

SECTION 23 74 13

CENTRAL-STATION AIR-HANDLING UNITS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes modular factory fabricated air-handling units and accessories.
- B. Related Sections:
 - 1. Division 23 - Variable-Frequency Drives
 - 2. Division 23 - Vibration and Seismic Controls for HVAC Piping and Equipment
 - 3. Division 23 - HVAC Insulation
 - 4. Division 23 - Direct-Digital Control System
 - 5. Division 23 - Hydronic Piping.
 - 6. Division 23 - Hydronic Piping Specialties
 - 7. Division 23 - Air Duct Accessories.
 - 8. Division 23 - Humidity Control Equipment: Product requirements for humidifiers and dehumidifiers for placement by this section.
 - 9. Division 26 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.

1.02 REFERENCES

- A. American Bearing Manufacturers Association:
 - 1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
 - 2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- B. Air Movement and Control Association International, Inc.:
 - 1. AMCA 99 - Standards Handbook.
 - 2. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
 - 3. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
 - 4. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
 - 5. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.
- C. Air-Conditioning and Refrigeration Institute:
 - 1. ARI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.
 - 2. ARI 430 - Central-Station Air-Handling Units.
 - 3. ARI 610 - Central System Humidifiers for Residential Applications.
 - 4. ARI Guideline D - Application and Installation of Central Station Air-Handling Units.
- D. ASTM International:
 - 1. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.
- E. National Electrical Manufacturers Association:
 - 1. NEMA MG 1 - Motors and Generators.
- F. Sheet Metal and Air Conditioning Contractors:
 - 1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

- G. Underwriters Laboratories Inc. :
 - 1. UL 900 - Air Filter Units.
 - 2. UL - Fire Resistance Directory.

1.03 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.
- C. Product Data, Submit the following:
 - 1. Published Literature: Indicate capacities, ratings, gages and finishes of materials, and electrical characteristics and connection requirements.
 - 2. Filters: Data for filter media, filter performance data, filter assembly, and filter frames.
 - 3. Fans: Performance and fan curves with specified operating point plotted, power, RPM.
 - 4. Sound Power Level Data: Fan outlet and casing radiation at rated capacity.
 - 5. Dampers: Include leakage, pressure drop, and sample calibration curves. Indicate materials, construction, dimensions, and installation details.
 - 6. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring. Indicate factory installed and field installed wiring.
- D. Manufacturer's Installation Instructions: Submit.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.04 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with authority having jurisdiction.
- B. Maintain one copy of each document on site.

1.06 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.

1.07 PRE-INSTALLATION MEETINGS

- A. Division 01 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Product storage and handling requirements.

- B. Accept units and components on site in factory protective containers, with factory shipping skids and lifting lugs. Inspect for damage.
- C. Protect units from weather and construction traffic by storing in dry, roofed location.

1.09 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish 18 month year manufacturer warranty for air handling units.

1.10 EXTRA MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish one set of filters for each unit.

PART 2 PRODUCTS

2.01 AIR HANDLING UNITS

- A. Manufacturers:
 - 1. Trane
 - 2. Temtrol
 - 3. Haakon
 - 4. Energy Labs
 - 5. Substitutions: Division 01 - Product Requirements.
- B. Configuration: Fan section fan and coil section plus accessories, including:
 - 1. Cooling coil section.
 - 2. Heating coil.
 - 3. Filter section.
 - 4. Combination filter/mixing box section.
 - 5. Mixing box section.
- C. General: Manufacturer to provide an integral base frame for either ceiling suspension of units or to support and raise all sections of the unit for proper trapping. Contractor will be responsible for providing a housekeeping pad when unit base frame is not of sufficient height to properly trap unit. Unit base frames not constructed of galvanized steel shall be chemically cleaned and coated with both a rust-inhibiting primer and finished coat of rust-inhibiting enamel. Unit base height to be included in trap
- D. Unit Casing:
 - 1. Unit manufacturer shall ship unit in segments as specified by the contractor for ease of installation in tight spaces. The entire air handler shall be constructed of galvanized steel. Casing finished to meet ASTM B117 250-hour salt-spray test. The removal of access panels or access doors shall not affect the structural integrity of the unit. All removable panels shall be gasketed. All doors shall have gasketing around full perimeter to prevent air leakage. Contractor shall be responsible to provide connection flanges and all other framework that is needed to properly support the unit.
 - 2. Casing performance - Casing air leakage shall not exceed leak class 6 (CL = 6) per ASHRAE 111 at specified casing pressure, where maximum casing leakage (cfm/100 ft² of casing surface area) = CL X P^{0.65}.

