TCF
TWIN CITY FAN

Glossary of Terms

Laboratory & Fume Exhaust Fans

ACTUATOR, 2-POSITION SPRING RETURN
A spring return actuator generally used to control the isolation dampers below the fans. This actuator allows for fully open or fully closed operation only. Commonly offered as either 115V or 24V.

ACTUATOR, MODULATING
A modulating actuator generally used to control the bypass damper in the mixing plenum box that allows the bypass damper to operate anywhere between full open and full close. Commonly offered as either 115V or 24V.

AIR VOLUME - VARIABLE AIR VOLUME (VAV)
The air volume coming into the inlet of the fan or mixing plenum box is variable. Usually due to multiple fume hoods being tied into a single fan and the use of the individual fumehoods varies. The mixing plenum box is commonly used to balance out the airflow with bypass air so that the fan will always see a constant volume and maintain a constant outlet velocity.

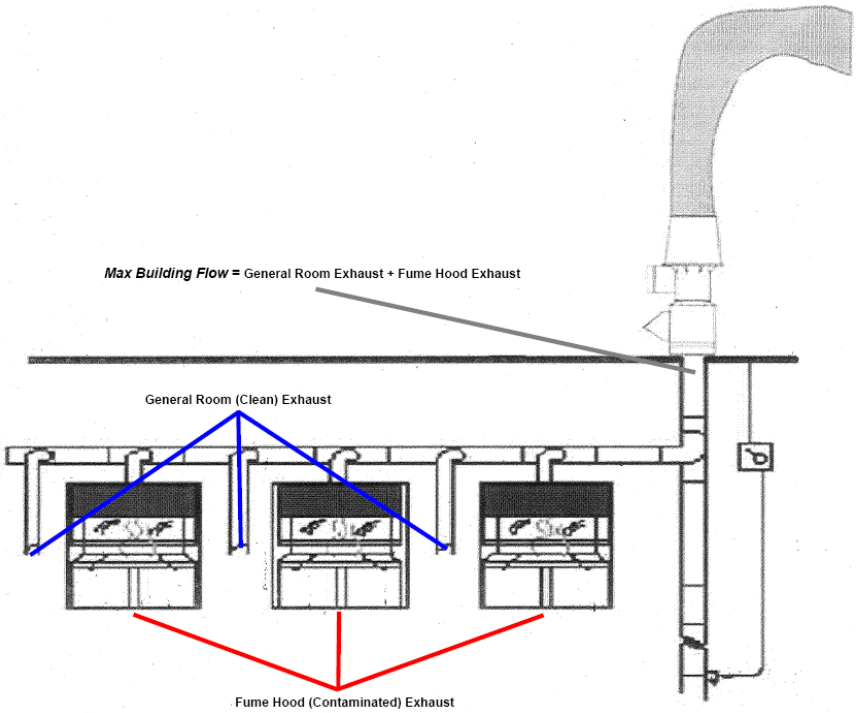
AIR VOLUME - CONSTANT AIR VOLUME (CAV)
The air volume coming into the inlet of the fan or mixing plenum box is constant. The volume coming into the fan does not vary so bypass air is not necessary to maintain constant outlet velocity.

AIRFLOW, BYPASS
Unconditioned, clean, outside air drawn into the mixing plenum box to mix with the contaminated lab effluent. Generally used to attain higher dilution, higher effective plume heights, or in direct drive applications it can be used to hit nominal motor RPMs. Also used to balance the system and maintain a constant airflow at the fan inlet in Variable Air Volume applications.

