



INDUSTRIAL PROCESS AND
COMMERCIAL VENTILATION SYSTEMS

MIXED FLOW INDUCED FLOW EXHAUST FANS

Model TVIFE, Direct Drive



**AMCA 260
TESTED**



Overview

TVIFE



TVIFE
Single Unit



TVIFE
Dual Unit

Twin City Fan & Blower offers the latest innovation in direct drive, induced flow exhaust fans. The TVIFE dramatically improves upon the conventional bifurcated design for direct drive fume exhaust fans with its patented Turbo-Vane™ design (U.S. Patent 8758101).

Available in twenty-two (22) sizes, 90 through 542, the TVIFE consists of a direct drive, vertically mounted mixed flow fan with one of three (3) different nozzles and specially designed windband to maximize dilution ratio (overall outlet volume/lab outlet volume) and exhaust plume height.

A revolutionary housing design integrates multiple vanes open to the exterior of the fan to allow for motor cooling and additional induced flow while minimizing turbulence inside the fan.

Mounted on a modular mixing plenum box or standard curb cap, the TVIFE is capable of generating an induced flow to meet stringent roof exhaust requirements.

TVIFE fans in a standard configuration utilize a heavy-duty curb cap. An optional modular mixing plenum box includes an integrated curb cap.

Benefits of Mixed Flow Fans

Twin City Fan & Blower Model TVIFE Mixed Flow Induced Flow fans combine the benefits of axial flow and centrifugal flow fans with the added benefit of entraining ambient air for a pre-diluted exhaust plume. The TVIFE has the advantages of an axial fan with its compact design and straight-through airflow combined with a centrifugal fan's preferred acoustical characteristics and high pressure capabilities. TVIFE fans offer superior air and sound performance and the AMCA certified rating seal for induced flow air and sound.

Sizes

12.25" to 66.0" impeller diameters

Performance

Airflow to 86,000 CFM
Static pressure to 8" w.g.



Twin City Fan & Blower certifies that the TVIFE Direct Drive Mixed Flow Induced Flow Exhaust Fans herein are licensed to bear the AMCA Seal. The ratings shown are based on test and procedures performance in accordance with AMCA Publication 211 and 311 and comply with the requirements of the AMCA Certified Ratings Program. The AMCA Certified Ratings Seal applies to Induced Flow Fan Air and Sound Performance tested in accordance with AMCA standard 260. See Catalog 1091 for sound ratings.



Scan the QR code to search Twin City Fan & Blower's AMCA-certified products.



Model TVIFE is available with UL/cUL 705 listing, for electrical, File No. E158680.



For complete product performance, drawings and available accessories, download our Fan Selector software at tcf.com.

Application

TVIFE

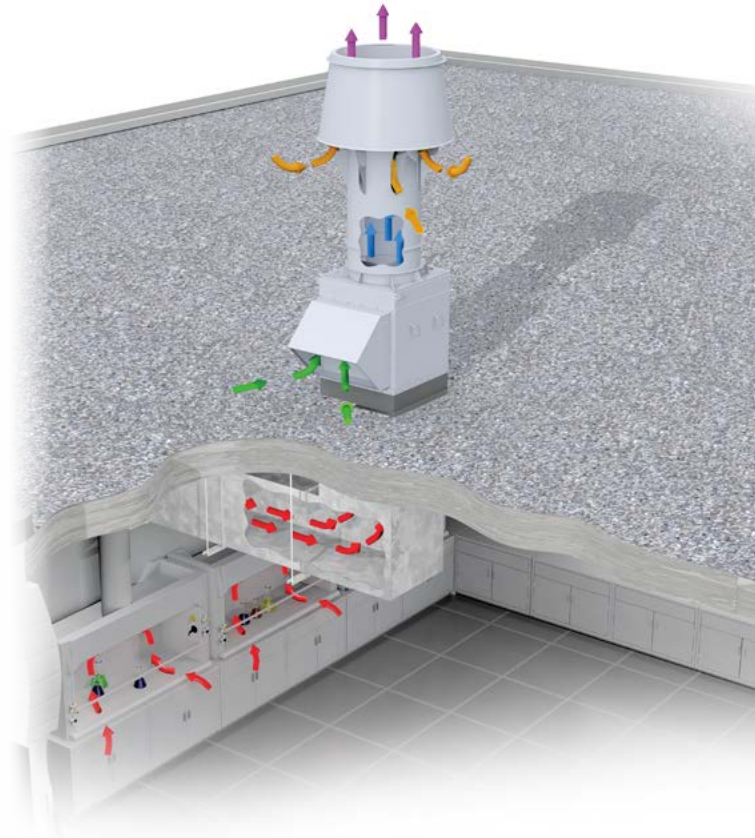
Application

The patented, TVIFE Induced Flow Mixed Flow Exhaust Fan (U.S. Patent 8758101) is intended for use in exhausting laboratory/hazardous fumes in a safe and efficient manner. The TVIFE housing uses an innovative Turbo-Vane™ design that integrates the internal nozzle and straightening vanes into one. Turbo-Vanes™ induce air within the fan housing as well as the windband, giving the best entrainment and efficiency in the industry. The design also allows for uniform motor cooling, while keeping the motor out of the airstream.

Induced flow exhaust fans dilute contaminated air at the outlet as well as increase the outlet volume of the fan. This accelerates the discharge air, increasing plume height without a tall stack.

