

SECTION 15834  
HIGH PLUME DILUTION FANS

PART 1 - GENERAL

1.01 PROVISIONS INCLUDED

- A. The general provisions of the Contract, including General and Supplementary Conditions, and Division 1 General Requirements, apply to work specified in this Section.
- B. Requirements of Section 15050, "Basic Mechanical Materials and Methods" apply to work specified in this Section.

1.02 SUMMARY

- A. This Section includes high-plume dilution fans.
  - 1. Exhaust fans
  - 2. Heat recovery coils
  - 3. Filter section
  - 4. Fan isolation dampers with actuators
  - 5. Electrical power wiring, variable frequency drive and fan disconnects
  - 6. Access doors and panels
- B. Related Work Specified in Other Sections:
  - 1. Section 15070, "Vibration Control & Seismic Restraints" for vibration hangers and supports.
  - 2. Section 16420, "Motor starters"
  - 3. Division 16, Electrical power wiring.

1.03 SUBMITTALS

- A. Product data for selected models, including specialties, accessories, and the following:
  - 1. Certified fan performance curves with system operating conditions indicated.
  - 2. Certified fan sound power ratings.
  - 3. Motor ratings and electrical characteristics plus motor and fan accessories.
  - 4. Material gages and finishes, including color charts.
  - 5. Dampers, including housings, linkages, and operators.
- B. Shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, required clearances, components, and location and size of field connections.
- C. Wiring diagrams that detail power, signal, and control wiring. Differentiate between manufacturer-installed wiring and field-installed wiring.
- D. Maintenance data for fans, for inclusion in Operating and Maintenance Manual specified in Section 01770 "Closeout Procedures and Submittals."

- E. Submit published discharge volume for all fans at specified primary exhaust flow.
- F. Basic O & M material requirements:
  - 1. All information must be project specific. Edit vendor O & M manuals to reflect exact equipment supplied. Cross out extraneous information not applicable to the specific equipment provided.
  - 2. Provide complete data relative to make/model number, size, capacity data, manufacturer name and address, accessories included, etc.
  - 3. If equipment contains multiple subassemblies provided by different manufacturers, include make/model number, size, capacity data, etc. for each subassembly.
  - 4. Include fan curves and sound power levels for all fans.
  - 5. Include clean and dirty filter pressure drops for all filters.

#### 1.04 QUALITY ASSURANCE

- A. Testing:
  - 1. Test and rate fans under AMCA 210-85, Laboratory Methods of Testing Fans for Rating, or British Standard 848, Part I, Methods of Testing Performance, 1980,
  - 2. Fans tests shall have been witnessed by an independent agency.
  - 3. Fans shall be tested and rated for air performance, aspiration, sound and vibration in the specified configuration with high velocity discharge nozzles and induction wind bands installed. Fan curves and fan performance de-rating based on calculated estimates are not acceptable.
    - a. Provide documented aspiration tests performed in conjunction with the fan performance test.
    - b. Sound testing shall be in accordance with AMCA 300 in a laboratory built to AMCA standards. Fans shall be guaranteed to meet specified octave band sound levels.
- B. UL compliance:
  - 1. Fans shall be designed, manufactured, and tested in accordance with UL 705 "Power Ventilators."
  - 2. Fans and components shall be UL listed and labeled.
- C. Listing and Labeling: Provide electrically operated fixtures that are listed and labeled. The Terms "listed" and "Labeled" shall be as defined in the National Electrical Code, Article 100.
- D. AMCA compliance:
  - 1. Standard 500, Damper leakage test procedure.
  - 2. Standard 210-99, Laboratory methods of testing fans for ratings,
  - 3. Standard 300-96, reverberant room method for sound testing of fans.

- E. NEMA Compliance: Provide motors and electrical accessories that comply with NEMA standard MG-1-1993.
- F. NFPA compliance:
  - 1. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."
  - 2. Fans shall meet the criteria of NFPA-45.
- G. Comply with USM IDAT requirements.

#### 1.05 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions by field measurements. Verify clearances.
- B. Do not operate fans until ductwork is clean, filters are in place, bearings are lubricated, and fans have been commissioned.

#### 1.06 COORDINATION AND SCHEDULING

- A. Lift and support units with the manufacturer's designated lifting or supporting points.
- B. Deliver fan units as a factory-assembled unit to the extent allowable by shipping limitations, with protective crating and covering.
- C. Coordinate the installation of roof curbs, equipment supports, and roof penetrations.
- D. Coordinate the size and location of structural steel support members.