3. Air leakage shall be determined at 1.00 times maximum casing static pressure up to 8 inches w.g. Specified air leakage shall be accomplished without the use of caulk. Total estimated air leakage shall be reported for each unit in CFM, as a percentage of supply air, and as an ASHRAE 111 Leakage Class.
4. Under 55F supply air temperature and design conditions on the exterior of the unit of 81F dry bulb and 73F wet bulb, condensation shall not form on the casing exterior. The AHU manufacturer shall provide tested casing thermal performance for the scheduled supply air temperature plotted on a psychrometric chart. The design condition on the exterior of the unit shall also be plotted on the chart. If tested casing thermal data is not available, AHU manufacturer shall provide, in writing to the County's Representative, a guarantee against condensation forming on the unit exterior at the stated design conditions above. The guarantee shall note that the AHU manufacturer will cover all expenses associated with modifying units in the field should external condensate form on them. In lieu of AHU manufacturer providing a written guarantee, the installing contractor must provide additional external insulation on AHU to prevent condensation.
5. Unit casing (wall/floor/roof panels and doors) shall be able to withstand up to 1.5 times design static pressure, or 8-inch w.g., whichever is less, and shall not exceed 0.0042 per inch of panel span (L/240).
6. Floor panels shall be double-wall construction and designed to support a 250-lb load during maintenance activities and shall deflect no more than 0.0042 per inch of panel span.
7. Unit casing panels shall be 2-inch double-wall construction, with solid galvanized exterior and solid galvanized interior, to facilitate cleaning of unit interior. Perforated liner shall be provided in sections.
8. Unit casing panels (roof, walls, floor) and doors shall be provided with a minimum thermal resistance (R-value) of 13 Hr*Ft²*°F/BTU.
9. Unit casing panels (roof, walls, floor) and external structural frame members shall be completely insulated filling the entire panel cavity in all directions so that no voids exist. Panel insulation shall comply with NFPA 90A.
10. Casing panel inner liners must not extend to the exterior of the unit or contact the exterior frame. A mid-span, no-through-metal, internal thermal break shall be provided for all unit casing panels.
11. Access panels and/or access doors shall be provided in all sections to allow easy access to drain pan, coil(s), motor, drive components and bearings for cleaning, inspection, and maintenance.
12. Access panels and doors shall be fully removable without the use of specialized tools to allow complete access of interior surfaces.

E. Access Doors

1. Access doors shall be 2-inch double-wall construction. Interior and exterior shall be of the same construction as the interior and exterior wall panels.
2. All doors downstream of the cooling coil shall be provided with a thermal break construction of door panel and door frame.
3. Gasketing shall be provided around the full perimeter of the doors to prevent air leakage.
4. Door hardware shall be surface-mounted to prevent through-cabinet penetrations that could likely weaken the casing leakage and thermal performance.
5. Handle hardware shall be designed to prevent unintended closure.
6. Access doors shall be hinged and removable without the use of specialized tools to allow.
7. Hinges shall be interchangeable with the door handle hardware to allow for alternating door swing in the field to minimize access interference due to unforeseen job site obstructions.
8. Door handle hardware shall be adjustable and visually indicate locking position of door latch external to the section.
9. All doors shall be a 60-inch high when sufficient unit height is available, or the maximum height allowed by the unit height.
10. Multiple door handles shall be provided for each latching point of the door necessary to maintain the specified air leakage integrity of the unit

