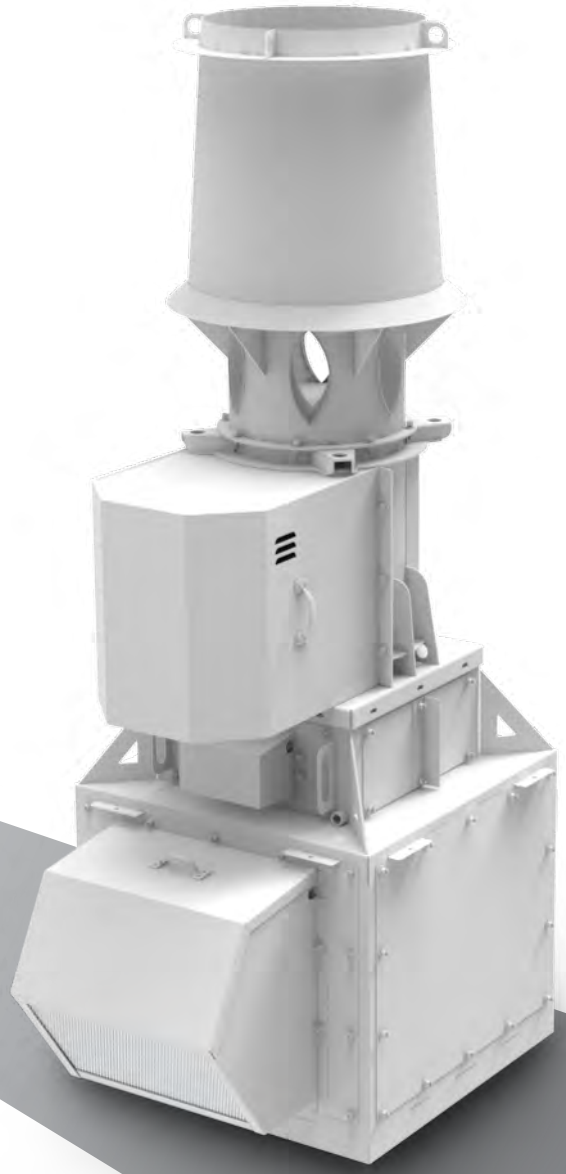
iPlume

Laboratory Exhaust System

INSTALLATION, OPERATION AND 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 in this document. Protect yourself and others by observing all safety information noted in this document. Failure to comply with these instructions could result in personal injury to others and/or property damage.

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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.

DANGER

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

CAUTION

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

CAUTION

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.

GENERAL SAFETY INFORMATION

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 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.

Inspection and Maintenance during Storage

Long-term storage is defined as storage for 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.

iPlume-122LV	iPlume-165HV	iPlume-245LV	iPlume-330HV
iPlume-122MV	iPlume-165XV	iPlume-245MV	iPlume-330XV
iPlume-122HV	iPlume-182LV	iPlume-245HV	iPlume-365LV
iPlume-122XV	iPlume-182MV	iPlume-245XV	iPlume-365MV
iPlume-135LV	iPlume-182HV	iPlume-270LV	iPlume-365HV
iPlume-135MV	iPlume-182XV	iPlume-270MV	iPlume-365XV
iPlume-135HV	iPlume-200LV	iPlume-270HV	iPlume-402LV
iPlume-135XV	iPlume-200MV	iPlume-270XV	iPlume-402MV
iPlume-150LV	iPlume-200HV	iPlume-300LV	iPlume-402HV
iPlume-150MV	iPlume-200XV	iPlume-300MV	iPlume-402XV
iPlume-150HV	iPlume-222LV	iPlume-300HV	iPlume-445LV
iPlume-150XV	iPlume-222MV	iPlume-300XV	iPlume-445MV
iPlume-165LV	iPlume-222HV	iPlume-330LV	iPlume-445HV
iPlume-165MV	iPlume-222XV	iPlume-330MV	iPlume-445XV

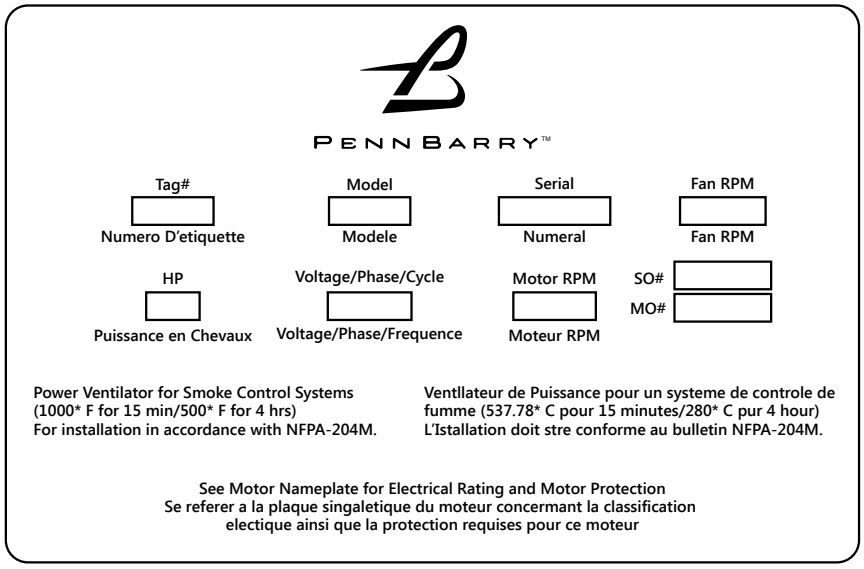
GENERAL INFORMATION

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.



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. See roof curb installation instructions for additional details.

