

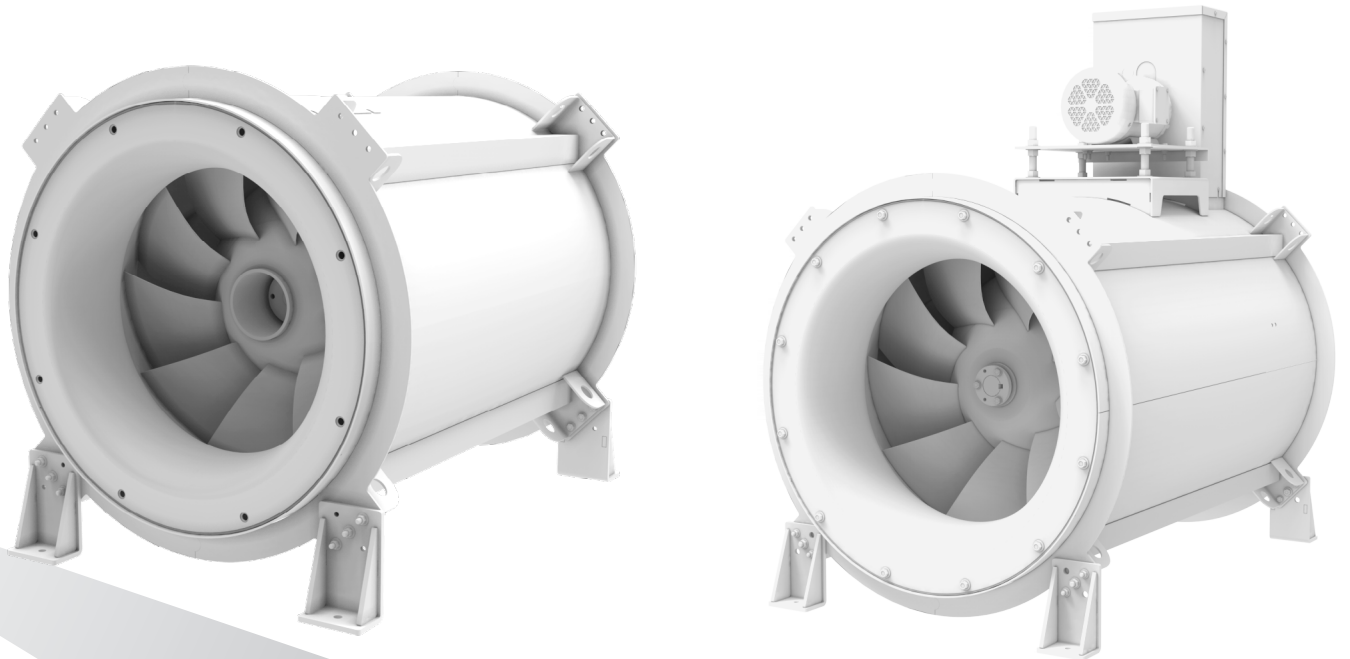
MXI

Mixed Flow Inline Fan

OPERATION & MAINTENANCE MANUAL



PENNBARRY™



IMPORTANT! Read before proceeding!

Please read and save these instructions. 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

GENERAL SAFETY INFORMATION	3-4
GENERAL INFORMATION	5
LIFTING INFORMATION	6
DUCT INSTALLATION	6
DRAINAGE PIPE/TRAP DETAIL	7
ELECTRICAL CONNECTIONS	8-13
PRE-START-UP CHECKS	14-15
MAINTENANCE	16-17
ACCESSORY	18

GENERAL SAFETY INFORMATION

Only qualified trained personnel should install or maintain equipment described in this document. Improper installation can result in electric shock, possible injury due to high speed moving parts, or other potential hazards. Special circumstances such as high winds or wet surfaces must be considered when installing the unit. Contact a PennBarry engineer if any questions or issues arise or if any other information is needed before installing or maintaining the fan.

1. Follow all local, state and federal electrical and safety codes, as well as the National Electrical Code (NEC) and the National Fire Protection Agency (NFPA) where applicable. Follow the Canadian Electrical Code (CEC) in Canada.
2. Make sure that the wheel spins freely without hitting or rubbing on any parts or objects.
3. The motor must be grounded; failure to ground a motor can result in a serious safety hazard.
4. The fan impeller should not be operated at RPM's exceeding the rated RPM. If fan speed is higher than rated, the motor may over amp, causing serious damage to the motor and other moving parts of the fan.
5. Power cord must be free of any kinks or pinches and must not come into contact with grease, oil or other liquids, flammable or otherwise.
6. Verify that incoming power to the unit is of the correct voltage stated on the unit and/or motor nameplate.
7. Turn unit off before opening any access panels.



Always disconnect power before working on or near a fan. Lock and tag the service switch or breaker to prevent accidental power up.



When servicing the fan, motor may be hot enough to cause pain or injury. Allow motor to cool before servicing.



Precaution should be taken in explosive atmospheres.

Receiving

PennBarry fans are carefully inspected and tested before leaving the factory. When the unit is received, inspect the packaging for any signs of tampering. Inspect the unit for any damage that may have occurred during transit and check for loose, missing or damaged parts. Mishandled units can void the warranty provisions. If units are damaged in transit, it is the responsibility of the receiver to make all claims against the carrier. PennBarry is not responsible for damages incurred during shipment. Avoid severe jarring and/or dropping. Handle units with care to prevent damage to components or finishes. If the unit is scratched due to mishandling, the protective coating may be damaged. Incorrect lifting may damage the fan and void the warranty.

Unpacking

Upon reception, verify that all required parts and the correct quantity of each part have been received. If any items are missing, report these to your local PennBarry representative. Due to variation in shipping carriers and availability, some items are shipped separate from one another. Confirmation of shipment(s) must be limited to only items on the bill of lading.

Storage

Store in a dry, protected area being sure fan shaft, bearings and impeller are protected against dust and corrosion. If it is necessary to store outdoors or within a building under construction, special care must be taken to prevent moisture, corrosion, dirt or dust accumulation. Coat the shaft with grease or a rust preventative compound. Cover and seal bearings to prevent entrance of contaminants. Impeller should be rotated at least once a month to circulate the grease in bearings. If stored outdoors over seven (7) days, cover completely with a tarp or heavy waterproof paper. Electrical connections and leads must be protected from moisture. Block impeller to prevent natural rotation. Do not allow material of any kind to be piled on top or inside of fan.

GENERAL SAFETY INFORMATION

Inspection and Maintenance during Storage

Long-term storage is defined as storage for a period exceeding one month from the date the equipment was received. Fans and motors should be stored in a dry, low humidity area indoors. Equipment which is to be installed, but not operated for several months, should first be blocked to take the weight off of the vibration isolators (if provided) and then given the same protection, periodic inspection and maintenance as a unit in storage. To prevent puddle corrosion of fan bearings that undergo long-term storage, the following preventive maintenance must be performed:

1. Fan bearings must be re-lubricated every month until the fans are put into service. A clear 1/16" bead of grease must appear on each side of the bearings. Fan wheels are to be rotated manually while the bearings are re-lubricated. Refer to the specific bearing lubrication instructions located on the fan housing for the type of lubricant to use.
2. Motor bearings should be lubricated as recommended by the motor manufacturer.

