National Turbine Corporation

INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

MILLENNIUM™ SERIES

MULTISTAGE CENTRIFUGAL BLOWERS AND EXHAUSTERS

Product Information-

Please take a moment to fill out the information below in order to aid us with any future sales or service inquiries. Model number and serial number information can be found on the inlet head of the blower/ exhauster. The motor information can be found on the name plate of the motor.

Exhauster & Blower Information	Motor Information
MODEL#:	Full Load Amps:
ORDER #:	Service Factor:
SERIAL#:	No Load Amps:
	No Load Amps for Vacuum Systems Only

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I. INTRODUCTION

Thank you for your purchase of a National Turbine **Millennium Series™** fabricated steel multi stage centrifugal unit.

Please take the time to review this manual in it's entirety to assure that you are familiar with all the requirements and features of your equipment. Proper installation, operation and maintenance will assure the user of years of trouble-free service. Always refer to your specific model number and serial number, which are stamped on the nameplate attached to the inlet head.

Our on going commitment to your satisfaction begins with the proper handling and installation of your new equipment.

II. EQUIPMENT DESCRIPTION

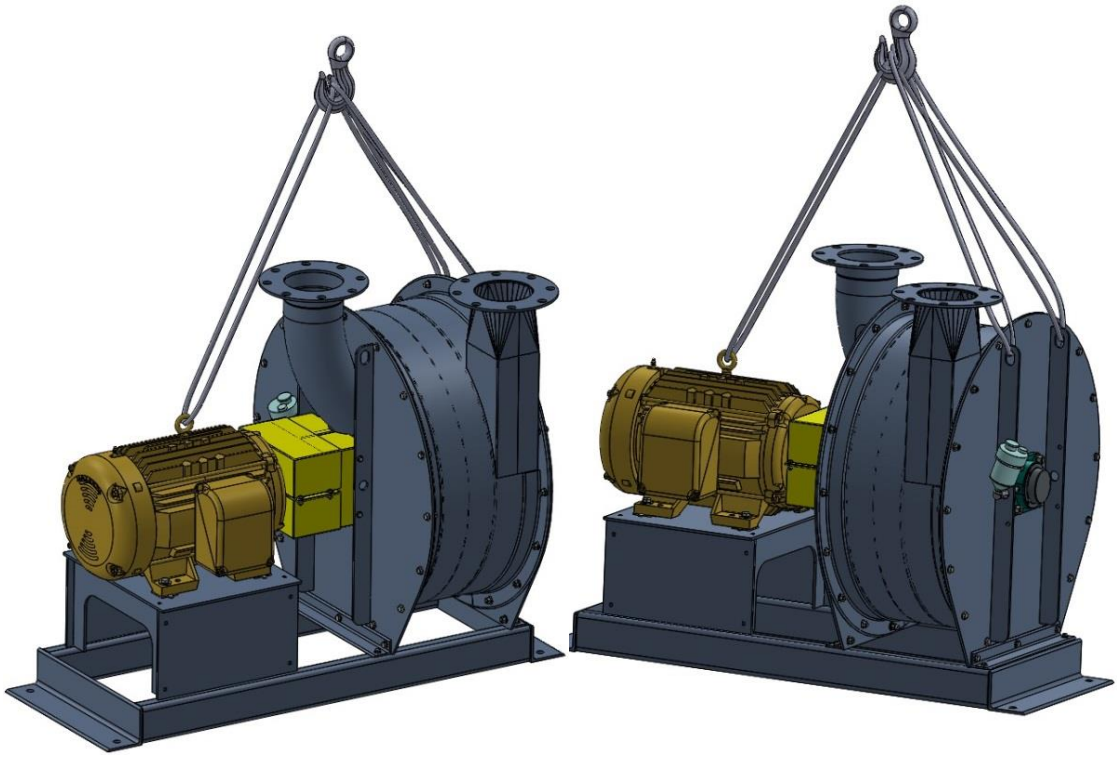
Multi stage centrifugal units are used to provide a constant pressure or vacuum under variable volumetric conditions.