Energy Recovery Systems

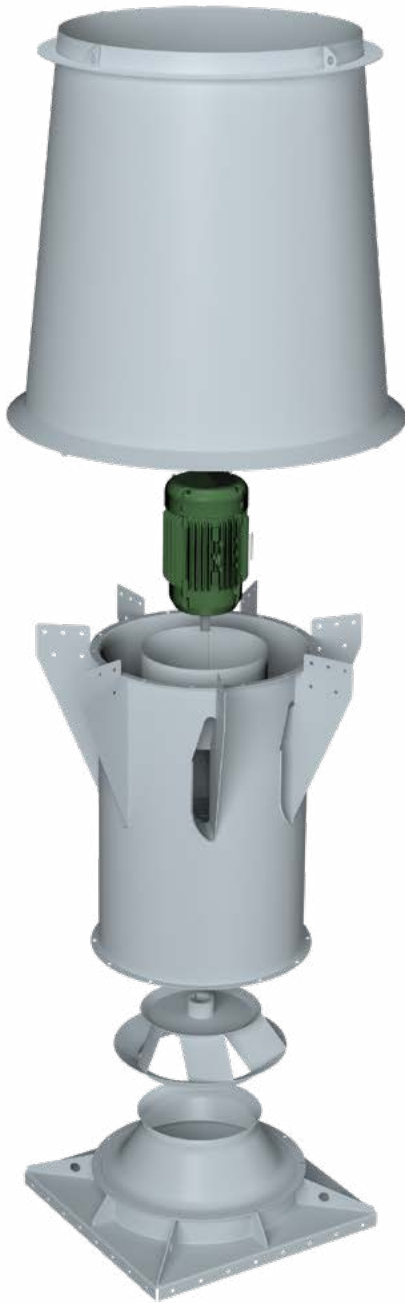
Twin City Fan & Blower's fume exhaust fans are designed to work seamlessly with energy recovery technology, offering efficient ventilation solutions for various applications. The combination of these fans with energy recovery systems ensures optimal air quality and energy efficiency, making them an excellent choice for environmentally conscious projects.



Energy Regulations

Twin City Fan & Blower supports energy efficiency regulations enacted by the U.S. Department of Energy (DOE) and specific states. The selection and application of fan products is a significant part of these regulations. Engineers and specifiers must understand how to apply TCF products to their specific applications to meet applicable DOE and state regulatory requirements. Twin City Fan & Blower has made significant investments in product testing and development to provide efficient products. Developments in Twin City Fan & Blower's Fan Selector software are in place to aid your decision in product selection to assist with meeting the efficiency requirements as stipulated in the applicable regulations.





Impeller is designed with die-formed, continuously-welded single-thickness or airfoil blades for a stable air performance throughout the operating range.

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

Turbo Vane™ housing integrates the internal nozzle and straightening vanes into one. Turbo Vanes™ convert tangential velocity pressure into useful static pressure, reducing turbulence and increasing efficiency while providing increased dilution to contaminated air and motor cooling. Extensive testing of various shapes and locations has resulted in the most efficient aerodynamic design of the straightening vanes.

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

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

NOTE: While precipitation entry into the fan and duct system is greatly reduced while the fan is in operation, precipitation may enter in while the fan is not operating. Care must be taken by the system designer, building owner and user to consider precipitation mitigation and moisture draining for the fume exhaust system.

Bolted Access Door for inspection or cleaning of the impeller.

Curb Cap attaches to the fan's inlet flange for curb mounting. Standard accessory on TVIFE without mixing plenum box.

Two-Piece Housing, on sizes 365 and larger, allows the main body of the housing to be raised off the inlet funnel section exposing the impeller for inspection and removal. This design allows for easy and efficient alignment and mounting of impeller and funnel.

