HIGH VELOCITY FUME EXHAUST FANS

Model TFE | Model QFE, Belt Driven
Twin City Fan & Blower offers specially modified versions of the TSL and QSL fans designated as TFE and QFE for laboratory fume hood exhaust applications, available in sizes 90 through 542.

The TFE and QFE fume exhaust fans consist of a vertically mounted tubular inline fan with a reinforced curb cab and discharge cap. The discharge cap includes an outlet venturi nozzle, increasing the outlet velocity to meet stringent roof exhaust requirements and maximize the over-all plume height of the laboratory exhaust.

TFE and QFE fans include a heavy-duty curb cap as standard. An optional modular mixing plenum box provides additional bypass air and the capability of multi-fan systems and future expandability.

Models TFE and QFE offer a wide range of nozzle sizes for each fan size to effectively accelerate the exhaust stream based on the specific building exhaust needs.

**Benefits of Model TFE and QFE**

Twin City Fan & Blower Models TFE and QFE are ideally suited for applications such as high schools and elementary schools with intermittent use due to the positive shut-off damper at the outlet of the venturi nozzle. The positive shut-off damper seals the interior of the fan off completely from the elements, giving complete rain protection even when the fan is not running! Model TFE and QFE are also an ideal choice for laboratories and universities requiring continuous use, but do not require the high-dilution of an induced flow fan.

**Sizes**

TFE: 10.5" to 54.25" wheel diameters  
QFE: 12.25" to 66.0" wheel diameters

**Performance**

Airflow to 55,000 CFM  
Static pressure to 7" w.g.

**Drive Configurations**

Available in belt drive, arrangement 9 configuration only

**Construction**

Class I & II

Model TFE is available with UL/cUL 705 listing, for electrical, File No. E158680.
**Model TFE & QFE**

**Inline Fume Exhaust Fans**

**Application**
The TFE & QFE High Velocity Exhaust Fans are intended for use in exhausting laboratory fumes and hazardous chemicals in such a manner that diminishes the likelihood of concentrated, contaminant-laden air from being re-entrained into the building’s intake or makeup air. These units are commonly used in exhaust systems for universities, schools, hospitals, research facilities, laboratories, restaurants and waste water treatment plants.

High Velocity Exhaust Fans exhaust contaminated air at the outlet at a higher outlet velocity. This increases the plume height of the fan without a tall stack.

**Wheel Design**
Model TFE fans utilize a centrifugal wheel design with single-thickness or airfoil blades. Model QFE utilizes a high efficiency mixed-flow wheel design with single-thickness or airfoil blades. Both the TFE and QFE fan impellers are designed for a stable air performance throughout the operation range. The impellers are statically and dynamically balanced prior to assembly by Twin City Fan & Blower.

**Standard Product Features**
- **Wheel:**
  - TFE (U.S. Patent 5171128)
    - Centrifugal wheel with either single thickness backwardly inclined blades or airfoil blades (size dependent)
    - Wheel diameters from 10.5" to 54.25"
  - QFE
    - Mixed flow wheel with either single thickness or airfoil blades (size dependent)
    - Wheel diameters from 12.25" to 66.0"
- Heavy duty coated steel curb cap
- Integrated windband
- Nozzle sizes ranging from 4" diameter to 60" diameter
- Positive shut-off backdraft damper
- Bolted access door
- Shaft seal
- Weather cover
- Housing drain
- 125 mph windload capability when mounted on Twin City Fan & Blower supplied roof curb

**Optional Features**
- Mixing plenum box
- Bypass damper
- Isolation damper
- AMCA “B” or “C” spark resistant construction
- Internal belt guard
- Special coatings
- Special materials of construction
- Stack extension

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**Fume Exhaust Definitions**

**Bypass Air**
Ambient air that is drawn through the bypass air plenum and mixed with the lab exhaust to increase dilution and plume rise. Bypass air is primarily used in variable volume applications to maintain a constant discharge volume.

**Fume Exhaust**
Caustic or noxious air that is being exhausted from laboratory or fume hood.

**Nozzle**
Device located internal to the fan windband, causing the fume exhaust air to accelerate upon entrance to the windband. A wide range of nozzles from 4" in diameter to 60" in diameter is available to provide a wide range of high outlet velocities. Each nozzle provides different flow characteristics. Nozzle should be selected based on the application requirements.

**Plume Rise**
The height of the fume exhaust and bypass air above the discharge of the windband.

**Plume Height**
Overall height of the discharge plume rise, plus the added height of the exhaust system above the roof-deck level. (See diagram below).