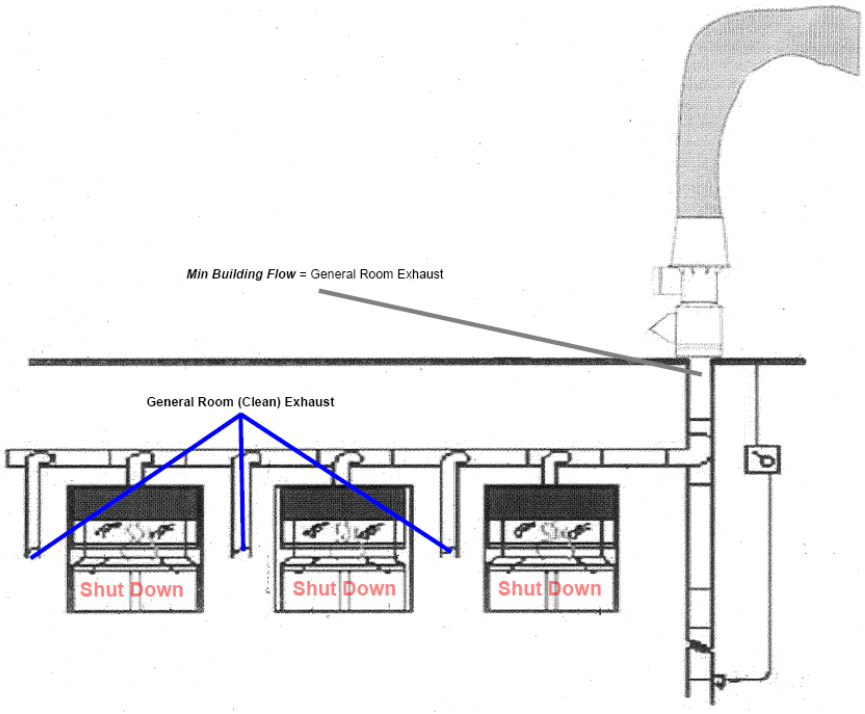
AIRFLOW, ENTRAINED/INDUCED
Additional outside air that is drawn into the air path of a fan around the windband or through the Turbo-Vanes within the fan.

AIRFLOW, LAB EFFLUENT
Contaminated and/or hazardous air exhausted from the building.

AIRFLOW, MAXIMUM BUILDING
Max Building Flow is a combination of the contaminated fumehood exhaust and the clean general room exhaust. It is the total amount of air that is being exhausted from inside the building.



AIRFLOW, MINIMUM BUILDING
Minimum Building Flow is the minimum amount of air required to be exhausted from a room for safe occupation. It is mostly comprised of the clean air, general room exhaust. The minimum building flow level is reached when the amount of air being drawn through the fumehoods themselves are at the minimum level. In a variable volume system the recommended method for obtaining the additional air required to keep a constant discharge would be brought in through the bypass dampers on the roof.



AIRFLOW, TOTAL
Total Airflow is the total amount of airflow exiting the windband of the fan. It is the sum of the Lab Effluent, the Additional Bypass Air, and the Entrained Air.

AMCA CERTIFIED RATINGS PROGRAM (CRP)
The AMCA CRP **e**nsures that all data is cataloged and verified per the relevant AMCA standards.

AMCA STANDARD 210
AMCA Standard 210 establishes a uniform method of laboratory testing of standard, non-induced flow fans in order to determine their aerodynamic performance in terms of inlet and outlet airflow rate, pressure developed, power consumption, air density, speed of rotation, and efficiency.

AMCA STANDARD 260
AMCA Standard 260 establishes a uniform method of laboratory testing of induced flow fans in order to determine their aerodynamic performance in terms of inlet and outlet airflow rate, pressure developed, power consumption, air density, speed of rotation, and efficiency. This standard is an adjunct to AMCA 210 in order to accommodate the induced flow fan's unique characteristics. All induced flow fans should be tested per this standard.

AMCA STANDARD 300
AMCA Standard 300 This standard applies to fans of all types and sizes. This standard is limited to the determination of airborne sound emission for the specified setups. Vibration is not measured, nor is the sensitivity of airborne sound emission to vibration effects determined. The size of a fan that can be tested in accordance with this standard is limited only by the practical aspects of the test setups. Dimensional limitations, test subject dimensions, and air performance will control the test room size and power and mounting requirements for the test subject. The test setup requirements in this standard establish the laboratory conditions necessary for a successful test. Rarely will it be possible to meet these requirements in a field situation. This standard is not intended for field measurements.

ANSI Z9.5
An American National Standard for Laboratory Ventilation" which is published by ANSI and the American Industrial Hygiene Association. It covers a variety of lab ventilation issues including hood monitoring, face velocities, exhaust velocities and laboratory room pressurization.

