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**Twin City Fan & Blower Guide Specification
Plenum Fans: Model EPF, Belt Driven**

**Twin City Fan & Blower’s E-Series Plenum Fan Model EPF** features a highly efficient and cost effective, nine-bladed airfoil wheel design. The high efficiency of the EPF will often allow the use of smaller fans without increasing power requirements. The EPF is Arrangement 3, belt driven design. Model EPF is AMCA certified for Sound and Air.

**Application**

The EPF offers a space saving, unhoused fan designed to operate inside of field-fabricated or factory-built air handling units. The fan wheel pressurizes the entire surrounding air plenum in which the fan is installed, allowing air ducts from any direction to be directly connected to the air handling unit enclosure.

Sizes (wheel diameters): 12.4 to 89.0 inches (315 mm to 2,261 mm)

Airflow: Up to 280,000 CFM (475,720 m3/hour)

Static Pressure: Up to 12 inches wg (2,981 Pa)

Twin City Fan & Blower (TCF) is an industry leading designer and manufacturer of high quality commercial and industrial fans and is a division of Twin City Fan Companies, Ltd. Our extensive product line includes centrifugal fans and blowers, axial fans, and power roof ventilators. For the commercial market, TCF supplies ventilation fans for retail and office buildings, restaurants, schools, hospitals, and government buildings. TCF’s industrial fans are used in a wide variety of process applications for numerous industries including Petrochemical, Nuclear, Cement, Steel, and Air Pollution Control. Special materials, construction, coatings, and accessories are available to fit any application requirements.

TCF has completed thousands of successful installations across the globe and has a proven track record for tackling the most technically complex applications within the fan industry. TCF is also known for its technical design capabilities, comprehensive testing services, and responsive sales team. Due to the company’s extensive expertise and long-standing reputation for proven quality, TCF products continue to be specified around the globe.

TCF occupies over 1,000,000 sq. ft. of manufacturing space across ten facilities in the U.S, with expanded manufacturing and service operations located in South America, Europe, India, China, and Singapore. Headquarters are located in Minneapolis, Minnesota, which houses the management, sales and marketing, accounting, human resources, material management, engineering personnel, as well as a state-of-the-art AMCA Registered testing lab.

We recommend you consult with your Twin City Fan & Blower Sales Representative, who can be contacted through: Twin City Fan & Blower, Minneapolis MN; (763) 551-7600; email: tcf\_sales@tcf.com; [www.tcf.com](http://www.tcf.com).

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SECTION 23 34 16.04 – PLENUM FANS

1. GENERAL
	* + 1. SUMMARY
				1. Section includes plenum fans, belt driven.
			2. REFERENCE STANDARDS
				1. American Bearing Manufacturers Association (ABMA): [www.americanbearings.org](http://www.americanbearings.org/):

ABMA 9 – Load Ratings and Fatigue Life for Ball Bearings

ABMA 11 – Load Ratings and Fatigue Life for Roller Bearings

* + - * 1. Air Movement and Control Association International, Inc. (AMCA): [www.amca.org](http://www.amca.org):

AMCA Standard 204 - Balance Quality and Vibration Levels for Fans

AMCA Standard 205 - Energy Efficiency Classification for Fans

AMCA Standard 210 - ASHRAE 51 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating

AMCA Publication 211 - Certified Ratings Program - Product Rating Manual for Fan Air Performance

AMCA Standard 300 - Reverberant Room Method for Sound Testing of Fans

AMCA Publication 311 - Certified Ratings Program - Product Rating Manual For Fan Sound Performance

* + - * 1. National Electrical Manufacturers Association (NEMA): [www.nema.org](http://www.nema.org)

NEMA MG 1 – Motors and Generators

* + - * 1. National Fire Protection Association (NFPA): [www.nfpa.org](http://www.nfpa.org):

NFPA 70 - National Electric Code

* + - * 1. Office of Statewide Health Planning and Development (OSHPD): https://www.oshpd.ca.gov/

OSHPD Special Seismic Certification Preapproval OSP-0355-10

ICC-ES AC 156 – Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components

* + - 1. ACTION SUBMITTALS
				1. Product Data: Include the following:

Rated capacities and operating characteristics.

Fan Performance Data: Fan performance curves with flow, static pressure and horsepower.

Sound Performance Data: Fan inlet and outlet sound power levels in eight octave bands and, A-weighted overall inlet and outlet sound power level or sone values.

Motor ratings and electrical characteristics.

Furnished specialty components.

Specified accessories.

Dimensioned standard drawings indicating dimensions, weights, and attachments to other work.

Specifier: If Contractor will be required to provide engineering drawings and calculations for vibration, seismic, or high wind design, insert requirements here.