III. INSPECTION

Immediately upon receipt, thoroughly examine the equipment. Both motor and blower shafts should rotate freely. There should be no evidence of damage, dented steel, or any other unusual observations. Check the packing list to verify that the shipment is complete, noting receipt of miscellaneous items in crates or boxes. If any damage has occurred, or any material is missing, make a note on the carrier's freight bill and make sure that the driver signs on the same receiving copy. Notify the delivering carrier at once and also notify National Turbine immediately.

IV. HANDLING

Your blower/exhauster is provided with 2 lifting eyes located on the inlet and outlet head. We recommend a 3-point lifting method by using the 2 lifting eyes on the unit and the one lifting eye on the motor.
DO NOT LIFT BY SHAFT OR BEARING HOUSINGS. AVOID BENDING OR DISTORTING OF BASE.



Failure to follow good safety practices when handling the machine could result in injury or death !

V. STORAGE

If your blower/exhauster is not going to be installed for a period of up to 90 days then you must store it in a clean, dry, well-ventilated area. The unit must be covered and keep out of the elements. Canvas is preferred over plastic. Rotation of the motor, unit shaft should be done at least once a week to redistribute bearing lubricant and prevent bearing damage. Keep a log of shaft rotation to ensure machine warranty protection.

If the storage of your blower/exhauster is longer than 90 days then in addition to the above storage information you will need to: suspend a bag of silica gel in the inlet and outlet heads to absorb excess moisture, coat exposed machine surfaces with a protective grease and follow motor manufactures instructions so that the motor is properly maintained.

VI. INSTALLATION

LOCATION

- Indoor locations are preferable.
- The location selected should be clean, dry, properly drained and adequately ventilated.
- Plan ahead. Ample room is required for maintenance, lubrication and the removal of the machine or driver for servicing.

