ESA

Efficient Silent Array™

OPERATION & MAINTENANCE MANUAL - PN 59705-0

PENN BARRY™

IMPORTANT! Read before proceeding!

The information contained herein is, to the best of our knowledge, accurate and applicable for proper operation and installation of the specified equipment at the time this document entered service. Before proceeding, it is recommended that you check for a more current version of this Installation Operation Manual (IOM) on our website at www.pennbarry.com.

Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.

TABLE OF CONTENTS

INTRODUCTION

This Installation Manual is provided as a guide for the installation of fans manufactured by PennBarry. It is the responsibility of the purchaser to provide qualified personnel experienced in the installation, operation, and maintenance of air moving equipment. Instructions given in this manual are general in nature and apply to a variety of models manufactured by PennBarry. Read this Installation Manual completely before installing the fan. Additional product and engineering information is available at www.PennBarry.com. Always follow good safety practices when installing, maintaining and operating air moving equipment.

If fans are located less than 7 feet above the floor, guarding is required in accordance with OSHA (Occupational Safety and Health Act) requirements.

Disconnect power before servicing or installing.

This fan should be assembled and installed by a qualified technician.

RECEIVING AND HANDLING

All PennBarry products are carefully constructed and inspected before shipment to ensure the highest standards of quality and performance. Compare all components with the bill of lading or packing list to verify that the proper unit was received. Check each unit for any damage that may have occurred in transit. Any damage should be reported immediately to the carrier, and the necessary damage report filed.

Handling of all air moving equipment should be conducted by trained personnel and be consistent with safe handling practices. Verify the lift capacity and operating condition of handling equipment. Maintain handling equipment to avoid serious personal injury.

Units shipped completely assembled may be lifted with slings and spreader bars. Lift the fan in a fashion that protects the fan and fan coating from damage. Never lift a fan by the inlet or discharge flange, shafting, drives, impeller, motor, motor base, or in any other manner that may bend or distort parts.

LIFTING INSTRUCTIONS

Fans are designed to be lifted and moved as a single module. PennBarry does not recommend lifting connected fan modules unless the fan modules are supported on a common base.

1. Carefully remove any crate and packing materials.
2. Place the bottom fans onto the mounting structure using the recommended lifting points as shown. Lift each fan individually into position.

Maximum Fan Weight Specifications	Product
Fan Size	Max. Total Weight (lbs.)
105	240
122	270
135	300
150	340
165	490
182	476
200	528
222	815
245	1263

INTRODUCTION

Preferred lifting method

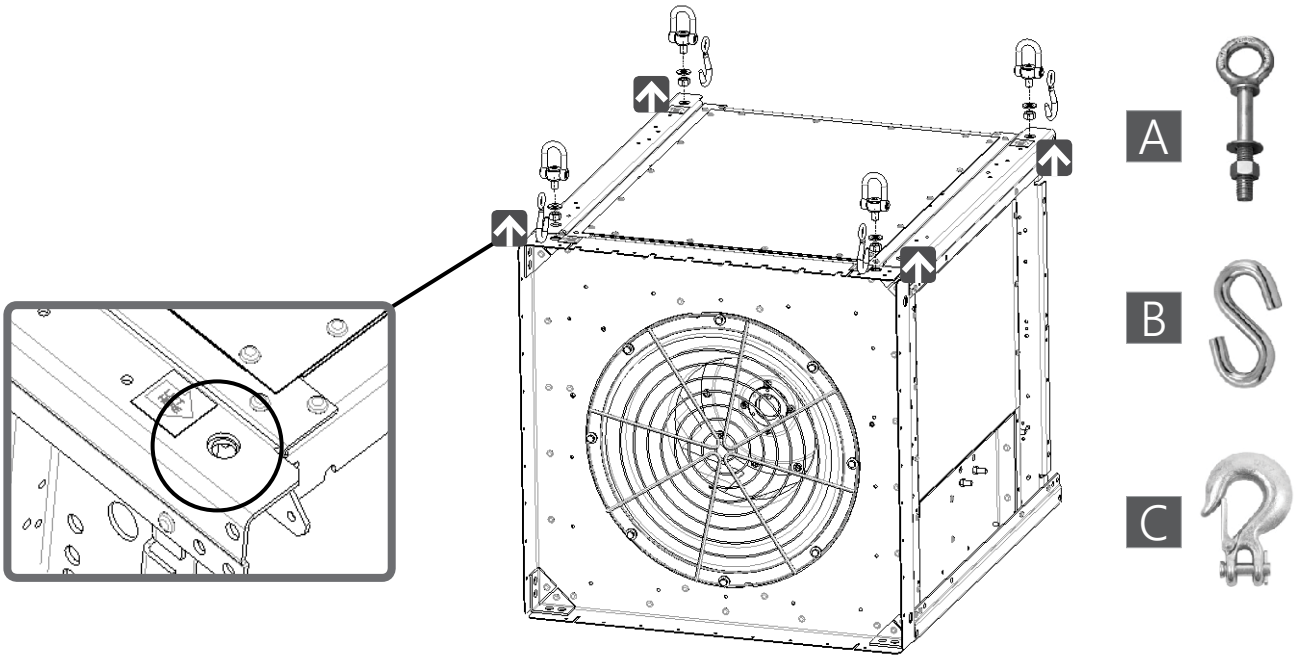
Ⓐ Eyebolt with washers and nut

Alternate lifting method

Ⓑ S-Hook

Ⓒ Clevis Hook

Lifting Points
– 5/8" diameter holes



INSTALLATION, OPERATION & MAINTENANCE

SHORT TERM STORAGE

If fan installation is delayed, store the unit in a protected area. Protect the fan and motor bearings from moisture and vibration (or shock loading).

LONG TERM STORAGE

If a fan is to be stored for any length of time and the bearings are re-greasable, the motor bearings should immediately be filled with grease while rotating the fan, and then the bearings should be re-greased and rotated monthly. This will prevent moisture, which condenses within the bearing, from corroding the raceways.

STORAGE PROCEDURES

Fans should be stored indoors whenever possible where control over temperature, humidity, shock and dust is reasonably maintained. If units are to be stored outside, they should be covered with a water-resistant material. Stored equipment should be on a clean, dry floor or blocked up off the ground to prevent unit from sitting directly on the ground.

PERIODIC CHECK

On a monthly interval, the equipment should be checked to ensure that it has remained in an acceptable stored condition. The fan and motor should be rotated several times by hand. The fan impeller should be repositioned approximately 180 degrees from the previous month to prevent damaging the motor bearings.

BASES (Foundation and Isolation)

Critical to every fan installation is a strong, level foundation. Structural bases must be sturdy enough to prevent flexing and vibration. PennBarry recommends using a spring isolated inertia base for all Efficient Silent Array™ applications. Design, fabrication, and installation of the isolation base are the customers responsibility.

After the fan, isolation base, and isolators are installed, the entire assembly must be leveled. Floor mounted fans should be installed on a flat, level, rigid foundation.

Fans mounted to or within a structure should be placed as close as possible to a rigid member such as a wall or column. The structure must be designed for rotating equipment; static design for strength is not sufficient to ensure proper operation. Structural resonance should be at least 20% above the maximum fan operating speed.

Any ducting should have independent support; do not use the fan to support ducting. Isolating the fan from ductwork with flex connections eliminates transmission of vibration.

UNIT START UP

When the unit is removed from storage, all grease should be purged and replenished with fresh grease. The following checklist is recommended to ensure proper operation:

Operation Check List

Verify proper safety precautions have been followed:

- Electrical power must be locked off.

Check fan mechanism components:

- System connections are properly made and tightened.
- Impeller and fan surfaces are clean and free of debris.
- Rotate the impeller by hand to verify it spins freely and has not shifted in transit.

Check fan electrical components:

- Motor is wired for proper supply voltage.
- Motor was properly sized for power.
- Motor is properly grounded.
- All leads are properly insulated.

Trial "bump":

- Turn on power just long enough to start assembly rotating.
- Check rotation for agreement with rotation arrow.

Perform checklist again until unit is operating properly. Verify fastener tightness. These may have become loose during shipment or installation.

- Bushing set screw torque.
- Bolts on inlet funnel.
- Motor bolt torque.
- Nuts holding housing frame to base and base to ground (customer specifications).
- Bushing fastener torque.
- Prevention of contact between piezo ring tubing and impeller.