#### 1.07 WARRANTY

- A. Provide a seven (7) year manufacturer's warranty on the complete assembly including the fan, motor, plenum and all accessories.
- B. Motors shall have a minimum of seven year warranty.

#### 1.08 SYSTEM START-UP

- A. Comply with the requirements in IDAT described in General Requirements Section 01400.
- B. Provide schedule for static and dynamic testing.

#### 1.09 EXTRA MATERIALS

- A. Furnish one additional complete set of belts for each belt driven fan.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

Subject to compliance with requirements, provide products of one of the following:

- A. Energy recovery units:
  - 1. Strobic Air
  - 2. Cambridgeport
  - 3. Dynamic Air Corp
  - 4. BossAire
  
- B. High plume dilution exhaust fans:
  - 1. Strobic Aire
  - 2. MK Plastics
  
- C. Low leakage dampers:
  - 1. Arrow AFD-20
  - 2. Ruskin CD-50
  - 3. Johnson D-1300 Airfoil
  
- D. Acoustical louvers:
  - 1. Arrow 401-HL.
  - 2. Ruskin Mfg. Div, Phillips Industries, Inc.
  - 3. Construction Specialties, Inc.
  
- E. Heat recovery coils:
  - 1. Marlo
  - 2. Heatcraft
  - 3. Aerofin
  - 4. RAE Corp.
  
- F. Filters:
  - 1. American Air Filter
  - 2. FGI
  - 3. Farr Co.
  
- G. Damper actuators:
  - 1. Delta Controls – 480 series
  - 2. Belimo
  - 3. Johnson Controls

### 2.02 MIXED FLOW HIGH PLUME EXHAUST FAN

- A. Direct drive, Arr. 4 with impeller mounted directly to the motor shaft. Motor shall be isolated from the primary exhaust air stream and shall be visible and accessible from the fan exterior for inspection and service.

1. Provide modular construction fans capable of being assembled on site.
  2. Provide PTFE gaskets at all companion flanged joints.
  3. Fasteners shall be a combination of 316 stainless steel and monel to prevent binding.
  4. Provide bolted access door for impeller inspection.
  5. Provide an internal drain system for fans and accessories to prevent rain water from entering building duct systems.
  6. Coatings - All steel and aluminum surfaces of fan, roof base, attenuator and wind band shall be prepared for coating by blasting or chemical etching. Coating will be Corrosion Resistant Interzone 954 Epoxy Phenolic.
    - a. Intermediate Coat 4-5 mil
    - b. Interthane 990 Top Coat 4-5 mil.
- B. Mixed flow impeller with combination axial-backward curve blades. Welded steel construction stationary discharge guide vane section. Non-stall and non-overloading characteristic with stable operation at any point on the fan curve. The fan shall be able to operate with the inlet isolation damper at full shutoff without any increase in vibration.
1. Provide a non ferrous inlet bell.
  2. Fan shall be spark-resistant construction per AMCA "C".
  3. Provide a vortex breaker at fan inlet.
  3. Provide stationary discharge guide vane sections.
  4. Provide fan and sound attenuator assemblies designed for mounting without the need for guy wire supports.
  5. Fan dynamic balance not to exceed 0.50 mil, peak-to-peak, at the blade pass area when operating at fan frequency. Limit isolation to rubber-in-shear pad type isolator.
- C. FRP discharge nozzle:
1. Provide two piece discharge nozzle for motor access.
  2. Provide a heavy duty fiberglass entrainment wind band to provide secondary induction of outside air. Induction shall take place downstream of the fan impeller.
  3. Size and selected fans that do not have full size induction wind bands on the discharge, and the required documented aspiration tests to induce secondary air into the inlet mixing plenum upstream of the blade fan inlet to match the specified fan discharge cfm.
- D. Electric motors shall be TEFC mill and chemical duty with a 1.15 service factor; C-Face and foot mounted.
1. Provide motor bearings with L-50 bearing life of 200,000 hours. Motors shall have sealed bearings up through a 256T NEMA frame.
  2. Provide motors compatible with the drive and use of the VFD shall not adversely effect the operation, useful life, or warranty.
  3. Provide a minimum Class F or H insulation as required.
  4. Provide NEMA 3R non-fused disconnect switch, mounted and wired to the motor. Disconnect shall be knife type suitable for use with a VFD.
- E. Accessories: The following accessories are required :

