

SECTION 23 73 00

INDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.01 SUBMITTALS

- A. Product Data: For each type of modular indoor air-handling unit indicated. Include the following:
 - 1. Certified fan-performance curves with system operating conditions indicated.
 - 2. Certified fan-sound power ratings.
 - 3. Provide maximum sound levels at the discharge, return and from casing.
 - 4. Certified coil-performance ratings with system operating conditions indicated.
 - 5. Motor ratings, electrical characteristics, and motor and fan accessories.
 - 6. Material gauges and finishes.
 - 7. Filters with performance characteristics.
 - 8. Dampers, including housings, linkages, and operators.
- B. Shop Drawings: Certified drawings from unit manufacturer.
 - 1. Design Calculations: calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 - 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.
 - 3. Wiring Diagrams: Power, signal, and control wiring.
- C. Manufacturer Seismic Qualification Certification: Submit certification that modular indoor air-handling units, accessories, and components will withstand seismic forces defined by current code requirements.

1.02 QUALITY ASSURANCE

- A. Source Limitations and Manufacturer's Qualifications: Firms regularly engaged in manufacture of packaged air handling units with characteristics, sizes, and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years. Product Options: drawings indicate size, profiles, and dimensional requirements of modular indoor air-handling units and are based on the specific system indicated.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. NFPA Compliance: Modular indoor air-handling units and components shall be designed, fabricated, and installed in compliance with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems." Provide air handling unit internal insulation having flame spread rating not over 25 and smoke developed rating no higher than 50.
- D. ARI Certification: Modular indoor 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.
- E. UL and NEMA Compliance: Provide electrical components required as part of air handling units, which have been listed and labeled by UL and comply with NEMA Standards.K to installation and electrical connections of ancillary electrical components of air handling units.
- F. ASHRAE Compliance: Construct and install refrigerant coils in accordance with ASHRAE 15, "Safety Code for Mechanical Refrigeration."
- G. International Energy Conservation Code 2015 compliance.

1.03 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.
- C. Coordinate size and location of structural-steel support members.

1.04 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Filters: One set for each modular indoor air-handling unit.
 - 2. Fan Belts: One set for each modular indoor air-handling unit fan.
 - 3. Gaskets: One set for each access door.

PART 2 PRODUCTS

2.01 MANUFACTURERS (Specify only those units with similar quality.)

- A. Engineered Air
- B. Annex Air
- C. McQuay
- D. Trane
- E. York
- F. Carrier

2.02 MANUFACTURED UNITS

- A. Modular indoor air-handling units shall be factory assembled and consist of fans, motor and drive assembly, coils, damper, plenums, filters, condensate pans, mixing dampers, control devices, and accessories.
- B. Provide air blender in the mixing section of all units.

2.03 CABINET

- A. Materials: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.
 - 1. Outside Casing: Aluminum, 0.063" thick.
 - 2. Inside Casing: Aluminum, 0.032" thick, perforated.
 - 3. Floor Plate: Stainless steel, 0.1406" thick.
- B. Cabinet Insulation: Comply with NFPA 90A or NFPA 90B.
 - 1. Materials: ASTM C 1071 with coated surface exposed to airstream to prevent erosion of glass fibers.
 - 2. Thickness: 2 inches.
 - 3. Thermal Conductivity (k-Value): 0.26 at 75 deg F mean temperature.
 - 4. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50, when tested according to ASTM C 411.
 - 5. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and ASTM C 916.
 - 6. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
 - 7. Location and Application: Factory applied with adhesive and mechanical fasteners to the internal surface of section panels downstream from and including the cooling coil section.
 - 8. Location and Application: Encased between outside and inside casing.
- C. Access Panels and Doors: Same materials and finishes as cabinet, complete with hinges, latches, handles, and gaskets. Inspection and access panels and doors shall be sized and located to allow periodic maintenance and inspections. Provide access panels and doors in the following locations:

1. Fan Section: Doors.
 2. Access Section: Doors.
 3. Coil Section: Inspection panel.
 4. Damper Section: Inspection and access panels.
 5. Filter Section: Doors to allow periodic removal and installation of filters.
- D. Condensate Drain Pans: Formed sections of stainless-steel sheet complying with requirements in ASHRAE 62.1. Fabricate pans with slopes in two planes to collect condensate from cooling coils (including coil piping connections and return bends) and humidifiers when units are operating at maximum catalogued face velocity across cooling coil.
1. Double-Wall Construction: Fill space between walls with foam insulation and seal moisture tight.
 2. Drain Connections: Both ends of pan.
 3. Pan-Top Surface Coating: Elastomeric compound.
 4. Units with stacked coils shall have an intermediate drain pan or drain trough to collect condensate from top coil.

