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**Twin City Fan & Blower Guide Specification
Tubeaxial HVAC Fans: Model TCTS, Belt Driven**

**Twin City Fan & Blower Model TCTS Series, Fixed Pitch Steel Wheel Tubeaxial Fans**, allow for efficient operation at any point on the fan curve, while affording the ability to rebalance the fan delivery and maintain efficient operation by manually adjusting the adjustable pitch sheave or by replacing the fixed pitch sheave. Model TCTS fans offer superior air and sound performance and are UL/cUL 705 listed for electrical.

Model TCTS is available in belt driven configurations. Model TCTS fans mount both vertically and horizontally, allowing for numerous applications with multiple mounting arrangements.

**Application**

The TCTS Fixed Pitch Steel Wheel Tubeaxial Fan is designed for where it is advantageous to have the motor out of the airstream due to the presence of corrosive or hazardous fumes, or dirt-laden, hot, or moist air. Standard fan configuration is suitable for a maximum temperature of 200°F (93°C), with optional configurations suitable for temperatures up to 300°F (149°C).

Sizes (wheel diameters): 12 to 54 inches (305 mm to 1,245 mm)

Airflow: Up to 80,000 CFM (135,918 m3/hour)

Static Pressure: Up to 4 inches wg (994 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 accredited testing lab.

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 13.01 – TUBEAXIAL HVAC FANS

1. GENERAL
	* + 1. SUMMARY
				1. Section includes belt driven fixed pitch tubeaxial fans.
			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 210 -  ASHRAE 51 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating

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

* + - * 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. Underwriters Laboratories, Inc. / Underwriters Laboratories of Canada (UL/cUL): [www.ul.com](http://www.ul.com):

UL/cUL 705 - Standard for Power Ventilators

* + - 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 sound power levels in eight octave bands and, A-weighted overall 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.

* + - 1. COORDINATION
				1. Coordinate sizes and locations of supports required for fan units.
				2. Coordinate sizes and locations of equipment supports, roof curbs, and roof penetrations.
			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 tubeaxial fans from a single manufacturer.
			2. PERFORMANCE REQUIREMENTS
				1. Fan Performance Ratings: [Project site elevation- based] [Sea level elevation-based].

Specifier: When required, retain the following paragraph.

* + - * 1. Compliance: Provide units that comply with requirements of UL 705.
				2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70.
			1. AXIAL FLOW FANS
				1. Belt-driven fixed pitch tubeaxial fans, configured for horizontal or vertical flow of relatively clean air for Heating, Ventilating, and Air-Conditioning (HVAC) applications, for air containing dirt, moisture, or hazardous fumes, or for air at elevated temperatures.

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

Permanently attach nameplate displaying serial number and unit information.

* + - * 1. Fan Capacities, Characteristics, and Configuration: Refer to Drawing schedule.
				2. Fan Wheel: Fabricate from die-formed stamped steel blades of single-surface airfoil shape welded to a spun steel central hub. Ensure precise blade attachment through use of welding jigs and fixtures.

Fabricate wheel with factory-set blade angles ranging from 30 to 50 degrees.

Hub Attachment to Shaft: Attach hub to drilled and tapped, stepped shaft with retaining washer.

Maintain blade tip clearance within tolerance to conform to certified performance.

Statically and dynamically balance wheel when fabricated, and again after fan unit has been assembled.

Specifier: Standard operating temperature in the following paragraph is 200 deg. F, but 300 deg. F is optional.

Maximum Operating Temperature: [200 deg. F (93 deg. C)] [300 deg. F (149 deg. C)].

* + - * 1. Fan Shaft: AISI 1045 steel, turned, ground, and polished steel. Select shaft diameter so that First Critical Speed is minimum 1.43 times maximum operating speed. Finish with petroleum based rust protectant.
				2. Bearings: Manufacturer's standard, self-aligning, field-lubricated pillow block ball or roller bearings, based on fan size and mounting orientation, with grease lines extended to outside fan housing.

Minimum L-50 Bearing Life: 200,000 hours at maximum operating speed, in accordance with AFBMA 9 for Ball Bearings, or AFBMA 11 for Roller Bearings.

* + - * 1. Belt Drives:

Specifier: In the following paragraph, select 120 option for motors up to 25 hp, and 150 option for motors 30 hp and larger.

Drive Components: V-belt drive, rated for minimum [120] [150] percent of motor nameplate horsepower, with machined, cast-iron pulleys, and heat resistant, oil resistant, conductive, static-free V-belts. Provide belt guard or motor cover to shield drives.

Motor 10 HP and Smaller: Adjustable pitch.

Motor Larger than 10 HP: Fixed pitch.

Motor and Drive Assembly: Rigidly mounted to fan structure.

Provide aerodynamically shaped belt fairing tubes to isolate drive components from airstream. Continuously weld tubes where they penetrate inner cylinder and outer housing.

