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**Twin City Fan & Blower Guide Specification
Inline Mixed Flow Smoke and Heat Fans: Model QSLSH, Belt Driven**

**Twin City Fan & Blower Model QSLSH Series Mixed Flow Fans** combine the benefits of axial flow and centrifugal flow fans. The QSLSH Mixed Flow Fans have the advantage of compact design and straight-through airflow as well as the preferred acoustic characteristics and high pressure capability. QSLSH fans offer superior air and sound performance and the AMCA certified rating seal for air and sound.

Mixed flow fans offer the economy of operation with a higher and broader efficiency range. The lower operating speed for a given performance provides longer and more reliable operation.

Model QSLSH is similar to the QSL but is specifically designed for smoke control applications. UL/cUL listed for smoke control systems for 500 deg. F (260 deg. C) for 4 hours or 1,000 deg. F (538 deg. C) for 15 minutes. Model QSLSH is available in belt driven configuration and mounts both vertically and horizontally, allowing for numerous applications with multiple mounting arrangements.

**Application**

Mixed flow fans are becoming a popular choice on many air supply, return, general and grease-laden exhaust and laboratory exhaust applications in the HVAC industry for both constant and variable air volume systems. The efficiency and sound characteristics of the mixed flow fans are often desired in buildings such as hospitals, libraries, theaters, and general offices. The Twin City Fan heavy-duty construction of QSLSH fans also make them suitable for many applications handling smoke and high temperature ambient air. Applications involving fumes, spray booth exhaust, particulate, heavy moisture content, or high temperature should be discussed with the factory for possible product modifications.

Sizes (wheel diameters): 18.25 to 89.00 inches (464 mm to 2,261 mm)

Airflow: Up to 160,000 CFM (271,837 m3/hour)

Static Pressure: Up to 8 inches wg (1,987 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.

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 13.03 – MIXED FLOW HVAC FANS

1. GENERAL
	* + 1. SUMMARY
				1. Section includes inline mixed flow fans, belt-driven, for smoke control applications.
			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)

MG 1 – Motors and Generators

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

NFPA 70 - National Electric Code

NFPA 92 - Standard for Smoke Control Systems

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

OSHPD Special Seismic Certification Preapproval OSP-0271-10

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

* + - * 1. Underwriters Laboratories, Inc. (UL): [www.ul.com](http://www.ul.com):

UL 705 - Standard for Power Ventilators

UL 793 - Standard for Automatically Operated Roof Vents for Smoke and Heat

* + - 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.

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 Publication 311 (sound performance).

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, [vibration isolation mounts] [seismic mounts and restraints].
			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 Twin City Fan & Blower 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 mixed flow 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.

Listed in accordance with UL 705.

UL/cUL listed for operation for 4 hours at 500 deg. F (260 deg. C).

UL/cUL listed for operation for 15 minutes at 1,000 deg. F (538 deg. C).

Listed in accordance with UL/cUL 793.

* + - * 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70.
			1. MIXED FLOW FANS
				1. Belt - Driven, Mixed Flow Fans: Tubular fan units, configured for horizontal or vertical flow of relatively clean air for Heating, Ventilating, and Air-Conditioning (HVAC) applications.

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

Permanently attach nameplate displaying serial number and unit information.

Specifier: If only one fan type is specified, retain appropriate subparagraph below. If two or more fan types are required, include configuration data in the Fan Schedule on the Drawings, and delete the following paragraph and its subparagraphs.

* + - * 1. Configuration:

Horizontal, Base-Mounted (HBM): Provide support leg bracket at each end of fan, for floor mounting.

Horizontal, Ceiling-Hung (HCH): Provide four welded hanger clips for support from above with hanger rods.

Horizontal, No Mounting Brackets (HOR):

Vertical, Roof-Mounted (VRM). Include discharge cap with gravity-type butterfly dampers that close when fan is not running. Comply with UL 793 snow load requirements for butterfly dampers.

Vertical, Discharge Up, Floor Mount Bracket at Inlet (VUI).

Vertical, Discharge Up, Ceiling Hung Bracket at Outlet (VUO).

Vertical, Discharge Up, No Brackets (VUN).

* + - * 1. Fan Wheel Impeller: Double-surface, hollow, die-formed steel construction with true airfoil profile, and continuously welded seams. Statically and dynamically balance wheel when fabricated, and again after fan unit has been assembled.

Maximum Operating Temperature: 500 deg. F (238 deg. C) for four hours, 1,000 deg. F for 15 minutes.