2.04 FAN SECTION

- A. Fan-Section Construction: Belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and support structure and equipped with formed-steel channel base for integral mounting of fan, motor, and casing panels. Mount fan with vibration isolation.
- B. Centrifugal Fan Housings: Formed- and reinforced-steel panels to make curved scroll housings with shaped cutoff, spun-metal inlet bell, and access doors or panels to allow entry to internal parts and components.
1. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
 2. Performance Class: AMCA 99-2408, Class I, or II, or III.
 3. Horizontal Flanged Split Housing: Bolted construction.
 4. Plug Fans: With steel cabinet. Fabricate without fan scroll and volute housing.
- C. Fan Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and motor horsepower.
- D. Backward-Inclined Fan Wheels: Steel construction with curved inlet flange, backplate, and backward-inclined blades welded or riveted to flange and backplate.
- E. Forward-Curved Fan Wheels: Black-enamel or galvanized-steel construction with inlet flange, backplate, and shallow blades with inlet and tip curved forward in direction of airflow and mechanically secured to flange and backplate; cast-steel hub swaged to backplate and fastened to shaft with set screws.
- F. Airfoil-Fan Wheels: Steel construction with smooth-curved inlet flange, heavy backplate, and hollow die-formed airfoil-shaped blades continuously welded at tip flange and backplate; cast-iron or cast-steel hub riveted to backplate and fastened to shaft with set screws.
- G. Coatings: Hot-dip galvanized or Powder-baked enamel.
- H. Shafts: Statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
1. Turned, ground, and polished hot-rolled steel with keyway. Ship with a protective coating of lubricating oil.
 2. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.
- I. Pre-lubricated and Sealed Shaft Bearings: Self-aligning, pillow-block-type ball bearings.
1. Ball-Bearing Rating Life: ABMA 9, L₁₀ of 50,000 hours.
- J. Grease-Lubricated Shaft Bearings: Self-aligning, pillow-block-type, tapered roller bearings with double-locking collars and two-piece, cast-iron housing.

1. Roller-Bearing Rating Life: ABMA 11, L₁₀ of 50,000 hours.
- K. Grease-Lubricated Shaft Bearings: Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing.
1. Ball-Bearing Rating Life: ABMA 9, L₁₀ of 50,000 hours.
 2. Roller-Bearing Rating Life: ABMA 11, L₁₀ of 50,000 hours.
- L. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation and with 1.2 service factor based on fan motor.
1. Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
 2. Motor Pulleys: Adjustable pitch for use with 5-hp motors and smaller; fixed pitch for use with motors larger than 5 hp. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 3. Belts: Oil resistant, nonsparking, and nonstatic; matched for multiple belt drives.
 4. Belt Guards: Fabricate to OSHA/SMACNA requirements; 0.1046" thick, ¾" diamond-mesh wire screen welded to steel angle frame or equivalent; prime coated. Provide belt guards for motors mounted on outside of cabinet.
- M. Motor Mount: Adjustable for belt tensioning.
- N. Discharge Dampers: Heavy-duty steel assembly with channel frame and sealed ball bearings, and parallel blades constructed of two plates formed around and welded to shaft, with blades linked out of airstream to single control lever.
- O. Vibration Control: Install fans on open-spring vibration isolators having a minimum of 1" static deflection and side snubbers.
- P. Fan-Section Source Quality Control:
1. 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.
 2. Factory test fan performance for flow rate, pressure, power, air density, rotation speed, and efficiency. Establish ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

2.05 MOTORS

- A. General: Refer to Specification Section 26 29 23 for additional requirements.
- B. Torque Characteristics: Sufficient to accelerate driven loads satisfactorily.
- C. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range.
- D. Temperature Rating: 50 deg C maximum temperature rise at 40°C ambient for continuous duty at full load (Class A Insulation).
- E. Service Factor: 1.15 for polyphase motors and 1.35 for single-phase motors.
- F. Motor Construction: NEMA MG 1, general purpose, continuous duty, Design B mounted on adjustable base.
- G. Bearings: The following features are required:
 1. Ball or roller bearings with inner and outer shaft seals.
 2. Grease lubricated.
 3. Designed to resist thrust loading where belt or other drives produce lateral or axial thrust in motor.
- H. Enclosure Type: The following features are required:
 1. Open drip-proof motors if satisfactorily housed or remotely located during operation.
 2. Guarded drip-proof motors if exposed to contact with employees or building occupants.