F. Primary Drain Pans

1. All cooling coil sections shall be provided with an insulated, double-wall, galvanized drain pan.

2. The drain pan shall be designed in accordance with ASHRAE 62.1 being of sufficient size to collect all condensation produced from the coil and sloped in two planes, pitched toward drain connections, promoting positive drainage to eliminate stagnant water conditions when unit is installed level and trapped per manufacturer's requirements. .
3. The outlet shall be located at the lowest point of the pan and shall be sufficient diameter to preclude drain pan overflow under any normally expected operating condition.
4. All drain pan threaded connections shall be visible external to the unit. Threaded connections under the unit floor shall not be accepted.
5. Drain connections shall be of the same material as the primary drain pan and shall extend a minimum 2-1/2-inch beyond the base to ensure adequate room for field piping of condensate traps.
6. The installing contractor is responsible to ensure the unit is installed level, trapped in accordance with the manufacturer's requirements, and visually inspected to ensure proper drainage of condensate.
7. Coil support members inside the drain pan shall be of the same material as the drain pan and coil casing.
8. If drain pans are required for heating coils, access sections, or mixing sections they will be indicated in the plans

G. Fans

1. Fan sections shall have a minimum of one hinged and latched access door located on the drive side of the unit to allow inspection and maintenance of the fan, motor, and drive components.
2. Provide fans of type and class as specified on the schedule. Fan shafts shall be solid steel, coated with a rust-inhibiting coating, and properly designed so that fan shaft does not pass through first critical speed as unit comes up to rated RPM. All fans shall be statically and dynamically tested by the manufacturer for vibration and alignment as an assembly at the operating RPM to meet design specifications. Fans controlled by variable frequency drives shall be statically and dynamically tested for vibration and alignment at speeds between 25% and 100% of design RPM. If fans are not factory-tested for vibration and alignment, the contractor shall be responsible for cost and labor associated with field balancing and certified vibration performance. Fan wheels shall be keyed to fan shafts to prevent slipping.
3. Belt-driven fans shall be provided with grease lubricated, self-aligning, anti-friction bearings selected for L-50 200,000-hour average life per ANSI/AFBMA Standard 9. Lubrication lines for both bearings shall be extended to the drive side of the AHU and rigidly attached to support bracket with zerk fittings. Lubrication lines shall be a clear, high-pressure, polymer to aid in visual inspection. If extended lubrication lines are not provided, manufacturer shall provide permanently lubricated bearing with engineering calculations for proof of bearing life.
4. All fans, including direct drive plenum fans, shall be mounted on isolation bases. Internally-mounted motor shall be on the same isolation base. Fan and motor shall be internally isolated with spring isolators. Unit sizes up to a nominal 4,000 CFM shall have 1-inch spring isolation. Units with nominal CFM's higher than 4,000 shall have 2-inch springs. A flexible connection (e.g. canvas duct) shall be installed between fan and unit casing to ensure complete isolation. Flexible connection shall comply with NFPA 90A and UL 181 requirements. If fans and motors are not internally isolated, then the entire unit shall be externally isolated from the building, including supply and return duct work, piping, and electrical connections. External isolation shall be furnished by the installing contractor in order to avoid transmission of noise and vibration through the ductwork and building structure

H. Motors And Drives

1. All motors and drives shall be factory-installed and run tested. All motors shall be installed on a slide base to permit adjustment of belt tension. Slide base shall be designed to accept all motor sizes offered by the air-handler manufacturer for that fan size to allow a motor change in the future, should airflow requirements change. Fan sections without factory-installed motors shall have motors field installed by the contractor. The contractor shall be responsible for all costs associated with installation of motor and drive, alignment of sheaves and belts, run testing of the motor, and balancing of the assembly.

2. Motors shall meet or exceed all NEMA Standards Publication MG 1 - 2006 requirements and comply with NEMA Premium efficiency levels when applicable. Motors shall comply with applicable requirements of NEC and shall be UL Listed.
3. Fan Motors shall be heavy duty, open drip-proof operable at 460 volts, 60Hz, 3-phase. If applicable, motor efficiency shall meet or exceed NEMA Premium efficiencies.
4. Belt driven fans shall use 4-pole, 1800 rpm, motors, NEMA B design, with Class B insulation, capable to operate continuously at 104 deg F (40 deg C) without tripping overloads.
5. Direct driven fans shall use 2-pole (3600 rpm), 4-pole (1800 rpm) or 6-pole (1200 rpm) motors, NEMA Design B, with Class B insulation capable to operate continuously at 104 deg F (40 deg C) without tripping overloads.
6. Motors shall have a +/- 10 percent voltage utilization range to protect against voltage variation.
7. V-Belt Drive shall be fixed pitch rated at 1.5 times the motor nameplate. Drives 20 hp and larger or any drives on units equipped with VFDs shall be fixed pitch.

