils of plate fins and seamless tubes. Fins shall have collars drawn, belled and firmly bonded to tubes by means of mechanical expansion of tubes. Do not use soldering or tinning in bonding process.
- D. Construct coil casings of galvanized steel with formed end supports and top and bottom channels. If two or more coils are stacked in unit, install intermediate drain channels between coils to drain condensate to main drain pans without flooding lower coils or passing condensate through airstream.
- E. Water Cooling Coils
 - 1. Clearly label supply and return headers on outside of units such that direction of coil water flow is counter to direction of unit airflow.
 - 2. Coils shall be proof tested to 300 psig and leak tested to 200 psig air pressure under water.
 - 3. Construct headers of round copper pipe or cast iron.
 - 4. Construct tubes of 1/2 inch O.D. minimum .016 inch thick copper and construct fins of aluminum.
- F. Steam Heating Coils
 - 1. Clearly label supply and return connections on outside of units.
 - 2. Provide non-freeze steam distributing type coils. Pitch steam coils in units for proper drainage of steam condensate from coils.
 - 3. Proof test coils to 300 psig air under water and leak test coils to 200 psig air pressure under

water.

4. Construct headers of cast iron or round copper pipe.
5. Construct tubes of 5/8 inch O.D. copper inner tubes and 1 inch O.D. minimum .031 inch thick copper outer tubes. Construct fins of aluminum.
6. Inner tubes shall have orifices that ensure even steam distribution across coil face. Direct orifices toward return connections to ensure steam condensate is discharged from coils.

G. Refrigerant Cooling Coils

1. Clearly label suction and liquid connections on outside of units.
2. Proof test coils to 450 psig air under water and leak test coils to 300 psig air pressure under water. Dry insides of coils after testing and seal all connections.
3. Construct suction headers of copper tubing. Suction connections shall penetrate unit casings to allow for sweat connections to refrigerant lines.
4. Coils shall have equalizing type vertical distributors sized in conjunction with capacities of coils.

2.08 DRAIN PAN CONSTRUCTION

- A. Provide insulated drain pans constructed of G90-U galvanized steel exterior panels and G90-U galvanized steel interior liner. Encase insulation between exterior and interior walls. Drain pans shall be sloped in 2 planes; cross break interior pans and pitch toward drain connections to ensure complete condensate drainage. Units with cooling coils shall have drain pans under complete cooling coil section. All drain pan connections will be to the side of the unit to enable proper trapping. Units without 2-way sloped drain pans shall coat drain pans with anti-microbial treatment.

2.09 EXTERNAL PIPING ENCLOSURE

- A. Piping enclosure shall be supplied by the manufacturer factory assembled and shall be of the same construction as the main unit casing. Piping cabinet shall be external to the unit and be shipped separate for field installation in order to facilitate piping of the unit coil(s). Piping cabinet to cover unit sections as specified on schedule and shall have access door(s), or removable panels, as specified.

2.10 FILTERS

- A. Provide factory-fabricated filter section of the same construction and finish as unit casings. Filter sections shall have filter guides and full height, double-wall, hinged doors for filter removal. Construct doors in accordance with Article 2.04 Paragraph C. Filter sections shall flange to other unit components. Provide filter blockoffs as required to prevent air bypass around filters.
- B. Provide [2 inch flat][4 inch flat] filter sections with throwaway filters. Filters shall be removable from one side(s) of filter sections.

2.11 DAMPERS

- A. Provide internally mounted ultra low leak outside air dampers as scheduled on drawings. Dampers shall be Ruskin CD60 double skin airfoil design or equivalent. Construct damper blades and damper frames of galvanized steel. Provide parallel blade action with metal compressible jamb seals and extruded vinyl blade edge seals. Blades shall rotate on stainless steel sleeve bearings. Damper blade lengths shall not exceed 60 inches. Leakage rate shall not exceed 5 CFM/square foot at one inch water gage and 9 CFM/square foot at 4 inches water gage. All Leakage testing and pressure ratings will be based on AMCA Publication 500.
- B. Provide a factory-mounted damper/airflow monitoring station in the outdoor air damper opening of the mixing box as specified on the schedule. Damper

blades shall be galvanized steel, housed in a galvanized steel frame and mechanically fastened to an axle rod rotating on bearings. The dampers shall be rated for a maximum leakage rate of less than 1 percent of nominal cfm (L/s) at 1 in. wg (249 Pa). The airflow measurement station shall measure up to 100 percent of airflow. The airflow monitoring station shall output a 2-10 VDC signal representing velocity and shall have a total accuracy of (+/-) 5 percent of actual flow down to 15 percent of nominal flow between -40 F (-40.0 C) and +158 F (70.0 C). Airflow monitoring stations that require a change in duct arrangements from the current design will not be acceptable.

2.12 FACTORY-INSTALLED STARTER / LINE BREAK SWITCH

- A. Provide IEC or NEMA Type Combination Starter / Line Break Switch for each fan motor. Each shall be properly sized, mounted, wired and commissioned by the AHU manufacturer. Package shall include line break switch, control transformer, Hands-Off-Auto (H-O-A) switch, N.O. auxiliary contact, electronic overloads (factory-set for the specific motor). Units with factory-mounted controls shall also include power wiring from the starter control transformer to the control system transformers, and start-stop wiring from the controller start-stop relay to the starter H-O-A switch. Wiring methods must comply with the National Electric Code and NFPA 70. Factory mounting will facilitate temporary heating, cooling, ventilation, and / or timely completion of the project.
- B. ENCLOSURE: Starter / Line Break Switch shall have full metal enclosures. Enclosures shall be weather tight and completely recessed inside the standard unit casing. The door should be identical construction to the access doors on the air handler. A manual shut down switch shall be located on the outside of the access door.
- C. FACTORY MOUNTING: Starter / Line Break Switch shall be factory mounted on the drive side of the air handling unit fan section. Ensure four feet of clearance from the side of the air handler.

- D. FACTORY WIRING: Starter / line break switches shall be wired to fan motor per required NEC, UL, and NFPA 90 requirements. Units with factory mounted controls shall also include power wiring from the starter control transformer to the control system transformers. Also a binary start-stop signal shall be wired complete from the direct digital controller to the starter.
- E. FACTORY COMMISSIONING: Trained factory personnel shall ensure proper operation of the starter by a thorough factory test. Fuses and overload heaters must be selected individually for the voltage, horsepower, and full load amps of the actual motor being supplied. Testing shall include a "Hypot" test of unit wiring to insure that no weaknesses exist in starter, wiring, or motor. "Hand" and "Auto" positions shall be verified to insure starter is operational.

2.13 FACTORY-INSTALLED VARIABLE FREQUENCY DRIVE / LINE BREAK SWITCH

- A. Combination Variable Frequency Drive / line break switches shall be properly sized, mounted, wired to the fan motor, and commissioned by the AHU manufacturer. Combination VFD / line break switches shall include the VFD, a circuit breaker disconnect, a Drive-Off (H-O-A) switch, and a control transformer. Factory mounting will facilitate temporary heating, cooling, ventilation, and / or timely completion of the project.
- B. VARIABLE FREQUENCY DRIVES: The VFD shall be supplied with a high performance flux vector drive with insulated gate bipolar transistors (IGBT's). The VFD shall have one 16 bit microprocessor control logic circuit board for all horsepower ratings. All programming shall be maintained in non-volatile RAM memory so the program will be maintained when power is removed. A digital operator keypad and display shall provide local control and readout for: run/stop/jog, speed, reset, volts, amps, kilowatts, and diagnostics. Output current overload should be rated at 125% of motor FLA for one minute. The VFD shall have the following minimal protective features: current limited stall prevention, auto

restart after momentary power loss, speed search for starting into rotating motor, anti-windmill w/ DC injection before start, phase to phase short circuit protection, and ground fault protection. Ambient service temperature rating of -10 to 40 degrees C, and humidity rating to 95% non-condensing. The VFD shall meet or exceed UL, CSA, IEEE 444 (ANSI-C343), and IEC: 146A.

- C. ENCLOSURE: VFD / Line Break Switch shall have full metal enclosures. Enclosures shall be weather tight and completely recessed inside the standard unit casing. The door should be identical construction to the access doors on the air handler. A manual shut down switch shall be located on the outside of the access door.
- D. FACTORY-MOUNTING: VFD/Disconnect shall be factory-mounted on the drive side of the air handling unit fan section. Ensure four feet of clearance to access panel.
- E. FACTORY WIRING: VFD / disconnects shall be wired to fan motor per required NEC, UL, and NFPA 90 requirements. Units with factory mounted controls shall also include power wiring from the VFD control transformer to the control system transformers. Also a binary start-stop signal and an analog speed signal shall be wired complete from the direct digital controller to the VFD.
- F. FACTORY COMMISSIONING: Trained factory personnel shall ensure proper operation of the VFD by a thorough factory test. Testing shall include "Hypot" test of unit wiring to insure that no weaknesses exist in VFD, wiring, or motor. VFD should be energized and fan run at 22Hz, 40Hz, and 60Hz to insure VFD will operate throughout usable range of drive and that the fan rotation is correct. If VFD has bypass, fan will additionally be tested in bypass position to insure bypass is operational.