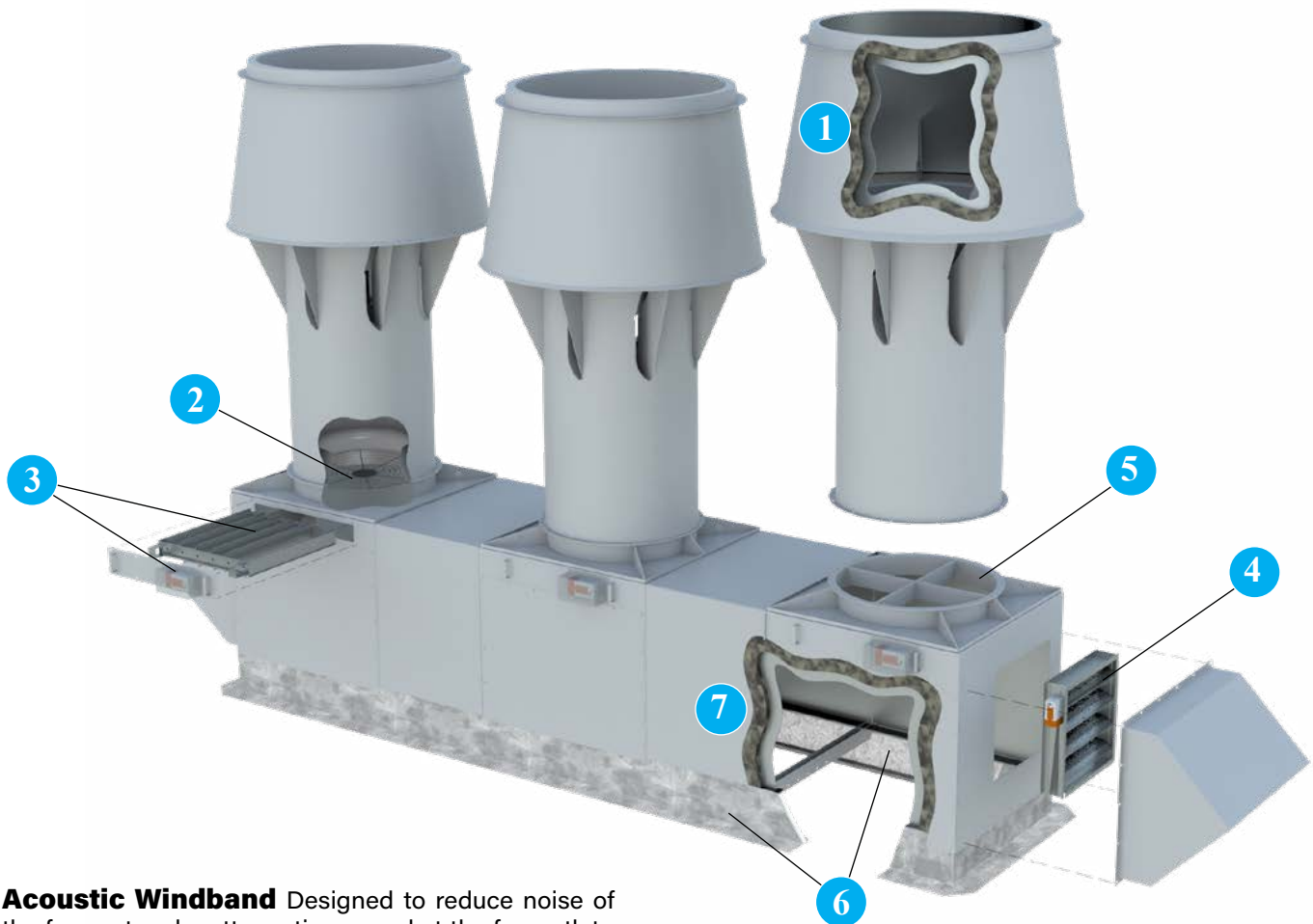
Other Standard Features

- Arrangement 4, Direct Drive Design
- Three (3) discharge nozzles available per fan size (medium, high and extra high velocity)
- Two (2) induced flow windbands (standard and high plume)
- Three (3) discrete impeller widths available (100%, 75%, 50%)



Unique applications require unique configurations. With the Twin City Fan & Blower modular mixing box, multiple configurations are able to be easily created and retrofitted.





1 Acoustic Windband Designed to reduce noise of the fan system by attenuating sound at the fan outlet.

2 Inlet Safety Screens can be provided for installation in the fan inlet.

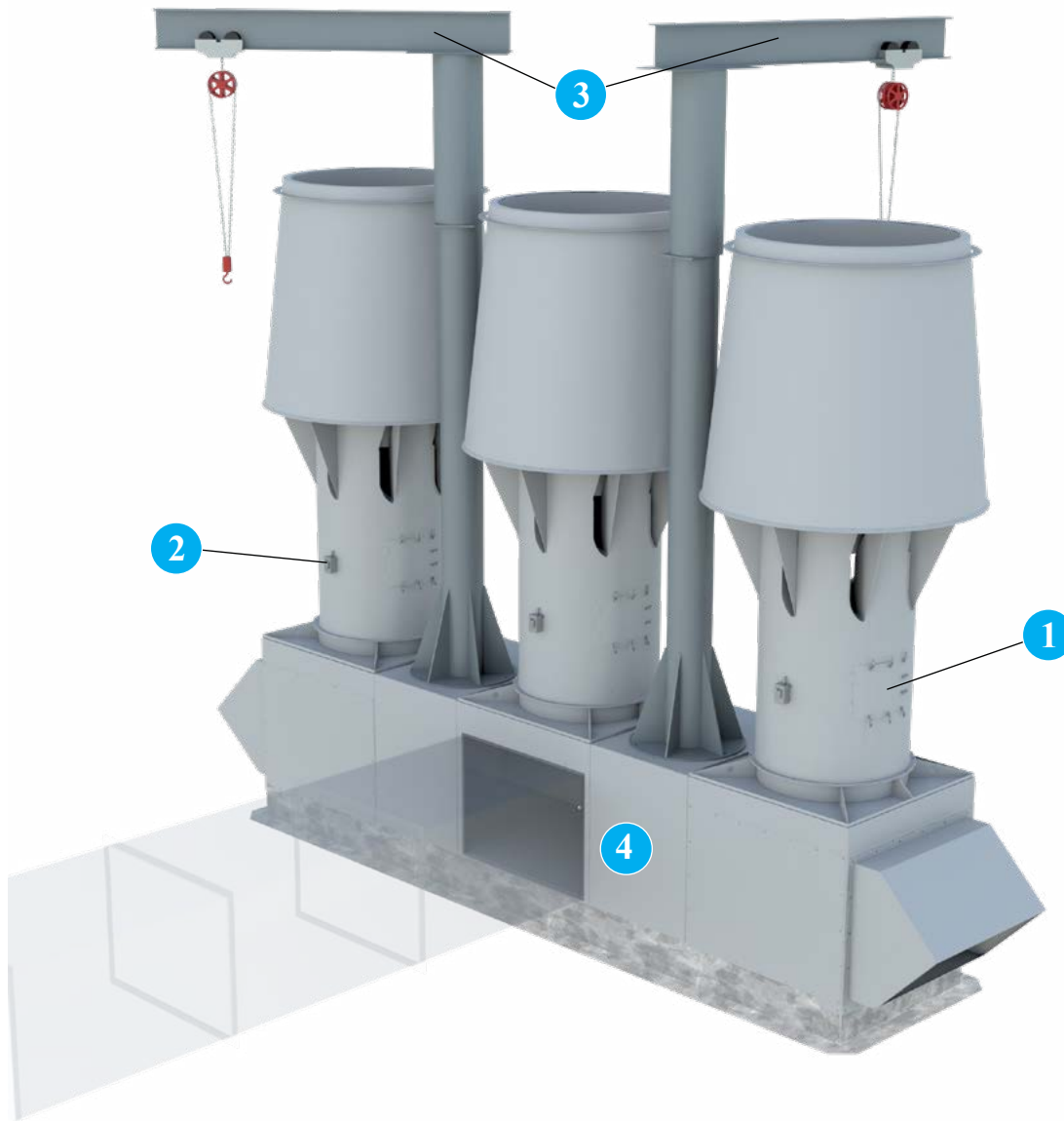
3 Isolation Damper are typically used on multi-fan systems to isolate individual fans. Isolation dampers are available with 2-position, spring-return controls and various materials of construction and coating options.

