



This publication contains the installation, operation and maintenance procedures for standard units of the MPA: Modular Plenum Array.



**Carefully read this publication and any supplemental documents prior to any installation or maintenance procedure.**

Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage. For information and instructions on special equipment, contact Loren Cook Company at (417) 869-6474.



## General Safety

Only qualified personnel should install the fan. Personnel should have a clear understanding of these instructions and should be aware of general safety precautions. Improper installation can result in electric shock, possible injury due to coming in contact with moving parts, as well as other potential hazards.

### **Important Guidelines:**

- Follow all local electrical and safety codes, as well as the National Electrical Code (NEC) and the National Fire Protection Agency (NFPA), where applicable. In Canada, follow the Canadian Electric Code (CEC).
- The rotation of the impeller is critical. It must be free to rotate without striking or rubbing any stationary objects.
- Motor must be securely mounted and adequately grounded.
- Do not operate fan impeller faster than max catalogued fan rpm. Adjustments to fan speed significantly effects motor load. If the fan speed is changed, the motor current should be checked to be sure it is not exceeding the motor nameplate amps.
- Do not allow the power cable to kink or come in contact with oil, grease, hot surfaces, or chemicals. Replace power cable immediately if damaged.
- Verify that the power source is compatible with the equipment.

## **⚠ WARNING**

### **Rotating Parts & Electrical Shock Hazard:**

Fans should be installed and serviced by qualified personnel only.

Disconnect electric power before working on unit (prior to removal of guards or entry into access doors).

Follow proper lockout / tagout procedures to ensure the unit cannot be energized while being installed or serviced.

A disconnect switch should be placed near the fan in order that the power can be swiftly cut off, in case of an emergency and in order that maintenance personnel are provided complete control of the power source.

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

Grounding is required. All field-installed wiring must be completed by qualified personnel. All field installed wiring must comply with National Electric Code (NFPA 70) and all applicable local codes.

Fans and blowers create pressure at the discharge and vacuum at the inlet. This may cause objects to get pulled into the unit and objects to be propelled rapidly from the discharge. The discharge should always be directed in a safe direction and inlets should not be left unguarded. Any object pulled into the inlet will become a projectile capable of causing serious injury or death.

When air is allowed to move through a non-powered fan, the impeller can rotate, which is referred to as windmilling. Windmilling will cause hazardous conditions due to unexpected rotation of components. Impellers should be blocked in position or air passages blocked to prevent draft when working on fans.

Friction and power loss inside rotating components will cause them to be a potential burn hazard. All components should be approached with caution and/or allowed to cool before contacting them for maintenance.

Under certain lighting conditions, rotating components may appear stationary. Components should be verified to be stationary in a safe manner, before they come into contact with personnel, tools or clothing.

Failure to follow these instructions could result in death or serious injury.

## Receiving and Inspection

Carefully inspect the fan and accessories for any damage and shortage immediately upon receipt of fan. All Cook products are carefully constructed and inspected before shipment to insure the highest quality and performance.

- Turn the wheel by hand to ensure it turns freely and does not bind.
- 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.
- Record on the Delivery Receipt any visible sign of damage.

## Handling

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 or drives, motor, impeller, motor base or housing, or in any other manner that may bend or distort parts.