I. Coils

1. Coils section header end panel shall be removable to allow for removal and replacement of coils without impacting the structural integrity of the unit.
2. Install coils such that headers and return bends are enclosed by unit casing to ensure that if condensate forms on the header or return bends, it is captured by the drain pan under the coil.
3. Coils shall be manufactured with plate fins to minimize water carryover and maximize airside thermal efficiency. Fin tube holes shall have drawn and belled collars to maintain consistent fin spacing to ensure performance and air pressure drop across the coil as scheduled. Tubes shall be mechanically expanded and bonded to fin collars for maximum thermal conductivity. Use of soldering or tinning during the fin-to-tube bonding process is not acceptable due to the inherent thermal stress and possible loss of bonding at that joint.
4. Construct coil casings of galvanized steel steel. End supports and tube sheets shall have belled tube holes to minimize wear of the tube wall during thermal expansion and contraction of the tube.
5. All coils shall be completely cleaned prior to installation into the air handling unit. Complete fin bundle in direction of airflow shall be degreased and steam cleaned to remove any lubricants used in the manufacturing of the fins, or dirt that may have accumulated, in order to minimize the chance for water carryover.
6. When two or more cooling coils are stacked in the unit, an intermediate drain pan shall be installed between each coil. The intermediate drain pan shall be designed being of sufficient size to collect all condensation produced from the coil and sloped to promote positive drainage to eliminate stagnant water conditions. The intermediate drain pan shall be constructed of the same material as the sections primary drain pan.
7. The intermediate drain pan shall begin at the leading face of the water-producing device and be of sufficient length extending downstream to prevent condensate from passing through the air stream of the lower coil.
8. Intermediate drain pan shall include downspouts to direct condensate to the primary drain pan. The intermediate drain pan outlet shall be located at the lowest point of the pan and shall be sufficient diameter to preclude drain pan overflow under any normally expected operating condition

J. Filters

1. Provide factory-fabricated filter section of the same construction and finish as unit casings. Filter section shall have filter guides and access door(s) extending the full height of the casing to facilitate filter removal. Construct doors in accordance with Section 2.04. Provide fixed filter blockoffs as required to prevent air bypass around filters. Blockoffs shall not need to be removed during filter replacement.
2. Filter type, MERV rating, and arrangement shall be provided as defined in project plans and schedule
3. Manufacturer shall provide one set of startup filters.

- K. Dampers: All dampers, with the exception of external bypass and multizones (if scheduled), shall be internally mounted. Dampers shall be premium ultra low leak and located as indicated on the schedule and plans. Blade arrangement (parallel or opposed) shall be provided as determined by the Developer Design/Builder. Dampers shall be Ruskin CD60 double-skin airfoil design or equivalent for minimal air leakage and pressure drop. Leakage rate shall not exceed 4 CFM/square foot at one inch water gauge complying with ASHRAE 90.1 maximum damper leakage and shall be AMCA licensed for Class 1A. All leakage testing and pressure ratings shall be based on AMCA Standard 500-D. Manufacturer shall submit brand and model of damper(s) being furnished, if not Ruskin CD60