BEARING LIFE
The expected life of a bearing under specific conditions, stated as percentage of failure over a period of time, commonly expressed in hours. For example an L10 life of 200,000 hours states that after 200,000 hours 10% of bearings will have failed. Further, an L50 of 200,000 hours states that after 200,000 hours 50% of bearings will have failed.

BRAKE HORSEPOWER (BHP)
The actual amount of energy required by a fan to perform a certain function.

Brigg's Equation
Used to calculate plume rise of an exhaust flow.
Defined as:

$h_e = (3 \times \{V \times d/U\})$
h_r = plume rise (ft)
V = exit velocity at wind band (fpm)
d = outlet diameter at wind band (ft)
U = cross wind velocity (fpm)

CHEMICAL RESISTANCE
The ability of a specific coating or material to endure in an environment where specific chemicals or fumes are present.

DAMPER, BACKDRAFT
Backdraft dampers can be automatic or motorized. They control the airflow going into or out of the fan as well as preventing entry of weather and nature from entering the fan and or building.

DAMPER, OPPOSED BLADE BYPASS
Used to maintain outlet velocities by allowing a constant volume at the fan discharge when exhaust air is reduced. The bypass damper is designed to fully modulate between open and closed.

DAMPER, PARALLEL BLADE ISOLATION
Standard isolation dampers are typically used on multi-fan mixing plenum boxes to isolate individual fans. This prevents leakage of contaminated exhaust air. Dampers are generally used as full open or full closed and do not modulate.

DILUTION RATIO
The ratio of the volume of entrained or induced air, combined with additional bypass air, divided by the volume of lab effluent coming from the building. This value shows the overall dilution occurring within the fume exhaust system.

EFFECTIVE PLUME HEIGHT
The height above the roofline that the exhaust flow, or "plume", will travel before reaching an upward velocity of zero. This value is the sum of the physical height of the fan added to the height of the plume rise.

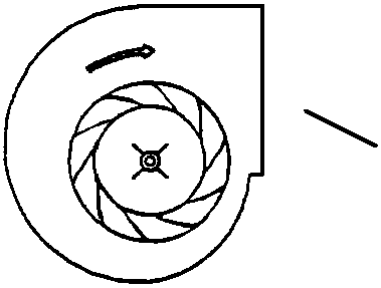
ENTRAINMENT RATIO
The ratio of the volume of entrained or induced air divided by the volume of lab effluent coming from the building. This value does not include any additional bypass air added into the system and shows a fan's actual entrainment capabilities.

FAN CLASS
AMCA designates minimum performance requirements for certain types of fans. These standards are based on the pressure and outlet velocity of the fan.

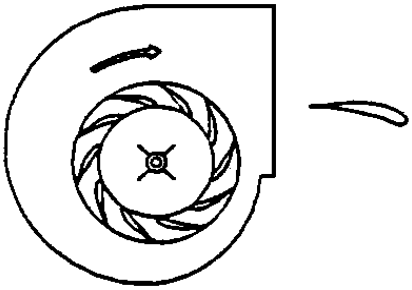
FAN EFFICIENCY GRADE (FEG)
Fan Efficiency Grade or AMCA standard 205 is an equipment efficiency standard for fans designed with the goal of helping the green buildings community understand potential energy savings in fans.

IMPELLER, AXIAL
An axial fan uses a propeller that is designed for straight through flow, low to medium pressure, and high volume designs.

IMPELLER, CENTRIFUGAL, BACKWARD INCLINED
The centrifugal backward inclined impeller is capable of medium to higher pressures. The air leaving the impeller exits 90 degrees to the air entering the impeller cone. The blades are flat, single surface.

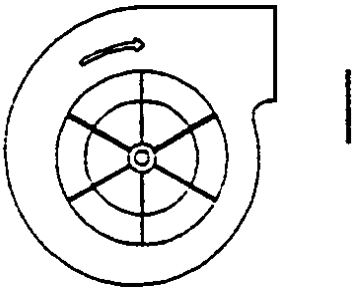


IMPELLER, CENTRIFUGAL, AIRFOIL
An airfoil bladed impeller is similar to a backward inclined impeller, but utilizes airfoil shaped blades that provide a higher overall efficiency. Airfoil impellers are not recommended for applications where high moisture or temperature are present. High moisture and/or temperature can cause condensation within the fan blade, which can lead to an imbalance of the wheel.