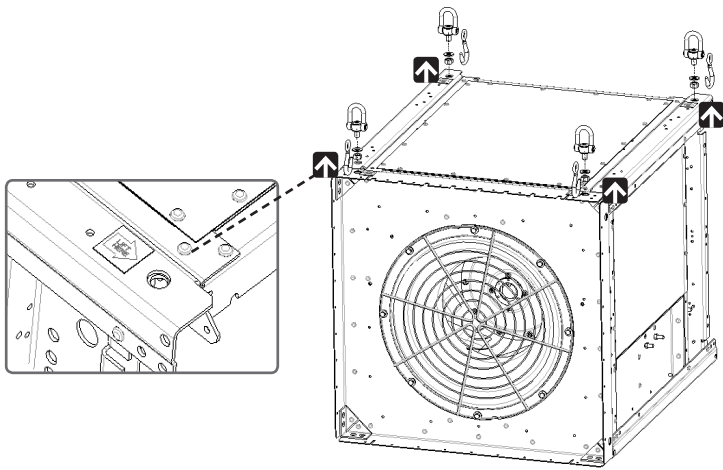
### Lifting Instructions

Fans are designed to be lifted and moved as a single module. Cook does not recommend lifting connected fan modules unless the fan module(s) is 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

Fan Size	Max. Fan Weight (lbs.)
MPA 100	240
MPA 120	270
MPA 135	300
MPA 150	340
MPA 165	430
MPA 180	476
MPA 195	528
MPA 225	815
MPA 245	890
MPA 270	975
MPA 300	1249
MPA 330	1331
MPA 365	2027
MPA 402	2110



#### Preferred lifting method:

Eyebolt with washers and nut



#### Alternate lifting methods:

S-Hook  
Safety Hook



Lifting Points – 5/8” diameter holes



## Storage

If the fan is stored for any length of time prior to installation, store it in its original shipping crate and protect it from dust, debris and the weather.

### Short Term Storage

If fan installation is delayed, store the unit in a protected area. Protect the 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 setting 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 left at approximately 180 degrees from that of the previous month to prevent damaging the motor bearings.

## Unit Start Up

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

## ⚠ CAUTION

### Electrical Hazard:

Verify that proper safety precautions are 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 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.

Verify fastener tightness, these may have loosened 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
- Ensure piezo ring tubing will not contact the impeller

Perform list again until unit is operating properly.

### C Bushing Fastener Torque

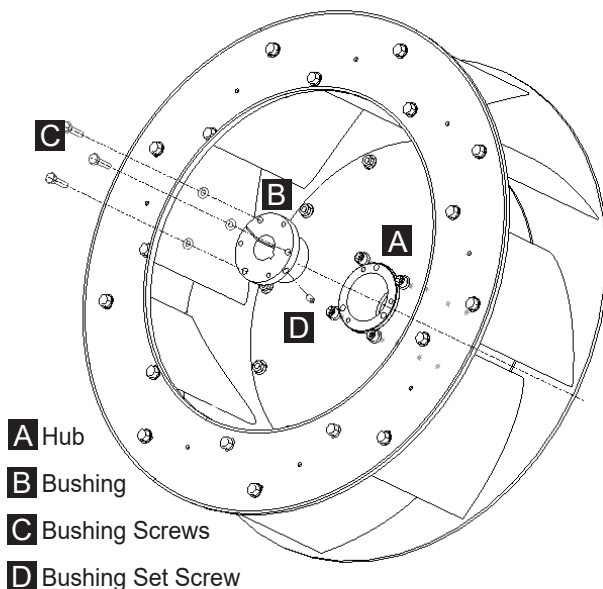
Bushing Type	Screw Size	Recommended Torque
JA	10-24	60 in-lbs.
SD/SDS	1/4-20	108 in-lbs.
SK	5/16-18	180 in-lbs.
SF	1/8-16	360 in-lbs.

### B Bushing Set Screw Torque

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	200 in-lbs.

### 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
324-365T	9/16	9/16	107
404T-405T	3/4	3/4	267



## Motor Maintenance

The three basic rules of motor maintenance are to keep the motor clean, dry, and properly lubricated. Keeping motors and windings clean is important because dirt and dust can cause heat to be trapped causing overheating and/or 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 using.

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; motors 15 to 50 hp, every 3 years; and motors 50 to 150 hp, yearly. See motor manufacturer specifications for recommended greases. For motors in a dusty or dirty environment or running 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. 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.

## Troubleshooting

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.