- I. Overload Protection: Built-in, automatically resetting, thermal-overload protection.
- J. Noise Rating: Quiet.
- K. Efficiency: Energy-efficient motors shall have a minimum efficiency as scheduled according to IEEE 112, Test Method B.
- L. Nameplate: Indicate ratings, characteristics, construction, special features, and full identification of manufacturer.
- M. Starters, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 16 Sections.

2.06 COILS

- A. Coil Sections: Common or individual, insulated, galvanized-steel casings for heating and cooling coils. Design and construct to facilitate removal and replacement of coil for maintenance and to ensure full airflow through coils. For multizone units, provide air deflectors and air baffles to balance airflow across coils.
- B. Water Coils: Continuous circuit self-draining coil fabricated according to ARI 410.
 - 1. Piping Connections: Threaded, on same end.
 - 2. Tubes: Aopper.
 - 3. Fins: Aluminum with fin spacing 0.125", maximum.
 - 4. Fin and Tube Joint: Silver brazed.
 - 5. Headers: Seamless copper tube with brazed joints, prime coated.
 - 6. Frames: Galvanized-steel channel frame, 0.0625".
 - 7. Ratings: Design tested and rated according to ASHRAE 33 and ARI 410.
 - a) Working-Pressure Ratings: 200 psig, 325 deg F.
 - 8. Source Quality Control: Test to 300 psig and to 200 psig underwater.
 - 9. No water on roofs.
- C. Steam Coils: Distribution header coil fabricated according to ARI 410, with threaded steam supply and condensate connections.
 - 1. Connections: Same end.
 - 2. Face-and-Bypass Dampers: Extruded-aluminum blades with full-length drive rod. (USE ONLY WITH 100% OUTSIDE AIR UNITS).
 - 3. Tubes: Copper.
 - 4. Fins: Aluminum with fin spacing 0.125", maximum.
 - 5. Fin and Tube Joint: silver brazed.
 - 6. Headers: Seamless copper tube with brazed joints, prime coated.
 - 7. Frames: Galvanized-steel channel frame, 0.0625".
 - 8. Frames: Stainless steel, 0.0625".
 - 9. Ratings: Design tested and rated according to ASHRAE 33 and ARI 410.
 - a) Working-Pressure Ratings: 100 psig , 400 deg F.
 - 10. Source Quality Control: Test to 300 psig and to 200 psig underwater.
- D. Refrigerant Coils: Coil designed for use with R-22 refrigerant, fabricated according to ARI 410, connected with brazed fittings.
 - 1. Tubes: Copper.
 - 2. Fins: Aluminum fin spacing 0.125", maximum.
 - 3. Fin and Tube Joint: Silver brazed.