IMPELLER, MIXED FLOW
A mixed flow impeller is a hybrid of an axial propeller and a centrifugal impeller. The backplate of the wheel is smaller than the front plate allowing for the straight through flow characteristics of an axial propeller with the pressure capabilities of a centrifugal impeller.

IMPELLER, RADIAL
The blades of a radial impeller are built “radial” to the shaft. A radial impeller is capable of extremely high pressures, generally at lower flow rates. Radial impellers can also handle particulate in the airstream.



INVERTER READY MOTOR
An inverter ready motor is a motor that is usable with a VFD (Variable Frequency Drive). A common requirement is that the motor meet NEMA MG 1 Part 31.4.4.2 which applies to 3 Ph motors 1 HP and above.

JIB CRANE
The jib crane is a small portable crane that can be attached to the mixing plenum box of a fan for use to remove the motor and/or windband of a fan. Most commonly used for direct drive inline fan applications.

MODULAR MIXING PLENUM BOX
A mixing plenum box is a plenum that is usually combined with a laboratory exhaust fan. The plenum is generally used as a place to mix the contaminated air from the building with clean, ambient air from outside. The clean air is drawn into the plenum through an opposed blade bypass damper. The plenum also houses the parallel blade isolation damper, which is right below the fan inlet. Mixing plenum boxes can be single wall, heavy gauge construction, or can be double wall insulated construction with a stainless steel liner which prevents condensation from building up on the fan plenum.

MODULAR MIXING PLENUM BOX, COMMON PLENUM
Multiple fume exhaust fans can be mounted on a common plenum. This can be done to offer fan redundancy, or to use multiple smaller fans in the place of one larger fan. Mixing plenum boxes should be modular in construction for ease of shipping and for future expansion of fume exhaust system.

MOTOR/DRIVE ARRANGEMENTS

ARRANGEMENT 1
Arrangement 1 fans are usually belt driven. The wheel is overhung on the shaft, i.e., mounted at the end of the shaft. The motor can be mounted in any of the four AMCA standard motor positions, W, X, Y, or Z. The two fan bearings are mounted on the bearing pedestal, out of the airstream. Arrangement 1 fans are thus recommended for high temperature or contaminated air applications. Belt driven configurations offer performance flexibility. If the performance requirements change after the fan has been installed, it is simple and inexpensive to change the drive.

ARRANGEMENT 2
Arrangement 2 is available as belt or direct drive. The fan wheel is overhung with bearings in a bracket supported by the fan housing. For direct drive applications the motor is directly coupled to the fan shaft.

ARRANGEMENT 4
Arrangement 4 is available in direct drive only. The fan wheel is mounted directly on the motor shaft with the motor mounted on a pedestal. An Arrangement 4 design offers low maintenance as there are no fan bearings, fan shaft or drive parts to maintain.

ARRANGEMENT 8
Arrangement 8 is a modified version of Arrangement 1 used for direct drive. The Arrangement 1 bearing pedestal is extended to accommodate the motor. A flexible coupling connects the fan and motor shaft.

ARRANGEMENT 9
Arrangement 9 is available as belt driven only. A motor slide base is mounted on the side of the bearing pedestal. This arrangement permits the unit to ship as a complete assembly with the motor and drive mounted. For centrifugal fan, the motor is typically mounted on the left side of the pedestal for CW rotation fans and on the right side for CCW rotation fans.

ARRANGEMENT 10
Arrangement 10 is available as belt driven only. An Arrangement 10 unit has an adjustable motor base mounted inside the bearing pedestal. This arrangement offers a more compact design than the Arrangement 9 and is suitable for roof or outdoor installations with a weather cover.

NEMA ENCLOSURE

NEMA 1
Enclosures constructed for indoor use to provide a degree of protection to personnel against access to hazardous parts and to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (falling dirt).

NEMA 3R
Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (falling dirt); to provide a degree of protection with respect to harmful effects on the equipment due to the ingress of water (rain, sleet, snow); and that will be undamaged by the external formation of ice on the enclosure.

NEMA 4/X
Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (windblown dust); to provide a degree of protection with respect to harmful effects on the equipment due to the ingress of water (rain, sleet, snow, splashing water, and hose directed water); that provides an additional level of protection against corrosion; and that will be undamaged by the external formation of ice on the enclosure.