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 including 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

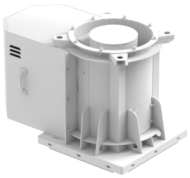
Fans should be hoisted with slings placed around the fan housing. When a single hoist is used, a "spreader" will keep the sling from slipping on the housing. If it is necessary to use hooks placed in lifting holes of fan, BE CAREFUL NOT TO DISTORT OR BEND THE HOUSING. Large units may have lifting lugs or holes which 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. The unit discharge nozzle is to be lifted per handling recommendations provided above by specified mounting points at the top of the cone, separately from the other sections of the unit.

The following is a list of recommendations for lifting the various assemblies of your iPlume fan system:

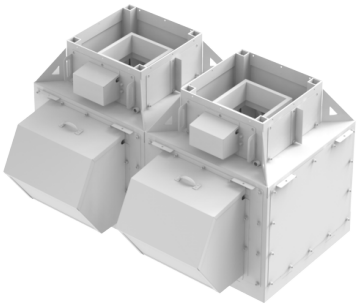
Discharge nozzle and stack extension may be pre-assembled and lifted as one assembly, or each component can be lifted separately. These lifting methods are recommended.

A. Lifting windband and nozzle: Use a sling in conjunction with lifting lugs at top of nozzle.

B. Lifting fan section: Use a sling in conjunction with lifting lugs at top of fan.



C. Lifting plenum section: Use a sling in conjunction with lifting lugs located at corner gussets of isolation damper box.



LIFTING INFORMATION

Size	Nozzle & Windband (lbs)	Belt Drive Fan Section w/o Motor (lbs)	Direct Drive Fan Section w/o Motor (lbs)	1x1 Mixing Box (lbs)	2x1 Mixing Box (lbs)	3x1 Mixing Box (lbs)
122	98	258	209	718	1436	2154
135	118	295	239	773	1546	2319
150	144	375	289	869	1738	2607
165	151	416	329	907	1814	2721
182	186	501	414	1441	2882	4323
200	220	571	481	1514	3028	4542
222	269	705	599	1640	3280	4920
245	254	818	709	1666	3332	4998
270	298	995	859	1644	3288	4932
300	366	1213	1060	1892	3784	5676
330	439	1429	1268	2063	4126	6189
365	390	1968	1773	2243	4486	6729
402	472	2294	2100	2373	4746	7119
445	574	2792	2559	2965	5930	8895

Size	Fan Curb (lbs)			1x1 Plenum Curb (lbs)			2x1 Plenum Curb (lbs)			3x1 Plenum Curb (lbs)		
	12"	18"	24"	12"	18"	24"	12"	18"	24"	12"	18"	24"
122	228	263	356	342	395	541	571	659	895	735	851	1176
135	244	281	381	365	421	577	609	701	952	775	903	1248
150	259	298	405	459	436	736	758	881	1198	965	1135	1569
165	275	315	429	467	544	748	770	895	1217	981	1152	1593
182	298	341	465	521	605	833	861	995	1353	1094	1277	1765
200	345	399	544	576	671	924	951	1104	1502	1210	1420	1965
222	368	425	581	607	706	972	1003	1161	1580	1274	1491	2073
245	392	451	617	615	714	984	1015	1174	1598	1288	1507	2085
270	415	477	653	639	741	1021	1054	1217	1657	1337	1560	2170
300	486	560	768	709	824	1137	1170	1354	1846	1485	1739	2409
330	517	595	817	764	885	1221	1260	1454	1981	1597	1863	2580
365	556	638	877	787	911	1258	1298	1496	2038	1642	1914	2623
402	626	722	993	849	986	1361	1400	1618	2207	1774	2074	2878
445	673	774	1065	896	1038	1434	1477	1703	2322	1868	2179	3023

CAUTION

Windband and nozzle assembly can be lifted as one piece, the fan sections and plenums must be lifted separately.

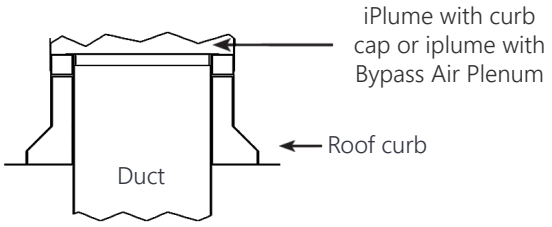
DUCT INSTALLATION FOR iPLUME

Bottom Inlet Duct Connection

If a customer supplied duct is to be installed on the unit, it is to be secured between the curb cap of the unit and the curb's top edge. If there is an isolation damper to be installed, it is to be installed between the duct and the unit.