2.14 CONTROLS

A. FACTORY-INSTALLED DDC CONTROLS

1. The programmable DDC controller and a majority

of the control components shall be selected, mounted, wired, and tested by the AHU manufacturer. Unit-mounted controls shall be covered by the AHU manufacturer's standard warranty of one year from AHU startup or 18 months from shipment, whichever comes first. Factory mounting will facilitate temporary heating, cooling, ventilation, and/or timely completion of the project. Field-installed systems are acceptable with the engineer's approval of actuators, valves, sensors, and control drawings prior to bid day.

2. A dedicated stand-alone programmable DDC controller shall be provided with each AHU. Control of more than one unit from a controller is not acceptable. This will ensure that a controller failure will not affect more than one AHU.
3. The programmable DDC controller shall be fully compatible with a Building Automation System. Complete communications and diagnostics including all AI, BI, AO, BO, set points, and alarms shall only require a twisted pair of wires. System optimization strategies shall be available to perform such energy management functions as resetting duct static downward until one VAV box is fully open, and resetting chilled water temperature upward until one valve is fully open.
4. All programming required for operation shall be retained in permanent memory. Battery backup (for a minimum of 72 hours) is also permissible. Include a lifetime battery replacement (parts and labor) warranty in the bid.
5. Each controller shall have an LCD screen and keypad for user interface mounted on the unit it is controlling. System passwords are required to prevent unauthorized use. A portable service tool is acceptable, but one must be permanently mounted at each AHU. Local access to AHU status, set points, and alarms is critical. No exceptions will be permitted.

6. Traq Comfort System: Outdoor airflow shall be sensed at the intake and maintained at the minimum outdoor airflow setpoint for the air handler as determined using ASHRAE STANDARD 62-89 EQUATION 6-1. The building automation system shall dynamically calculate equation 6-1 taking into account all connected spaces to determine the minimum outdoor airflow setpoint.
7. Damper Actuators shall be selected, sized, mounted, wired and tested by the air handling unit manufacturer. Actuators shall be direct coupled to minimize linkage. Manual overrides shall be available.
8. Manual reset low limit switches with will shut down the fan, close the outside air damper, and open the heating valve to protect the unit. The low limit switches shall be factory mounted to maximize coil coverage. Field installation will be acceptable if the proper capillary clips are used and all four corners of the coil and the coil face are uniformly protected. Units with greater than 21 square feet of coil shall have at least two low limits. Averaging sensors must be installed with the same quality procedures across the coil face.
9. Valves shall be provided by the air handling unit manufacturer. They shall be shipped directly to the job site or mechanical contractor. The piping contractor shall install them. Quick connect electrical connections shall simplify field wiring.

2.15 AIR HANDLING UNIT SCHEDULE

Drawing Code	Unit AS-1	Unit AS-2	Unit AS-3
Manufacturer			
Model			
Type			
Arrangement			
Coil Velocity Max			
Filter Velocity Max			
Fan			
Capacity CFM			
ESP inch Wg			

TSP inch Wg
Motor hp
Max Fan bhp
Heating Coil
-Fin Series
-Type
-Height inch
-Width inch
-Rows
-Capacity Btu/hr
-Air Entering deg F
-Air Leaving deg F
-Air SP Drop inch Wg
-Water Entering deg F
-Water Leaving deg F
-Water Pressure Drop f
-Steam Capacity lb/hr
-Steam Pressure psi
Cooling Coil
-Fin Series
-Type
-Height inch
-Width inch
-Rows
-Capacity Btu/hr
-Air Entering
-Dry Bulb deg F
-Wet Bulb deg F
-Air Leaving
-Dry Bulb deg F
-Wet Bulb deg F
-Water, gal/min
-Water Entering deg F
-Water Leaving deg F
-Water Pressure Drop f
-Saturated Suction deg
-Condensing Temp

PART 3 EXECUTION

PART 4 SEQUENCE OF OPERATIONS

END OF SECTION