NEMA 7/9
Enclosures constructed for indoor use in hazardous (classified) locations classified as Class I, Division 1, Groups A, B, C, or D as defined in NFPA 70, as well as locations classified as Class II, Division 1, Groups E, F, or G as defined in NFPA 70.

NOZZLE, HIGH VELOCITY AIR
A contraction of the airstream at the outlet of the fan that efficiently forces the air to pass through a smaller area causing the velocity of that air to increase using the following equation.

V=Q/A
V=Outlet Velocity at Nozzle or wind band (fpm)
Q=Flow Rate (cfm)
A=Outlet Area of Nozzle or wind band (sq ft)

NOZZLE, SPRAY DOWN
Spray down nozzles can be installed in the fan or ductwork to prevent build-up of especially corrosive and/or explosive gases. Frequently used in Perchloric Acid applications.

PIEZOMETER RING
A piezometer ring is available as part of an airflow measuring system, based on the principle of a flow nozzle. The inlet cone of the fan is used as the flow nozzle. The flow can be calculated by measuring the pressure drop through the inlet cone. No tubes or sensors are inserted in the high velocity airstream which could obstruct airflow. The system consists of a piezometer ring mounted at the throat and a static pressure tap mounted on the face of the inlet cone. A differential pressure transducer and digital display can also be provided. The pressure drop is measured from the tap located on the face of the inlet cone to the piezometer ring in the throat. The inlet tap is connected to the high-pressure side of the transducer and the piezometer ring is connected to the low-pressure side. Based on Twin City Fan laboratory tests, the system was determined to be accurate within +/-5%.
Refer to Twin City Fan Engineering Supplement ES-105

PLUME RISE
The height above the outlet of a fan that exhaust flow will travel before reaching an upward velocity of zero.

PRESSURE, STATIC (SP)
Static pressure is the measure of the potential energy of the airstream. SP acts equally in all directions. It is this pressure in the duct that tends to burst or collapse the duct.

PRESSURE, VELOCITY (VP)
Velocity pressure, the measure of the energy content of the airstream. Velocity pressure acts in the direction of the airflow. It is the pressure necessary to accelerate the air.

PRESSURE, TOTAL (TP)
Total pressure, the measure of the energy content of the airstream. It is the sum of static pressure (SP) and velocity pressure (VP).

ROOF CURB
A mounting structure used to transition between the roof of a building and the inlet of the fan. Generally constructed of heavy gauge galvanized steel. Allows for the passage of airflow while fully supporting the fans weight. For fume exhaust applications a roof curb must be able to fully support the fans weight in up to a 125 MPH cross-wind. Standard heights available are 8", 12", 18", and 24".

RPM, FAN MAXIMUM
The maximum RPM (Revolutions Per Minute) at which a wheel or impeller is designed to safely operate. Operating above this level could cause failure within fan components.

RPM, FAN OPERATING
The actual RPM (Revolutions Per Minute) at which a wheel or impeller rotates to achieve a specified performance.

RPM, NOMINAL MOTOR
The approximate RPM (Revolutions Per Minute) that the motor shaft will spin at. Actual motor RPM will be slightly less due to losses in the motor. EX: Nominal motor RPM is 1800, actual motor RPM is estimated between 1740 and 1770 RPM.

SERVICE FACTOR
Many products have a safety factor built in to prevent a failure within a product. The standard service factor for drives in a fume exhaust application is 2.0, meaning the drives are actually capable of withstanding twice the load that they could potentially be subject to.

SOUND

dBA
Estimated sound pressure level in the space using "A" weighting.

Lp
Sound Pressure Level, Describes the loudness level of the sound, like the brightness level of a light bulb. This value varies with the distance from the sound source and the environment surrounding the sound source. Sound pressure is usually expressed in decibels with a reference level to 0.0002 microbars.

Lw
Sound Power Level. Describes the total amount of acoustical energy the fan emits, like the watt rating of a light bulb describes the total amount of energy the light emits. This value is independent of location, distance, and environment. Sound Power is usually expressed in decibels with a reference level to 10^{-12} watts.