**Total Airflow**
The total airflow exiting the windband, including fume exhaust and bypass air.

**Windband**
Device used to direct the fume exhaust and allow the plume to properly develop as it leaves the housing of the exhaust fan.

\[
\begin{align*}
Q_B &= \text{Bypass Flow} \\
Q_F &= \text{Fan Flow} \\
Q_L &= \text{Laboratory Flow (Contaminated Air)} \\
Q_T &= \text{Total Flow} \\
Q_T &= Q_F = Q_B + Q_L
\end{align*}
\]
Plume Height Calculation

\[ h_e = h_r + h_s^* \]

\[ h_e = [3.0 \times (V \times d/U)] + h_s \]

- \( h_e \) = Effective plume height (ft)
- \( h_r \) = Plume rise (ft)
- \( h_s \) = Stack height (height from roof to outlet of windband) (ft)
- \( V \) = Windband exit velocity (ft/min)
- \( d \) = Windband outlet diameter (ft)
- \( U \) = Crosswind speed (ft/min)

Note: Plume height calculations are typically calculated with a 10 mph (880 ft/min) crosswind.

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Construction Features

Housing
All fans are constructed of heavy-gauge steel and continuously welded for strength and rigidity. All TFE & QFE fans are provided with punched inlet and outlet flanges as standard.

Straightening Vanes
Straightening vanes convert tangential velocity pressure into useful static pressure, reducing turbulence and increasing efficiency. Extensive testing of various shapes and locations has resulted in the most efficient aerodynamic design of the straightening vanes.

Windband
Windbands designed to maximize plume height. Constructed of heavy-gauge steel for strength and rigidity, the windband is mounted directly to the fan housing.

Weather Cover
Weather covers completely enclose the motor and V-belt drive from the elements. Provided with slots for ventilation, covers are easily removable for inspection and maintenance.

Curb Cap
Attached to the fan’s inlet flange for curb mounting. Standard accessory on TFE & QFE without mixing plenum box.

Extended Lube Lines
Allow for ease of lubrication on all sizes.

Stainless Steel Hardware
Corrosion resistant stainless steel hardware is standard.

Bearings
Standard bearings are selected to exceed the L-10 life of 200,000 hours at the maximum operating speed.

Drives
Cast iron, adjustable or fixed pitch drives are selected for at least 200% of motor horsepower. Adjustable sheaves are provided on motors up to 10 HP, fixed sheaves for 15 HP and above.

V-belt drives with motors and drives mounted by Twin City Fan & Blower are set to the required RPM and test run as a complete assembly and rechecked for balance.

Sealed Belt Tube
A sealed belt tube encloses the belts and drive components, protecting them from the airstream.

Motor Mounting Platform
A heavy-duty motor mounting platform pivots to offer easy and positive adjustment of belt tension.

Inner Cylinder
The inner tube is rigidly constructed to support the shaft and bearings. The removable discharge cone provides full access to the shaft, bearings, and fan sheave.

Drain
A drain coupling welded to the lowest point of the housing allows drainage of condensate from fan housing.

Bolted Access Door
Wheel area access door for inspection or cleaning of the wheel.

Shaft Seal
To limit the air entering the inner cylinder and avoid contact of airstream contaminants with the bearings and V-belt drive. Consists of a Teflon wear pad/plate and a rubber check seal at the wheel end of the inner cylinder. Please note that a shaft seal does not make the inner cylinder gas tight.
**Mixing Plenum Box**
Designed to handle windloads up to 125 mph, the mixing plenum box features modular construction allowing for multiple configurations and effortless retrofitting. Bottom intake is standard, side intake option available upon request.

**Disconnect Switches**
A NEMA 1, 3R, 4 or 7/9 safety disconnect switch is available for positive electrical shutoff of the fan and the protection of service personnel. Disconnects are available shipped loose for field mounting and wiring or factory mounted and wired, excluding NEMA 7/9 disconnects.

**Vortex Breaker**
Installed in the mixing plenum box at the fan inlet, the vortex breaker minimizes air ‘swirl’. Recommended for side intake or multi-fan configurations.

**Isolation Damper**
Standard isolation dampers, constructed of heavy duty galvanized steel, are typically used on multi-fan mixing plenum boxes to isolate individual fans. The isolation damper can be supplied with an automatic operator. Controls are not included.

**Stack Extension**
Additional spool section can be provided to reach a minimum 10 foot stack height above the roof line.

**Bypass Damper**
Used to maintain outlet velocities by allowing a constant volume at the fan discharge when exhaust air is reduced. The bypass damper can be supplied with an automatic operator. Controls are not included.

**Spark Resistant Construction**
Various grades of spark resistance are as dictated by AMCA.

**Roof Curb**
Standard roof curbs are 12” high and are constructed of heavy duty galvanized steel and include 1½” thick insulation. Contact factory for other roof curb options. Note: 125 mph windload ratings require a Twin City Fan & Blower supplied roof curb.

**UL/cUL Listing**
Model TFE and QFE are available with UL/cUL 705 listing for electrical when supplied with specific motors.