1. Mixing plenum:
  - a. Provide a single fan inlet continuously welded, 12 gauge single wall mixing plenum sized to support the weight and performance requirement scheduled.
  - b. Coat outer skin with Kynar powder coating; coating same as specified for fan.
  - c. Mount fans on top of plenum. Plenums shall be capable of supporting the fan(s) without guy wires or supports.
  - d. Provide plenum with integral lifting lugs.
  - e. Provide plenum provided with duct inlets, with sizes and locations as shown on plans. Provide a 1/2" X 1/2" stainless mesh screen over all inlets.
  - f. Provide an aluminum, airfoil, opposed blade bypass damper on each side of the plenum for mixing outside make-up air with primary exhaust. Provide a 1/2" X 1/2" stainless mesh screen over dampered inlets.
  - g. Provide a fiberglass weather hood and 4" deep acoustical louver for each by-pass damper opening. Provide and mount a modulating direct drive spring return electric actuator for each damper with a 4-20ma input follower. under weather hood on side of bypass damper.
  - h. Provide a hinged door on the side of each plenum.
  - i. Provide extended braided stainless steel motor lube lines. Extend lines to an accessible location, secure in place and terminate with Zerk fittings.

2. Discharge attenuator: Provide a self supporting modular discharge attenuator for each fan. The silencer shall be designed as an integral component of the exhaust fan discharge nozzle.

- a. Maximum air pressure drop shall be 0.01" W.C. when installed.
- b. Constructed from fiberglass and all welded galvaneal steel, with a structural fiberglass outer wall and 22 ga. perforated inner wall.
- c. Colored or coated to match the fans.
- d. Acoustic media: 3# density fiberglass isolated from the air stream by a Mylar or tedlar film, non fibrous acoustical media, or pack less with no acoustical fill.
- e. Provide silencer attenuation values and fan sound pressure as specified in the following schedule. The published insertion loss values shall be obtained from testing with the silencer installed on the fan in the specified configuration.

		Octave Band Center Frequency (Hz)							
Fan Size/Silencer Model	Length	63	125	250	500	1000	2000	4000	8000
TS3-DNS	88"	8	7	12	15	15	13	10	6

- f. The fan with the specified silencer shall have an operating sound pressure level measured at a distance Ft. from the fan as follows:

		Octave Band Center Frequency (Hz)							
Fan Size/Silencer Model	Length	63	125	250	500	1000	2000	4000	8000
TS3-DNS	88"	60	69	64	60	59	57	58	52

- F. Alternate fan arrangement: Include the following items:
  1. Belt drive fans, or direct drive fans with horizontally mounted motors.

2. Seismic rated spring vibration isolators compliant with Section 15070. Isolation of the fan mixing plenum is not acceptable.
3. ¼" thick neoprene inlet and outlet flexible connectors on the fan inlet and discharge.
4. A welded structural steel mounting frame fabricated of 3" X 3" X 3/8" steel angle designed to allow the fans to be suspended from the framework and separated from the plenum and the building structure with the spring isolators and the flexible connectors.
5. The structural steel framework shall also support the fan discharge Silencer and architectural screen enclosure. The framework and silencer shall be rated for a 120 mph wind load without supplemental structural supports or guide wires.
6. The overall height and the footprint of the assembly with the plenum, fans, support structure and discharge attenuators shall not exceed the dimensions and weight shown on the plans.

## 2.03 ENERGY RECOVERY UNIT

### A. FACTORY BUILT MODULAR UNITS

1. Base shall consist of steel beams or channel for direct bearing support for components in casing, and shall be painted with Rustoleum primer and Rustoleum exterior enamel. Base shall have minimum of four removable ½" thick steel lifting lugs at corners of each module. Provide back-to-back channels at each shipping split.
  - a. The exhaust air handler base shall be fabricated to allow the unit to counter flash the curb by a minimum of 1.5".
  - b. Floor
    - Floor shall be of 12 gauge steel plate welded to sub-base. Provide 12 gauge thick galvanized steel flooring in exhaust section. The floor covering shall have a 2" flange turned-up on the outer perimeter of the unit to form a watertight drain pan. All seams in the floor shall be continuously welded. Pan shall be braced to support internal equipment components without sagging or pulsating. Provide drains with Type L copper piping extending through sides of unit base in each compartment. Drains to be 2" diameter, with grating material at the floor surface.
    - Underside shall be insulated continuously with 2 in. thick rigid, high density fiberglass or polyisocyanurate foam insulation. For installations mounted on steel platforms the bottom of base shall be covered with min. 18 ga. galvanized sheet metal and sealed weather tight at all joints and penetrations.
2. Housing walls and roof shall be galvanized, separate frame and panel or integral frame and panel.
  - a. Panel skin thickness, stiffener and frame spacing and thickness, and core density shall be designed to eliminate panel pulsation and to limit maximum deflection to 1/200 of any span at design positive or negative pressures. Design pressure shall be equal to 1.5 times fan static pressure.
  - b. Panels: double wall with interior sheet and non-perforated exterior sheet. Panels shall be 2" thick with 2" polyisocyanurate foam insulation and an overall "U" factor of .10 BTU/Hour/Square foot/Deg F. All panel seams shall be designed to ensure complete air seal.