LwA
Sound Power Level 'A' weighted. This is a single value representing the fan's overall sound power level. 'A' weighting adjusts the sound power level for the response of the human ear. This value is often used in the calculation of sound pressure levels.

SPARK RESISTANT CONSTRUCTION
Fan applications may involve the handling of potentially explosive or flammable particles, fumes or vapors. Such applications require careful consideration by the system designer to insure the safe handling of such gases. It is the specifier or the user's responsibility to specify the type of spark resistant construction with full recognition of the potential hazards and the degree of protection required. AMCA Standard 99-0401-86 provides the guidelines for spark resistant construction.

TYPE A
All parts of the fan in contact with the airstream must be made of non-ferrous material — usually aluminum and limited to 250°F operation.

TYPE B
The fan shall have a non-ferrous wheel and nonferrous ring about the opening through which the shaft passes — usually aluminum wheel and rub ring and limited to 250°F construction.

TYPE C
The fan shall be so constructed that the shift of the wheel or shaft will not permit two ferrous parts of the fan to rub or strike. This is accomplished with an aluminum inlet cone and rub ring. This construction is limited to 500°F. Construction to 800°F is available using a steel inlet cone with copper/bronze lining.

TURBO-VANE
The innovative Turbo-Vane™ design integrates the internal nozzle and straightening vanes of a fan into one. Turbo-Vanes™ induce air within the fan housing as well as the windband, providing extremely high efficiency and entrainment capabilities. The design also allows for uniform motor cooling, while keeping the motor out of the air-stream.

UL 705 STANDARD
UL 705 covers power ventilators of the roof-and wall-mounted types and duct fans of the straight-through type intended for commercial or industrial use, residential fans intended for heated and conditioned air and for connection to permanently installed wiring systems in accordance with the National Electrical Code, NFPA 70.

VARIABLE RESISTANCE BOX
One of the key pieces to the AMCA 260 Standard for induced flow fans. This box allows the measurement of total discharge flow (Ps = 0 in. w.g. to simulate discharging the fan to atmosphere) at all points along its fan curve

VELOCITY, NOZZLE
Velocity, commonly stated in fpm, at the outlet of the fan nozzle. Does not include induced flow volume or windband and is based on the area of the outlet of the fan nozzle.

VELOCITY, WINDBAND
Velocity, commonly stated in fpm, at the outlet of the windband of the fan. Includes induced flow volume and is based on the area of the outlet of the windband.

VIBRATION ISOLATION

DEFLECTION
The amount a structural element will displace, or move, under a load. The vertical distance a spring is designed to compress under the calculated load.

RIS
Rubber-In-Shear, a type of isolator composed of a neoprene pad.

SPRING
A type of isolator composed of a coiled metal spring.

RAILS
Metal plates supplied with either Spring or RIS isolators to provide additional stiffness and support.

ISOLATION BASE
Heavy structural base for fan, motor and drive is designed for use with spring or rubber-in-shear type isolators. Use of flexible connectors at inlet and outlet is required on fans with isolators.

INERTIA BASE
A structural steel base provides common support to fan, motor and drive including guards. This style of base requires adequate foundation integrity for proper operation and is filled with concrete.

BLOCK
Thickness of concrete base (in inches) within an Inertia Base. Commonly 6 or 8 inches.

VORTEX BREAKER
Installed in the mixing plenum box at the fan inlet, the vortex breaker minimizes are swirl and turbulence. Recommended for intakes where the air is forced to make a 90 deg turn and on multi-fan configurations.

WINBAND, STANDARD
Device used to direct the exhaust as it leaves the housing of the exhaust fan. It also allows for the exhaust plume to more fully develop before being exposed to any outside conditions such as a cross wind.

WINDBAND, INDUCED FLOW
Device used to direct the exhaust as it leaves the housing of the exhaust fan and entrain dilution air.

WINDBAND, INDUCED FLOW, ACOUSTIC
Device used to direct the exhaust as it leaves the housing of the exhaust fan and entrain dilution air. Also includes an acoustic medium to reduce overall outlet sound of fan.

WINDLOAD RATING
The maximum cross wind rating that a fan is tested to be able to withstand. A common requirement for fume exhaust fans is a minimum rating of 125 fpm without the use of guide wires. Achieving this rating requires the use of the fan manufacturer's roof curbs and mounting instructions.