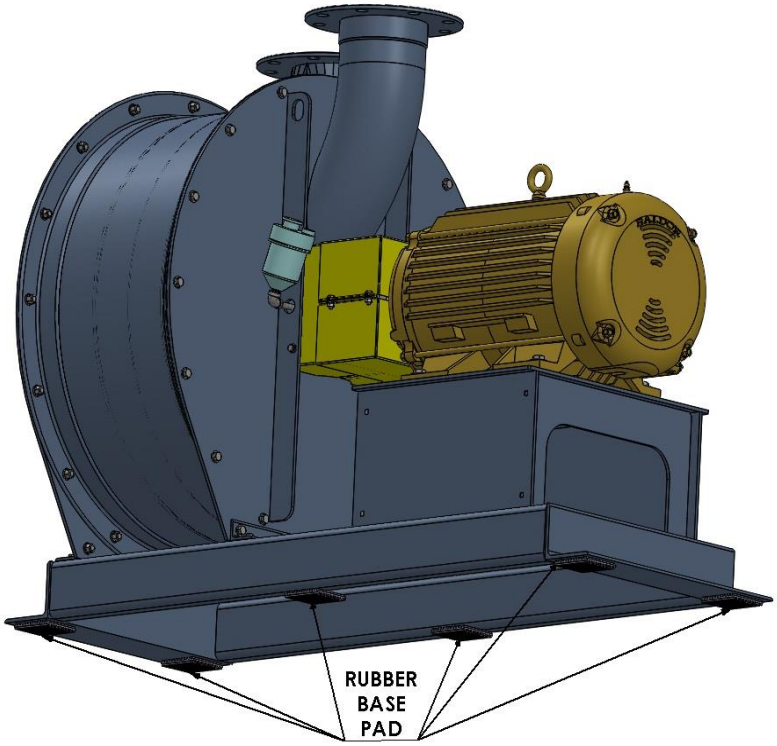
FOUNDATION

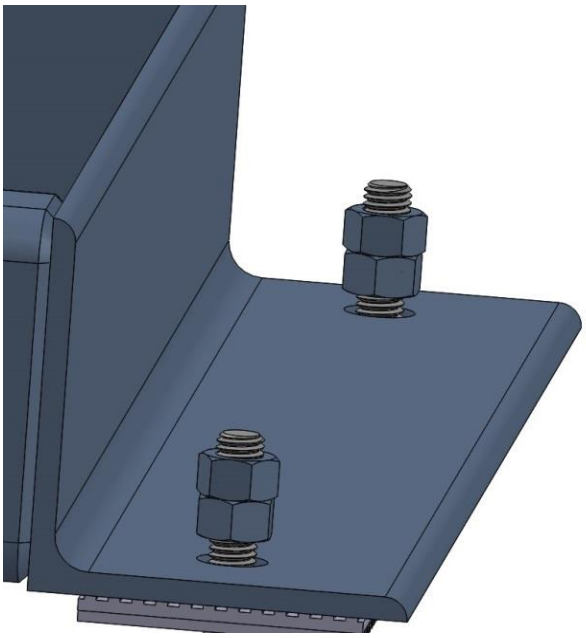
The blower/exhauster should be located on a solid, level, and flat surface. The best surface is a reinforced concrete slab however; a well reinforced above grade surface is suitable. Avoid mezzanines or catwalks and hollow floors.

POSITIONING

Bolt holes are provided for shipping and positioning purposes as seen in the image below. If floor bolts are used the nuts should **NOT TOUCH THE BASE! TIGHTENING MAY DISTORT THE BASE OR RESTRICT THE BASE PAD MOVEMENT AND CAUSE EXCESIVE VIBRATION. DO NOT WRENCH TIGHTEN BASE BOLTS. THIS COULD VOID THE EQUIPMENT WARRANTY.**

Rubber vibration isolation pads have been supplied. These must be installed under the base as follows: one under each corner of the unit and one under each side of the base at approximately the middle of the unit.

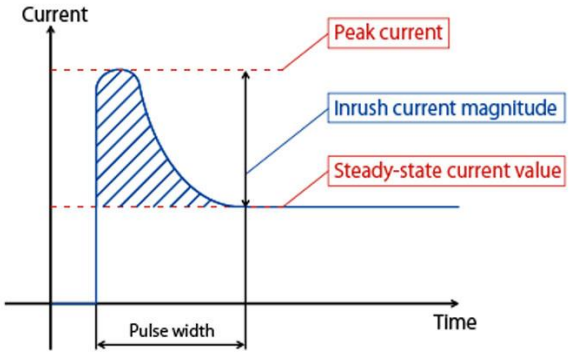




ELECTRICAL

Read and comply with motor manufacturer's installation and operation instructions which are attached to the motor. Make sure that the motor nameplate requirements agree with the available power supply at job site. ***All wiring MUST be done by a licensed electrician (industrial experience preferred) in accordance with the National Electrical Code (NEC-NFPA 70), and other applicable national and local regulations.***

ELECTRIC MOTOR RECOMMENDATIONS



Every time an electric motor is energized the motor will draw 10-30 times the motor name plate amps. This initial amperage spike is commonly referred to as the "inrush current" and typically only lasts a few seconds until the motor can reach the normal operating current or what is called "steady state".

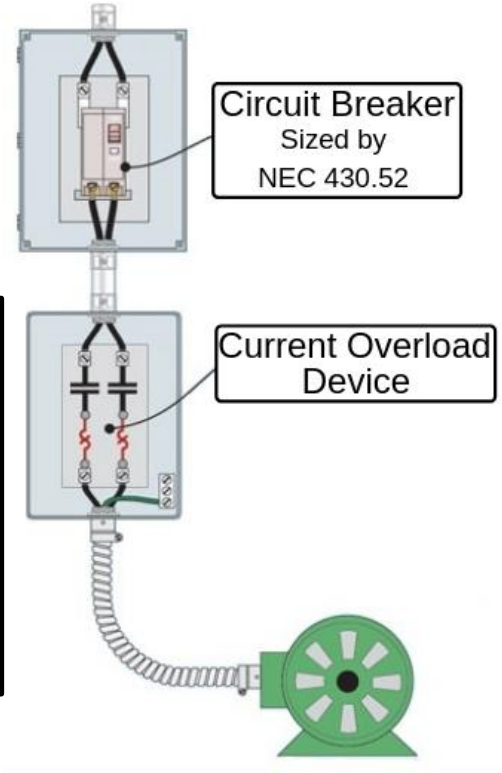
It is necessary to account for the inrush current when installing motors and starters; to avoid tripping breakers or blowing fuses unnecessarily when the blower/exhauster is energized. National Turbine recommends following NEC article 430 when installing electric motors.

Electrical Soft Starters

Electrical soft starters are used reduce the voltage supplied to the motor when it is energized which reduces the inrush current. The voltage is then slowly increased to the line voltage over several seconds (depending on the soft start this can be up to 30 seconds). Many electrical soft starters monitor current and have settings to protect the motor from over drawing amperage. Soft starters are sized by the size motor they are driving and should be installed to the manufactures specifications.

Sizing Circuit Breaker

Correctly sizing the circuit breaker for a motor is critical to suppling the amount of current required to start the motor. Due to the inrush current the circuit breaker should be sized by using NEC code 430.52. Below is a reduced table from NEC 430.52 for reference.



NEC Table 430.52 Sizing Circuit Breaker for Motor Power Supply

	Percent of Full-Load Current		
Type of Motor	**Non-Time Delay Fuse**	**Dual-Element (Time-Delay) Fuse**	**Inverse Time Breaker**
Single-phase Three-phase	300	175	250

Note: Sizing is based on full load amp values shown in Table 430.247 through 430.250, NOT MOTOR NAMEPLATE VALUES

Current Overload Device

National Turbine recommends installing a current overload device to protect the motor. The breaker is oversized allowing the motor to draw the required current to start the motor but this can leave the motor susceptible to overload under normal operation.

VII. PRE-STARTUPS CHECKS

1. A visible inspection should be done to insure unit is on a solid, flat, level, and smooth foundation with vibration pads installed.
2. Check motor connection to make sure it is wired properly. Refer to motor nameplate and control panel connections per electrical drawings. If additional items such as: temperature sensors, surge controls, vibrations switch's etc. have been provided then these must be correctly wired per manufacturer's instructions.
3. Check for and remove any foreign material that might be located in the intake or discharge piping.
4. Remove coupling guard and recheck coupling aliment. The blower/exhauster and motor shafts were properly aligned at the factor prior to shipment. However, rough handling in transit could have disturbed this alignment. Therefore alignment MUST be rechecked and the unit realigned. Refer to coupling alignment in sections VIII.
5. After alignment has been checked the shaft should be rotated by hand several times to insure that the rotation is free and the unit rotor assembly does not rub.
6. Lubrication. Your blower/exhauster has been pre-lubricated at the factory. The automatic lubrication system for the blower/exhauster bearings should be installed as outlined in section IX (Lubrication Installation) before operation. Motor bearings should be lubricated per manufactures instructions.
7. Bump the power to the motor to ensure that the direction of rotation agrees with sticker on the inlet head. The direction of rotation may be observed on many TEFC motors by watching the cooling fan at the end of the motor. (This will allow the coupling guard to be reinstalled for this check.) **NOTE: CAUTION SHOULD BE OBSURVED TO KEEP HANDS, FEET AND ANY LOOSE CLOTHING AWAY FROM THIS ROTATING EQUIPMENT. THE COUPLING GUARD IS ONLY REMOVED TO CHECK ALIGNMENT AND ROTATION IF ROTATION CAN NOT BE OBSERVED IN ANOTHER LOCATION. NEVER OPERATE THIS EQUIPMENT WITHOUT THE COUPLING GRARD SECURELY BOLTED IN PLACE.**

8. Restricting the flow of air into or out of your blower/exhauster will help reduce the high amperage draw time of the motor on start-up. If your blower/exhauster does not have a butterfly intake valve built into the inlet, check the piping entering and exiting the blower/exhauster for a valve to close and restrict the air flow.
   Note: It will take about 15 seconds for the unit to come up to full speed with the air flow restricted.
9. Place an amp meter on one incoming power lead to measure the amp draw.
   Note: A true RMS meter is best to measure 3 phase current.
10. If your blower/exhauster is equipped with a butterfly intake valve follow the procedure outlined in section IX before proceeding with step 11.
11. Start the blower/exhauster. Once it reaches its full speed slowly open any valves that were closed while watching the amp meter.

NEVER EXCEED THE MOTOR F.L.A.!!

12. Allow the unit to run until it has reached full operating temperature. This should take about 15 minutes.
13. Now that the blower/exhauster is running check for unusual noises and vibration.

    NOTE: IF ANY NOISE OR VIBRATION IS DETECTED SHUT THE UNIT DOWN IMMEDIATELY.
14. Now that the blower/exhauster is running a check should be made on any on the operation of any optional item such as: surge protection device, surge prevention device, bearing temperature devices etc. Refer to individual operating instructions sheet for each specific item.

VIII. OPERATION STANDARDS

Although it may vary depending on size of unit and application, normal operating levels are:

Vibration: Less than .24 in/sec (6.1 mm/sec) in the vertical plane at each bearing.

Note: Vibration is measured at operating speed with air flowing through the machine.

Temperature Range: Inlet = 85°F to 120°F (29°C to 49°C)

Outlet = 170°F to 235°F (77°C to 113°C)

OPERATING TEMPERATURES

It is the nature of centrifugal compressors to run hot due to heat of compression and internal friction caused by movement of air. The higher temperatures will be on the discharge side of the machine. The following information will serve as a guide in determining acceptable temperature limitations under normal operating conditions. For specific applications, or operating temperatures outside of the figures shown, contact the factory.

BEARING TEMPERATURES

Bearings used in your centrifugal blower are designed to operate continuously in temperatures in excess of 200°F (93°C), measured on the bearing housing. Standard alarm circuitry, if supplied, is set to alarm at 230°F (110°C). If bearing temperature monitors are not supplied, check bearing housing temperatures, periodically, and notify National Turbine if readings exceed 220°F (104°C).

DISCHARGE AIR TEMPERATURE

Under normal operating conditions, using ambient or atmospheric air, typical discharge air temperatures may also exceed 200°F (93°C) measured in the discharge air stream or on the surface of the discharge (outlet) head. Discharge temperature is affected by many factors including efficiency, flow, pressure, altitude, inlet temperature etc. so it is difficult to determine the exact discharge temperature to expect.

Generally speaking, the discharge air temperature should not exceed 275°F (135°C) under normal operating conditions. In all cases where other than ambient or atmospheric air is being compressed, or discharge temperatures reach 275°F (135°C), consult factory. Failure to do so could nullify factory warranty.

CAUTION: If your centrifugal blower is being used in a hot application such as steam re-compression, or similar application where inlet temperatures exceed 200°F (93°C), the machine must be preheated slowly to 180°F (82°C) minimum, prior to introduction of hot process air, gas or vapor. Sudden introduction of above without preheating can cause serious damage to the machine and will void the factory warranty.
Information about the residual risks that remain despite the inherent safe design measures, safeguarding and complementary protective measures adopted.

Blower and motor surfaces can remain hot for an extended period of time after equipment shut down. Exercise caution when working on or around this equipment when hot.

A NOTE ON NOISE...
Every effort has been made to keep the noise level of operating equipment below 85dBA, the current acceptable limit mandated by OSHA. Although hearing protection in not required by law, the manufacturer suggests the use of hearing protection when operating or working around this equipment.

IX. COUPLING ALIGNMENT

The following procedure is applicable to direct driven machines only. Correct alignment will ensure a longer life and trouble free operation of you blower/exhauster. **REALIGNMENT AFTER INSTALLATION MUST BE DONE. Damage to equipment due to improper alignment is not covered by your equipment warranty.**

Misalignment is one of the most common causes of unit vibration and will cause premature bearing failure.

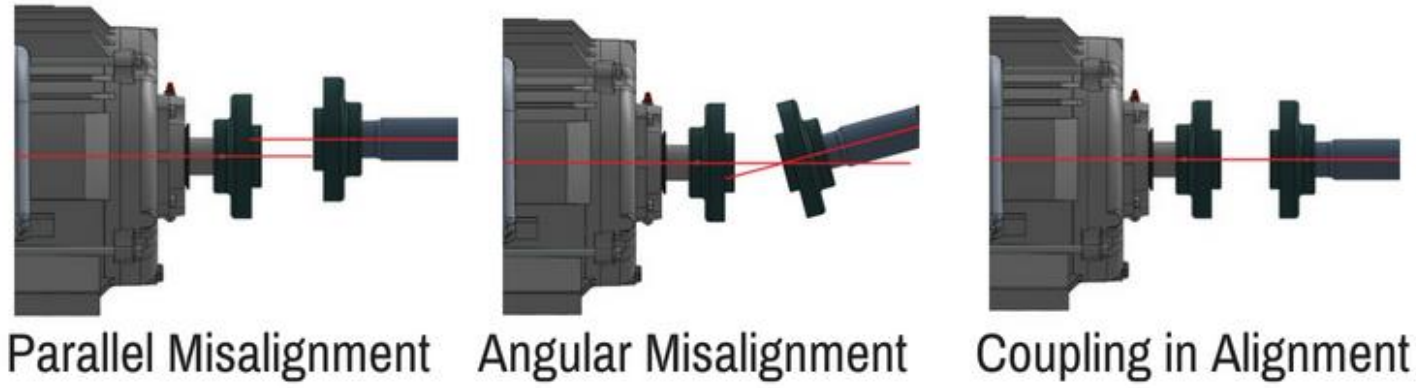
NOTE: FINAL SHAFT ALIGNMENT IS THE RESPONSIBILITY OF THE INSTALLER/OWNER. The following conditions can affect alignment and can be a factor in trying to achieve a good alignment.

1. Base and foundation not level and smooth.
2. System piping not isolated with flexible sleeve or expansion joint.
3. Blower/exhauster base not mounted on vibration pads.
4. Blower/exhauster bolted down

NOTE: LACK OF VIBRATION ON START-UP DOES NOT INDICATE THAT THE UNIT IS IN PERFECT ALIGNMENT.

TYPES OF MISALIGNMENT:

Misalignment can occur as either parallel or as an angular displacement on two of the three possible axes. The manufacturer recommended alignment tolerance is +/- .005 inches parallel and .250 degree angular.

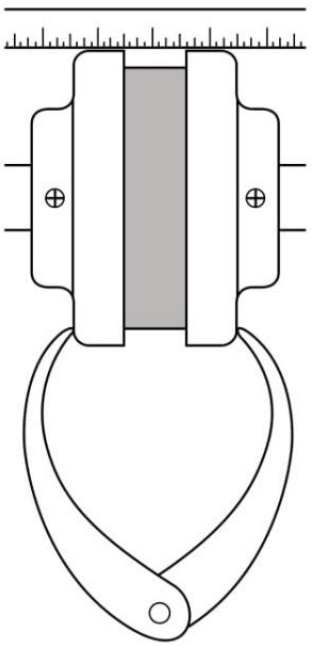


Alignment can be done by several different methods.

- Laser Alignment - is the most accurate and quickest method.
- Dial Indicator Methods
    - Reverse Dial Indicator Method
    - Single Dial Indicator or Rim and Face Alignment

TOOLS NEEDED FOR ALIGNMENT:

1. Calipers
2. Dial Indicator
3. Straight Edge
4. 6” Level

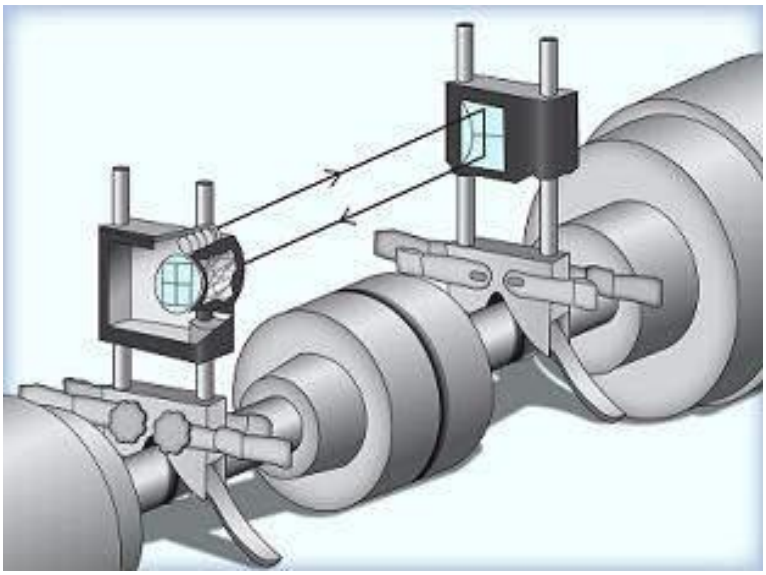


ROUGH ALIGNMENT:

A rough alignment may be necessary due to the range limitations of the dial indicators. The simplest method is to use a straight edge and calipers to bring the machines into rough alignment. Place a straight edge across the outside diameters (O.D.) of the coupling hubs at 90-degree intervals to check and correct the parallel misalignment. Use the calipers to check and correct the angular misalignment. The calipers should be used at the same 90 degree intervals as the straight edge.

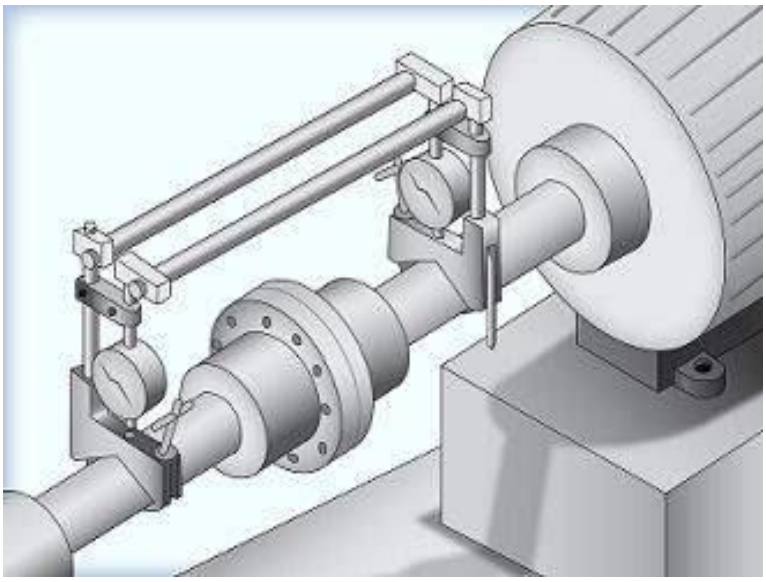
LASER ALIGNMENT METHOD:

The laser alignment method uses a laser to span the shaft-to-shaft distance. As both shafts are rotated together the misalignment is determined by the movement of the laser beam on the detector surface. The laser is connected to a computer to that displays the misalignment and the amount of correction needed. This is the most accurate method available and is the recommended method for National Turbine equipment.



REVERSE DIAL INDICTOR METHOD:

The reverse dial method is similar to the laser alignment method, however, less accurate and can take more time. This method also takes shaft-to-shaft readings but uses two dial indicators instead of a laser for measurement. As both shafts are rotated together, both the parallel and angular misalignment are combined in one indicator reading. This method will require the use of two special brackets to hold the indicators during the measurements.

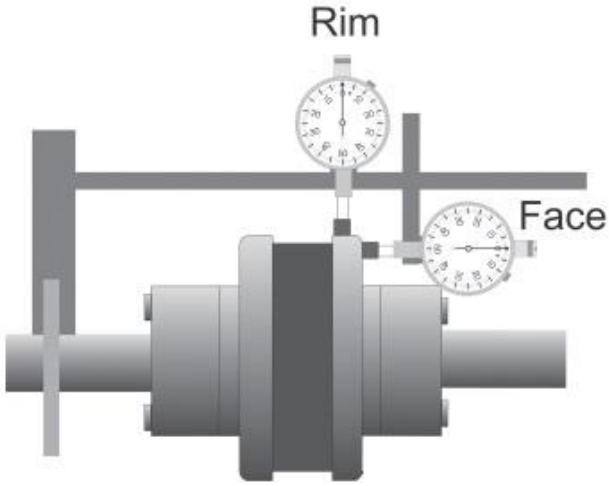


SINGLE DIAL INDICATOR OR RIM AND FACE ALIGNMENT METHOD:

This method is similar to the rough alignment but more accurate since dial indicators are used. The rim reading measures the offset between the coupling halves. The face reading measures the angular difference between the faces of the coupling.