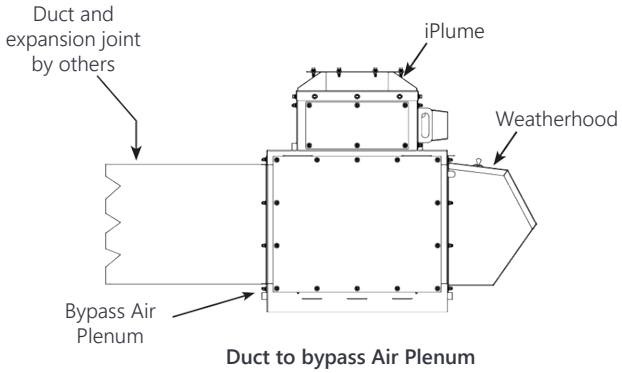
Option 1

- No isolation damper in roof curb
- Bottom inlet on iplume



Option 2

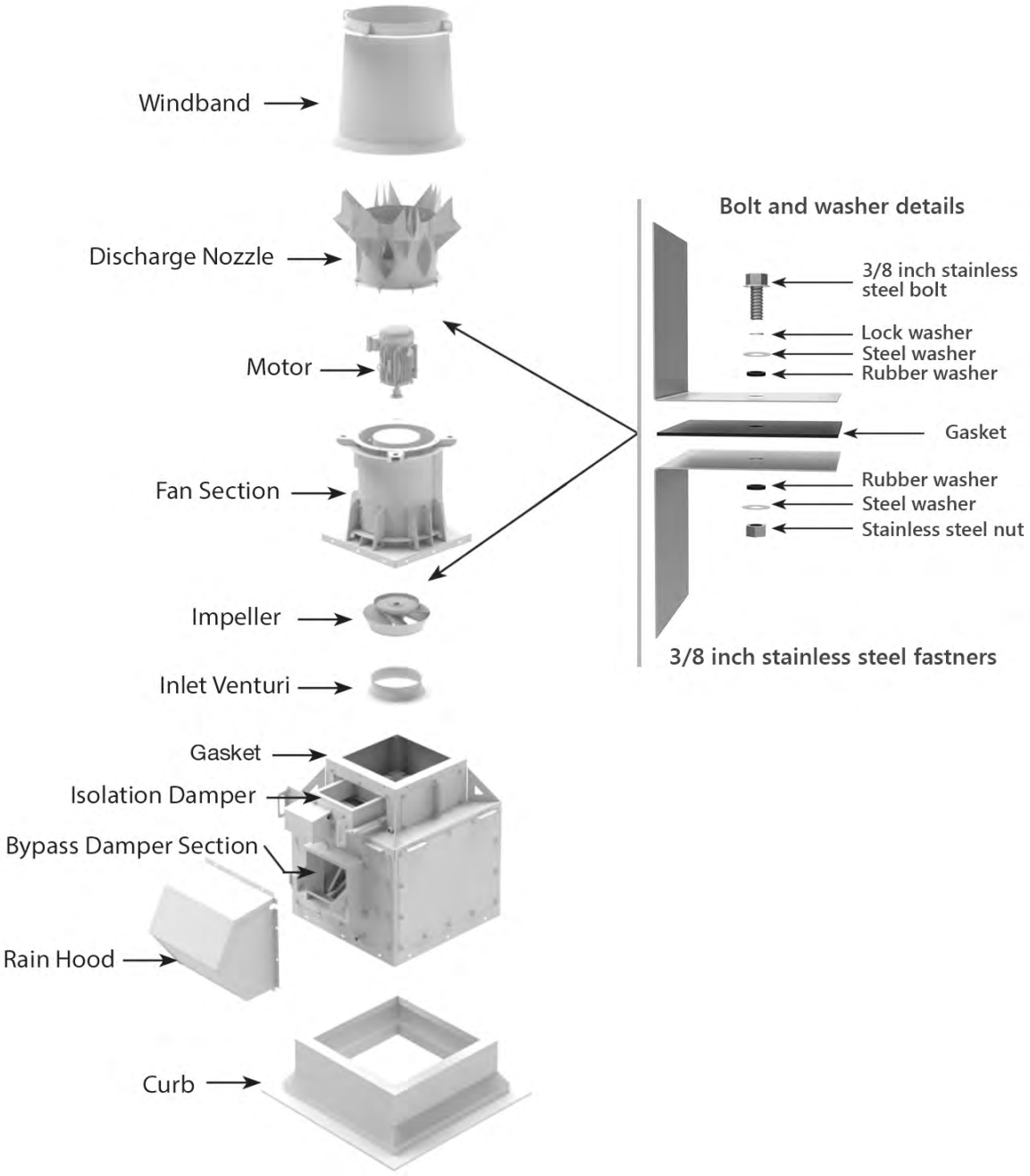
- No isolation damper in duct
- Side inlet on iplume with Bypass Air Plenum



Duct to bypass Air Plenum

Notes:
Steel, concrete or wood roof support is per structural engineer and in accordance with load requirements and applicable building codes.

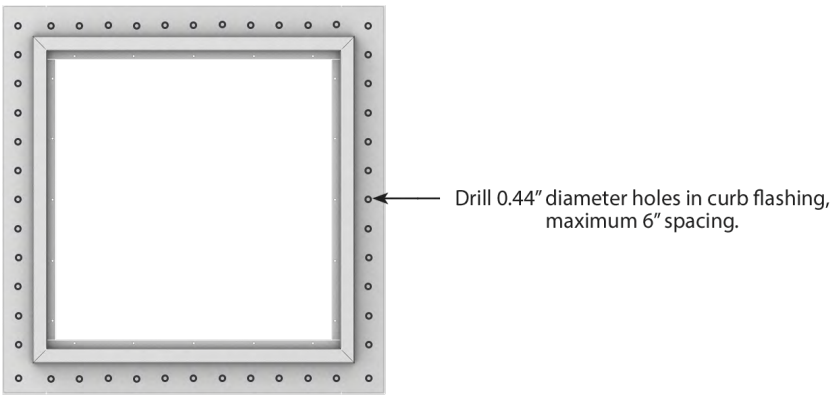
iPLUME SYSTEM ASSEMBLY

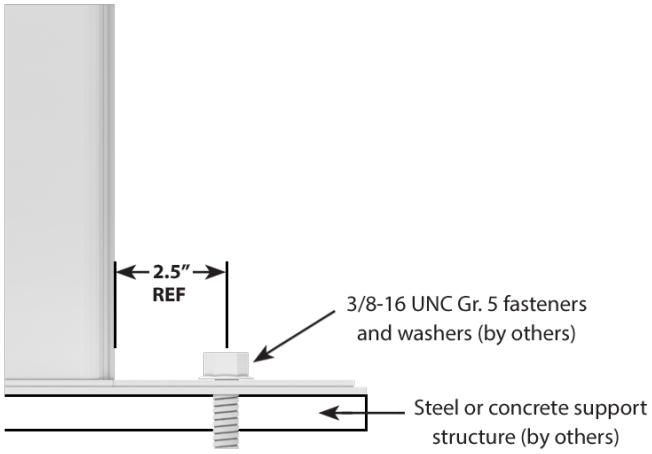


iPLUME SYSTEM ASSEMBLY

Sequence for Curb Installation to Roof

The roof curb is to be placed and fully secured to a level steel or concrete roof structure (by others) with 3/8-16UNC Gr. 5 cap screws and washers (supplied by others) as depicted below. Fasteners must be centered on the curb flange and bolt spacing is not to exceed 6". It is important that a Structural Engineer is consulted to verify the support structure and attachment method can adequately support the fan weight and wind loads.