* + - 1. INFORMATIONAL SUBMITTALS
				1. Source quality-control reports.
				2. Field quality-control reports.
				3. ISO-9001 certificate.
			2. CLOSEOUT SUBMITTALS
				1. Operation and Maintenance Data: Include routine maintenance, adjustment requirements, safety information, and troubleshooting guide.
			3. QUALITY ASSURANCE
				1. 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.

Specifier: Retain paragraph below if Owner allows substitutions but requires strict control over qualifying of substitutions.

Approval of Comparable Products: Submit the following in accordance with project substitution requirements, within time allowed for substitution review:

Product data, including certified independent test data indicating compliance with requirements.

Project references: Minimum of 5 installations not less than 5 years old, with Owner contact information.

Sample warranty.

Substitutions following award of contract are not allowed except as stipulated in Division 01 General Requirements.

Approved manufacturers must meet separate requirements of Submittals Article.

* + - * 1. AMCA Compliance:

Provide fan types tested in accordance with AMCA Standard 210 (air performance) and AMCA Standard 300 (sound performance) in an AMCA-accredited laboratory.

Provide fan units rated according to AMCA Standard 211 (air performance) and AMCA Standard 311 (sound performance) in an AMCA-accredited laboratory.

Provide fan units rated according to AMCA Standard 205 (fan efficiency grade).

* + - 1. COORDINATION
				1. Coordinate sizes and locations of supports required for fan units.
				2. Coordinate sizes and locations of equipment supports.
			2. FIELD CONDITIONS
				1. 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.
			3. WARRANTY

Specifier: Consult TCF for available special Project-specific warranties.

* + - * 1. 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.

Warranty Period: 12 months from startup or 18 months from shipment by manufacturer, whichever first occurs.

1. PRODUCTS
	* + 1. MANUFACTURER
				1. Basis-of-Design Manufacturer: Provide fan units manufactured by **Twin City Fan & Blower**, Minneapolis MN; (763) 551-7600; email: tcf\_sales@tcf.com; website: [www.tcf.com](http://www.tcf.com).
				2. Source Limitations: Obtain plenum fans from a single manufacturer.
			2. PERFORMANCE REQUIREMENTS
				1. Fan Performance Ratings: [Project site elevation- based] [Sea level-based].
				2. AMCA Compliance: Provide units that bear the AMCA-Certified Ratings Seal.
				3. Compliance:

Classified under AMCA Standard 205.

Classified under UL 705.

* + - * 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70.
			1. PLENUM FANS
				1. Description: Belt - driven, plenum fan units, configured for horizontal flow of relatively clean air for Heating, Ventilating, and Air-Conditioning (HVAC) applications.

Basis of Design Product: **Twin City Fan & Blower, Model EPF**.

Permanently attach nameplate displaying serial number and unit information.

* + - * 1. Fan Capacities, Characteristics, and Configuration: Refer to Drawing schedule.
				2. Fan Wheel:

Wheel 24.5 inch (622 mm) Diameter and Smaller: Provide wheel with nine airfoil-shaped extruded aluminum blades, and non-tapered style blade retaining ring on inlet side. Fabricate hollow blade wheels with continuous welds around edges.

Specifier: For 27 inch (686 mm) wheels and larger, die formed steel blades are standard. Aluminum blades are optional.

Wheel 27 Inch Diameter and Larger: Provide wheel with nine airfoil-shaped [die formed steel] [extruded aluminum] blades, and non-tapered style blade retaining ring on inlet side. Fabricate hollow blade wheels with continuous welds around edges.

* + - * 1. Inlet Cone: Provide heavy-gauge, spun steel inlet cones that are closely matched to wheel intake rim.
				2. Housing: None.
				3. Fan Shaft: AISI 1040 or 1045 steel, turned, ground, polished and ring-gauged; keyed to wheel hub. Select shaft diameter so that maximum operating speed is higher than 143 percent of First Critical Speed.

Check shaft straightness with dial indicator after machining operations are complete. Straighten shaft as required.

* + - * 1. Bearings: Manufacturer's standard, self-aligning, field-lubricated spherical roller or adapter mounted ball bearings with pillow block mounting, based on fan size[, with grease lines extended to allow for lubrication while fan is operating].

Minimum L-10 Bearing Life: 80,000 hours at maximum operating speed, in accordance with ABMA 9 for Ball Bearings, or ABMA 11 for Roller Bearings.

* + - * 1. Belt Drives:

Drive Components: V-belt drive, rated for minimum 150 percent of motor nameplate horsepower, with machined, cast-iron pulleys, and heat resistant, oil resistant, static-free V-belts.

Motor 10 HP and Smaller: Adjustable pitch.

Motor 15 HP and Larger: Fixed pitch.

Motor and Drive Assembly: Resiliently mounted.

* + - * 1. Motor: 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."

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.

Motor Speed: [3,600] [1,800] [1,200] [900] rpm.

Enclosure Type: [Open, Drip Proof (ODP)] [Totally Enclosed Fan Cooled (TEFC)] [Explosion Proof (XP)].

Specifier: Select motor enclosure type in first following subparagraph.

Provide motors that comply with the Energy Independence and Security Act of 2007 (EISA).

Specifier: For motors controlled by VFDs, retain the following subparagraph.

When controlled with a Variable Frequency Drive (VFD), provide premium efficiency motors suitable for inverter duty use.

Specifier: Select motor electrical data in following subparagraphs, or show this data on the drawing fan schedule. Do not show the data in both places.

Electrical Data:

Voltage: [115] [208] [230] [277] [460] [575] [\_\_\_\_\_] V; [1] [3] phase; 60 Hz.

Full Load Amps: [\_\_\_\_\_] A.

* + - * 1. Motor Pedestal: Heavy-duty motor mounting platform.

Specifier: Retain paragraph and subparagraph below when isolation is required, and coordinate options with project design.

* + - * 1. Vibration Isolation:

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."

Specifier: Retain the following paragraphs for smaller sized fans only. Select options as required. Consult TCF for assistance.

For fans mounted directly to foundation, provide [spring] [neoprene-in-shear] vibration isolators, [and seismic restraints].

Spring Isolators: Select for [1 inch (25.4 mm)] [2 inch (51 mm)] deflection.

Specifier: Retain the following paragraphs if fan is to be mounted on a separate base.

Isolation Type Base:

Specifier: Select options as required.

Spring isolation base: Provide spring isolators [and seismic restraints] with [1 inch (25.4 mm)] [2 inch (51 mm)] deflection.

Inertia type base: Provide spring isolators [and seismic restraints] with [1 inch (25.4 mm)] [2 inch (51 mm)] deflection.

* + - * 1. Finishes:

After fabrication, deburr, clean and chemically pretreat metal parts by phosphatization.

Apply two coats of following finish:

Specifier: The first paragraph below is manufacturer's standard finish. Those that follow are optional finishes. Select finish that is required.

If fans specified for the project have different finishes, include the finish for each fan on the Drawings and delete here.

Air-dried enamel.

High-temperature aluminum paint.

Asphaltum.

Vinyl PVC.

Zinc.

Air-dried epoxy.

Synthetic resin, Santile 855.

Air-dried phenolic, Heresite VR 506.

Epoxy, Carboguard 890 series.

Phenolic epoxy, Plasite 7122L

Baked phenolic, Heresite P 413

Coal tar epoxy.

High-Build baked epoxy, Skotchkote 324.

* + - * 1. Accessories:

Specifier: Accessories listed in subparagraphs below are optional TCF features for this unit. Consult TCF representative for recommended options based upon Project requirements.

Specifier: When volume control is required, inlet vanes as described in the following paragraph are an economical option. Inlet vanes are not recommended on fans smaller than size 200 due to noise and performance loss.

Variable Inlet Vanes: Provide nested in fan inlet to allow air volume control, with manual or motorized operation. Support blades with fatigue-resistant steel shafts and two permanently lubricated needle roller bearings with lip seals, riding on zone-hardened surfaces. Weld vane bearing housings in position and stiffen with welded support ring.

Inlet Collar: Provide means for flex connecting on vertical arrangements.

Specifier: Select option for OSHA belt guard in the following paragraph. Retain paint color option when required.

Belt Guard, OSHA Type: Provide [OSHA type] [OSHA (E9-97) Quick Access] guard. [Paint belt guard yellow.]

Specifier: Select options in the following paragraph to require screens to protect the fan inlet, fan assembly, or both.

Inlet Safety Screen: Welded wire safety screens.

Protective Enclosure: Powder-coated, welded safety screens enclosing sides and back of the fan. Side panels to be removable to provide access to the wheel.

Specifier: Retain the following paragraph when the fan is controlled by a Variable Frequency Drive.

Shaft Grounding Ring: Provide conductive ring to stay in continuous contact with motor shaft to collect stray currents and shunt them to frame ground.

Specifier: When sound control is critical, select the following subparagraphs that describe the optional Aero Acoustic Diffuser™, which reduces fan sound power level. The Aero Acoustic Diffuser™ is available on all E-Series plenum fan sizes, both direct drive and belt drive.

Aero Acoustic Diffuser™ Provide to reduce discharge sound power level by up to 3 dBA while increasing aerodynamic static efficiency by up to 4 percent.

Fabricate of galvanized steel that mounts at front and back of fan wheel. Include acoustic attenuating material inserted within solid housing and perforated frontplate that directs airflow across diffuser.

Provide mounting brackets constructed of galvanized steel mount directly to framework allowing for mounting within existing fan framework.

Provide diffuser [factory mounted] [as retrofit kit for existing fans].

Specifier: Where flow measurement is required, retain following subparagraph. This ring sensor can be used with instrumentation provided by Twin City Fans, or instrumentation provided as the work of a separate contract.

The standard material for pressure sensor tubing is nylon, with optional copper.

Piezometer Ring: Provide piezometer ring type differential pressure sensor with [nylon] [copper] tubing to connections for field-installed flow measuring instrumentation.

Pressure Transducer without Display: Provide piezometer ring and transducer to convert differential pressure readings to 4-20 mA DC signal proportional to flow.

Specifier: When required, retain enclosure option in following paragraph.

Pressure Transducer/Transmitter with Display [Panel Mounted] [NEMA 4X Enclosure]: Provide piezometer ring and transducer with local digital display to convert differential pressure readings to 4-20 mA DC signal proportional to flow. Program digital display to show fan flow in cubic feet per minute (cfm). Include two independently adjustable SPDT dry-contact outputs. [Mount pressure transducer/transmitter inside NEMA 4 enclosure.]

Aluminum Frame and Pedestal: Continuously welded construction.

Stainless steel nameplate. Attach to fan frame.

Specifier: Retain the following paragraph when OSHPD Seismic Certification is required for the project

Available accessories when OSHPD Seismic Certification is required are limited to the following:

Round Inlet Collar • Extended Life Bearings

Extended Lube Lines • Aero Acoustic Diffuser

Piezometer Ring • Pressure Transducer/Transmitter

Shaft Grounding Ring • Inlet Screen

Protective Enclosure • Stainless Steel Nameplate

Thrust Restraint Bracket

Belt Guard: OSHA type, Quick Access

OSHPD Seismic Certification: Provide unit construction compliant with California’s Office of Statewide Health Planning and Development seismic certification of equipment and components.

The Design will be in Accordance with ASCE 7-10 Chapter 13.

Specifier: Retain Paragraph B for Arrangement 3 fans. Retain Paragraph C for Arrangement 3HA, 3VA Fans.

Fan will include a 1” Isolation base with seismic spring isolators.

Fan will be mounted to seismic spring isolators.

* + - 1. SOURCE QUALITY CONTROL
				1. Factory Run Test: Test run assembled fan units prior to shipment at specified operating speed or maximum RPM allowed. Statically and dynamically balance each wheel in accordance with AMCA 204 "Balance Quality and Vibration Levels for Fans" to Fan Application Category BV-3, Balance Quality Grade G6.3. Obtain balance readings by electronic equipment in the axial, vertical, and horizontal directions on each set of bearings.

Submit report of factory run test.

1. EXECUTION
	* + 1. EXAMINATION
				1. 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.
			2. PROTECTION
				1. Protect adjacent construction and finished surfaces during installation and testing.
				2. Except for operational testing, do not operate fan during construction.
			3. INSTALLATION
				1. Install fans in accordance with Contract documents and manufacturer's published instructions.

Specifier: Insert applicable installation requirements for vibration, seismic, and high wind design if applicable to installation.

* + - * 1. Install fan units with adequate clearances for service and maintenance.

Specifier: Coordinate duct installation and specialty arrangements with schematics on Drawings and with requirements specified in duct systems. If Drawings are explicit enough, these requirements may be reduced or omitted.

* + - * 1. Electrical Connections: Connect wiring in accordance with NFPA 70 and Division 26 section "Low-Voltage Electrical Power Conductors and Cables."

Ground and bond equipment according to Division 26 section "Grounding and Bonding for Electrical Systems."

* + - * 1. Equipment Identification: Label units according to Division 23 section "Identification for HVAC Piping and Equipment."
			1. FIELD QUALITY CONTROL

Specifier: Select option in paragraph below to define the party responsible for final tests and inspections to be performed.

* + - * 1. [Owner will retain] [Contractor shall retain] qualified testing agency to perform field tests and inspections.

Specifier: Retain first paragraph below to describe tests and inspections to be performed.

* + - * 1. Tests and Inspections:

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.

Verify that cleaning and adjusting are complete.

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.

Verify that manual and automatic volume control, and fire and smoke dampers in connected ductwork systems are in fully open position.

Disable automatic temperature-control actuators, energize motor, adjust fan to indicated rpm, and measure and record motor voltage and amperage.

Shut unit down and reconnect automatic temperature-control actuators.

Remove and replace malfunctioning units and retest as specified above.

* + - * 1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
				2. Submit test and inspection reports.
			1. ADJUSTING AND CLEANING
				1. Adjust, clean, and maintain installed fan units in accordance with manufacturer's published instructions.

END OF SECTION