- c. Exterior skin: 16 gauge galvanized steel with 8-10 mil DFT Ameron 385 epoxy exterior finish factory applied.
  - d. Interior skin in exhaust air section: 16 gauge galvanized steel. Section safing walls shall be 1 inch thick double wall insulated.
  - e. Roof panels: peaked in center - sloping to each end, with 16 gauge galvanized exterior, with a minimum pitch of 1/8" per foot. Interior skin shall be same as walls.
  - f. Access doors:
    - double wall construction as specified for panels; 2" thick with integral frame - double gasketed, tapered to allow for door swing and easy panel removal.
    - at least 54" high x 24" wide, unless noted otherwise, and shall have three hinges and three tapered latches to force door against gasket. All hinges are to be Kason #1070.
    - suction side of fan shall swing out. Latches shall operate from both sides of door.
  - g. Panels: factory-sealed, air tight at corners and seams without visible caulking on casing exterior. Modules shall be assembled with caulking and gasketing in field and shall be air tight without exterior visible caulking.
  - h. Safing panels to seal coils, filter banks and attenuator banks to casing and casing to building structure: aluminum or stainless steel for heat recovery coils and aluminum, stainless or galvanized steel otherwise.
4. Roof: slightly pitched as indicated. After complete unit assembly, cover roof with continuous rubber Hypalon membrane roofing system with 20 year warranty, such as Tremco Lexply, or standing seam roof equal to exterior panel construction. Roof membrane shall be installed by unit Manufacturer. Provide 16 gauge galvanized flashing for roof perimeter, with prime finish. Provide rain gutters over exterior access doors.
5. Fan Support Curbs
- a. Provide fan support roof curbs integral to the enclosure for each exhaust fan. Roof curbs shall be 12" high with inner skin, outer skin and insulation to match air handling unit and internal structural reinforcement.
  - b. Provide a vortex breaker at fan inlet.
6. Duct Connections: Provide duct connections as shown on drawings, with 1" duct collar.
- C. Provide exhaust heat recovery coil for 40% propylene glycol and water. Provided ARI certified coil performance ratings.
- D. Glycol heat recovery coils:
- 1. 5/8" O.D., 0.035" thick wall copper tubes with helically wound .01" thick aluminum fins.
  - 2. Casing: 16 ga. stainless steel with 1.5" punched flange.
  - 3. Connections: 3" Carbon Steel MPT and turned toward entering face; Same end connections.
  - 4. Turbulators: where required to improve heat transfer and prevent laminar fluid flow.
  - 5. Coil frames: 12 Ga. Stainless steel factory-fabricated frame independent of unit casing.



- E. Filter Section:
1. Provide side service tracks with gaskets
  2. Filters: 2" deep, 20-25% efficient, 3 ply link panel type; 80% efficient on particles 5 micron and larger.
  3. Provide a magnehelic pressure gauge for each filter bank.
  4. Provide hinged and latched filter service access door for each filter bank.
- F. Dampers
1. Provide aluminum, opposed blade bypass damper on each side of the plenum for mixing outside make-up air with primary exhaust. Dampers shall have a ½" square mesh screen on the inlet side. Dampers shall have a heavy duty manual locking quadrant.
  2. Provide heavy duty, low leakage extruded aluminum, parallel blade fan isolation dampers at the exhaust duct connection. Dampers shall have vinyl blade edge seals, stainless steel spring jamb seals, 1.5" x 8" x 1.5" extruded aluminum frame, jamb mounted concealed linkage and nylon bearings. Coat dampers with two coats of white epoxy phenolic. Provide dampers with an extended shaft projecting through the plenum sidewall for connection to a two position, spring return electric actuator. Mount actuators and linkage in weatherproof enclosures outside the plenum. Damper shaft extensions shall be provided with a support bushing at the plenum wall.
  3. Leakage characteristics: 6 cfm per sq. ft. at 4" wg differential pressure. Dampers shall be suitable for 9" w.c. static pressure and 6,000 FPM free velocities.
  4. Frames and blades to be minimum 12 ga. (.081") extruded aluminum. Blades to be of single unit air foil design, 6" wide with the PIN-Lock an integral section within the blade core.
  5. Provide overlapping blades and seals to assure minimum air leakage. Provide extruded silicone seals fit into a ribbed groove insert in blades with a formed stainless steel, spring steel at the jamb.
  6. Frames: extruded aluminum channel with reinforcing bosses.
  7. Pivot rods: ½" dia. extruded aluminum, PIN-LOCK design interlocking into blades section. Bearings to be Double Sealed type with Celcon inner bearing on rod riding in Polycarbonate outer bearing inserted in frame so that outer bearings cannot rotate.
  8. Rod bearings shall be designed so that there shall be no metal-to-metal or metal-to-bearing riding surfaces. Inter-connecting linkage to have separate Celcon bearing to eliminate friction in linkage.
  9. Blade linkage hardware: non-corrosive reinforced material or cadmium-plated steel. All linkage shall be concealed in damper frame.