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**Mounting Configurations**

Unique applications require unique configurations. With the Twin City Fan & Blower Modular Mixing Box, multiple configurations are able to be easily created and retrofitted.
### Table 1. QFE Maximum RPM, Wheel Weights, and WR² (Moment of Inertia)

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QFE

'NH' NUMBER OF 'DH' DIA. HOLES ON 'CB'
DIA. B.C. EQUALLY SPACED STRADDLING CENTER LINE

MOTOR 'FR'
MAX. MTR.

1. Standard QFE fan includes weather cover, access door and shaft seal.
2. Optional stack section can be added to increase overall height.
3. Standard curb height is 12", available 18" and 8".

**NOTES:**

**TABLE:**

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**DIMENSIONS SUBJECT TO CHANGE. CERTIFIED DRAWINGS AVAILABLE UPON REQUEST.**
NOTES:
1. Standard TFE fan includes weather cover, access door and shaft seal.
2. Optional stack section can be added to increase overall height.
3. Standard curb height is 12", available 18" and 8".

Dimensions subject to change. Certified drawings available upon request.
Model TFE & QFE High Velocity Fume Exhaust Fan, where indicated on drawings and schedules, shall be of the non-overloading design, and shall be of the size and capacity as indicated in the fan schedule. High Velocity Fume Exhaust Fans shall be as manufactured by Twin City Fan and Blower, Minneapolis, Minnesota.

Fans shall be designed for maximum efficiency. Fans shall have a sharply rising pressure characteristic extending through the operating range and continuing to rise well beyond the efficiency peak to assure quiet and stable operation under all conditions. Horsepower characteristics shall be truly self-limiting and shall reach a peak in the normal selection area.

**PERFORMANCE** — Fans shall be tested in accordance with AMCA test codes for air moving devices and shall be guaranteed by the manufacturer to deliver rated published performance levels. Models TFE & QFE shall be UL/cUL 705 listed for electrical.

**HOUSING** — Housings shall be cylindrical and welded steel throughout. Inlets shall be fully streamlined. Housings shall be suitably braced to prevent vibration or pulsation. Totally enclosed weather cover shall enclose motor and V-belt drives. Punched inlet flange shall be equipped for curb cap or mixing plenum box mounting. Extended lube lines shall be provided for ease of lubrication. Models TFE & QFE shall include outlet nozzle, windband, heavy duty coated steel curb cap, access door, shaft seal and weather cover, and a sealed belt tube for the protection of belts and drive components from the airstream.

**WHEEL** — Fan wheels shall have die-formed blades designed for maximum efficiency, and quiet and stable operation. Blades shall be continuously welded to the back plate and wheel cone. Wheels shall be statically and dynamically balanced and the complete fan assembly including motor and drive shall be test balanced at or near the operating speed at the factory prior to shipment.

**SHAFT** — Shafts shall be AISI 1040 or 1045 hot rolled steel, accurately turned, ground, polished, and ring gauged for accuracy. Shafts shall be sized for the first critical speed of at least 1.43 times the maximum speed.

**BEARINGS** — Bearings shall be heavy duty, grease lubricated, anti-friction ball or roller, self-aligning, pillow block type and selected for a minimum L-10 life of 200,000 hours at the maximum fan RPM. Bearings shall be equipped with extended lubrication lines with grease fittings outside of the fan housing.

**DRIVE** — Motor sheaves shall be cast iron, variable pitch on applications 10 HP and smaller, and fixed pitch on 15 HP and larger. Drives shall be sized for at least 200% of motor horsepower.

**CURB CAP** — A heavy-duty, coated steel or galvanized curb cap shall be included to provide for a weather-tight transition between the roof curb and the fan.

**NOZZLE AND WINDBAND** — A nozzle and windband combination shall be provided to efficiently increase discharge velocities to be a recommended minimum of 3,000 FPM without significantly affecting BHP requirements.

**WEATHER COVER** — A raintight, easily removable weather cover shall be provided to completely enclose the motor and exposed parts of the V-belt drive.

**OPTIONAL ACCESSORIES** — Where required the fans shall be provided with:

- AMCA “B” or “C” spark resistant construction
- Modular mixing plenum box
- Bypass damper with actuator
- Isolation damper with actuator
- Disconnect switches
- Roof curb
- Vortex breaker
- Special coatings (Epoxy, Air-Dry Phenolic, Synthetic Resin) on airstream parts or entire unit
- Special materials of construction
- Stack extension to reach 10 feet from roof line

**SUBMITTALS** — Submittals for approval of equipment shall include copies of outline drawings, AMCA Certified Ratings, and percentage pressure-volume performance curves showing point of operation.

**GUARANTEE** — The manufacturer shall guarantee the workmanship and materials for its TFE & QFE High Velocity Fume Exhaust Fans for three (3) years from shipment.