4 Bypass Dampers are used to maintain outlet velocities by allowing a constant volume at the fan when exhaust air is reduced. Bypass dampers are available with either a manual, locking quadrant (handle) or with electrical controls and various materials of construction and coating options.

5 Vortex Breaker Installed in the mixing plenum box at the fan inlet, the vortex breaker minimizes air 'swirl'. Recommended for multi-fan configurations and where mixing box intakes are not directly across from the inlet of the fan.

6 Insulated 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. Parallel backdraft dampers are available for mounting in roof curbs.

7 Mixing Plenum Box w/ Weather Hood; w/ Insulation & Stainless Steel Liner Bottom Intake The mixing plenum box features modular construction allowing for multiple configurations and effortless retrofitting. Bottom intake is standard, side intake option available upon request.



1 Quick Open Access Doors are designed for quick impeller inspection and maintenance. Access doors are specified where examination and cleaning of the fan interior is frequently required.

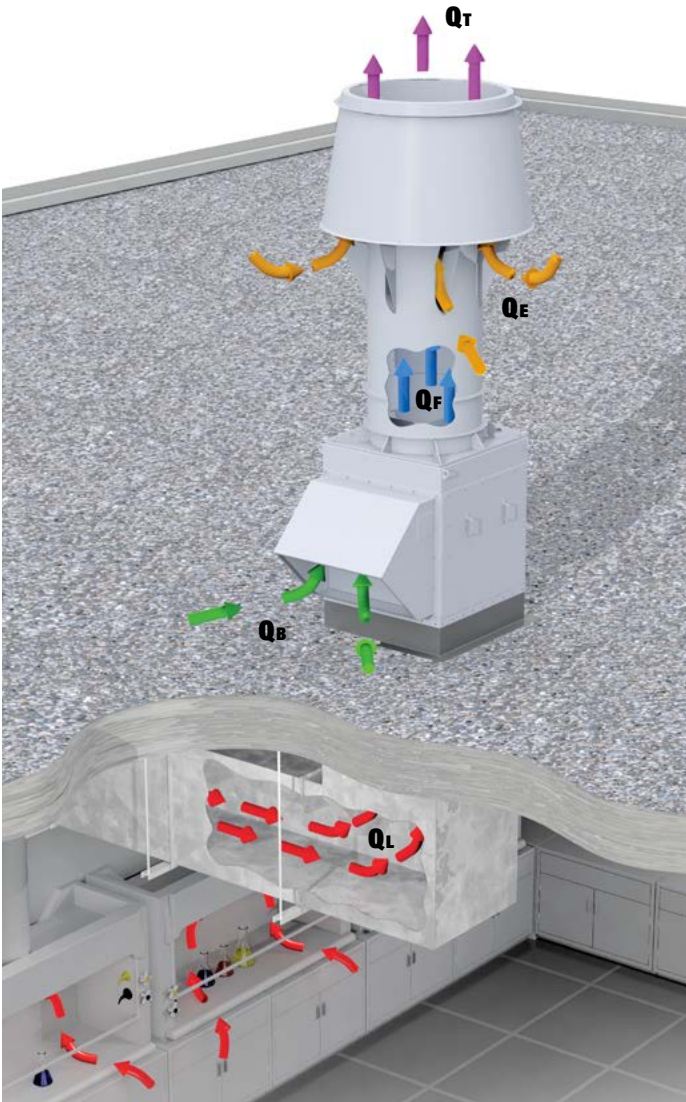
2 NEMA 3R Disconnect Switch, rain proof, disconnect is available shipped loose for field mounting and wiring or factory mounted and wired. Also available with a NEMA 4 or 7/9 switch.

3 Jib Crane Heavy-duty jib crane is designed to handle the weight of the heaviest individual component. The mount is connected to the specially reinforced mixing box spacer mixing box structure. Single and double mixing boxes receive one (1) jib crane. 3x1 and 4x1 configurations receive two (2) jib cranes.

4 Mixing Plenum Box w/ Weather Hood; Side Intake The mixing plenum box features modular construction allowing for multiple configurations and effortless retrofitting. Bottom intake is standard, side intake option available upon request.

