

**SECTION 233414
MIXED-FLOW HVAC FANS**

PART 1 GENERAL**1.01 SUMMARY**

- A. Section includes inline mixed flow fans, belt driven. RF-1

1.02 REFERENCE STANDARDS

- A. American Bearing Manufacturers Association (ABMA): www.americanbearings.org:
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. (AMCA): www.amca.org:
1. AMCA Standard 204 - Balance Quality and Vibration Levels for Fans
 2. AMCA Standard 205 - Energy Efficiency Classification for Fans
 3. AMCA Standard 210 / ASHRAE 51 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating
 4. AMCA Publication 211 - Certified Ratings Program - Product Rating Manual for Fan Air Performance
 5. AMCA Standard 300 - Reverberant Room Method for Sound Testing of Fans
 6. AMCA Publication 311 - Certified Ratings Program - Product Rating Manual For Fan Sound Performance

1.03 ACTION SUBMITTALS

- A. Product Data: Include the following:
1. Rated capacities and operating characteristics.
 2. Fan Performance Data: Fan performance curves with flow, static pressure and horsepower.
 3. Sound Performance Data: Fan sound power levels in eight octave bands and, A-weighted overall sound power level or sone values.
 4. Motor ratings and electrical characteristics.
 5. Furnished specialty components.
 6. Specified accessories.
 7. Dimensioned standard drawings indicating dimensions, weights, and attachments to other work.

1.04 INFORMATIONAL SUBMITTALS

- A. Source quality-control reports.
- B. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Include routine maintenance, adjustment requirements, safety information, and troubleshooting guide.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Approved ISO 9001-compliant manufacturer listed in this Section with minimum 10 years' experience in manufacture of similar products in successful use in similar applications, and with an ASME NQA-1 compliant Program.
1. Approval of Comparable Products: Submit the following in accordance with project substitution requirements, within time allowed for substitution review:
 - a. Product data, including certified independent test data indicating compliance with requirements.
 - b. Project references: Minimum of 5 installations not less than 5 years old, with Owner contact information.
 - c. Sample warranty.
 2. Substitutions following award of contract are not allowed except as stipulated in Division 01 General Requirements.

3. Approved manufacturers must meet separate requirements of Submittals Article.
- B. AMCA Compliance:
 1. Provide fan types tested in accordance with AMCA Standard 210 (air performance) and AMCA Standard 300 (sound performance) in an AMCA-accredited laboratory.
 2. Provide fan units rated according to AMCA Standard 211 (air performance) and AMCA Standard 311 (sound performance).
 3. Provide fan units rated according to AMCA Standard 205 (fan efficiency grade).

1.07 COORDINATION

- A. Coordinate sizes and locations of supports required for fan units.
- B. Coordinate sizes and locations of equipment supports, roof curbs, and roof penetrations.

1.08 FIELD CONDITIONS

- A. Handling and Storage: Handle and store fan units in accordance with manufacturer's published instructions. Examine units upon delivery for damage. Store units protected from weather.

1.09 WARRANTY

- A. Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to furnish replacement components for fan units that demonstrate defects in workmanship or materials under normal use within warranty period specified.
 1. Warranty Period: 12 months from startup or 18 months from shipment by manufacturer, whichever first occurs.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Basis-of-Design Manufacturer: Twin City Fan & Blower, Minneapolis MN; www.tcf.com.

2.02 PERFORMANCE REQUIREMENTS

- A. Fan Performance Ratings: Project Elevation of 850ft above sea level.
- B. AMCA Compliance: Provide units that bear the AMCA-Certified Ratings Seal.
- C. Compliance:
 1. Classified under AMCA Standard 205.
 2. Provide units that comply with requirements of UL 705.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70.

2.03 MIXED FLOW FANS

- A. Description: Belt - Driven, Mixed Flow Axial Fans: Axial fan units, configured for horizontal or vertical flow of relatively clean air for Heating, Ventilating, and Air-Conditioning (HVAC) applications.
 1. Basis of Design Product: Twin City Fan & Blower, Model QCLB.
 2. Permanently attach nameplate displaying serial number and unit information.
- B. Fan Capacities, Characteristics, and Configuration: Refer to Drawing schedule.
- C. Fan Wheel/Impeller: Provide fabricated wheel/impeller with die-formed, single-thickness blades, continuously welded to wheel backplate and wheel outer rim. Hub to be keyed to shaft.
 1. Materials of Construction: Manufacturer's standard, based on wheel size and pressure class.
 2. Statically and dynamically balance wheel.
 3. Minimum Balance Quality Grade: G6.3, in accordance with AMCA Standard 204.
- D. Fan Shaft: AISI C1045 hot rolled steel, accurately turned, ground, polished, and ring gauged. Select shaft diameter so that first critical speed is minimum 1.43 times maximum speed for each fan class.
 1. Apply petroleum based rust prevention coating.
- E. Bearings: Manufacturer's standard field-lubricated ball or roller bearings, based on fan size and mounting orientation, with grease lines extended to outside fan housing.