4. Suction and Distributor: Seamless copper tube with brazed joints.
 5. Frames: Galvanized-steel channel frame, .0625”.
 6. Ratings: Design tested and rated according to ASHRAE 33 and ARI 410.
 - a) Working-Pressure Rating: 300 psig.
 7. Source Quality Control: Test to 450 psig and to 300 psig underwater.
- E. Direct Evaporative Cooling Section:
1. Stainless steel sumps and housings. Stainless steel fasteners within as well as dielectric gaskets between housing and rest of air handling unit. Provide for water bleed-off.
 2. Evaporative cooling section shall be downstream of all coils to avoid mineral build-up due to drifting of water droplets. Drift eliminators are desired if necessary.
 3. Provide P-traps for sump drain. Provide a daily drying-out cycle for evaporative media and weekly sump drain-down. Provide automatic drain-down when subject to freezing.
 4. Provide sump low-water pump cut-off switch in other than residential-size evaporative-cooling systems.
- F. Electrical Heating Coils, Controls, and Accessories: comply with UL 1995.
1. Casing Assembly: Slip-in type with galvanized-steel frame.
 2. Heating Elements: Coiled resistance wire of 80 percent nickel and 20 percent chromium surrounded by compacted magnesium-oxide powder in tubular-steel sheath; with spiral-wound, copper-plated, steel fins continuously brazed to sheath.
 3. Overtemperature Protection: Disk-type, automatically resetting, thermal-cutout, safety device; serviceable through terminal box without removing heater from duct or unit.
 - a) a. Secondary Protection: Load-carrying, manually resetting or manually replaceable, thermal cutouts; factory wired in series with each heater stage.
 4. Control Panel: Unit mounted with disconnecting means and overcurrent protection. Include the following controls:
 - a) Magnetic contactor.
 - b) Solid-state step-less pulse controller.
 - c) Toggle switches, one per step.
 - d) Step controller.
 - e) Time-delay relay.
 - f) Pilot lights, one per step.
 - g) Airflow proving switch.

2.07 DAMPERS

- A. General: Leakage rate, according to AMCA 500, "Laboratory Methods for Testing Dampers for Rating," shall not exceed 2 percent of air quantity at 2000-fpm face velocity through damper and 4” wg pressure differential.
- B. Damper Operators: Electric specified in Division 23
- C. Low-Leakage, Outside-Air Dampers: Double-skin, airfoil-blade galvanized-steel dampers with compressible jamb seals and extruded-vinyl blade edge seals, in opposed-blade arrangement with steel operating rods rotating in stainless-steel sleeve bearings mounted in a single galvanized-steel frame, and with operating rods connected with a common linkage. Leakage rate shall not exceed 5 cfm/sq. ft. at 1” wg and 9 cfm/sq. ft. at 4” wg.
- D. Face-and-Bypass Dampers: Opposed-blade galvanized-steel dampers with steel operating rods rotating in sintered bronze or nylon bearings mounted in a single galvanized-steel frame and with operating rods connected with a common linkage. Break-form damper blades, provide gaskets and edge seals, and mechanically fasten to operating rod.

- E. Zone Dampers: Two single-blade galvanized-steel dampers offset 90 degrees from each other on steel operating rod rotating in sintered bronze or nylon bearings mounted in a single galvanized-steel frame. Break-form damper blades, provide gaskets and edge seals, and mechanically fasten to operating rod.
- F. Mixing Boxes: Parallel-blade galvanized-steel dampers mechanically fastened to steel operating rod in reinforced, galvanized-steel cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously.
- G. Combination Filter and Mixing Box: Parallel-blade galvanized-steel dampers mechanically fastened to steel operating rod in reinforced, galvanized-steel cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously. Cabinet support members shall hold 2" thick, pleated, flat permanent or throwaway filters. Provide hinged access panels or doors to allow removal of filters from both sides of unit.

2.08 FILTER SECTION

- A. Filters: Comply with NFPA 90A and DPS filter standards as specified in Section 23 40 00 Air Cleaning.
- B. Filter Section: Provide filter holding frames arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side.
- C. Disposable Panel Filters: Factory-fabricated, viscous-coated, flat-panel-type, disposable air filters with holding frames.
 - 1. Media: Interlaced glass fibers sprayed with nonflammable adhesive.
 - 2. Frame: Galvanized steel with metal grid on outlet side, steel rod grid on inlet side, hinged, and with pull and retaining handles.
 - 3. Duct-Mounting Frames: Welded, galvanized steel with gaskets and fasteners, suitable for bolting together into built-up filter banks.