C

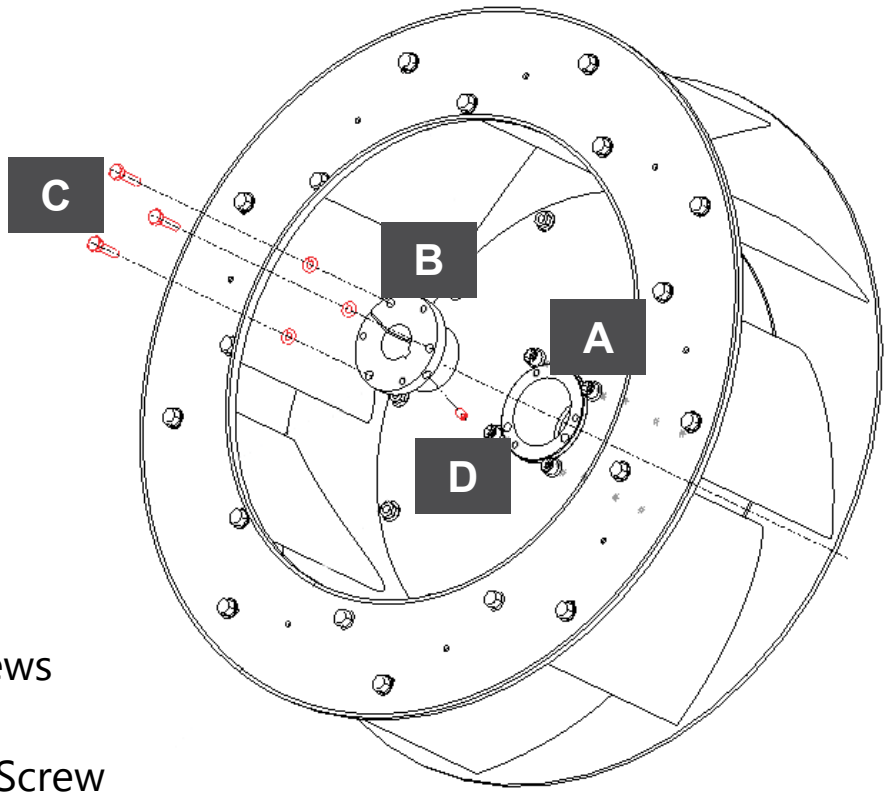
Bushing Fastener Torque		
Bushing Type	**Screw Size**	**Recommended Torque**
JA	10-24	60 in-lbs.
SD/SDS	1/4-20	108 in-lbs.
SK	5/16-18	180 in-lbs.
SF	3/8-16	360 in-lbs.

D

Bushing Set Screw		
Bushing Type	**Screw Size**	**Recommended Torque**
SD/SDS	1/4-20	60 in-lbs.
SK	5/16-18	110 in-lbs.
SF	3/8-16	110 in-lbs.

UNIT START UP

Motor Bolt Torque			
NEMA Frame	Bolt Size (Grade 5)	Washers Size (Top and Bottom)	Recommended Torque (ft-lb)
56-145T	5/16	5/16	18
182-215T	3/8	3/8	31
254U-286TS	1/2	1/2	75
324T-365T	9/16	9/16	107



A Hub

B Bushing

C Bushing Screws

D Bushing Set Screw

MOTOR AND STRUCTURAL MAINTENANCE

MOTOR MAINTENANCE

The three basic rules of motor maintenance are: keep the motor clean, dry and properly lubricated. Keeping motors and windings clean is important as trapped dirt and dust may impede air flow and heat convection causing motor windings to overheat possibly leading to premature failure. Blow dust and dirt out of windings and off the motor periodically. Use low pressure (50 psi) airstream to prevent winding damage. Keep the areas surrounding the motor clear so the air can circulate through the motor cooling fan.

Motors should be kept dry to avoid electrical short circuits. Motors kept in storage for long periods of time can have moisture condense on the windings. Be certain the motor is dry before use.

Some smaller motors are permanently lubricated. Motor bearing lubrication, if required, must follow a rigorous schedule. Motors less than 10 hp running eight hours a day in a clean environment should be lubricated once every five years. Lubricate 15 to 50 HP motors every 3 years and 50 to 150 HP motors yearly. See motor manufacturer specifications for recommended greases. For motors in a dusty or dirty environment or which run 24 hours a day, divide the service interval by 2. If the environment is very dirty or high temperatures exist, divide the service interval by 4. Lubrication requirements are normally attached to the motor. Do not over-lubricate.

The major cause of motor bearing failure is contamination of grease, insufficient grease, over lubrication, and incompatibility of grease.

