

**SECTION 237313
MODULAR INDOOR CENTRAL-STATION AIR-HANDLING UNITS**

PART 1 GENERAL**1.01 SUMMARY**

- A. Section Includes: Indoor, Modular, Variable-air-volume, air-handling units

1.02 WARRANTY

- A. Basic: Two years parts and labor from start of beneficial use.
B. Fan Array: 5 years for components (material only).

1.03 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design vibration isolation details, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
B. Structural Performance: Casing panels shall be self-supporting and capable of withstanding 133 percent of internal static pressures indicated, without panel joints exceeding a deflection of L/100 where "L" is the unsupported span length within completed casings.

1.04 SUBMITTALS

- A. Product Data: For each air-handling unit indicated.
1. Unit dimensions and weight.
 2. Cabinet material, metal thickness, finishes, insulation, and accessories.
 3. Fans:
 - a. Certified fan-performance curves with system operating conditions indicated.
 - b. Certified fan-sound power ratings.
 - c. Fan construction and accessories.
 - d. Motor ratings, electrical characteristics, and motor accessories.
 4. Certified coil-performance ratings with system operating conditions indicated.
 5. Dampers, including construction, housings, linkages, and operators.
 6. Filters with performance characteristics.
 7. Generated sound performance data for supply connection, return connection and breakout sound power levels.

1.05 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.
C. ARI Certification: Air-handling units and their components shall be factory tested according to ARI 430, "Central-Station Air-Handling Units," and shall be listed and labeled by ARI.
D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
E. ASHRAE/IESNA 90.1-2010 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."
F. Comply with NFPA 70.

1.06 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Filters: Two sets of pre-filters and one set of final filters for each unit.
 2. Fan Belts: One set for each air-handling unit fan.

1.07 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

- B. Coordinate sizes and locations of structural-steel support members, if any, with actual equipment provided.
- C. Coordinate access for moving equipment into existing mechanical spaces, locations as indicated on the drawings.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Comply with ASHRAE 62, Section 5 (mold and corrosion resistant casings, filters upstream of wetted surfaces, and drain pan design).
- B. Comply with ASHRAE 62, Section 7 (practices to be followed during construction and startup). Protect equipment from moisture by appropriate in-transit and on-site procedures.
- C. Follow manufacturer's recommendations for handling, unloading and storage.
- D. Protect, pack, and secure loose-shipped items within the air-handling units. Include detailed packing list of loose-shipped items, including illustrations and instructions for application.
- E. Protect, pack and secure controls devices, motor control devices and other electronic equipment. Do not store electronic equipment in wet or damp areas even when they are sealed and secured.
- F. Enclose and protect control panels, electronic or pneumatic devices, and variable frequency drives. Do not store equipment in wet or damp areas even when they are sealed and secured.
- G. Seal openings to protect against damage during shipping, handling and storage.
- H. Wrap indoor units with a tight sealing membrane. Wrapping membrane shall cover entire AHU during shipping and storage. Cover equipment, regardless of size or shape. Alternatively AHU must be tarped for shipment and storage.
- I. Wrap equipment, including electrical components, for protection against rain, snow, wind, dirt, sun fading, road salt/chemicals, rust and corrosion. Keep equipment clean and dry.
- J. Clearly mark AHU sections with unit tag number, segment sequence number, and direction of airflow. Securely affix safety-warning labels.
- K. Shipping Splits: As identified on the Drawings.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. BASIS OF DESIGN Manufacturer/Product: Establishes minimum product requirements and characteristics subject to compliance with requirements described in this section.
 - 1. Daikin: Vision Plus
- B. MANUFACTURERS: Subject to compliance with requirements in this section and meets or exceeds minimum performance established by Basis of Design Product the following manufactures are also approved.
 - 1. TRANE: Performance Climate Changer
 - 2. JCI York: Solution

2.02 DESCRIPTION

- A. Manufacturer's Semi-Custom Modular Air-Handler Product Line

2.03 UNIT CASINGS

- A. General Fabrication Requirements for Casings:
 - 1. General Construction: Double wall 2" insulated panels constructed of galvanized sheet steel. All sections shall be washdown
 - a. Interior and Exterior Galvanized Steel Sheet: 20ga
 - 2. Perforated Inner Liner: All Fan Sections, discharge sections down stream of housed supply air fans, and inlet sections upstream of plenum type return fans.
 - a. Liner: Non-Combustible Tedlar (or equivalent) film between inner metal sheet and insulation to ensure no exposed combustible foam and maintain wash-down rating.
 - 3. Forming: Form walls, roofs, and floors with at least two breaks at each joint.

4. Casing Joints: Sheet metal screws or pop rivets.
 5. Gasketing: Elastomeric closed-cell foam between each section.
 6. Sealing: Seal all joints with water-resistant sealant.
 7. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1
- B. Casing Insulation and Adhesive:
1. Materials: Injected Rigid Cellular Foam Insulation
 2. Location and Application: Encased between outside and inside casing.
 3. Performance: Min R-Value: 13 ft²h°F/Btu
- C. Inspection and Access Panels and Access Doors:
1. Panel and Door Fabrication: Formed and reinforced double-wall, insulated panels of same materials and thicknesses as casing. Panels removable while maintaining structural integrity.
 2. Inspection and Access Panels:
 - a. Fasteners: Two or more camlock type for panel lift-out operation. Arrangement shall allow panels to be opened against air-pressure differential unless noted otherwise.
 - b. Gasket: Neoprene, applied around entire perimeters of panel frames.
 - c. Size: Large enough to allow inspection and maintenance of air-handling unit's internal components.
 3. Access Doors:
 - a. Hinges: A minimum of two ball-bearing hinges or stainless-steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against air-pressure differential.
 - b. Gasket: Neoprene, applied around entire perimeters of panel frames.
 - c. Windows: Double-glazed, wire-reinforced thermos-pane safety glass with an air space between panes and sealed with interior and exterior rubber seals.
 - d. Size: At least 18 inches wide by full height of unit casing up to a maximum height of 72 inches.
 4. Locations and Applications:
 - a. Fan Section: Door with window
 - b. Access Section: Door
 - c. Coil Section: Door
 - d. Filter Section: Doors large enough to allow periodic removal and installation of filters.
 - e. Mixing Section (and other Damper Sections): Door with window
 5. Service Light: LED Relocatable, hand held, Service Lights. A single external switch for the entire unit is acceptable. Local switch at each light device in addition.
 - a. Locations: Each section accessed with door. Mounded securely to casing but removable with coiled cord.
 6. Units shall be designed for split shipping. Contractor to coordinate with manufacturer factory splits to bring the unit down to equipment room. Contractor shall disassemble and re-assemble the unit as required.
- D. Condensate Drain Pans:
1. Fabricated with two percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and from humidifiers and to direct water toward drain connection.
 - a. Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1
 - b. Depth: A minimum of 2 inches deep.
 2. Double-wall, stainless-steel, insulated with injected foam.
 3. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple.
 - a. Minimum Connection Size: NPS 1 but sized adequately for maximum design condensate flow.

4. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

2.04 BASE RAIL:

- A. Structural steel base rail: Under the full perimeter of the unit.
 1. Height: As indicated on the Drawings. If not specified on the drawings minimum 6" tall.
- B. Clearances: As required for proper external trapping of drain pans and steam condensate.
- C. Lifting Lug System: Steel, for use without requiring additional support for rigging

2.05 FAN, DRIVE, AND MOTOR SECTION

- A. Multiple Fan Arrays:
 1. Type: Direct drive, single inlet centrifugal plenum type.
 2. Pressure Characteristics (Fan Curve): Sharply rising extending throughout the operation range including overdriving and beyond peak efficiency.
 3. Non-Overloading, Non-Surge type Design with self-limiting horsepower characteristics.
 4. Construction: Scroll type housing with non-overloading backward incline airfoil wheel.
 5. Frame & Inlet Panel: Structural Steel and heavy gauge construction with removable spun inlet cone
 6. Wheel: Spun non-tapered.
 7. Backdraft dampers: To block airflow in event of fan failure.
 8. Finish/Coatings: Rust Preventative
 9. Wiring: Fan motors shall be field individually wired to a junction box on the unit casing for field installation and control by field provided VFDs.
- B. Motor: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 1. Type: Brushless, DC electronically commutated motor (ECM) with external rotor and integrated maintenance-free electronic circuitry.
 2. Listing: UL 1995.
 3. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
 4. Motor Sizes: Minimum size as indicated.
- C. Wiring & Controls:
 1. Controllers, Electrical Devices, and Wiring: Comply with NEC requirements.
 2. Factory mounted and wired single point power panel with external disconnect.
 3. Lockable HOA switch.
 4. Panel to accept 0-10 VDC signal in Auto mode for BAS control.

2.06 COIL SECTION

- A. General Requirements for Coil Section:
 1. Comply with ARI 410.
 2. Fabricate coil section to allow removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
 3. Coils shall not act as structural component of unit.
 4. Casings:
 - a. Cooling/Dehumidification Coils: Stainless Steel
 - b. Heating Coils: Galvanized Steel or Stainless Steel

2.07 AIR FILTRATION SECTION

- A. General Requirements for Air Filtration Section:
 1. Comply with NFPA 90A.
 2. Provide minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
 3. Filter Holding Frame: Arranged for flat or angular orientation, removable from front or one side of unit. Full filter holding frame providing for removal of individual filter panels from the front access plenum or all cartridges from access side of unit in accordance with

ASHRAE standard.

4. MERV Ratings / Efficiencies: As scheduled on the drawings
- B. Disposable Panel Filters:
1. Factory-fabricated, viscous-coated, flat-panel type.
 2. Media: Interlaced glass fibers sprayed with nonflammable adhesive and antimicrobial agent.
 3. Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, hinged, and with pull and retaining handles.
- C. Filter Gauge:
1. 3-1/2-inch diameter, diaphragm-actuated dial in metal case.
 2. Vent valves.
 3. Black figures on white background.
 4. Front recalibration adjustment.
 5. 2 percent of full-scale accuracy.
 6. Range: 0- to 2.0-inch wg .
 7. Accessories: Static-pressure tips with integral compression fittings, 1/4-inch plastic tubing, and 2- or 3-way vent valves.

2.08 DAMPERS

- A. General Requirements for Dampers: Leakage rate CLASS 1A according to AMCA 500, "Laboratory Methods for Testing Dampers for Rating," shall not exceed 4 cfm/sqft of damper face area at 1-inch wg AND 1 percent of air quantity at 2000-fpm face velocity through damper and 4-inch wg pressure differential.
1. Blade Action: As Recommended by the equipment manufacturer for the application.
- B. Outdoor Air, Relief, & Exhaust Air: Gasketed, Thermally Insulated, Extruded Aluminum high performance dampers.
1. Basis of Design: TAMCO 9000 Series
 2. Frame: 4", constructed from min 0.08" thick 6063-T5 Extruded aluminum, with min 1" duct mounting flanges on both sides. Extruded Silicon Frame seals fastened via extrusion slots.
 3. Blades: 4" deep extruded 6063-T5 aluminum air-foil type. 0.06-inch min wall thickness. Internally insulated with injected polyurethane foam. R-2.25 Min. Extruded Silicone blade seals, secured via slotting into blade extrusion slots and mechanically fastened.
 4. Bearings: Dual Ball Bearing System Celcon Inner Race with polycarbonate outer race press fit into the frame
 5. Control shaft: Hexagonal profile 7/16", integral to blade axle.
 6. Linkage: Aluminum and/or Stainless steel out of the air-stream and accessible after damper installation.
- C. Applications not listed in 2.7, B above:
1. Basis of Design: TAMCO 1500 Series
 2. Frame: 4", constructed from min 0.08" thick 6063-T5 Extruded aluminum, with min 1" duct mounting flanges on both sides. Extruded Silicon Frame seals fastened via extrusion slots.
 3. Blades: 4" deep extruded 6063-T5 aluminum air-foil type. 0.06-inch min wall thickness. Extruded Silicone blade seals, secured via slotting into blade extrusion slots and mechanically fastened.
 4. Bearings: Dual Ball Bearing System Celcon Inner Race with polycarbonate outer race press fit into the frame
 5. Control shaft: Hexagonal profile 7/16", integral to blade axle.
 6. Linkage: Aluminum and/or Stainless steel out of the air-stream and accessible after damper installation.

2.09 CAPACITIES AND CHARACTERISTICS

- A. Schedules: Refer to Drawings.

- B. Casing:
 1. Outside Casing: Galvanized steel, 20ga
 2. Inside Casing: Galvanized steel, 20ga
 3. Floor Plate: Heavy Gauge Aluminum Diamond Plate
 4. Insulation Thickness: 2 inches
 5. Static-Pressure Classifications for Unit Sections before Fans: 1% Leakage of rated CFM @ negative 4" WC.
 6. Static-Pressure Classifications for Unit Sections after Fans: 1% Leakage of rated CFM @ positive 6" WC.
- C. Fans:
 1. Fan array in arrangement as indicated on the drawings.
 2. Motors: Direct drive, ECM
- D. Preheat Coil:
 1. Coil Type: Self-draining Cleanable
 2. Tube Material: Copper
 3. Fin Type: Plate
 4. Fin Material: Aluminum
 5. Fin and Tube Joint: Mechanical bond
 6. Headers: Cast iron or seamless copper tube with brazed joints, prime coated.
 7. Frames: Channel frame, minimum 0.052inch thick galvanized steel.
 8. Coil Working-Pressure Ratings: 200 psig, 325 deg F.
- E. Cooling Coil:
 1. Coil Type: Self-draining Cleanable
 2. Tube Material: Copper
 3. Fin Type: Plate Spiral
 4. Fin Material: Aluminum
 5. Fin and Tube Joint: Mechanical bond
 6. Headers: Cast iron or seamless copper tube with brazed joints, prime coated.
 7. Frames: Channel frame, minimum 0.052-inch- thick stainless steel.
 8. Coil Working-Pressure Ratings: 200 psig, 325 deg F.

2.10 SOURCE QUALITY CONTROL

- A. Fan Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Fans shall bear AMCA-certified sound ratings seal.
- B. Fan Performance Rating: Factory test fan performance for airflow, pressure, power, air density, rotation speed, and efficiency. Rate performance according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating."
- C. Water Coils: Factory tested to 300 psig according to ARI 410 and ASHRAE 33.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Installing Contractor is responsible for final unit shipping split verification and coordination with project provided or existing openings and access conditions into installation location. Field verify and reference architectural and structural drawings.
- B. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- C. Examine casing insulation materials and filter media before air-handling unit installation. Reject insulation materials and filter media that are wet, moisture damaged, or mold damaged.
- D. Examine roughing-in for hydronic and condensate drainage piping systems and electrical services to verify actual locations of connections before installation.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Equipment Mounting: Install air-handling units on concrete bases with neoprene isolation pads. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration Controls for HVAC Piping and Equipment."
 - 1. Install galvanized-steel plate to equally distribute weight over neoprene pad.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
- B. Arrange installation of units to provide access space around air-handling units for service and maintenance.
- C. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with new, clean filters.
- D. Install filter-gage, static-pressure taps upstream and downstream of filters. Mount filter gages on outside of filter housing or filter plenum in accessible position. Provide filter gages on filter banks, installed with separate static-pressure taps upstream and downstream of filters.

3.03 CONNECTIONS

- A. Comply with requirements for piping specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to air-handling unit to allow service and maintenance.
- C. Connect piping to air-handling units mounted on vibration isolators with flexible connectors.
- D. Connect condensate drain pans using pipe size shown on drawings, ASTM B 88, Type M copper tubing. Extend to nearest floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.
- E. Hot- and Chilled-Water Piping: Comply with applicable requirements in Division 23 Section "Hydronic Piping." Install shutoff valve and union or flange at each coil supply connection. Install balancing valve and union or flange at each coil return connection.
- F. Connect duct to air-handling units with flexible connections. Comply with requirements in Division 23 Section "Air Duct Accessories."

3.04 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Provide for the engagement of a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
 - 1. Leak Test: After installation, fill water and steam coils with water, and test coils and connections for leaks.
 - 2. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Air-handling unit or components will be considered defective if unit or components do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.05 STARTUP SERVICE

- A. Provide for the engagement of a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Verify that shipping, blocking, and bracing are removed.
 - 3. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers, and switches.
 - 4. Verify proper motor rotation direction, free fan wheel rotation, and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.
 - 5. Verify that bearings, pulleys, belts, and other moving parts are lubricated with factory-recommended lubricants.
 - 6. Verify that zone dampers fully open and close for each zone.
 - 7. Verify that face-and-bypass dampers provide full face flow.
 - 8. Verify that outdoor- and return-air mixing dampers open and close, and maintain minimum outdoor-air setting.
 - 9. Comb coil fins for parallel orientation.
 - 10. Verify that proper thermal-overload protection is installed for electric coils.
 - 11. Install new, clean filters.
 - 12. Verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.
- B. Starting procedures for air-handling units include the following:
 - 1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm.
 - 2. Measure and record motor electrical values for voltage and amperage.
 - 3. Manually operate dampers from fully closed to fully open position and record fan performance.

3.06 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.

3.07 CLEANING

- A. After completing system installation and testing, adjusting, and balancing air-handling unit and air-distribution systems and after completing startup service, clean air-handling units internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.08 DEMONSTRATION

- A. Provide for the engagement of a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-handling units.

END OF SECTION 237313