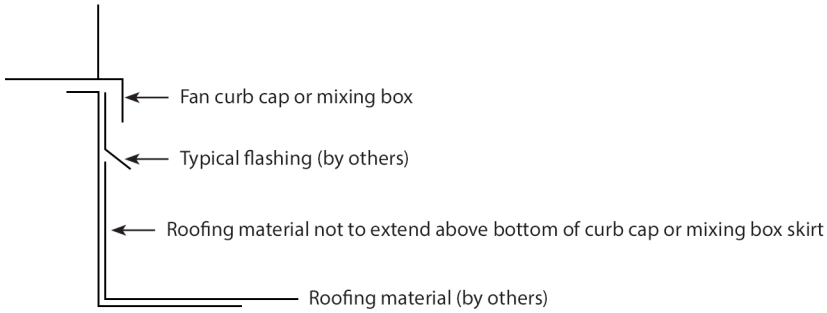


In order to avoid structural resonance, the structure must be designed with adequate stiffness so the natural frequencies are at least 120% above fan maximum operating speed.

Notes:
An inadequately designed roof structure may impact fan performance, longevity, and/or result in injury. All roof structures should be in accordance with all local building codes.

iPLUME SYSTEM ASSEMBLY

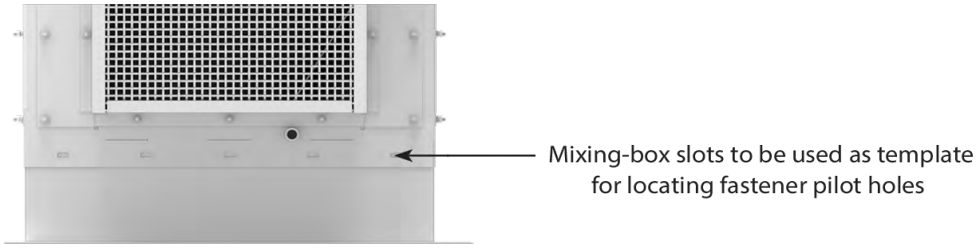
Flashing Detail



Sequence for Bypass Plenum or Fan to Roof Curb

Install the provided roof curb gasket by adhering it to the top of the roof curb. Rig and lift plenum or fan (if plenum not provided) as per lifting information section of this manual and place carefully on top of roof curb ensuring not to damage gasket material.

Dill 0.348 pilot holes into roof curb using plenum or fan as a template and install provided 3/8 self-threading fasteners. Figures below represent the typical installation of plenum and fan to curb.



Typical installation of plenum onto roof curb

For fans without a plenum, the fan is to be installed in a similar manner by using the fan slots as fastener pilot holes.

Typical installation of fan without plenum to roof curb.

iPLUME SYSTEM ASSEMBLY

Sequence for Fan to Bypass Plenum

Install gasket onto the top of the plenum, using the adhesive to adhere the gasket to the plenum.
Place the bottom of the fan onto the top of the plenum and secure with mounting hardware through the units mounting holes as shown in diagrams.

Sequence for Discharge Nozzle to Fan

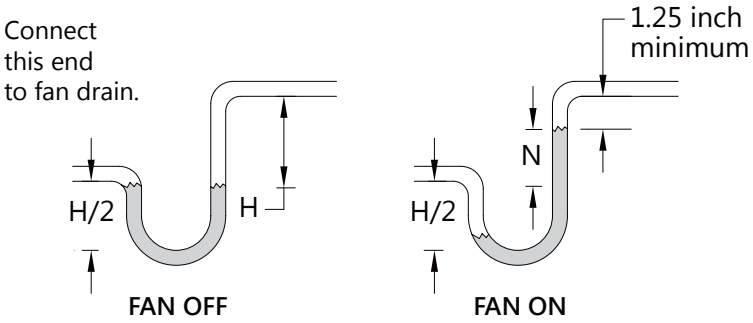
Install gasket onto the top of the fan section, using the adhesive to adhere the gasket to the fan.
Install discharge nozzle to the top of the fan section as shown in the diagrams, and secure with mounting hardware through the units mounting holes; be sure to include gasket.

iPLUME
DRAINAGE PIPE/TRAP DETAIL (BY OTHERS)

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

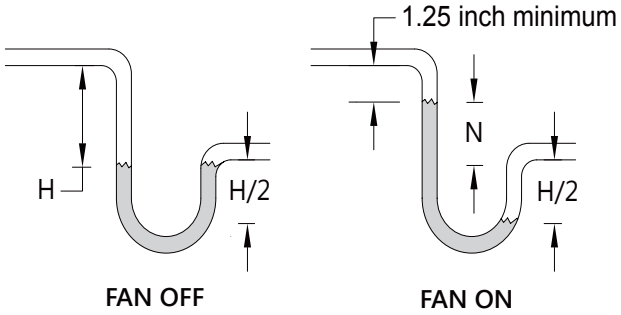
1. Drain connections are 3/4 inch NPT
2. Drain piping installed must have proper slope
3. P traps are to be filled to proper level prior to unit start up

Positive Pressure Trap on Tubular Fan Housing



N = Negative fan pressure (inches W.C.)
H = N - (0.5 inches minimum)

Negative Pressure Trap on Bypass Air Plenum



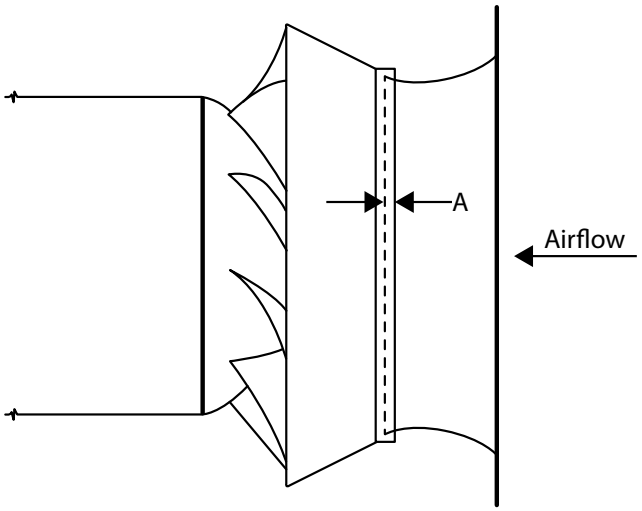
N = Negative fan pressure (inches W.C.)
H = N - (0.5 inches minimum

Rain Mitigation

Inline laboratory exhaust fans, such the iPlume, require mitigation of water below the fan if the fan is not running at all times. The iPlume has drains in the nozzle and funnel but water entry is possible during heavy rain events. In bottom intake installations rain mitigation must take place in the ductwork below the fan. A side intake mixing box is another solution, the side intake mixing box will not allow water into the ductwork.

Fan should be selected at nozzle velocities of 3000 fpm or higher to prevent rain from entering during operation.

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

PRE-START-UP CHECKS

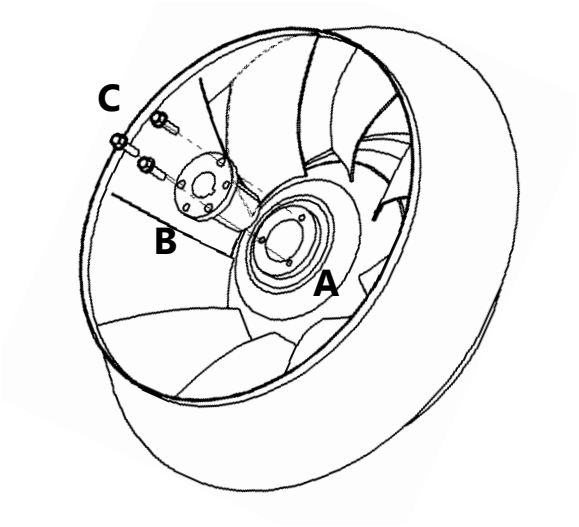
Trial "bump"

- 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
D	Bushing set screw

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

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.

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

CAUTION

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

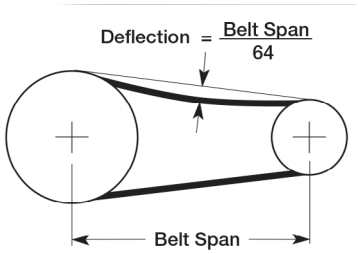
BELTS

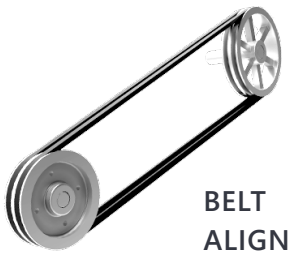
Improper belt tensioning is the most common cause of early belt failures. As such, it is imperative to tension a belt down to the correct tension, which is the lowest tension at which the belt does not slip at peak running speed.

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.





BELT ALIGNMENT

FASTENERS AND SET SCREWS

All hardware, screws and fasteners should be checked for torque 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.

MOTOR FUSES

Fuses to be of the time delayed type.

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 3 months at a time, 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.

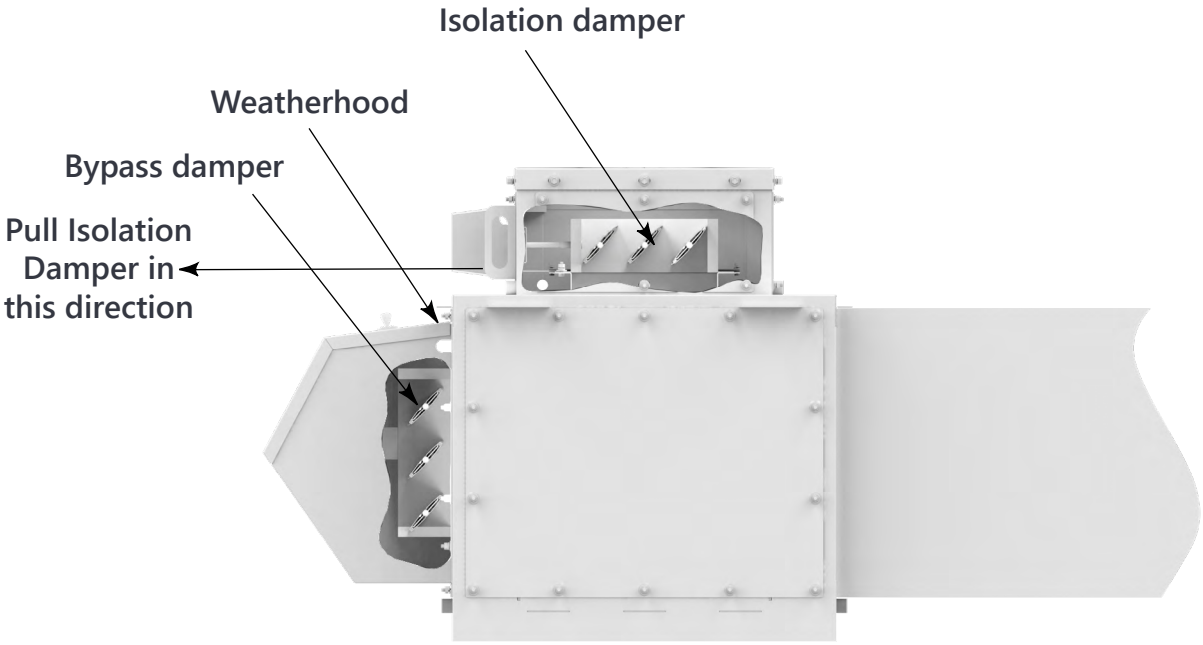
DAMPER AND DAMPER ACTUATORS

Notes: Disconnect power to damper before attempting any maintenance.

If access is required to a gravity isolation damper, remove the panel adjacent to the weatherhood on the bypass air plenum section and slide the damper straight out toward you.

When performing maintenance on a motorized isolation damper, unbolt the panel with the isolation actuator. Then, pull the panel, actuator and damper assembly out.

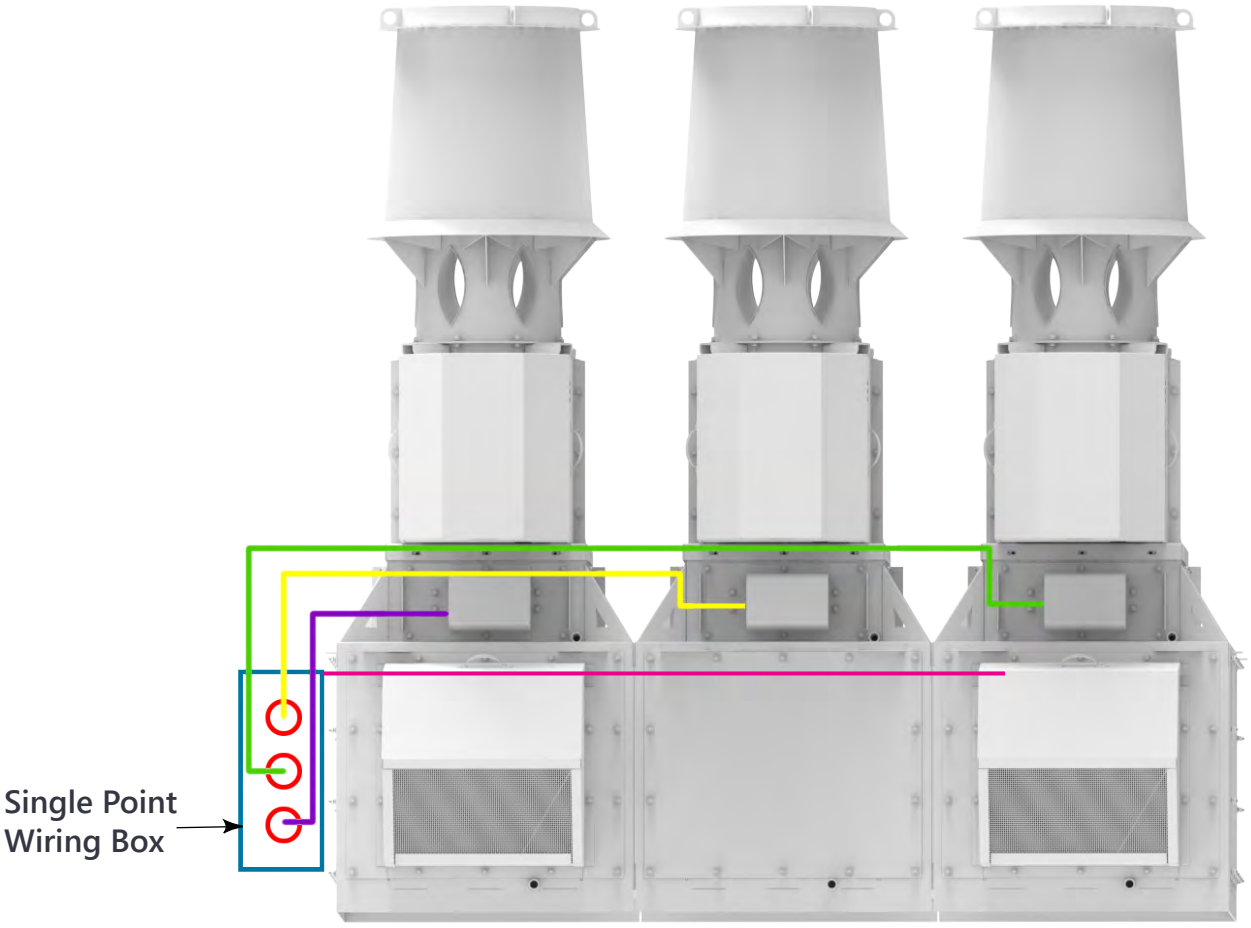
Damper actuators, when supplied by PennBarry, are designed to be maintenance free. No lubrication is required.



Fan Size	Bypass Damper Size ID (in)	Max Flow per Damper (CFM)
122	14	4900
135	16	6200
150	18	7900
165	18	8700
182	20	10600
200	22	12800
222	24	16000
245	24	16000
270	24	16000
300	30	25000
330	30	25000
365	36	36000
402	36	36000
445	48	55000

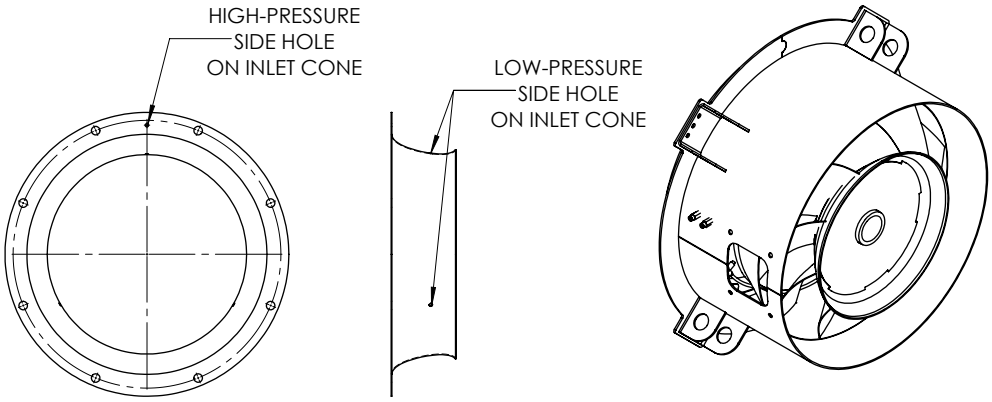
CONTROLS AND SINGLE POINT WIRING PANEL

The optional single point wiring panel allows all of the dampers to be wired to one location for easy field wiring.



Reference the iQ-LFC-Lab Fan Controller installation manual for details on PennBarry lab fan control system installation.

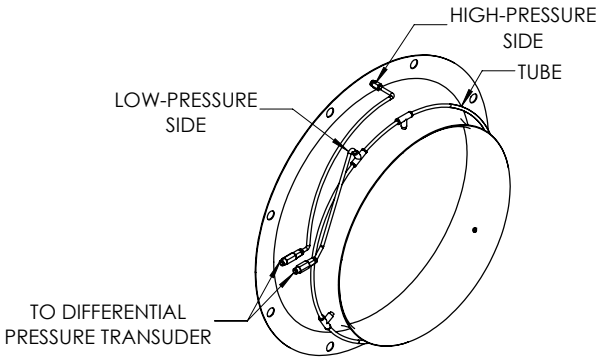
PIEZOMETER RING

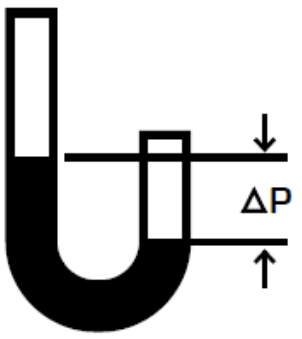


Difference in the cone surface pressure and fan inlet pressure (Δp) can be correlated to the volumetric air flow rate (Q) using equation shown below to an accuracy of 5%.

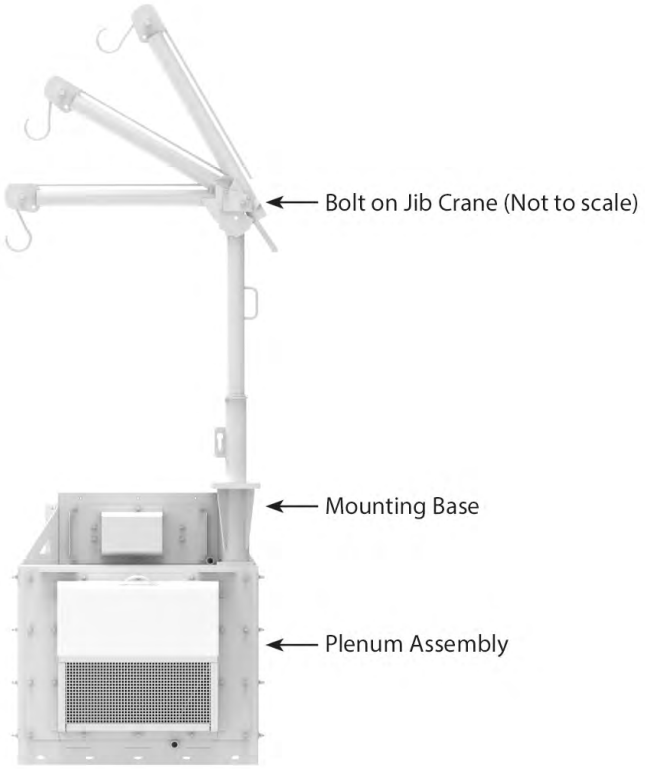
$Q = K * \sqrt{(\Delta p)}$
Q = Volumetric flow rate (CFM)
Δp = Differential Pressure (inWC)
K = Fan constant, as noted in table below:

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





JIB CRANE MOUNTING INSTRUCTIONS



Crane mounted to top of plenum assembly (fan not shown for clarity)

Locate Mounting Base for crane mounting. Clear flange face free of any debris.

Erect pedestal per instructions of specific model shown at the links below:

https://thern.com/wp-content/uploads/A14473-1016_5PFseries.pdf

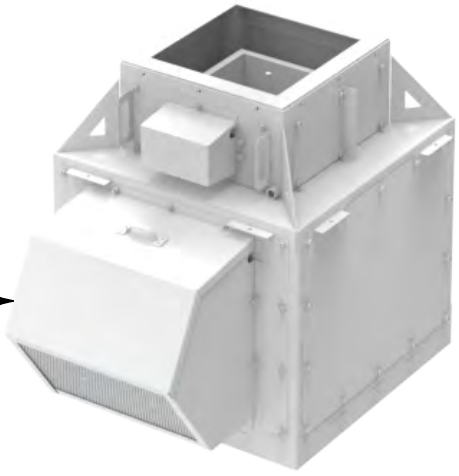
https://thern.com/wp-content/uploads/2020/09/A12376-J_5PTCseries_0820_V3.pdf

iPLUME WITH MIXING BOX

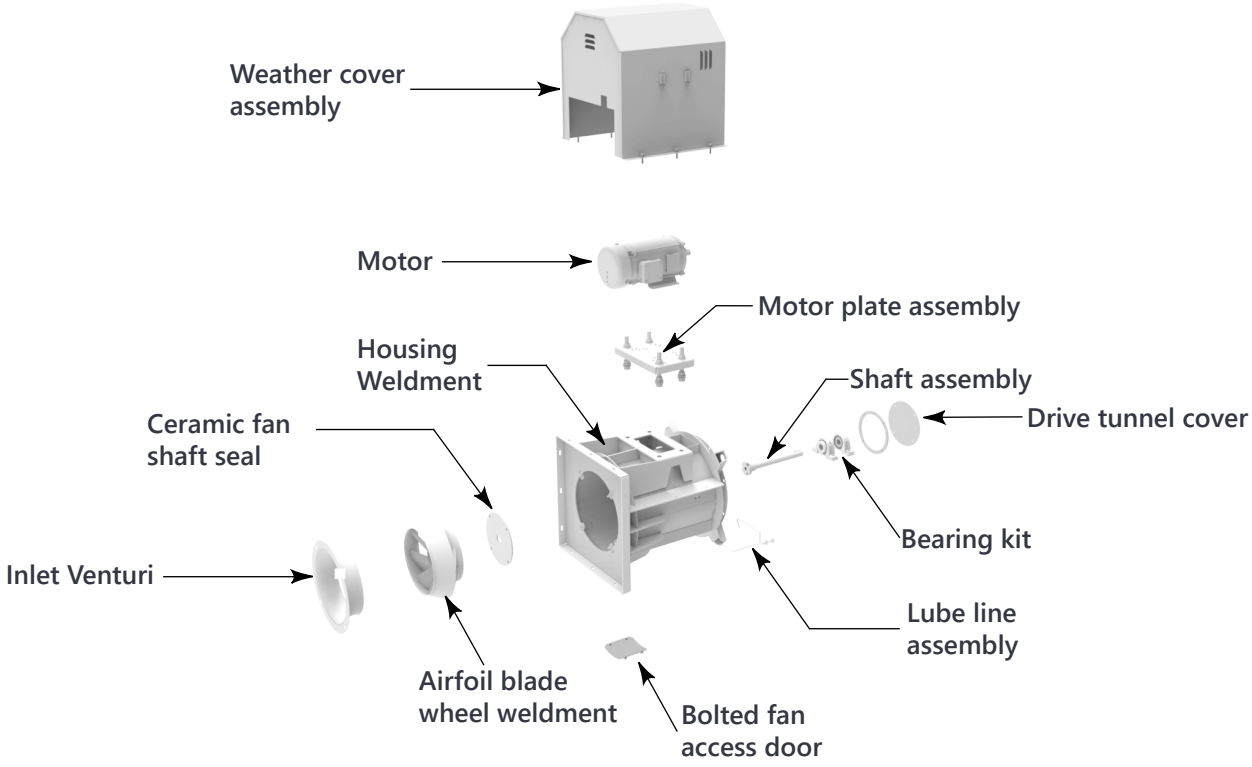
WINDBAND AND NOZZLE ASSEMBLY

FAN ASSEMBLY

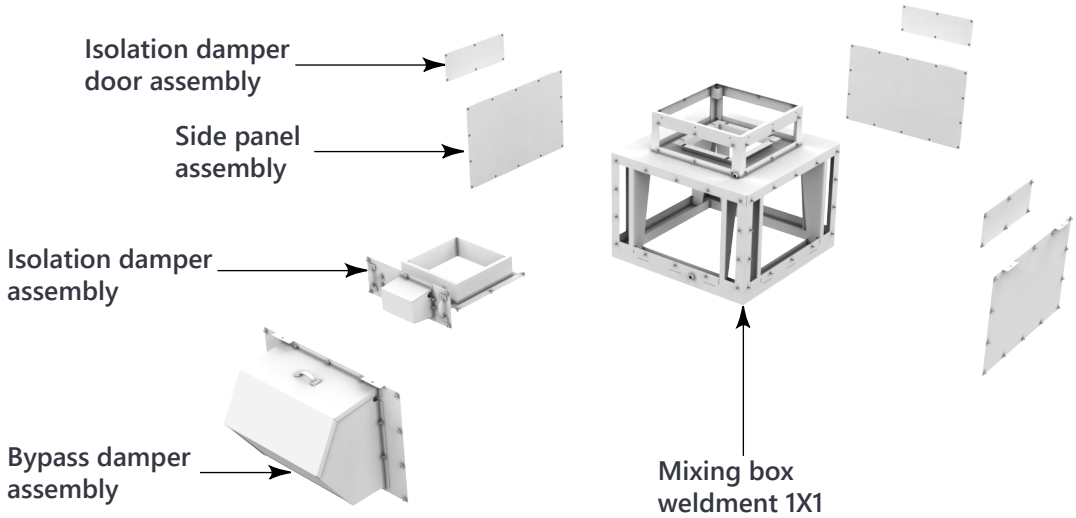
MIXING BOX ASSEMBLY, 1X1 BOTTOM INLET



EXPLODED VIEW OF MXI FOR iPLUME ASSEMBLY



EXPLODED VIEW OF MIXING BOX



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