## 2.04 CONTROL MATERIALS AND EQUIPMENT

- A. Provide DDC control products in sizes and capacities indicated, consisting of valves, dampers, sensors, controllers, temperature sensors, flow sensors (air & water) thermostats, wiring, switches, relays, transformers, tubing, and other components as required for complete installation. Provide manufacturer's standard materials and components as published in their product information; designed and constructed as recommended by manufacturer, and as required for application indicated.

- B. Automatic Control Dampers: Provide all automatic control dampers not specified to be supplied integral to HVAC equipment.
1. Dampers to be low leakage type; opposed blade type proportional dampers; opposed or parallel blade type two position dampers.
  2. Damper frames 16 gauge galvanized steel; blades 14 gauge galvanized steel. Blade width not to exceed 6 inches. Dampers and seals suitable for temperature ranges of -50 to 250 degrees F. Provide mounting holes for enclosed duct mounting.
  3. Provide dampers equipped with neoprene edge seals and compressible metal jamb seals. Leakage not to exceed 3 cfm/s.f. at 1-inch W.G. differential, when tested in accordance with AMCA 500. Pressure drop across damper not to exceed 0.03 inches of water gauge differential pressure at 1,000 feet/minute velocity and 0.06 inches water gauge or less differential pressure at 1,500 feet/minute velocity.
  4. Manufacturer and Model: Ruskin, Model CD60 or equal.
- C. Electric actuators: Damper actuators to be low voltage (24 VAC), linear in response to a sensed load, and properly sized to stroke damper smoothly and efficiently throughout its range. Actuators to be spring return unless otherwise noted.
1. Air Control Damper Actuators Subject To Below Freezing Atmospheric Conditions:
    - a. Face and bypass dampers: proportional spring return to bypass position.
    - b. Outside air and relief air dampers: proportional spring return to closed position.
    - c. Return air dampers: proportional spring return to open position.
    - d. Exhaust air and combustion air intake dampers: On / Off spring return to closed position.
  2. Air Control Damper Actuators Not Subject To Below Freezing Atmospheric Conditions:
    - a. Face and bypass: floating or proportional without spring return.
    - b. Outside air, return air, and relief air dampers: floating or proportional without spring return.
    - c. Exhaust air and combustion air intake dampers: On/Off or floating without spring return.
  3. Actuator torque rated in inch pounds by the guaranteed minimum torque (GmT) method. Actuators rated by maximum torque and requiring a reducing factor based on ambient temperature, voltage conditions, and electronic component aging are not acceptable.
  4. Spring return actuators capable of either clockwise or counter clockwise spring operation by reversing actuator on shaft. Actuators capable of being mechanically and electrically paralleled to increase torque where required.
  5. Actuators containing environmentally sensitive materials such as oil filled gear train, internal energy storage battery, internal energy storage capacitor, internal chemical energy storage, are not acceptable.