2.09 UNIT CONTROLS

- 1. Factory-wired control panel in accordance with NEC.
- 2. Connect to Integrated Building Automation System. Refer to Section 25 50 00 – Integrated Building Automation System (IBAS) for interface requirements. Temperature controls are to be provided by section 25 50 00 Controls and connected to Integrated Building Automation System. Refer to Section 25 50 00 – Integrated Building Automation System (IBAS) for interface requirements.
- 3. Economizer Fault Detection and Diagnostics (FDD)
 - a) The following temperature sensors shall be permanently installed to monitor system operation:
 - i) Outside air.
 - ii) Supply air.
 - iii) Return air.
 - b) Temperature sensors shall have an accuracy of $\pm 2^{\circ}\text{F}$ over the range of 40°F to 80°F .
 - c) Refrigerant pressure sensors, where used, shall have an accuracy of ± 3 percent of full scale.
 - d) The unit controller shall be capable of providing system status by indicating the following:
 - i) Free cooling available.
 - ii) Economizer enabled.
 - iii) Compressor enabled.
 - iv) Heating enabled.
 - v) Mixed air low limit cycle active.
 - vi) The current value of each sensor.
 - e) The unit controller shall be capable of manually initiating each operating mode so that the operation of compressors, economizers, fans and the heating system can be independently tested and verified.

- f) The unit shall be capable of reporting faults to a fault management application accessible by day-to-day operating or service personnel, or annunciated locally on zone thermostats.
- g) The FDD system shall be capable of detecting the following faults:
 - i) Air temperature sensor failure/fault.
 - ii) Not economizing when the unit should be economizing.
 - iii) Economizing when the unit should not be economizing.
 - iv) Damper not modulating.
 - v) Excess outdoor air.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of steam, hydronic, and condensate drainage piping systems and electrical services to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Concrete Bases: install floor mounting units on 4” high concrete bases.
- B. Install modular indoor air-handling units with the following vibration-control devices.
 - 1. Units with Internally Isolated Fans: secure units to anchor bolts installed in concrete bases.
 - 2. Floor-Mounted Units: support on concrete bases using neoprene pads. Secure units to anchor bolts installed in concrete bases.
 - 3. Suspended Units: suspend units from structural-steel support frame using threaded steel rods and spring hangers.
- C. Arrange installation of units to provide access space around modular indoor air-handling units for service and maintenance.

3.03 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.
- C. Connect piping to modular indoor air-handling units mounted on vibration isolators with flexible connectors.
- D. Connect condensate drain pans using NPS 1-1/4, Type M copper tubing. Extend to nearest equipment or 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 Specification Section 23 11 13 Hydronic Piping. Connect to supply and return coil tappings with shutoff or balancing valve and union or flange at each connection.
- F. Steam and Condensate Piping: comply with applicable requirements in Specification Section 23 22 13 Steam and Condensate Piping. Connect to supply and return coil tappings with shutoff valve and union or flange at each connection.
- G. Refrigerant Piping: comply with applicable requirements in Specification Section 23 23 00 Refrigerant Piping. Connect to supply and return coil tappings with shutoff valve and union or flange at each connection.
- H. Duct installation and connection requirements are specified in Specification Section 15900 Ductwork and Accessories. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connections.

- I. Electrical: Comply with applicable requirements in Division 26 Sections for power wiring, switches, and motor controls.

3.04 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
 - 1. Leak Test: after installation, fill water and steam coils with water and test coils and connections for leaks. Repair leaks and retest until no leaks exist.
 - 2. Charge refrigerant coils with refrigerant and test for leaks. repair leaks and retest until no leaks exist.
 - 3. Fan Operational Test: after electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
 - 4. Test and adjust controls and safeties. replace damaged and malfunctioning controls and equipment.

3.05 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Final Checks before Startup: perform the following:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. 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, starters, and disconnect switches.
 - 3. Perform cleaning and adjusting specified in this Section.
 - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify free fan wheel rotation and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.
 - 5. Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.
 - 6. Set zone dampers to fully open position for each zone.
 - 7. Set face-and-bypass dampers to full face flow.
 - 8. Set outside- and return-air mixing dampers to minimum outside-air setting.
 - 9. Comb coil fins for parallel orientation.
 - 10. Install clean filters.
 - 11. Verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.
- C. Starting procedures for modular indoor 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.
- D. Refer to Specification Section 23 05 93 Testing, Adjusting, and Balancing for additional requirements.

3.06 ADJUSTING

- A. Adjust damper linkages for proper damper operation.

3.07 CLEANING

- A. Clean modular indoor air-handling units internally, on completion of installation, according to manufacturer's written instructions. Clean fan interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheels, cabinets, and coils entering air face.
- B. After completing system installation and testing, adjusting, and balancing modular indoor air-handling and air-distribution systems, clean filter housings and install new filters.

END OF SECTION 23 73 00