Provide wheel with cooling fins to draw air across fan shaft and bearings.

* + - * 1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub. Select shaft diameter so that maximum operating speed is lower than 70 percent of First Critical Speed.
				2. 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.

Minimum L-10 Bearing Life: 40,000 hours at maximum operating speed, in accordance with ABMA 9 for Ball Bearings, or ABMA 11 for Roller Bearings.

* + - * 1. Housing: Heavy-gauge steel with continuously welded seams. Provide punched inlet and outlet flanges.

Specifier: In following subparagraph, a bolted access door is standard. A quick open latched access door is optional.

[Bolted] [Quick Open Latched] Access Door.

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

* + - * 1. Inner Cylinder: Steel, rigidly constructed to support fan shaft and bearings, with removable discharge cone.

Specifier: To allow for fan shaft, bearing, and sheave service, design duct access door adjacent to discharge end of fan.

Design fan to allow for servicing fan shaft, bearings, [and sheave] by removing discharge cone.

* + - * 1. Straightening Vanes: Steel, aerodynamically designed to recover velocity pressure and convert it to static pressure in downstream ductwork.

Specifier: Retain paragraph and subparagraphs below for belt-driven units only.

* + - * 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. Provide pulleys with minimum two belt configuration.

Motor 10 hp and Smaller: Adjustable pitch.

Motor 15 hp and Larger: Fixed pitch.

Specifier: Retain one of the two following paragraphs, depending on whether it is necessary to shield the drive belts from the airstream.

Motor and Drive Assembly: Rigidly mounted and isolated from airstream. Provide belt shield tubes.

Specifier: Retain first following subparagraph for indoor fans. Retain second following subparagraph for outdoor fans, if required. Weather cover is available in hinged or bolt-on configurations.

Belt Guard: Steel, totally enclosed and non-sealed.

[Hinged] Outdoor Weather Cover: Provide [hinged] 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.

Electrical Data:

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

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

Specifier: Select motor enclosure type in first following subparagraph. For motors controlled by VFDs, retain second following subparagraph.

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

Provide premium efficiency motor, suitable for inverter duty.

Specifier: If factory disconnect is required, select NEMA enclosure rating in following paragraph, and select one subparagraph below to specify factory or field mounting.

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

Ship disconnect switch loose for field mounting and wiring.

Factory mount and wire disconnect switch.

Specifier: Retain paragraph below for belt-driven units only.

* + - * 1. Motor Mounting Platform: Heavy-duty motor mounting platform that pivots to allow adjustment of drive belt tension. Provide eight 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:

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.

Belt Guard Painted Yellow

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

Fusible Link: Holds butterfly dampers on discharge cap open until fusible link melts at 165 deg. F (74 deg. C).

Magnetic Damper Latches: Provide where required to keep dampers closed while fan is not running.

Roof Curb: Minimum 12 inches (300 mm) high, unvented, with 1-1/2 inch (38 mm) thick insulation.

Specifier: Retain following paragraphs below for roof mounted units only.

Curb Cap: One-piece, weather-tight construction, pre-punched mounting holes for correct attachment to roof curb. Fabricate from steel and include flange to mate with fan unit inlet flange.

Discharge Cap: Provide [steel] [aluminum] discharge cap with integral butterfly damper flaps operated by fan flow.

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.

Piezometer Ring: Provide piezometer ring type differential pressure sensor with nylon 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.]

Thrust Restraint: Provide thrust restraint support member when fan is horizontally mounted and not anchored to building structure.

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:

• Belt Guard • Belt Tube

• High Temperature Package • Shaft Seal-std. type

• Piezometer Ring • Painted Finish

• Stainless Steel Construction • Bolted Access Door

• Two Groove Drive – Minimum • UL Listed Smoke Control

• Flange: Inlet, Outlet; Punched, Unpunched

• Weather Cover: Std. Type, Hinged type

• Outlet Screen: Aluminum, Carbon steel, Stainless Steel

• Extended Lube Lines: Std. type, Copper

• Disconnect Switch: NEMA 1, NEMA 3R, NEMA 4X

• Spark Resistant Construction: A, B, C

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.

Fan will be mounted to seismic spring isolators.

* + - * 1. Fan Capacities and Characteristics: Refer to Drawing schedule.
			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 ANSI/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."
				2. 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
				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.

Specifier: Retain option in following paragraph for belt driven units. Otherwise, delete option.

[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