Removing from Storage

Fans should be hoisted with slings placed around the fan housing. When a single hoist is used, a "spreader" will keep the sling from slipping on the housing. Fans must be protected and maintained from the time of storage to the time of assembly and installation.

Ensure that the fan is in working order before assembly and installation. Be sure that no damage has occurred between storage and time of assembly.

1. Ensure that all fasteners, fittings, screws, etc. are tightened to recommended specifications.
2. Make sure that no parts or objects are rubbing on the fan wheel as it is turned.

Notes: This document is applicable for the following PennBarry models. Size maybe followed by -AF

MXI-122	MXI-122-AF	MXI-300	MXI-300-AF
MXI-135	MXI-135-AF	MXI-330	MXI-330-AF
MXI-150	MXI-150-AF	MXI-365	MXI-365-AF
MXI-165	MXI-165-AF	MXI-402	MXI-402-AF
MXI-182	MXI-182-AF	MXI-445	MXI-445-AF
MXI-200	MXI-200-AF		MXI-490
MXI-222	MXI-222-AF		MXI-542
MXI-245	MXI-245-AF		MXI-600
MXI-270	MXI-270-AF		

GENERAL INFORMATION

Unit identification tags

Each unit has a permanently affixed nameplate with various identifications including, but not limited to, the unit model and serial numbers, motor ratings and voltages.

The figure below is an example of a PennBarry unit nameplate. It includes all of the specifications of the unit, as referenced above. When contacting your PennBarry representative, please have the information on the nameplate readily available, as this will help to streamline your help request.

Fan components may arrive in pieces or assemblies depending on the fan configuration. Components of the fan will have matching nameplates, and these components should not be mixed with other PennBarry fans. If mismatched components are installed in the same fan, fan performance may be reduced.

The diagram shows a rectangular nameplate with the PennBarry logo at the top center. Below the logo, the name "PENN BARRY™" is printed. The nameplate contains several fields for identification and specifications, each with a corresponding label in English and French. The fields are arranged in two rows. The first row includes Tag# (Numero D'etiquette), Model (Modele), Serial (Numeral), and Fan RPM (Fan RPM). The second row includes HP (Puissance en Chevaux), Voltage/Phase/Cycle (Voltage/Phase/Frequence), Motor RPM (Moteur RPM), and SO# (SO#) and MO# (MO#). Below the fields, there is a bilingual warning: "Power Ventilator for Smoke Control Systems (1000° F for 15 min/500° F for 4 hrs) For installation in accordance with NFPA-204M." and "Ventilateur de Puissance pour un systeme de controle de fumme (537.78° C pour 15 minutes/280° C pur 4 hour) L'Installation doit stre conforme au bulletin NFPA-204M." At the bottom, there is a note: "See Motor Nameplate for Electrical Rating and Motor Protection" and "Se referer a la plaque singaletique du moteur concernant la classification electique ainsi que la protection requises pour ce moteur".

Tag# Numero D'etiquette	Model Modele	Serial Numeral	Fan RPM Fan RPM
HP Puissance en Chevaux	Voltage/Phase/Cycle Voltage/Phase/Frequence	Motor RPM Moteur RPM	SO# MO#

Power Ventilator for Smoke Control Systems
(1000° F for 15 min/500° F for 4 hrs)
For installation in accordance with NFPA-204M.

Ventilateur de Puissance pour un systeme de controle de fumme (537.78° C pour 15 minutes/280° C pur 4 hour)
L'Installation doit stre conforme au bulletin NFPA-204M.

See Motor Nameplate for Electrical Rating and Motor Protection
Se referer a la plaque singaletique du moteur concernant la classification electique ainsi que la protection requises pour ce moteur

Pre-Installation information

Ensure that the mounting surface where the unit is to be installed is completely level and free of debris. The mounting surface must also be able to bear the entire weight of the fan.

Electrical service switches

An electrical service switch must be installed either on the unit or in visual proximity to the unit, so that the unit can be easily turned off for maintenance or trouble shooting. These must be locked out when the unit is being maintained or serviced.

Moving parts

Any moving parts on the unit must have covers or guards to protect any servicers or personnel. These guards are to be installed in accordance with local codes. The fan wheel must be secured before performing any maintenance on the unit; damage to the wheel is possible if this precaution is not taken.

Guards (Motor/Weather cover)

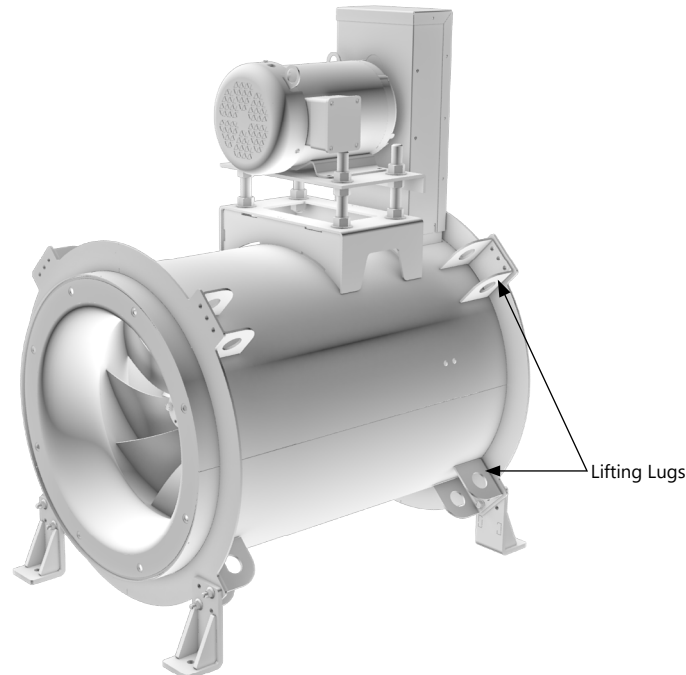
All parts of the unit, including guards and covers, must be installed before attempting to start the unit. Do not operate the unit with any missing pieces, particularly any guards or covers; this includes any hardware such as nuts and bolts, which hold these covers in place.

Air pressure and suction

Fans moving at any speed create suction with varying degrees of strength. Special consideration needs to be taken when working around these units. Do not leave any loose articles of clothing or materials in or around air intake or fan inlet.

LIFTING INFORMATION

Fans should be hoisted with slings placed around the fan housing. When a single hoist is used, a “spreader” will keep the sling from slipping on the housing. If it is necessary to use hooks placed in lifting holes of fan, BE CAREFUL NOT TO DISTORT OR BEND THE HOUSING. Lifting lugs or holes should be used only to stabilize the unit while using a sling to support the weight. Chain or wire slings should be well-padded where they contact the fan, especially where special coatings and paints are involved. Rubber, phenolic enamels, etc. require special care as they may easily be damaged by contact in lifting. Even a small chip will destroy the corrosion prevention seal of the coating and allow corrosion to start. Always repair scratched surfaces with touch up of like coating prior to installation.



Fan Assembly

DUCT INSTALLATION

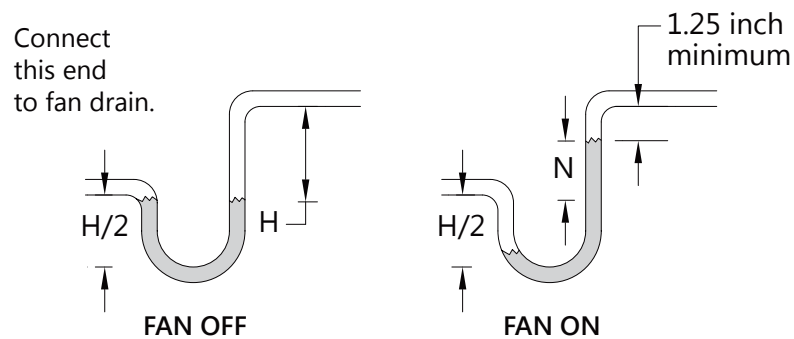
Slip-fit duct connections are available at both the inlet and outlet connections. Fan may be installed directly onto the ducting by slipping over the connecting duct. Some applications may require the use of flanged connections or flexible duct connections, both of which are accessories offered by PennBarry. For vertical applications, a flanged connection type is preferable.

DRAINAGE PIPE/TRAP DETAIL

Drainage ports provided on the fan housing provide drainage for the system. It is recommended that these drains are piped to allow proper drainage of any condensation collected in the unit.

1. Drain connections are 3/4 inch NPT.
2. Drain piping installed must have proper slope.
3. P traps are to be filled to proper level prior to unit start up.

Positive Pressure Trap on Tubular Fan Housing



N = Fluid displacement based on system pressure (field determined)
 H = N + (1.25" minimum)

ELECTRICAL CONNECTIONS



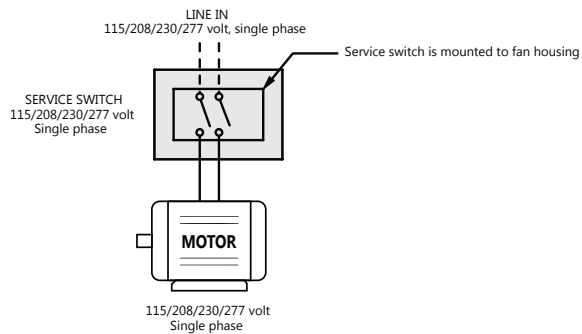
Warning: follow state and local electrical codes

Ensure supplied electrical power is of the correct voltage, current and phase and that electrical connections are properly sized and suitable for the intended application. All connections to the unit must conform to local electrical codes and standards. If the unit has an installed service switch, be sure that it is wired correctly to the fan motor. Do not install electrical power to the unit unless the service switch is in the off position. If there is no connection, ensure that the breaker supplying voltage to the unit is in the off position.

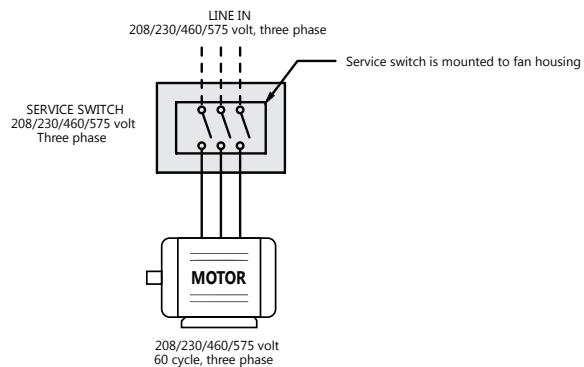
Service Switch Wiring Diagram

The service switch should always be mounted within visible sight of the unit, and if at all possible, it should be mounted on the unit itself.