6. Actuators producing less than 75 inch pound guaranteed minimum torque (GmT) to have a power consumption no greater than 2 watts DC or 6 VA AC per unit. Actuators producing more than 75 inch pound guaranteed minimum torque (GmT) to have a power consumption no greater than 8 watts DC or 15 VA AC per unit.
7. Combined mechanical and electrical noise level of actuators not to exceed 35 dBA in public areas and 45 dBA in mechanical areas.
8. Actuators without spring return to have a gear release accessible without removal of actuator cover, allowing the manual positioning of air control damper.
9. Actuators to operate in installed environment without exceeding rated non condensing humidity and ambient temperature limits.
10. Actuators to have a minimum fifteen year design life when operating within manufacturers recommendations.
11. Actuators CSA certified, and UL Listed.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances, roof curbs, equipment supports, and other conditions affecting performance of fans.
- B. Do not proceed until unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION, GENERAL

- A. Install roof curbs and fans level and plumb, in accordance with manufacturer's written instructions.
- B. Arrange installation of units to provide access space around fans for service and maintenance. Locate equipment with minimum service area size and location recommended by manufacturer.

### 3.03 INSTALLATION, CONTROLS:

- A. Provide variable frequency drive for AF-22 with by-pass and Hand-Off-Auto Switch
  - B. When the H-O-A switch is in the Hand position, the fan motor shall be energized and the fan shall run. When the switch is on the Off position, the fan motor shall be de-energized and the fan shall remain off. When the switch is on Auto (normal operational position), signal fan to start/stop through building DDC system.
2. Interlock EF-22 with AH-2 such that exhaust fan shall start and run when AH-2 is started. EF-22 shall remain off if AH-2 is scheduled off or signaled off on safety.

3. Indicate exhaust fan operation to the DDC system by fan motor current sensor. A variation from current draw limits on the running fan shall constitute exhaust fan failure alarm.
4. Modulate the general exhaust variable frequency drive to maintain exhaust duct static pressure set point. The system shall also measure general exhaust air flow.
5. Provide a normally closed, spring return isolation damper upstream of the inlet to EF-22. When the fan is commanded on, the isolation damper shall open. Damper position shall be confirmed open via an end switch. The isolation damper actuator shall be wired in series with the fan VFD through an integral transformer to ensure that fan and damper operation is interlocked, and that both start simultaneously. When the fan is commanded off, the isolation damper shall automatically close. (Note: The fan has a non-stall characteristic and can run against a fully closed damper).
6. With the duct static pressure at its set point and the air flow measuring station indicates the discharge velocity is falling below 3,000 fpm the DDC controller shall modulate the outside air bypass damper(s) (*normally closed, spring return*) to maintain the minimum discharge velocity at its set-point. Upon an increase in flow rate above the set point the outside bypass dampers shall modulate closed to allow the flow rate and the static pressure control to maintain the system pressure and flow rate.

#### 3.04 CONNECTIONS

- A. Duct installations and connections are specified in other Division 15 sections. Make final duct connections with flexible connections.
- B. Electrical Connections: The following requirements apply:
  1. Provide temperature control wiring and interlock wiring as specified in Division 15 Section "Control Systems".
  3. Grounding: Connect unit components to ground in accordance with the National Electrical Code.

#### 3.05 ADJUSTING, CLEANING, AND PROTECTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Lubricate bearings.
- D. After completing installation, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes including chips, scratches, and abrasions.
- E. Clean unit interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheel and housing.

### 3.06 START UP AND TESTING

- A. Perform the following operations and checks before start-up:
  - 1. Remove shipping blocking and bracing.
  - 2. Verify unit is secure on mountings and supporting devices and that connections for ductwork, and electrical are complete. Verify proper thermal overload protection is installed in motors, starters, and disconnects.
  - 3. Perform cleaning and adjusting specified in this Section.
  - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free 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. Verify that manual and automatic volume control and fire dampers in connected ductwork systems are in the full open position.
  - 7. Disable automatic temperature control operators.
- B. Starting procedures for fans:
  - 1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated RPM. Replace fan and motor pulleys as required to achieve design conditions.
  - 2. Measure and record motor electrical values for voltage and amperage.
- C. Shut unit down and reconnect automatic temperature control operators.
- D. Refer to Section 15950 "Testing, Adjusting, and Balancing" for procedures for fan-system testing, adjusting, and balancing.

### 3.07 DEMONSTRATION

- A. Comply with USM IDAT requirements.
- B. Demonstration Services: Arrange and pay for a factory-authorized service representative to train Owner's maintenance personnel on the following:
  - 1. Procedures and schedules related to start-up and shutdown, troubleshooting, servicing, preventative maintenance, and how to obtain replacement parts.
  - 2. Familiarization with contents of Operating and Maintenance Manuals specified in Section 01770 "Project Closeout" and Section 15050 "Basic Mechanical Materials and Methods."
- C. Schedule training with at least 7 days advance notice.

END OF SECTION 15834