The following chart on page 4 indicate possible areas to check when air or sound values do not meet expectations. Most fan problems can be pinpointed to one of these areas:



## Problem and Potential Cause

### Air Capacity:

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

### Noise:

- Fan is not at design point of operation. Fan forced to operate in an unstable flow region.
- Bearing failure. Check bearings.
- Supply voltage high or inconsistent supply frequency. Adjustable frequency controllers can generate motor noise.
- Objects which are installed in a high velocity airstream can generate noise. This includes flow sensors, turning vanes, etc.
- Non-uniform fan inlet conditions.
- Acoustics or sound measurement procedure incorrect.

### Vibration:

- Misalignment of drive components.
- Poor foundations or mounting structure (resonances).
- Foreign object trapped in rotating components.
- Damaged rotating components.
- Broken, loose or missing setscrews.
- Loose bolts.
- Vibration transmitted by another source.
- Water accumulating in airfoil blades.
- Fan is operating in stall or unstable flow region.

NOTE: All MPA's 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 or if the motor and wheel have been removed or replaced. If a final trim balance is required, it is the end user's responsibility to bring the fan back to factory specifications (0.15 in/sec Max). Final trim balancing is not the responsibility of Cook.

## Foundation

Critical to every fan installation is a strong, level 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 insure 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 duct work with flex connections eliminates transmission of vibration.

## Isolation

Structural bases must be sturdy enough to prevent flexing and vibration. 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.

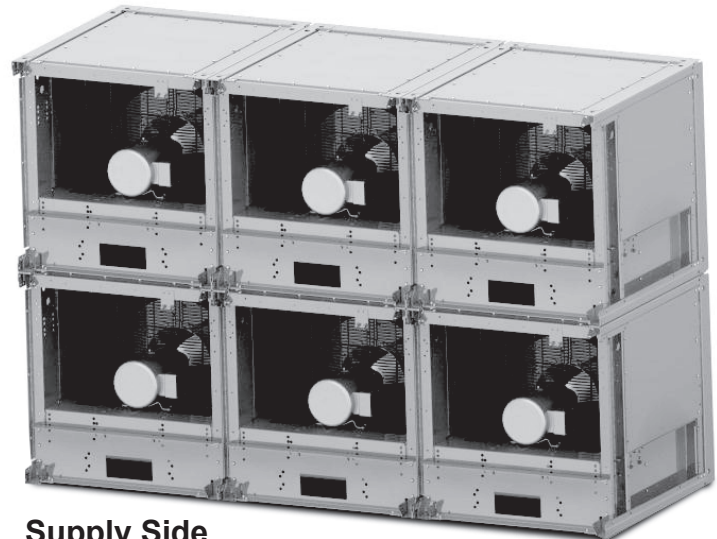
## Installation

Bolt the fan to the structure and adjacent fans using the inlet and outlet mounting flanges. The first row of fans should be securely installed before installing the second row of fans. Cook does not recommend lifting and moving assembled MPAs, as this may cause bending, distortion, and lead to component misalignment.

### A (top, bottom, and side connections)



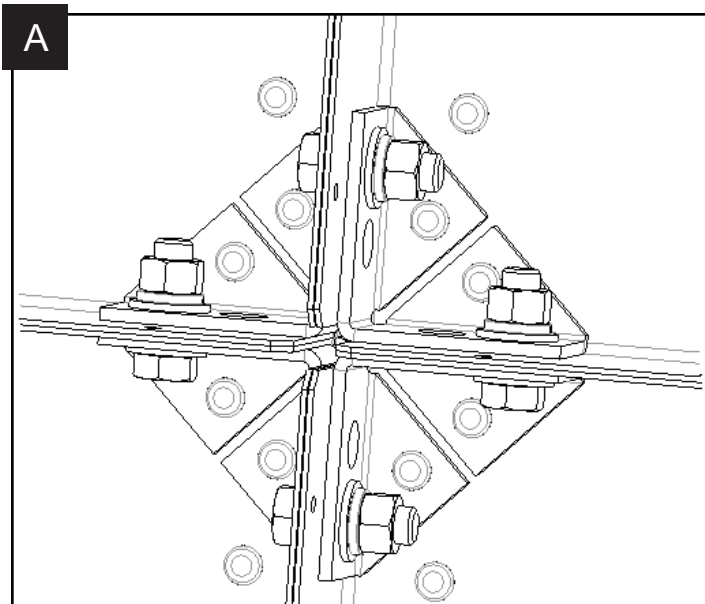
Intake Side



Supply Side

**\*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).

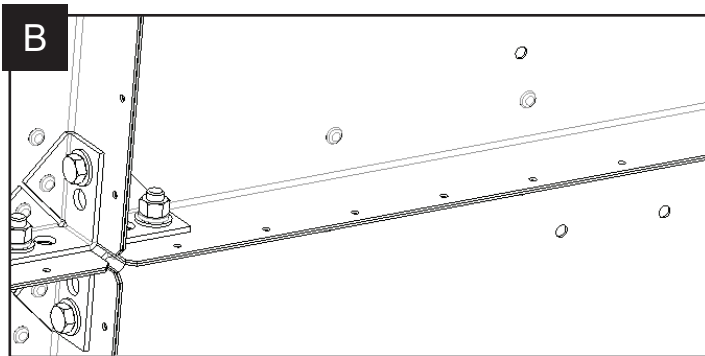


**A \*Intake Side**

**B (Middle connections)**

**\*Intake Side Shown**

- Intake Side Panel Connection: A series of .22" diameter holes, 3" on center are provide 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.



**B \*Intake Side**

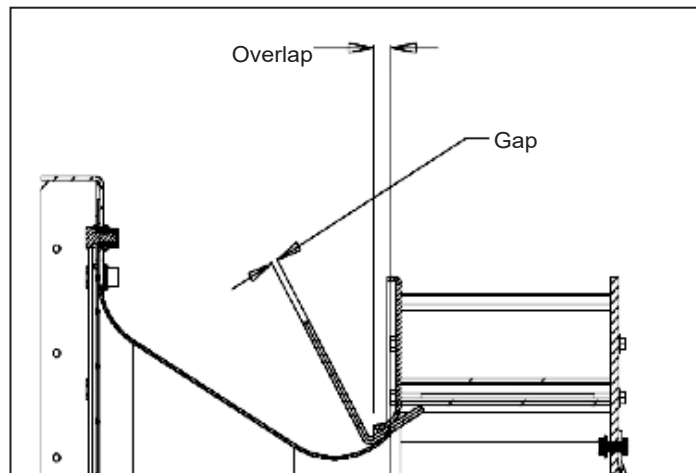
**Radial Gap, Overlap, and Impeller Alignment**

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.

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



**Gap/Overlap Dimensions**

Model	Minimum Overlap (in.)	Maximum Overlap (in.)	Minimum Gap (in.)
100	0.12	0.29	0.06
120	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
180	0.31	0.50	0.11
195	0.38	0.57	0.12
225	0.44	0.63	0.14
245	0.50	0.69	0.17
270	0.56	0.76	0.20
300	0.62	0.88	0.24
330	0.75	0.96	0.26
365	0.81	1.13	0.27
402	0.88	1.23	0.31

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

**⚠ CAUTION**

**Motor Interferences Hazard:**

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

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.

# Piezometric Data

## How It Works

The Piezo 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 in the throat. The inlet tap is connected to the high-pressure side of the transducer and the piezometer is connected to the low-pressure side (see following diagram). Measurement of Airflow

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

- There are no vanes or other obstructions in or near the inlet
- Impeller to inlet funnel overlap
- Flow entering the funnel (no pre-swirl)
- Accurate determination of air density at the inlet

### K Factor Table

Model	K Factor
100	592
120	842
135	963
150	1147
165	1450
180	1671
195	2087
225	2458
245	2941
270	4156
300	4810
330	5748
365	7072
402	8609

## Calculation when using the Piezometer

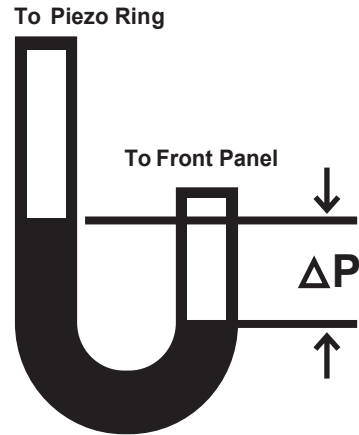
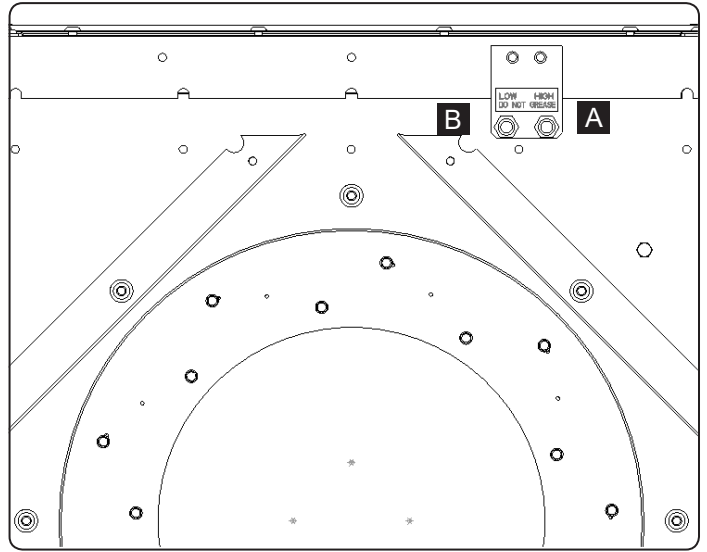
For standard air ( $\rho = 0.075 \text{ lb/ft}^3$ ):