Inner Cylinder: Isolated shaft and bearing assembly from high velocity airstream.

Specifier: Retain first following subparagraph for indoor fans. Retain second following subparagraph for outdoor fans, if required.

Belt Guard: Steel, totally enclosed and sealed.

Outdoor Weather Cover: Provide bolt-on steel weather cover to shield motor and belt-drive from weather. Fabricate with rainproof ventilation slots.

* + - * 1. 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."

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.

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.

Specifier: Select either 60 Hz or 50 Hz electrical data from the following subparagraphs. Do not mix voltages between 50 Hz and 60 Hz paragraphs.

Electrical Data:

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

Specifier: Select motor enclosure type in following subparagraph.

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

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

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

When required, provide premium efficiency motor, suitable for inverter duty, for motors controlled by Variable Frequency Drive (VFD).

Specifier: If factory disconnect is required, select NEMA enclosure rating in following paragraph, and select one subparagraph below to specify factory or field mounting. Retain second subparagraph when NEMA 7/9 (explosion proof) option is selected.

Provide unfused disconnect switch, NEMA [1] [3R] [4] [4X] [7/9 explosion proof], selected in accordance with Division 26 section "Enclosed Switches."

Factory mount and wire disconnect switch.

Ship disconnect switch loose for field mounting and wiring.

* + - * 1. Motor Mounting Platform: Heavy-duty motor mounting platform allows adjustment of drive belt tension. Provide standard locations around fan unit circumference for placement of motor mounting platform.
				2. Vibration Isolation:

Specifier: Retain paragraph and subparagraph below, and coordinate options with project design.

Provide [spring] [neoprene-in-shear] vibration isolators, [and seismic restraints] in accordance with fan manufacturer's requirements, and Division 23, Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

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

* + - * 1. Finishes:

Do not apply coatings to aluminum components/

After fabrication, clean and chemically pretreat ferrous 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 dry enamel.

Carbocoat 30

Hot Dip Galvanizing.

Plasite 4310 Vinyl Ester

Plasite 7122L Air Dry Phenolic

Heresite VR506 Air Dry Phenolic.

Dupont ASA, 70 Gray polyester.

* + - * 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: Retain first following subparagraph for indoor fans. Retain second following subparagraph for outdoor fans, if required.

Belt Guard: Steel, totally enclosed and non-sealed. [Paint belt guard yellow.]

Weather Cover: Provide [hinged] [bolt-on] steel weather cover to shield motor and belt-drive from weather. Fabricate with rainproof ventilation slots.

Inlet or Outlet Safety Screen: Welded wire safety screens fabricated for easy installation and removal.

Clamshell Housing: Fabricate housing in two halves that mate together with bolted connections. Fabricate unit such that all internal components are accessible when clamshell housing is removed.

Swingout Construction: Only available on vertical discharge configurations, provides complete access to the propeller for maintenance, cleaning and inspection and removal without the ductwork having to be removed. Inner cylinder is not split.

High Temperature Construction: Fans modified to operate with airstream temperatures between 201°F (94oC) and 300°F (149oC) continuous. Modifications include reverse flow configuration: Reversing the belt tube, lengthening the inner shell, and adding a thrust washer retaining bolt.

Specifier: Following paragraph cannot be used in conjunction with high temperature modification.

High Moisture Construction: For use on applications where steam or condensation may collect in the fan housing.

Access Door - General Observation: Bolted door located adjacent to the motor base.

Access Door - General Wheel Area: Bolted door located adjacent to the fan wheel.

Shaft seal, including non-asbestos rubbing ring and metal cover plate, to limit airstream infiltration.

Slip-on companion flanges that match fan flanges for making connections to ductwork.

Discharge Cap: Provide steel stack cap with gravity operated butterfly dampers at fan discharge. Include gasket and pre-punched flange holes to enable bolted connection to fan outlet. Finish with manufacturer's standard paint.

Retain first paragraph below for roof mounted units only.

Curb Cap: Welded steel, one-piece, weather-tight construction, to adapt from square roof curb to round fan inlet. Fabricate from steel and include pre-punched flange to mate with fan unit inlet flange.

Roof Curb: 12 inch high canted, galvanized with 1-1/2 inch thick insulation. Available on VRM discharge only.

Provide anti-static shaft grounding blocks to protect motor bearings by draining stray currents to ground.

Inlet/Outlet Cone: Cones can be provided to adapt from the fan diameter to the adjacent duct diameter. Cones are flanged and drilled to mate up to the fan flange.

Inlet Bell: Provide spun steel inlet bell with pre-punched flange holes to enable bolted connection to fan inlet. Finish with manufacturer's standard paint.

Variable Inlet Vanes: [Automatic] [Manual] operation vanes designed for flange mounting on the fan inlet with vane mechanism outside of the airstream and controlled by a single van lever.

* + - 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. 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."

Install connecting ducts with adequate clearances for service and maintenance.

* + - * 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