STRUCTURAL MAINTENANCE

All structural components or devices used to support or attach the fan to the isolation base or other structure should be checked at regular intervals. Vibration isolators, bolts, foundations, etc, are subject to failure from corrosion, erosion, and other causes. Improper mounting can lead to poor operation characteristics, fan fatigue, and failure. Check components for corrosion, cracks, or other signs of stress.

TROUBLESHOOTING GUIDELINES

Use safety practices when investigating fan or system performance problems. General safe practices and performance troubleshooting guidelines can be found in AMCA Publication 410: Recommended Safety Practices for Users and Installers of Industrial and Commercial Fans, and AMCA Publication 202-98 (R2011): Troubleshooting. Fan application and field measurement procedures can be found in AMCA Publication 201-02 (R2011): Fans and Systems, and AMCA Publication 203-90 (R2011): Field Performance Measurement of Fan Systems.

Troubleshooting Performance Problems:

The lists below indicate possible areas to check when air or sound values do not meet expectations. Most fan problems can be pinpointed to one of these common causes.

Air Capacity Problems:

1. Air resistance of system is not at design rating. If air resistance is lower than expected, airflow may be higher, and the associated horsepower lower. If air resistance is higher than anticipated, air volume will likely be lower.
2. Fan speed is not at design speed.
3. Air density is not at design values. Also, check air performance measurement techniques / procedures.
4. Mechanical air devices (e.g. dampers or filters) are closed or plugged.
5. Impeller is mounted improperly or is rotating in reverse.
6. Parts of system or fan have been damaged or need cleaning.

Noise Problems:

1. Fan is not at design point of operation, or fan is operating in an unstable flow region.
2. Bearings failed. Check bearings.
3. Supply voltage is high, or supply frequency is inconsistent. Variable frequency controllers can generate motor noise.
4. Objects which are installed in a high velocity airstream can generate noise. This includes flow sensors, turning vanes, etc.
5. Fan inlets develop non-uniform conditions.
6. Acoustics or sound measurement procedures are incorrectly administered.

Vibration Problems:

1. Misalignment of drive components.
2. Poor foundations (isolation base) or mounting structure (resonances).
3. Trapped foreign object in rotating components.
4. Damaged rotating components (bearings, shaft, fan, impeller).
5. Broken, loose or missing set screws.
6. Loose bolts.
7. Vibration transmitted by another source.
8. Water accumulating in airfoil blades.
9. Fan operation in stall or unstable flow region.

NOTE: All fans manufactured by PennBarry are factory balanced prior to shipment. Improper handling and movement of the fan during shipment may cause the rotating assembly to shift out of alignment. Balance should be checked once the fan is installed. If a final trim balance is required, it is the end user's responsibility to bring the fan back to factory specifications. Final trim balancing is not the responsibility of PennBarry.

INSTALLATION

EFFICIENT SILENT ARRAY™ ASSEMBLY

Intake Side

Supply Side

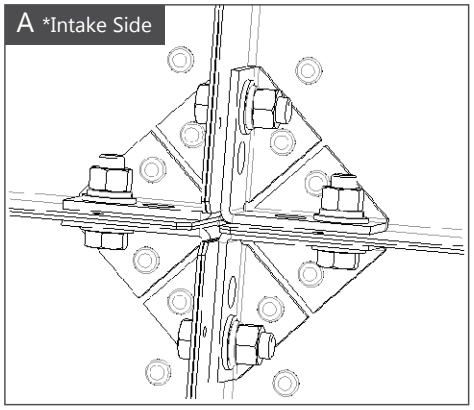
Intake Side

Bolt bottom Efficient Silent Array™ modules to the isolation base, or other structure, and adjacent modules using the inlet and outlet mounting flanges. The first row of modules should be securely installed before installing the second row of modules. PennBarry does not recommend lifting and moving an assembled Efficient Silent Array™, as this may cause bending, distortion, and lead to component misalignment.