$$(\text{CFM}) = K \text{ Factor} * \sqrt{(\text{delta pressure})}$$

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

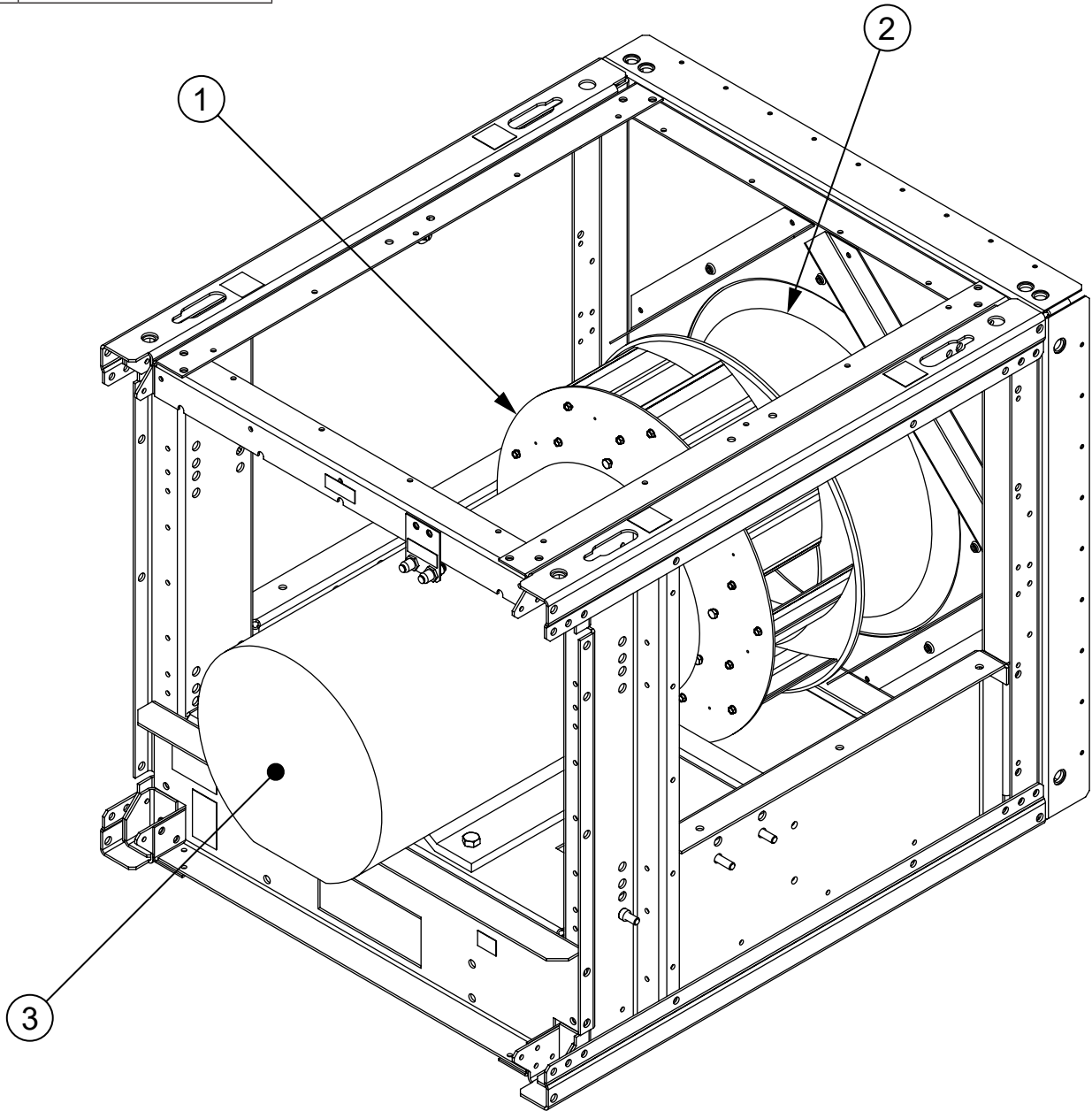
**A** Front Pressure Tap  
HIGH PRESSURE

**B** Piezometer  
LOW PRESSURE



## Parts List

Part No.	Description
1	Wheel
2	Inlet
3	Motor



## **Limited Warranty**

Loren Cook Company warrants that your Loren Cook fan was manufactured free of defects in materials and workmanship, to the extent stated herein. For a period of one (1) year after date of shipment, we will replace any parts found to be defective without charge, except for shipping costs which will be paid by you.

This warranty is granted only to the original purchaser placing the fan in service.

This warranty is void if the fan or any part thereof has been altered or modified from its original design or has been abused, misused, damaged or is in worn condition or if the fan has been used other than for the uses described in the company manual. This warranty does not cover defects resulting from normal wear and tear.

To make a warranty claim, notify Loren Cook Company, General Offices, 2015 East Dale Street, Springfield, Missouri 65803-4637, explaining in writing, in detail, your complaint and referring to the specific model and serial numbers of your fan. Upon receipt by Loren Cook Company of your written complaint, you will be notified, within thirty (30) days of our receipt of your complaint, in writing, as to the manner in which your claim will be handled. If you are entitled to warranty relief, a warranty adjustment will be completed within sixty (60) business days of the receipt of your written complaint by Loren Cook Company.

This warranty gives only the original purchaser placing the fan in service specifically the right. You may have other legal rights which vary from state to state.

For fans provided with motors, the motor manufacturer warrants motors for a designated period stated in the manufacturer's warranty. Warranty periods vary from manufacturer to manufacturer. Should motors furnished by Loren Cook Company prove defective during the designated period, they should be returned to the nearest authorized motor service station. Loren Cook Company will not be responsible for any removal or installation costs.



# **LOREN COOK COMPANY**

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