1. Minimum Average Bearing Life: AMBA L-10 = 80,000 hours at maximum operating speed.
- F. Inner Cylinder: Steel, rigidly constructed to support fan shaft and bearings, with removable discharge cone.
 1. Design fan to allow for servicing fan shaft, bearings, and sheave by removing discharge cone.
- G. Straightening Vanes: [Steel] [Aluminum] aerodynamically designed to recover velocity pressure and convert it to static pressure in downstream ductwork.
- H. Housing: Formed [steel] [aluminum] with continuously welded seams and aerodynamic inlet. Provide punched inlet and outlet flanges.
- I. Belt Drives:
 1. Drive Components: V-belt drive, rated for minimum 150 percent of motor nameplate horsepower, with machined, cast-iron sheaves, and heat resistant, oil resistant, static-free V-belts.
 - a. Motor 10 HP and Smaller: Adjustable pitch.
 - b. Motor 15 HP and Larger: Fixed pitch.
 2. Motor and Drive Assembly: Motor to be rigidly mounted on adjustable mounting plate with drives isolated from airstream. Provide belt shield tubes.
 3. Belt Guard: OSHA compliant. Steel, totally enclosed and sealed.
- J. Motors: Comply with NEMA MG-1 for designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 section "Common Motor Requirements for HVAC Equipment."
 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 2. Motor Speed: Based upon performance requirements and application.
 3. Electrical Data:
 - a. Voltage: 460V; 3 phase; 60 Hz.
 4. Enclosure Type: Open, Drip Proof (ODP) or Totally Enclosed Fan Cooled (TEFC)
 5. Provide motors that comply with the Energy Independence and Security Act of 2007 (EISA).
 6. Motor Efficiency: Premium, suitable for use with Variable Frequency Drive (VFD).
- K. Motor Mounting Platform: Heavy-duty motor mounting platform that allows adjustment of drive belt tension. Provide eight standard locations around fan unit circumference for placement of motor mounting platform. Motor location per drawing schedule.
- L. Vibration Isolation:
 1. Provide isolation of fan from connected piping, duct work and foundation in accordance with fan manufacturer's requirements, and Division 23, Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
 - a. For fans suspended from the ceiling, provide spring vibration isolators provided by the manufacturer
 - 1) Spring Isolators: as selected and furnished by the manufacturer for field assembly.
 - 2) Suspension rods, nuts, bolts and supporting angles are to be provided by the customer.
 2. Thrust Restraint: Provide thrust restraint support member when fan is horizontally mounted and not anchored to building structure.
- M. Finishes:
 1. After fabrication, deburr, clean and chemically pretreat metal parts by phosphatization.
 2. Apply two coats of following finish: Air Dried Epoxy
- N. Accessories:
 1. Quick-open, latched access door.
 2. Provide slip-on companion flanges with factory punched holes to match fan flanges for making connections to ductwork.

2.04 SOURCE QUALITY CONTROL

- A. Factory Run Test: Statically and dynamically balance each wheel in accordance with AMCA Standard 204 "Balance Quality and Vibration Levels for Fans" to Fan Application Category BV-3, Balance Quality Grade G6.3. Test run assembled fan units prior to shipment at specified operating speed or maximum RPM allowed. Obtain balance readings by electronic equipment in the axial, vertical, and horizontal directions on each set of bearings.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Examine areas to receive fans. Notify Engineer regarding conditions that may adversely affect installation, operation, or maintenance of fans. Proceed with installation once conditions are in accordance with manufacturer's published instructions.

3.02 PROTECTION

- A. Protect adjacent construction and finished surfaces during installation and testing.
- B. Except for operational testing, do not operate fan during construction.

3.03 INSTALLATION

- A. Install, adjust, and clean fans in accordance with Contract documents and manufacturer's published instructions.
- B. Install fan units with adequate clearances for service and maintenance.
- C. Duct Connections: Drawings indicate general arrangement of ducts and duct accessories. Where indicated on Drawings, install factory-furnished companion flanges and make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 section "Air Duct Accessories."
 - 1. Install connecting ducts with adequate clearances for service and maintenance.
- D. Electrical Connections: Connect wiring in accordance with NFPA 70 and Division 26 section "Low-Voltage Electrical Power Conductors and Cables."
 - 1. Ground and bond equipment according to Division 26 section "Grounding and Bonding for Electrical Systems."
- E. Equipment Identification: Label units according to Division 23 section "Identification for HVAC Piping and Equipment."

3.04 FIELD QUALITY CONTROL

- A. Perform field tests and inspections.
 - 1. Verify that unit is secured to supports, and that duct and electrical connections are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 2. Verify that cleaning and adjusting are complete.
 - 3. Disconnect fan belt drive from motor. Verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - 4. Verify that manual and automatic volume control, and fire and smoke dampers in connected ductwork systems are in fully open position.
 - 5. Disable automatic temperature-control actuators, energize motor, adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 - 6. Shut unit down and reconnect automatic temperature-control actuators.
 - 7. Remove and replace malfunctioning units and retest as specified above.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Submit test and inspection reports.

END OF SECTION 233414