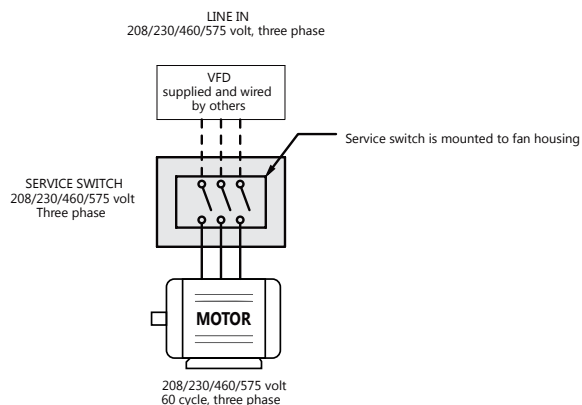
Single Phase Belt Drive



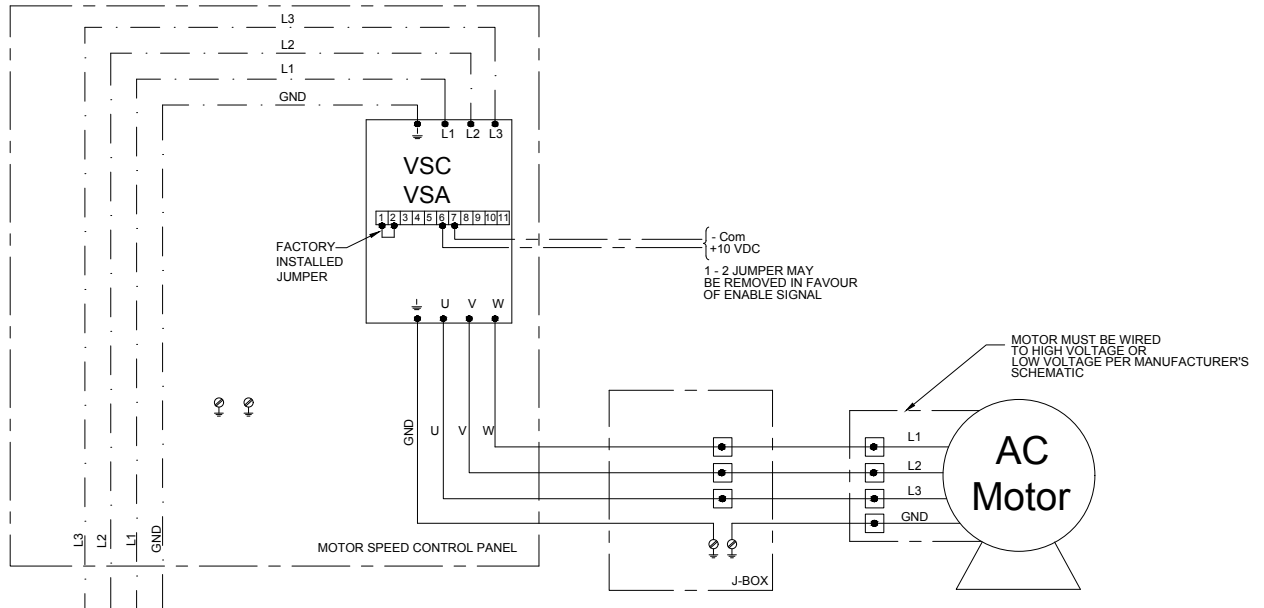
Three Phase Belt Drive



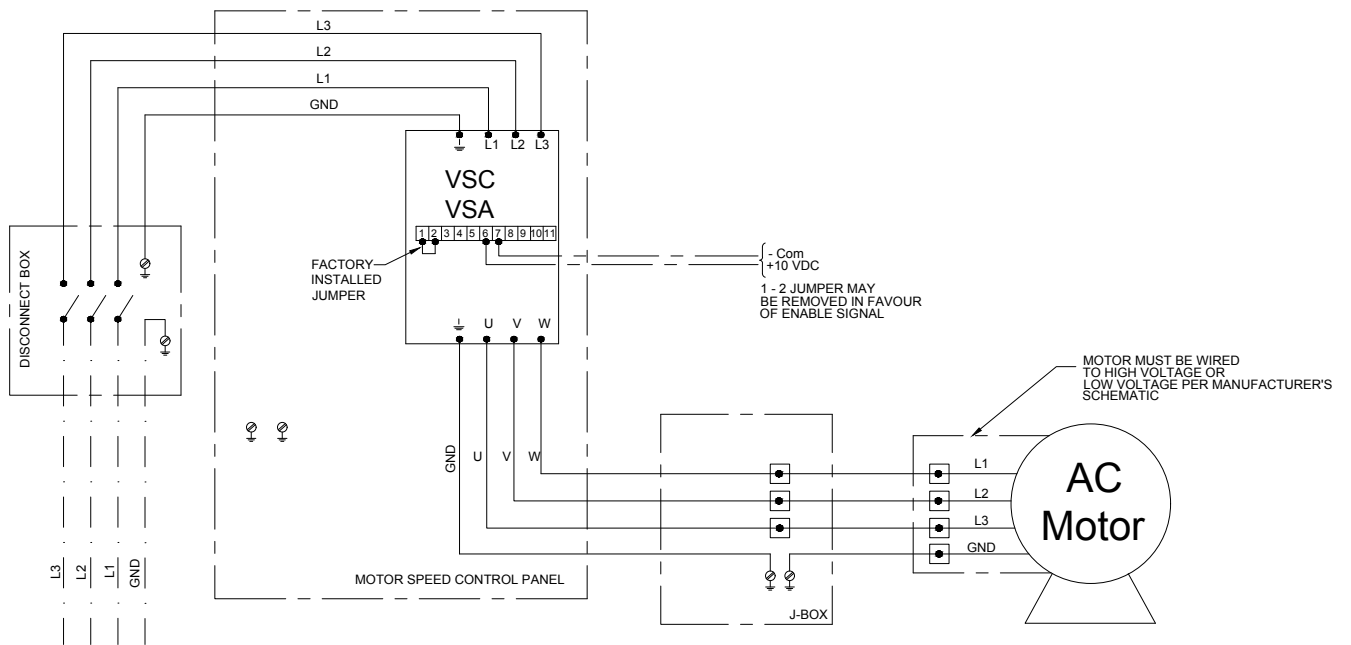
Three Phase with Variable Frequency Drives Belt Drive



ELECTRICAL CONNECTIONS



Three Phase with VSC/VSA IP20 No Disconnect

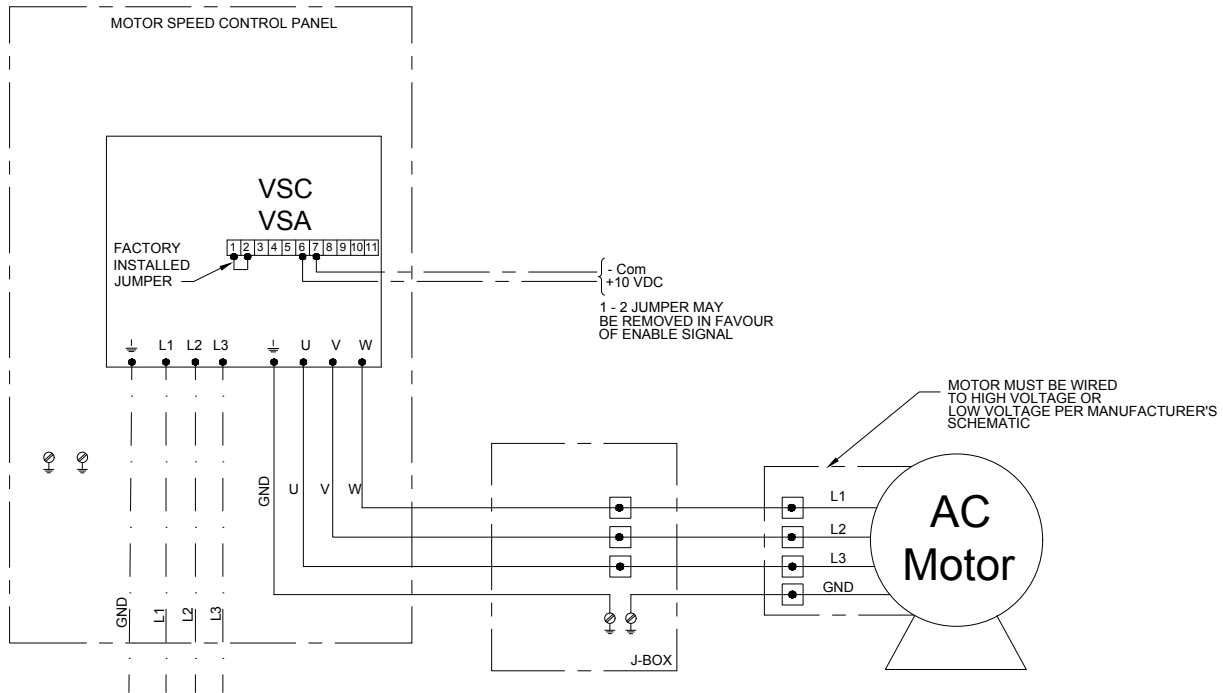


Three Phase with VSC/VSA IP20 W/Disconnect Direct Drive

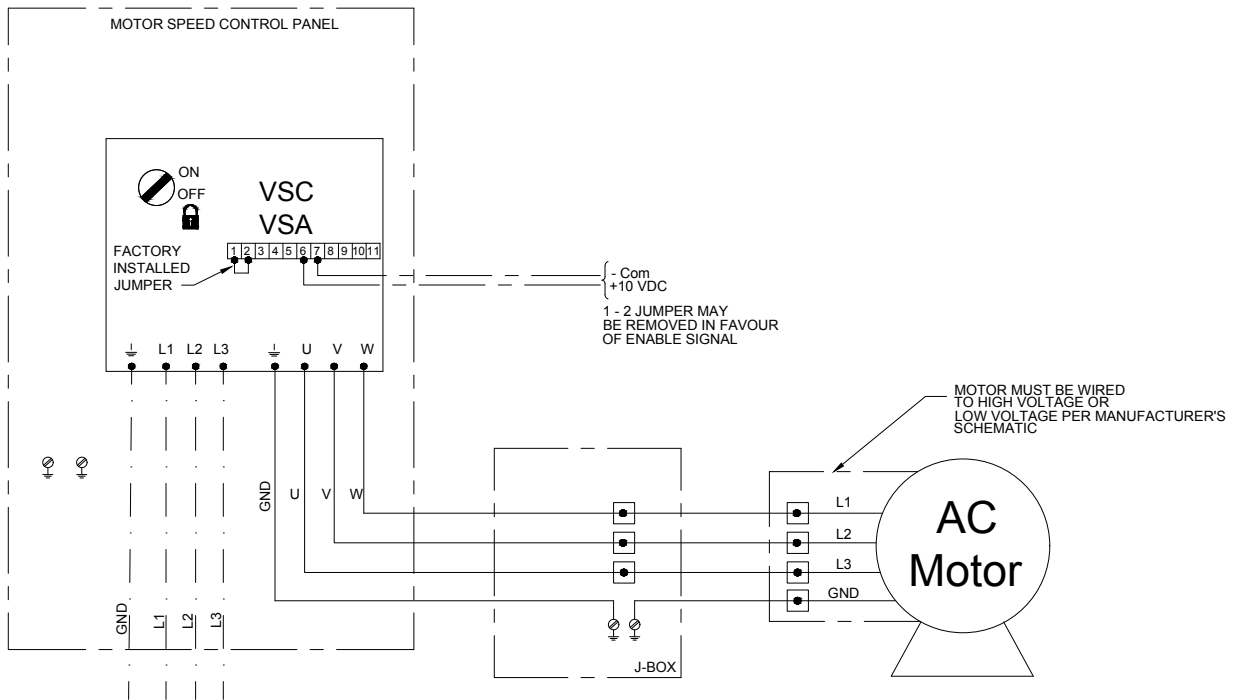
Notes:

- Factory Wired
- - - Field Wired
- Wire Nut

ELECTRICAL CONNECTIONS



Three Phase with VSC/VSA IP66 No Disconnect

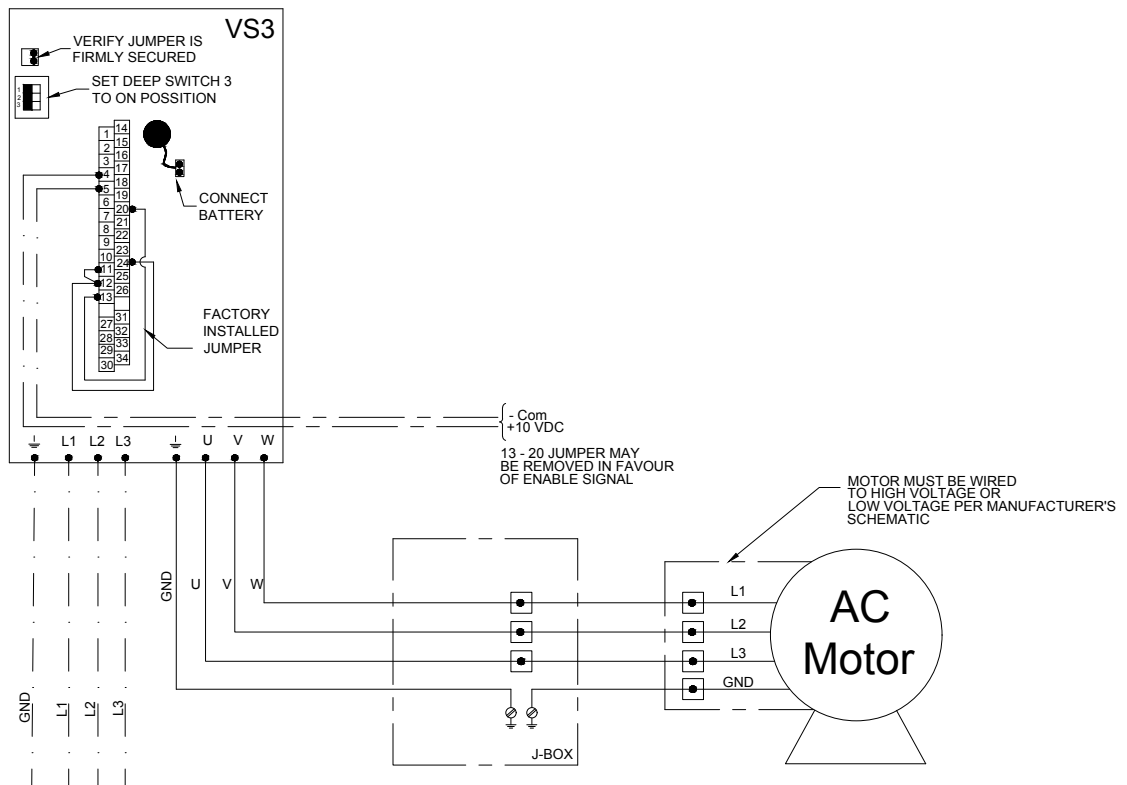


Three Phase with VSC/VSA IP66 W/Disconnect
Direct Drive

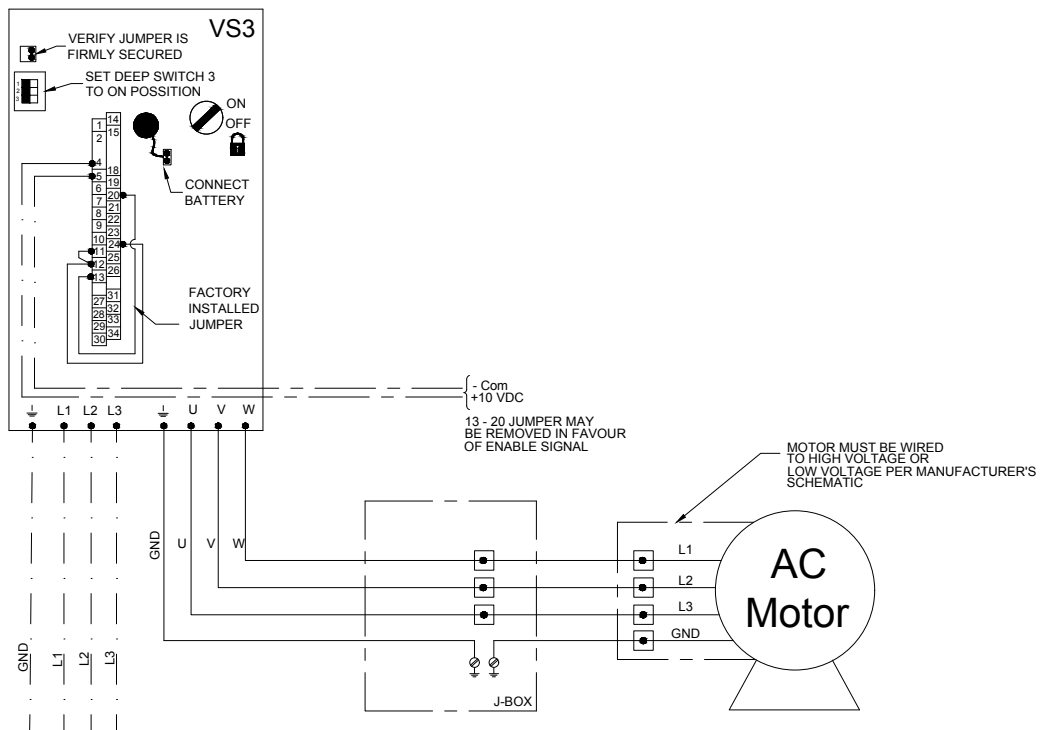
Notes:

	Factory Wired
	Field Wired
	Wire Nut

ELECTRICAL CONNECTIONS



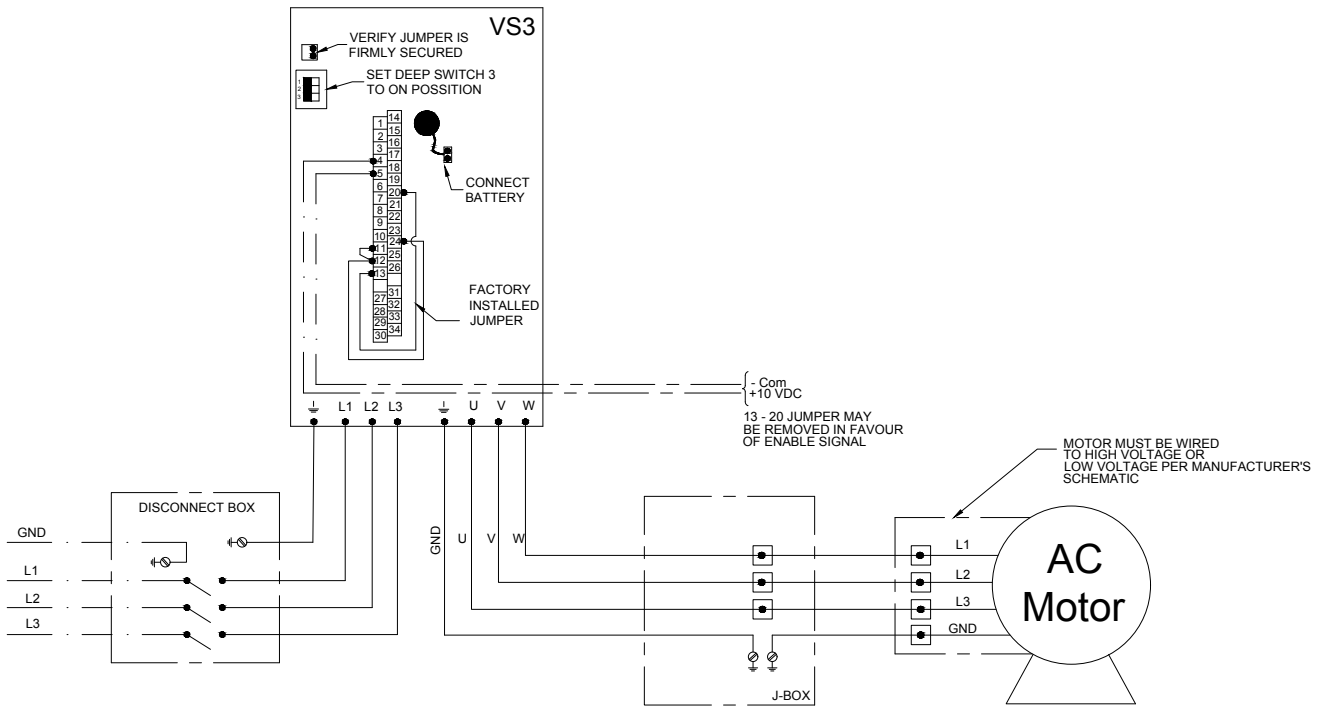
Three Phase with VS3 No Disconnect



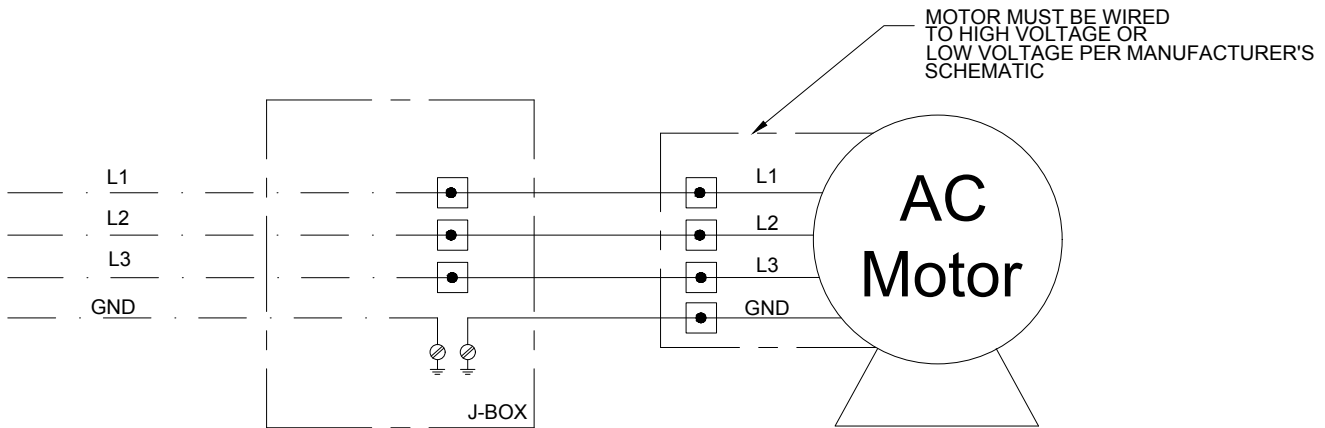
Three Phase with VS3 W/Disconnect
Direct Drive

Notes:

ELECTRICAL CONNECTIONS



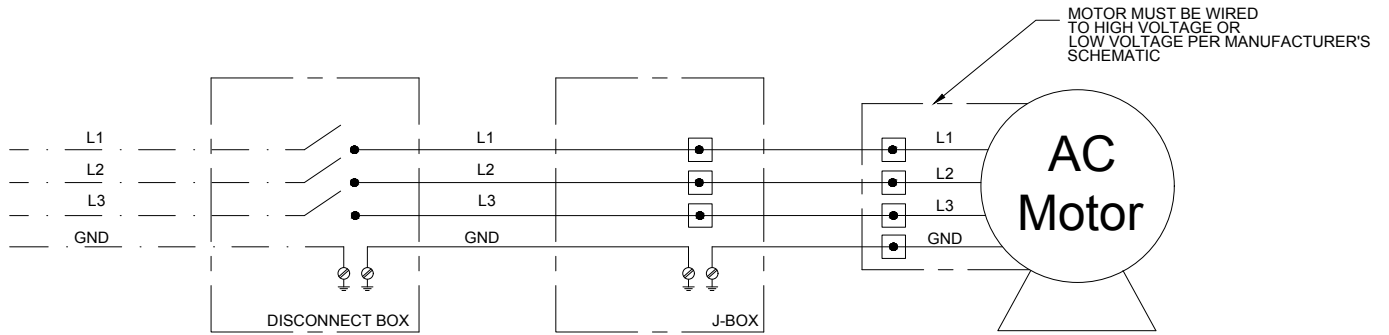
Wiring Diagram VS3 W/Disconnect



Three Phase with No Speed Control No Disconnect Direct Drive

Notes:	
—	Factory Wired
- - -	Field Wired
■	Wire Nut

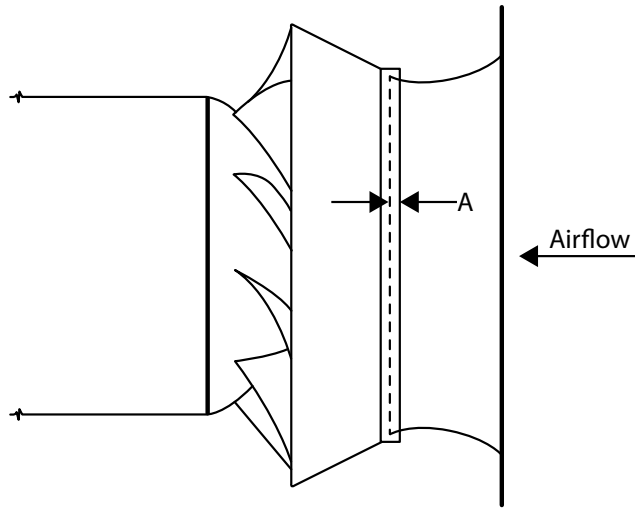
ELECTRICAL CONNECTIONS



**Three Phase with No Speed Control W/Disconnect
Direct Drive**

- Notes:**
- Factory Wired
 - - - Field Wired
 - ◼ Wire Nut

PRE-START-UP CHECKS



Ensure that all mounting hardware and fasteners are properly installed and tightened to recommended torque specifications.

Ensure that the wheel is aligned and has the correct spacing in relation to the inlet venturi; it should be centered in the inlet venturi as well. If adjustment is needed, loosen the inlet venturi bolts and shift the inlet venturi until the radial gap is the same at every point across the circumference of the inlet venturi.

If adjustment of the overlap between the wheel and inlet venturi is needed, loosen the taper lock bushing, slide the wheel forwards or backwards until the correct overlap is achieved, and then tighten the set screws back down.

There is a rotation sticker on the unit that specifies the direction the wheel should turn. Ensure that the wheel is rotating in the proper direction before powering on the unit. In 3 phase units, simply switch two incoming leads to reverse rotation.

Notes: Any increase in fan speed represents a substantial increase in horsepower required from the motor. Always check motor load amperage and compare to nameplate rating when changing fan speed.

Gap/ overlap dimensions	
Size	Inlet Venturi to Wheel Overlap Dimensions A (inches)
122	0.39
135	0.43
150	0.46
165	0.47
182	0.51
200	0.57
222	0.66
245	0.76
270	0.83
300	0.92
330	1.02
365	1.12
402	1.27
445	1.33
490	1.49
542	1.65
600	1.98

PRE-START-UP CHECKS

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

Operation Check List

Check fan mechanism components

- System connections are properly made and tightened.
- Impeller and fan surfaces are clean and free of debris.
- Impeller has been rotated by hand to verify it 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.

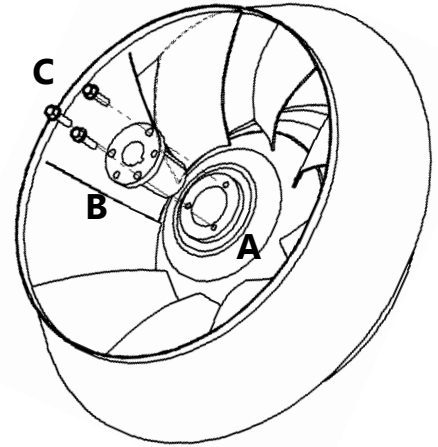
Trial "bump"

- 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 loosened during shipment or installation.

- Bolts on inlet funnel.
- Motor bolt torque.
- Nuts holding housing frame to base and base to ground (customer specifications).
- Bushing fastener torque.

Ensure piezo tubing will not contact the impeller.



- A Hub
- B Bushing
- C Bushing screws

C Bushing fastener torque		
Bushing type	Screw size	Recommended torque
P1 & P2	5/16 - 18	192 in-lbs
Q1 & Q2	3/8 -16	348 in-lbs
R2	3/8 -16	348 in-lbs
S2	1/2 -13	840 in-lbs

MAINTENANCE

The benefits of regular inspections and routine maintenance are well documented; regular service intervals keep the system operating at peak efficiencies, extend operational life and ensure safe product operation.

Notes: In this section, routine service internals are recommended.

Scheduled maintenance must be performed on the unit after it is in operation to ensure that it runs efficiently and reliably.



Ensure that all incoming power to the unit is switched off before attempting to service the unit. If this measure is not taken, serious injury can occur to the servicer.

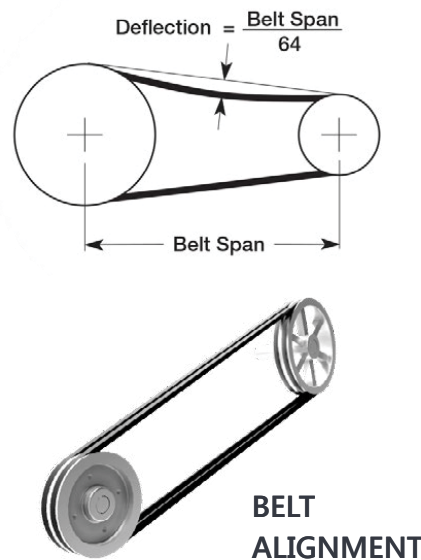
BELTS

Improper belt tensioning is the most common cause of early belt failures. As such, it is imperative to tension a belt down to the correct tension, which is the lowest tension at which the belt does not slip at peak running speed.

As a general rule, the belt should not deflect any more than 1/64 inch for every inch of belt span.

It is advised to check the belt tension at least twice within 24 hours of installation and regularly with scheduled maintenance thereafter. Adjust belt tension by loosening the bolts on the motor plate to relieve the tension. Tighten belt tension by tightening down the bolts on the motor plate.

Drive pulleys must be properly aligned, or belt slippage can occur. If pulleys are not aligned, the unit will not run efficiently, and noise or premature failure can occur.



FASTENERS AND SET SCREWS

All hardware, screws and fasteners should have torque checked at every scheduled maintenance.

MOTORS

Most fractional horsepower motors provided with the unit do not require greasing or lubrication after they are installed. If motors have grease fittings, then they should be re-lubricated according to motor manufacturer specifications.

REMOVAL OF DUST AND DIRT

The impeller and interior surfaces of the unit should be inspected and cleaned, if necessary, on a regular basis in accordance with the maintenance schedule. Dirt and dust accumulation can throw the wheel off balance and cause other early failures in the unit. Do not get water in bearings or motors when attempting to clean the unit.

FAN SHAFT BEARINGS

Bearings selected for Pennbarry fans are specially paired with the unit to achieve the maximum attainable efficiency and performance of the fan. As such, they are one of the most crucial parts of the fan and must be maintained and mounted accordingly.

MAINTENANCE

Ensure bearing set screws and collars are torqued to the correct specifications upon installation and every scheduled maintenance thereafter. Never mix lubricants or greases while re-greasing bearings; check bearing specifications for the correct grease recommended by the manufacturer.

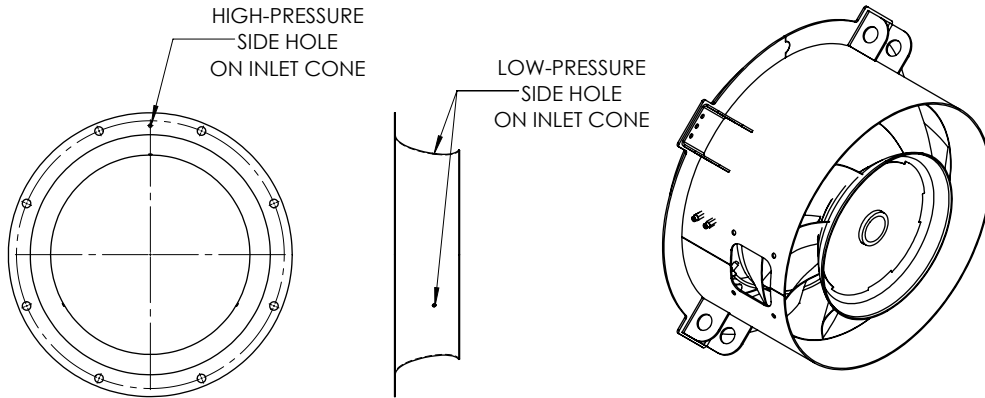
- Lubrication intervals depend on many factors such as temperature, moisture, or dirt. Consult a local PennBarry representative for lubrication recommendations.
- Lubricant should be selected based on the bearing manufacturer specifications.
- If the unit is stored for longer than a month, rotation of the shaft is recommended to free up grease in the bearing.

SHAFT SIZE	OPERATING SPEED (RPM)									
	500	1000	1500	2000	2500	3000	3500	4000	4500	5000
	LUBRICATION FREQUENCY (Months)									
0.50" - 1.00"	6	6	6	6	6	6	4	4	2	2
1.06" - 1.44"	6	6	6	6	6	6	4	4	2	1
1.50" - 1.75"	6	6	6	4	4	2	2	2	1	1
1.88" - 2.19"	6	6	4	4	2	2	1	1	1	
2.25" - 2.44"	6	4	4	2	2	1	1	1	-	-
2.50" - 3.00"	6	4	4	2	1	1	1	-	-	-
3.06" - 3.50"	6	4	2	1	1	1	-	-	-	-
3.56" - 4.00"	6	4	2	1	1	-	-	-	-	-

* Lubrication interval is based on 12 hour per day operation and maximum 160°F. housing temperature. For 24 hour per day operation, the interval should be cut in half.

** Lubricant should be added with the shaft rotating and until clean grease is seen purging from the bearing. The lubrication interval may be modified based on the condition of the purged grease. If bearing is not visible to observe purged grease, lubricate with number of shots indicated for bore size.

ACCESSORY

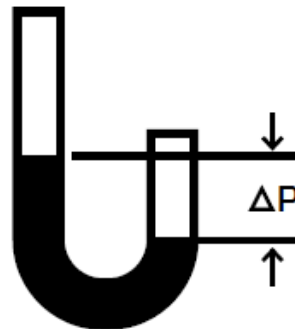
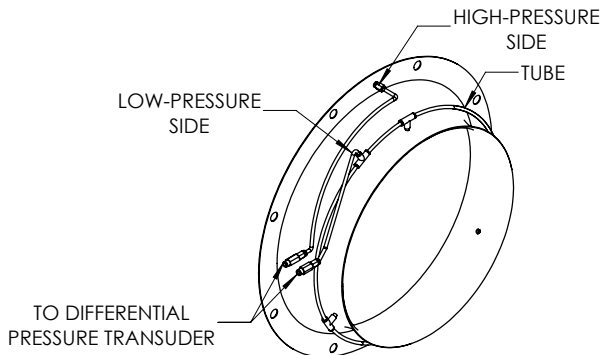


Difference in the cone surface pressure and fan inlet pressure (Δp) can be correlated to the volumetric air flow rate (Q) with which fan is moving, using equation shown below and can be analysed to read out the real time fan performance accurate to 5%. To complete the installation of the transducer, follow the installation instructions located at 5%

- $Q = K * \sqrt{\Delta p}$
- Q = Volumetric flow rate (CFM)
- Δp = Differential Pressure (inWC)
- K = Fan constant, as noted in table:

Fan Size	K
122	2512
135	3336
150	4286
165	5236
182	6313
200	7453
222	8847
245	10304
270	11887
300	13787
330	15688
365	17905
402	20248
445	22972
490	25823
542	29117
600	32791

Field Calculate K-Value - Occasionally, pressure readings can vary significantly, when using a Piezo Ring, while the fan is performing at desired CFM, in this case, the K-Value may need to be field calculated. To calculate K-Value, use Measure CFM (typically from a Test & Balance Report) and ΔP ((Measured Total Pressure(High Side)) - (Measured Total Pressure(Low Side))). Next solve for $K = ((\text{Measured CFM})/(\sqrt{\Delta \text{ Measured Total Pressure}}))$. Field Calculated K-Values go be as high as 35,000 - 60,000. Note, Measured Total Pressure readings can exceed System Pressure, but the Δ should not exceed the fan capability.





PENNBARRY™

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.

PennBarry | www.pennbarry.com | pbtsr@pennbarry.com | tel: 765-493-5800

PennBarry reserves the right to make changes at any time, without notice, to models, construction, specifications, options and availability. This manual illustrates the appearance of PennBarry products at the time of publication.

View the latest updates on the PennBarry website.

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