2.02 OUTSIDE AIR MEASURING AND MODULATION DEVICE

- A. Factory mounted in outside air.
- B. Damper and airflow measurement assembly sized to accommodate minimum economizer outside airflow.
- C. Construction:
1. Frame: Extruded aluminum.
 2. Blades:
 - a. Modulating Air Control:
 - 1) Style: Airfoil-shaped, single-piece.
 - 2) Action: Parallel.
 - 3) Orientation: Horizontal.
 - 4) Material: Heavy gage 6063-T5 extruded aluminum.
 - 5) Width: Maximum 5 inches.
 - b. Stationary Sensing:
 - 1) Style: Airfoil-shaped, single-piece.
 - 2) Orientation: Horizontal.
 - 3) Material: Heavy gage 6063-T5 extruded aluminum.
 - 4) Width: Maximum 5-1/4 inches.
 - 5) Finish: Anodized.
 3. Bearings: Self-lubricating molded synthetic sleeve, turning in extruded hole in frame.
 4. Seals:
 - a. Blade: Extruded rubber. Mechanically attached to blade edge.
 - b. Jamb: Stainless steel, flexible metal compression type.
 - c. Linkage: Concealed in frame.
 - d. Axles: Minimum 1/2 inch diameter plated steel, hex-shaped, mechanically attached to blade.
 - e. Mounting: Vertical.
 - f. Electric Actuator: 24 V, 60 Hz, modulating, with position feedback.
 5. Digital Controller: Application specific controller. Programming logic and calibration in nonvolatile EPROM. Controller uses generic 0 - 10 vdc inputs and outputs for interface to building automation system.
 6. Air Straightener Section: 3 inches deep section contained in 5 inch long sleeve attached to damper-airflow monitor frame.
 7. Finish: Mill aluminum.
- D. Performance Data:
1. Temperature Rating: Withstand -40 to 140 degrees F.

2. Accuracy: Plus or minus 5 percent.
3. Leakage: Maximum of 2.0 cfm per square foot at 1.0 inches wg pressure differential.
4. Measures from 15 percent to 100 percent of unit nominal air flow.
5. Adjusts air flow for temperature variations.
6. Provides 2 to 10 volt DC signal corresponding to actual air flow.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Division 01 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify roof curbs are installed and dimensions are as shown on shop drawings.

3.02 INSTALLATION

- A. Install in accordance with ARI 430.
- B. Install flexible connections between unit and inlet and discharge ductwork. Install metal bands of connectors parallel with minimum 1 inch flex between ductwork and fan while running. Refer to Division 23.
- C. Install assembled units with vibration isolators. Install isolated fans with resilient mountings and flexible electrical leads. Install restraining snubbers. Adjust snubbers to prevent tension in flexible connectors when fan is operating. Refer to Division 23.
- D. Install condensate piping with trap and route from drain pan to condensate drainage system.
- E. Insulate coil headers located outside airflow as specified for piping. Refer to Division 23.

3.03 INSTALLATION CHILLED WATER COOLING COIL

- A. Make connections to coils with unions or flanges.
- B. Connect water supply to leaving airside of coil (counter flow arrangement).
- C. Locate water supply at bottom of supply header and return water connection at top.
- D. Install water coils to allow draining and install drain connection at low points.
- E. Install the following piping accessories on chilled water piping connections. Refer to Division 23.
 1. On supply:
 - a. Thermometer well and thermometer.
 - b. Well for [control system] temperature sensor.
 - c. Shutoff valve.
 - d. Strainer.
 - e. Control valve.
 - f. Pressure gage.
 2. On return:
 - a. Thermometer well and thermometer.
 - b. Well for [control system] temperature sensor.
 - c. Pressure gage.
 - d. Shutoff valve.
 - e. Balancing valve.

F. Install manual air vents at high points complete with shutoff valve. Refer to Division 23.

3.04 MANUFACTURER'S FIELD SERVICES

A. Division 01 - Quality Requirements: Requirements for manufacturer's field services.

B. Furnish initial start-up and shutdown during first year of operation, including routine servicing and checkout.

3.05 CLEANING

A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.

B. Vacuum clean coils and inside of unit cabinet.

C. Install temporary filters during construction period. Replace with permanent filters at Substantial Completion.

3.06 DEMONSTRATION

A. Division 01 - Execution and Closeout Requirements: Requirements for demonstration and training.

B. Demonstrate unit operation and maintenance.

C. Furnish services of manufacturer's technical representative for one week to instruct County's personnel in operation and maintenance of units. Schedule training with County's Representative, provide at least 7 days notice to County's Representative of training date.

3.07 PROTECTION OF FINISHED WORK

A. Division 01 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION