PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Variable Air Volume Terminal Units

1. Reheat

1.02 REFERENCE STANDARDS

A. AHRI 410 – Standard for Forced-Circulation Air-Cooling and Air-Heating Coils.

B. AHRI 880 – Performance Rating of Air Terminals.

C. AHRI 885 – Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets.

D. ASHRAE Std 130 – Methods of Testing Air Terminal Units.

E. NFPA 90A – Standard for the Installation of Air-Conditioning and Ventilating Systems.

F. UL 181 – Standard for Factory-Made Air Ducts and Air Connectors.

G. UL 94 – Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including performance data for each size and type of air terminal furnished; certified sound power data for each unit; schedule showing drawing designation, room location, number furnished, model number, size, and accessories furnished.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weight loadings, required clearances, methods of assembly of components and electrical characteristics and connection requirements.

C. Certificates: Certify that coils are tested and rated in accordance with AHRI 410.

D. Wiring Diagrams: Submit ladder-type wiring diagrams for electric power and control components, clearly indicating required field electrical connections.

E. Nameplate Data: Nameplate data shall be submitted in a timely manner so as to allow proper coordination with the Electrical Contractor. Submittals that do not have nameplate data will be rejected.

F. Manufacturer's Installation Instructions: Indicate support and hanging details, installation instructions, recommendations, and service clearances required.

G. Project Record Documents: Record actual locations of units and locations of access doors required for access of valving.

H. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include this data, product data, shop drawings, and maintenance data in maintenance manual; in accordance with requirements of Division 1.

1.04 QUALITY ASSURANCE

A. ADC Compliance: Provide air terminals which have been tested and rated in accordance with ADC standards, and bear ADC Seal.

B. UL/ETL Compliance: Air terminal units shall be UL or ETL listed as a complete assembly. All electrical components shall be UL listed and installed in accordance with the National Electric Code.

C. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.05 SPARE PARTS

A. If HVAC equipment is used during construction, the contractor is fully responsible for it’s cleaning just before substantial completion prior to testing and balancing.

PART 2 - PRODUCTS

2.01 VARIABLE AND CONSTANT AIR VOLUME TERMINAL UNITS

A. Manufacturers:

1. Carnes Co.
2. Carrier Corp.; Sub. of United Technologies Corp.
3. Environmental Technologies, Inc.
4. Johnson Controls, Inc.
5. Krueger Mfg. Co.
6. Metalaire.
7. Nailor Industries, Inc.
8. Price Industries.
9. Tempmaster Corp.
10. Titus Products Div.; Philips Industries, Inc.
11. Trane (The) Co.

B. Construction

1. Casings: Construct of galvanized sheet metal of minimum 22 gauge thickness or die-cast aluminum of minimum 20 gauge thickness.

    a) Assembled with longitudinal lock seam construction.
    b) Construct casings such that when subjected to 0.5-in w.g. pressure for low pressure units, and 3.0-in w.g. pressure for high pressure units, total leakage does not exceed 2% of specified air flow capacity with outlets sealed and inlets wide open.

2. Air Inlet Collar: Provide round, suitable for standard flexible duct sizes or rectangular where needed to meet airflow requirements.
3. Unit Discharge: Rectangular, with slip-and-drive connections.
4. Acceptable Liners:

    a) Linings: Line inside surfaces of casings with fiberglass, lining material to provide acoustic performance, thermal insulation, and to prevent condensation on outside surfaces of casing. Provide minimum thickness of 1/2". Secure lining to prevent delamination, sagging, or settling.
    b) Linings: Line inside surfaces of casings with lining material to provide acoustic performance, thermal insulation, and to prevent condensation on outside surfaces of casing. Provide minimum thickness of 1/2". Lining shall be closed cell foam and comply with UL 181 and NFPA 90A. Insulation shall be 1-1/2 lb. density.

Insulation shall be equivalent to Titus Fibre-Free Liner. Refer to Drawings for terminal units noted with this liner.

5. Access: Provide removable panels in casings to permit access to air dampers, fans and other parts requiring service, adjusting, or maintenance.

   a) Provide airtight gasket and quarter-turn latches.

6. Provide hanger brackets for attachment of supports.

C. Sound Attenuator

1. Provide if required to meet scheduled acoustical performance requirements.
2. Construction to consist of a continuous extension of the casing and liner as required to achieve required attenuation.
3. At 2000 fpm inlet velocity, the additional differential pressure drop with attenuator not to exceed 0.2 inch wg.
4. All sound data shall be compiled in an independent ADC certified laboratory and in accordance with the latest version of AHRI 880. All units shall be AHRI certified and bear the AHRI certification label.

D. Primary Air Damper Assembly

1. Heavy-gauge, galvanized steel or extruded aluminum construction with solid steel, nickel-plated shaft pivoting on HDPE, self-lubricating bearings.
2. Provide integral position indicator or alternative method for indicating damper position over full range of 90 degrees.
3. Incorporate low leak damper blades for tight airflow shutoff.

   a) Air Leakage Past Closed Damper: Maximum two percent of unit maximum airflow at 3 inch wg inlet static pressure, tested in accordance with ASHRAE Std 130.

E. Hot Water Heating Coil:

1. Seamless copper tubes, mechanically expanded into aluminum or aluminum-plated fins.
2. Include low-leakage access door for coil inspection and cleaning.
3. Coil leak tested to minimum 200 psig.
4. Base performance data on tests run in accordance with AHRI 410.

F. Electrical Requirements:

1. Single-point power connection.
2. Equipment wiring to comply with requirements of NFPA 70.
3. All electrical components shall be UL or ETL listed or recognized and installed in accordance with the National Electrical Code.

4. All electrical components shall be mounted in a control box.
5. The entire assembly shall be UL or ETL listed (cETL in Canada) and so labeled.

G. Control Transformers: Factory supplied and mounted for electric and electronic control applications.

H. Controls: Provide controls accurate to 1.5 degrees F and adjustable from 65 degrees F to 85 degrees F. Provide air flow measurement station at terminal unit inlet. Provide control type as indicated below.

1. DDC (Direct Digital Control): Provide direct digital controls, compatible with direct digital control system specified in other Division 23 sections.

a) The unit level controller to include the following:

1) 24 VAC power terminal or RJ-12 Power connection.
2) Port for thermostat connection.
3) Service Port for diagnostic equipment.
4) Damper actuator.
5) LED indication for troubleshooting.
6) Heating output signal(s).
7) Cooling output signal(s).
8) Supply air temperature sensor input.
9) Contact closure input.
10) BACNET communication capability.

b) Include a factory-installed, unit-mounted direct-digital controller.
c) Bi-directional Damper Actuator: 24 volt, powered closed, spring return open.
d) Microprocessor-Based Controller: Air volume controller, pressure-independent with electronic airflow transducers, factory-calibrated maximum and minimum CFM's.

1) Occupied and unoccupied operating mode.
2) Remote reset of temperature or CFM set points.
3) Proportional, plus integral control of room temperature.
4) Monitoring and adjusting with portable terminal.
5) Time-proportional reheat coil control.

e) Room Sensor:

1) Compatible with temperature controls specified.
2) Wall-mounted, system powered, with temperature set-point adjustment including connection access for portable operator terminal.

2. Airflow Sensor: Differential pressure airflow device measuring total, static, and wake pressures.

a) Sensor Requirements:

1) Plastic parts shall be fire-resistant, complying with UL 94.
2) Control tubing shall be protected by grommets at the wall of the air flow sensor's housing.
3) Furnished with multiple total and static pressure sensing ports and a center averaging chamber that amplifies the sensed air flow signal.
4) Provide sensor with a pressure transducer to interface with the building control system.

b) Signal accuracy: Provide accuracy within 5 percent throughout the terminal unit operating range.

I. Identification: Provide label on each unit indicating Plan Number, cfm range, cfm factory-setting, and calibration curve (if required).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that conditions are suitable for installation.

B. Verify that field measurements are as indicated on drawings.

3.02 INSTALLATION

A. Install products in accordance with manufacturer’s instructions.

B. Install the inlets of air terminal units and air flow sensors a minimum of three duct diameters from elbows, transitions, and duct takeoffs.

C. Provide ceiling access doors or locate units above easily removable ceiling components.

3.03 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design flow to scheduled minimum flow.

3.04 FIELD QUALITY CONTROL

A. Upon completion of installation and prior to initial operation, test and demonstrate that air terminals, duct connections to air terminals, and water coils are leak-tight.

1. Leak Test:

a) Repair or replace air terminals and duct connections as required to eliminate leaks, and retest to demonstrate compliance.
b) Repair water leaks and retest until no leaks exist.

2. Operational Test:

a) After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
b) Test and adjust controls and safeties.
c) Replace damaged and malfunctioning controls and other equipment.

3.05 CLEANING

A. Clean the entire unit including cabinet interiors just prior to substantial completion to remove foreign material and construction dirt and dust. Vacuum clean fan wheel and cabinet.

B. Install new filters.

END OF SECTION

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