OTHER ACCESSORIES:

- Stainless Steel Hardware
- Inlet/Outlet Flange (Punched)
- Pressure Transducer
- Curb Cap



- Q_B = Bypass Flow
- Q_E = Entrained Flow
- Q_F = Fan Flow
- Q_L = Laboratory Flow (Contaminated Air)
- Q_T = Total Flow

$$Q_T = Q_E + Q_F$$

$$Q_F = Q_B + Q_L$$

$$\therefore Q_T = Q_E + Q_B + Q_L$$

$$\text{Dilution Ratio} = \text{D.R.} = \frac{Q_T}{Q_L}$$

$$\text{Entrainment Ratio} = \text{E.R.} = \frac{Q_T}{Q_F}$$

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 but can also be used to increase overall exhaust volume and dilution. (See diagram to left.)

Dilution Ratio

The ratio of the total fan outlet volume to the lab exhaust volume. (Total Volume/Lab Exhaust Volume). Value includes any additional bypass air in the calculation. (See diagram to left.)

Entrainment Air

Air that is entrained (induced flow) through the windband and fan housing, mixed with the laboratory exhaust to increase the dilution ratio and plume rise. (See diagram to left.)

Entrainment Ratio

The ratio of the total fan outlet volume to the fan inlet volume. (Total Volume/Fan Inlet Volume - see diagram to left.)

Nozzle

Device located internal to the fan housing, providing fume exhaust air to accelerate upon entrance to the windband. Several nozzles per fan size are available on the TVIFE; medium-velocity, high-velocity and extra-high-velocity. Each nozzle provides different flow characteristics. Nozzle should be selected based on the application requirements.

Plume Rise

The height of the fume exhaust and entrainment air above the discharge of the windband. (See page 9 for diagram and calculations.)

Plume Height

Overall height of the discharge plume rise, plus the added height of the exhaust system above the roofdeck level. (See page 9 for diagram and calculations.)

Total Airflow

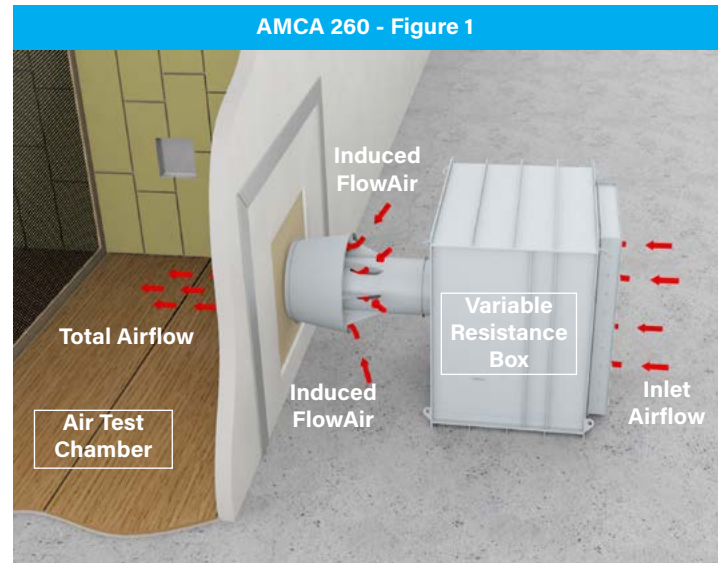
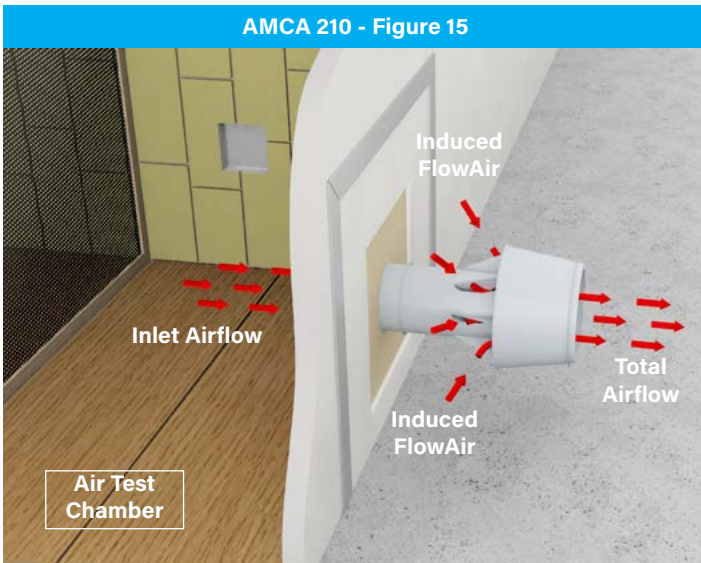
The total airflow exiting the windband, including fume exhaust, bypass air and entrainment air. (See diagram to left.)

Windband

Device used to direct the fume exhaust as it leaves the housing of the exhaust fan and entrain dilution air.

The following illustrations describe the procedure for determining the total laboratory exhaust fan discharge flow. The total discharge flow is the sum of inlet airflow and entrained airflow. The key requirement to AMCA 260 is the variable resistance box. This box allows the measurement of total discharge flow ($P_s = 0$ in. w.g. to simulate discharging the fan to atmosphere) at all points along its fan curve.

Without the variable resistance box, the entrained airflow can only be measured at the free air point of its fan curve. The entrained airflow obtained can be used to calculate an effective plume height. Therefore, AMCA 260 certification is necessary to ensure the laboratory exhaust fan specified is providing the plume rise and entrainment submitted.



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)

* Equation taken from ASHRAE Laboratory Design Guide, Equation 9-2.
 Note: Plume height calculations are typically calculated with a 10 mph (880 ft/min) crosswind.

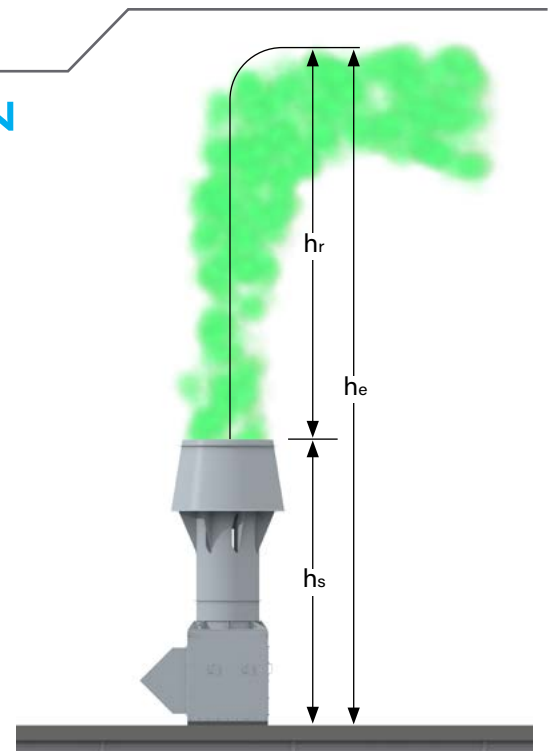


Table 1. Maximum RPM, Impeller Weights and WR² (moment of inertia in lb-ft²)

FAN SIZE	CLASS I			CLASS II		
	MAX. RPM	WEIGHT LB.	WR ² LB-FT ²	MAX. RPM	WEIGHT LB.	WR ² LB-FT ²
90	4225	9	1.05	-	-	-
122	3450	12	2.15	-	-	-
135	3137	15	3.5	-	-	-
150	2721	24	5.5	3558	28	71
165	2483	32	8	3247	36	10.3
182	2232	38	12	2918	44	15
200	2027	48	20	2650	52	23
222	1839	57	29	2405	62	34
222P	1839	57	29	2405	62	34
245	1655	69	45	2165	75	52
245P	1655	69	45	2165	75	52
270	1505	82	66	1968	90	76
270P	1505	82	66	1968	90	76
300	1360	140	133	1779	150	145
300P	1360	140	133	1779	150	145
330	1234	167	197	1613	179	215
330P	1234	167	197	1613	179	215
365	1116	233	320	1459	247	347
402	1013	324	588	1325	324	588
445	915	393	883	1197	393	883
490	828	478	1321	1082	478	1321
542	752	591	1934	984	591	1934

Table 2. Bare Fan with Windband Weights (lb)

FAN SIZE	CLASS I	CLASS II
90	253	-
122	354	-
135	407	-
150	467	467
165	542	542
182	659	659
200	784	784
222	833	833
222P	934	934
245	1046	1046
245P	1166	1166
270	1214	1221
270P	1359	1366
300	1541	1541
300P	1719	1719
330	1849	1849
330P	2065	2065
365	2255	2255
402	2777	2795
445	3377	3400
490	4104	4131
542	5035	5035

NOTE:

Weights do not include motor, mixing plenum box or roof curb weights. See Table 4 for mixing plenum box weights. See Table 5 for separate windband weights.

Table 3. Temperature and Altitude Density Ratios

AIR TEMP °F	ALTITUDE IN FEET ABOVE SEA LEVEL											
	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	15000
	BAROMETRIC PRESSURE IN INCHES OF MERCURY											
	29.92	28.86	27.82	26.82	25.84	24.90	23.98	23.09	22.22	21.39	20.58	16.89
-50	1.293	1.247	1.201	1.159	1.116	1.076	1.036	0.997	0.960	0.924	0.889	0.729
0	1.152	1.111	1.071	1.032	0.995	0.959	0.923	0.889	0.856	0.824	0.792	0.650
70	1.000	0.964	0.930	0.896	0.864	0.832	0.801	0.772	0.743	0.714	0.688	0.564
100	0.946	0.912	0.880	0.848	0.818	0.787	0.758	0.730	0.703	0.676	0.651	0.534
150	0.869	0.838	0.808	0.770	0.751	0.723	0.696	0.671	0.646	0.620	0.598	0.490
200	0.803	0.774	0.747	0.720	0.694	0.668	0.643	0.620	0.596	0.576	0.552	0.452

Table 4. Mixing Plenum Box Weights (lb)

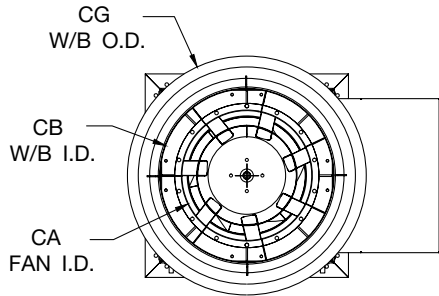
FAN SIZE	SINGLE	DOUBLE	TRIPLE	QUAD
90	269	554	852	1148
122	342	706	1086	1464
135	337	708	1095	1484
150	439	906	1392	1880
165	462	964	1488	2012
182	506	1062	1644	2228
200	519	1110	1725	2340
222	738	1590	2478	3368
222P	738	1590	2478	3368
245	926	1974	3066	4160
245P	926	1974	3066	4160
270	952	2070	3234	4400
270P	952	2070	3234	4400
300	1135	2450	3822	5192
300P	1135	2450	3822	5192
330	1320	2824	4392	5960
330P	1320	2824	4392	5960
365	1449	3114	4851	6588
402	1588	3422	5337	7248
445	1814	3892	6057	8224
490	1999	4310	6720	9128
542	2208	4776	7452	10132

Table 5. Windband Weights (lb)

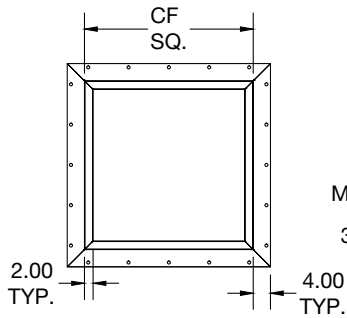
FAN SIZE	WEIGHT
90	96
122	142
135	171
150	146
165	174
182	216
200	262
222	212
222P	314
245	250
245P	370
270	300
270P	445
300	367
300P	545
330	444
330P	661
365	536
402	648
445	789
490	961
542	1159

NOTES:

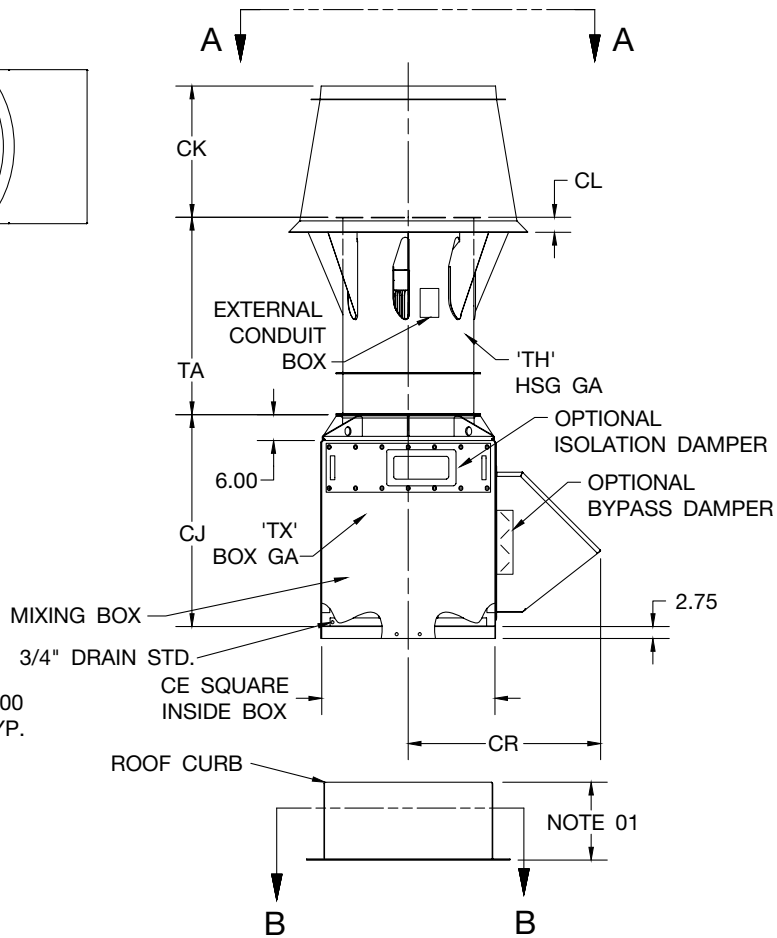
- Weights do not include roof curb, dampers or actuators.
- Weights are for non-insulated, bottom-intake mixing boxes without jib crane mounting.



VIEW A-A



SECTION B-B



NOTES:

1. Bottom intake standard; side intake, closed bottom optional.
2. Standard roof curb height is 12". Other heights available upon request.
3. 125 mph windload ratings require a Twin City Fan & Blower supplied roof curb.
4. Motor not shown, Min. and Max. Motor Frame 'FR'.

FAN SIZE	CA	CB	CE	CF	CG	CJ	CK	CL	CR	TA	TH	TX	FR	
													MIN	MAX
90	13.79	18.13	24.00	23.00	25.00	33.00	48.53	1.85	28.31	22.81	12	10	48C	145C
122	16.81	22.25	28.00	27.00	30.63	37.00	59.36	2.27	32.13	27.93	12	10	48C	184C
135	18.54	24.44	28.00	27.00	33.69	37.00	65.29	2.52	32.13	30.72	12	10	48C	184C
150	20.23	27.06	33.00	32.00	37.25	40.00	47.96	2.79	37.13	32.63	10	10	48C	215C
165	22.29	29.63	34.00	33.00	40.50	43.00	52.63	3.00	38.13	35.76	10	10	56C	215C
182	24.67	32.69	36.00	35.00	45.38	45.00	58.50	3.38	10.13	39.78	10	10	56C	256C
200	27.04	36.31	37.00	36.00	50.00	46.00	64.43	3.70	41.13	43.80	10	10	56C	256C
222	30.04	40.00	40.00	39.00	55.06	49.00	32.94	2.69	44.13	45.50	10	7	56C	284C
222P	30.04	40.00	40.00	39.00	55.06	49.00	50.00	2.69	44.13	45.50	10	7	56C	284C
245	33.10	44.44	46.00	45.00	67.19	55.00	36.65	3.16	50.13	50.56	7	7	184C	286C
245P	33.10	44.44	46.00	45.00	67.19	55.00	55.59	3.16	50.13	50.56	7	7	184C	286C
270	36.48	48.88	47.00	46.00	67.31	56.00	40.24	3.32	51.13	55.62	7	7	184C	324C
270P	36.48	48.88	47.00	46.00	67.31	56.00	61.06	3.32	51.13	55.62	7	7	184C	324C
300	40.54	54.06	53.00	52.00	74.44	59.00	44.57	3.62	56.13	61.52	7	7	213C	324C
300P	40.54	54.06	53.00	52.00	74.44	59.00	67.63	3.62	56.13	61.52	7	7	213C	324C
330	44.61	59.63	60.00	59.00	82.13	59.00	49.13	3.68	59.63	67.84	7	7	215C	326C
330P	44.61	59.63	60.00	59.00	82.13	59.00	74.57	3.68	59.63	67.84	7	7	215C	326C
365	49.36	65.94	65.00	64.00	90.75	59.00	54.31	4.44	62.13	75.00	7	7	254C	404C
402	54.36	72.56	71.00	70.00	99.94	59.00	59.79	4.90	65.13	82.58	7	7	256C	405C
445	60.17	80.38	80.00	79.00	110.69	59.00	66.25	5.38	69.63	91.43	7	7	286C	444C
490	66.23	88.88	87.00	86.00	122.38	59.00	73.24	6.01	73.13	101.12	7	7	324C	445C
542	73.36	97.75	95.00	94.00	134.63	59.00	80.55	6.58	77.13	111.23	7	7	364C	445C

BC1003201A

DIMENSIONS ARE SUBJECT TO CHANGE. CERTIFIED DRAWINGS AVAILABLE ON REQUEST.



Model TVIFE

Model TVIFE Direct Drive Induced Flow Exhaust Fans, 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. Induced flow exhaust fans shall be as manufactured by Twin City Fan & Blower, Minneapolis, Minnesota.

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. Model TVIFE shall be licensed to bear the AMCA certified ratings seal for air, sound and induced flow. Sound certification shall apply to both inlet and outlet sound power levels. Model TVIFE shall be UL/cUL 705 listed for electrical.

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.

HOUSING — Housings shall be cylindrical and welded steel throughout. Inlets shall be fully streamlined. Housings shall be suitably braced to prevent vibration or pulsation. Housing shall be furcated with Turbo-Vanes™ to allow for increased induced flow and motor ventilation. Punched inlet flange shall be equipped for curb cap or mixing plenum box mounting. Model TVIFE shall include outlet nozzle, windband, heavy-duty coated steel curb cap, access door.

IMPELLER — Fan impellers shall have die-formed blades designed for maximum efficiency, and quiet and stable operation. Blades shall be continuously-welded to the back plate and impeller cone. Impellers 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.

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 induce ambient airflow from outside the fan housing and increase discharge velocities to be a recommended minimum of 3,000 FPM without significantly affecting BHP requirements. The windband shall provide a minimum discharge height of 84" from roof surface.

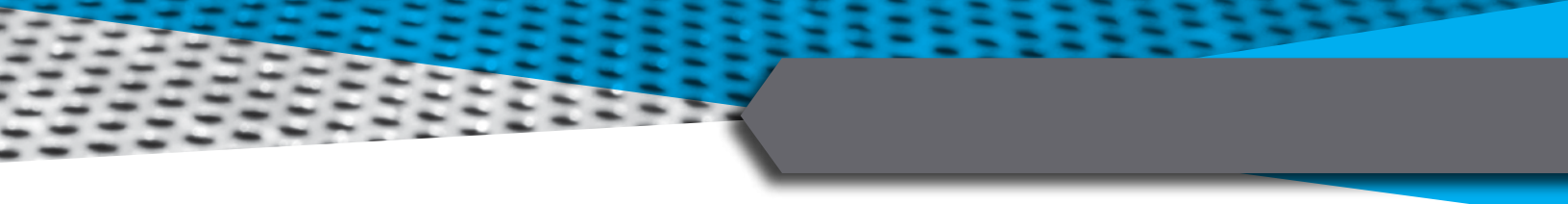
MOTOR — Fan motors shall be C-Face, continuous duty, variable torque type suitable for operation on voltage, phase and hertz, as listed in the fan schedule, closely matched to the fan load. Bearings shall be selected for a minimum L-50 life of 200,000 hours. An externally mounted conduit box shall be factory installed and wired to the fan as standard. Extended lube lines shall be provided for ease of lubrication. Motor shall be mounted within the fan, isolated from the airstream. All motors shall be UL recognized.

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

- AMCA "B" or "C" spark resistant construction
- Modular mixing plenum box (bottom-intake or side-intake)
- 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

FACTORY RUN TEST — All fans prior to shipment shall be completely assembled and test run as a unit at operating speed or maximum RPM allowed for the particular construction type. Each impeller shall be statically and dynamically balanced in accordance with ANSI/AMCA 204-96 "Balance Quality and Vibration Levels for Fans" to Fan Application Category BV-3, Balance Quality Grade G6.3. Balance readings shall be taken by electronic type equipment in the axial, vertical and horizontal directions on each of the bearings. Records shall be maintained and a written copy shall be available upon request.

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.



INDUSTRIAL PROCESS AND COMMERCIAL VENTILATION SYSTEMS

CENTRIFUGAL FANS | UTILITY SETS | PLENUM & PLUG FANS | INLINE CENTRIFUGAL FANS
MIXED FLOW FANS | TUBEAXIAL & VANEAXIAL FANS | WALL MOUNTED FANS | ROOF VENTILATORS
CENTRIFUGAL ROOF & WALL EXHAUSTERS | CEILING VENTILATORS | GRAVITY VENTILATORS | DUCT BLOWERS
RADIAL BLADED FANS | RADIAL TIP FANS | HIGH EFFICIENCY INDUSTRIAL FANS | PRESSURE BLOWERS
LABORATORY EXHAUST FANS | FILTERED SUPPLY FANS | MANCOOLERS | FIBERGLASS FANS | CUSTOM FANS



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