A

Top, Bottom and Side Connections
***Intake Side Shown**

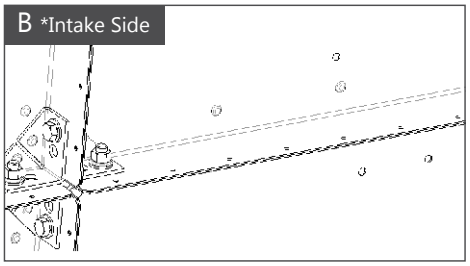
- 1/2-13 x 1.00 Grade 5 Hex Head Cap Screw (or equivalent) 4 required (1 in each corner)
- 1/2 Flat Washer, 8 required (2 in each corner)
- 1/2-13 Hex Nut (or equivalent), 4 required (1 in each corner). Recommended torque setting of 18 (ft-lb)
- Split Lock Washer (or equivalent), 4 required (1 in each corner)



B

Middle Connections *Intake Side Shown

- Intake Side Panel Connection: A series of .22" diameter holes, 3" on center, are provided to connect the front panel of the fan assembly to the customer's equipment. The holes are sized for 1/4" sheet metal screws.
- All installation hardware supplied by end user.



INSTALLATION

RADIAL GAP, OVERLAP AND IMPELLER ALIGNMENT

Efficient fan performance can be maintained by having the correct gap and overlap between the impeller and inlet funnel. These items should be checked at installation, after the fan has been in operation for 24 hours, and after the unit has been serviced.

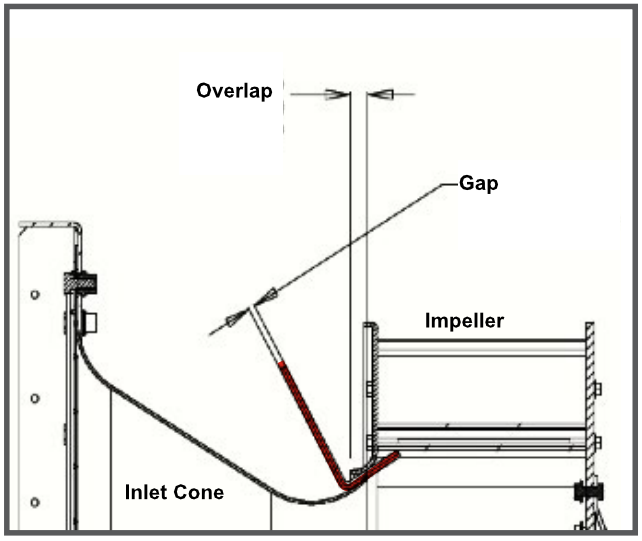
Gap – distance between the OD of the funnel and the ID of the impeller concentricity.

Overlap – distance the funnel and impeller overlap one another.

Gap/Overlap Dimensions			
Model	Minimum Overlap (Inches)	Maximum Overlap (Inches)	Minimum Gap (Inches)
105	0.12	0.29	0.06
122	0.12	0.32	0.07
135	0.12	0.35	0.07
150	0.19	0.41	0.09
165	0.25	0.47	0.11
182	0.31	0.5	0.11
200	0.38	0.57	0.12
222	0.44	0.63	0.14
245	0.50	0.69	0.17
165	0.25	0.47	0.11
182	0.31	0.5	0.11
200	0.38	0.57	0.12
222	0.44	0.63	0.14
245	0.50	0.69	0.17

Overlap is adjusted by loosening the impeller hub from the shaft and moving the impeller to the desired position along the shaft. The transition between the inlet funnel and impeller should be as shown; there is a smooth feel to the profile when moving from one component to the other.

This sketch shows both the gap and overlap dimensions for all sizes.



Gap is adjusted by loosening the inlet funnel bolts and centering the funnel on the impeller.

CAUTION

Caution: Never loosen the motor attachment bolts to make adjustments to the impeller-to-funnel gap.

INSTALLATION

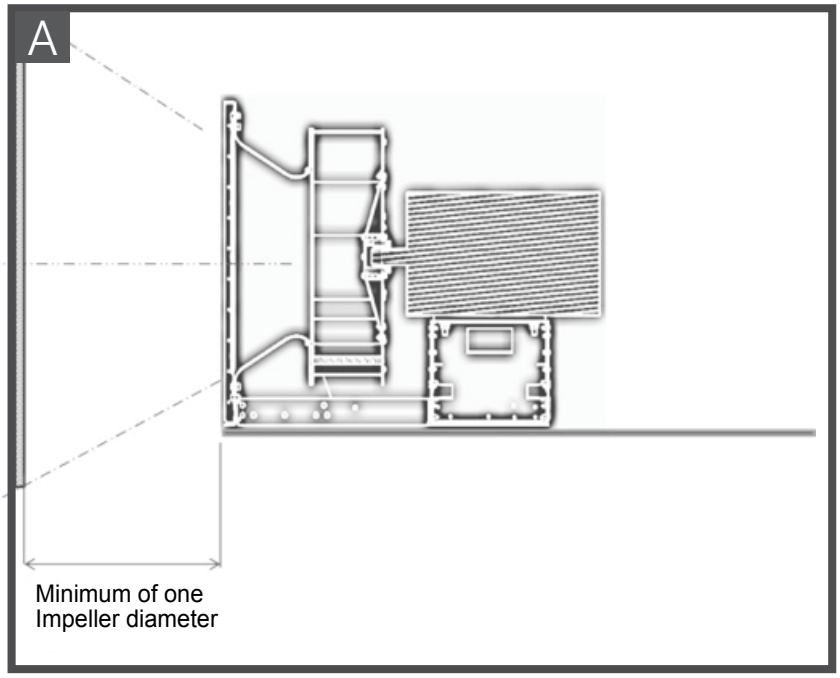
FAN SPACING

Location and Placement of Plenum Fans in Air Handlers

- Center the fan inlets in both the horizontal and vertical planes.
- For inlet clearance, see A

A minimum of one fan impeller diameter clearance is recommended.

Recommended Inlet Spacing



PIEZOMETER RING DATA

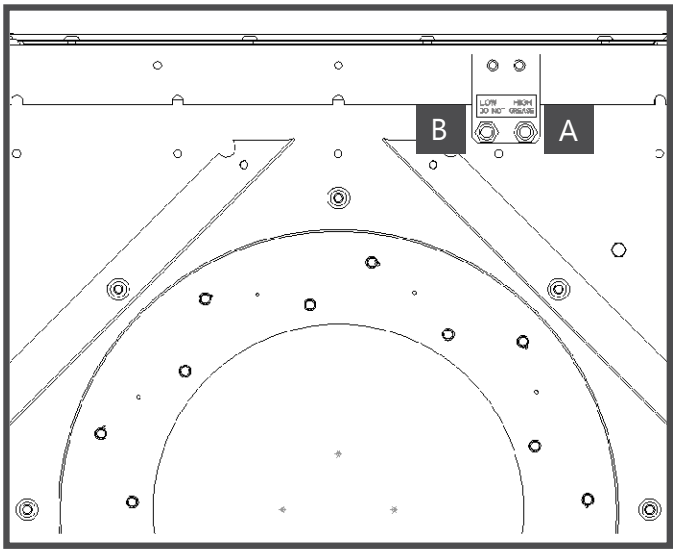
HOW IT WORKS

The Piezo Ring system is based on the principle of a flow nozzle. The inlet funnel of the fan is used as the flow nozzle, and the flow can be calculated by measuring the static pressure drop through the inlet funnel. The pressure drop is measured from the tap located on the face of the inlet funnel 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 (see diagram below).

K Factor		
Fan Size	**iCorus & Corus DDP**	**Efficient Silent Array**
105	592	592
122	842	842
135	963	963
150	1147	1147
165	1450	1450
182	1671	1671
200	2087	2087
222	2458	2458
245	2941	2941

A Front Pressure Tap
HIGH PRESSURE

B Piezometer Ring
LOW PRESSURE



MEASUREMENT OF AIRFLOW

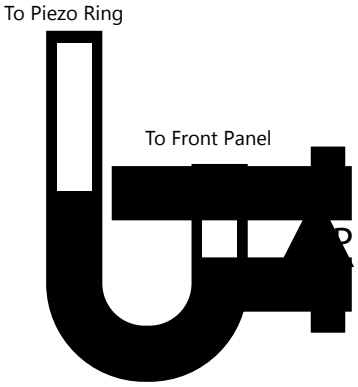
Several factors affect the accuracy of this method of determining flow. The equations below assume the following:

- A lack of vanes or other obstructions in or near the inlet
- Impeller to inlet funnel overlap
- Unpressurized flow entering the funnel (no pre-swirl).
- Accurate determination of air density at the inlet

CALCULATION WHEN USING THE PIEZO RING

For standard air (ρ = 0.075 lb/ft3): (CFM) = K Factor * √(delta pressure)

- K Factor = value from chart
- Delta Pressure (ΔP) = The differential in static pressure from the piezometer ring and the front pressure tap (inches w.g.)



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PennBarry is proud to be your preferred manufacturer of commercial and industrial fans and blowers. Learn how PennBarry can assist you in your next application by contacting your PennBarry Representative or visiting us on the web at www.pennbarry.com.

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