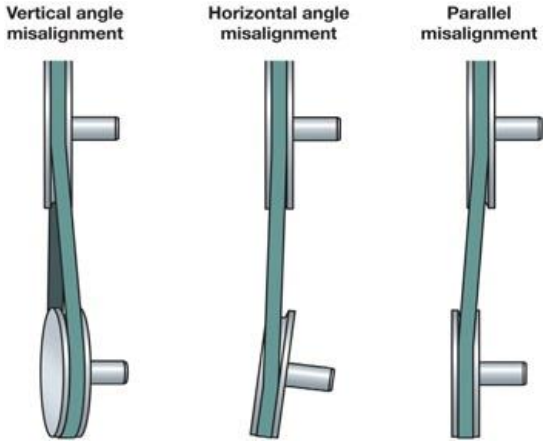
The procedure is as follows -

1. Clamp dial indicator on driving (Motor) side of coupling and locate the indicator probe on the rim (O.D.) of the driven (Blower) coupling half. Rotate shaft and take reading at 90-degree intervals to determine the amount of parallel misalignment. Misalignment of coupling is ½ of Total Indicator Reading (TIR).
2. Locate indicator probe at the extreme point on the coupling face, rotate shaft and take readings at 180-degree intervals to correct any angular misalignment.
3. Once the angular misalignment has been corrected be sure to re-check the rim alignment to ensure it is still correct.



BELT DRIVEN ALIGNMENT:

Remove belt guard and inspect the belts and sheaves to insure that they are clean and dry. **DO NOT APPLY ANY BELT DRESSING.**



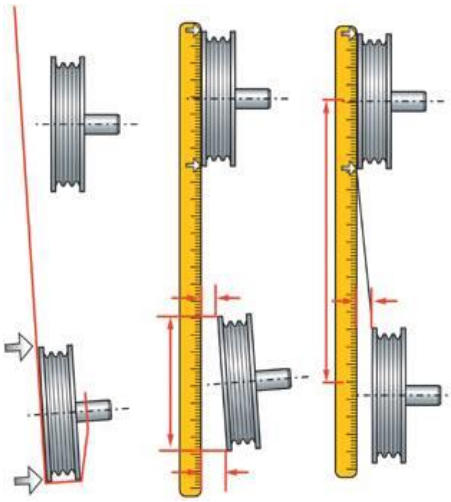
MISALIGNMENT

Misalignment of belt drive sheaves and will cause premature belt failure. The illustration below shows the different types and direction of misalignment. Vertical misalignment is the least common direction to have misalignment and is corrected by shimming the motor feet. Horizontal and parallel misalignment are more common and can be corrected by adjusting the motor slide base or the motor.

PROCEDURE

Start by placing a straight edge across the face of the blower sheave to check the alignment of the motor sheave. If properly aligned the straight edge will contact both sheaves faces squarely. If the two faces do not meet then alignment can be adjusted by moving the motor into proper position as shown below.

1. If the motor sheave is extended past the face of the blower sheave slide the sheave up the shaft or move the motor back.
2. Hold a straight edge up to the face of the blower sheave and measure the horizontal misalignment. This misalignment can be corrected by adjusting the motor slide base. The alignment is correct when the both measurements are equal.
3. Once the horizontal misalignment has been corrected the motor sheave should be moved out to correct the parallel misalignment.
4. The vertical misalignment should be checked by holding a straight edge to the bottom of the blower sheave on the one end and the bottom of the motor sheave on the other end. Then the straight edge should be moved to the top of the blower sheave on one end and the top of the motor sheave on the other end. If properly aligned the straight edge will contact both sheaves faces squarely



BELT TENSION

Proper belt tension is important and will ensure maximum belt and bearing life. If the belts are too tight it will add stress to your bearings leading to premature bearing failure. When the belts are loose on the pulley, the belt can slip during operation and cause extra friction. The additional friction can result in a buildup of heat on the belts and the pulleys leading to premature belt failure.

Belt tension is done with a tension meter. These can be obtained at any local belt supply house. Follow the instructions supplied to determine proper belt tension.

Belts will stretch after a few hours of operation. You should re-check the belt tension.

Each belt drive system is designed for the specific application and site conditions of that blower/exhauster. Please contact **National Turbine** for the specific belt drive information required to keep your belts properly tensioned.

BELT DRIVE INFORMATION

New Belts Deflection

Distance - _____

Force - _____

Used Belts Deflection

Distance - _____

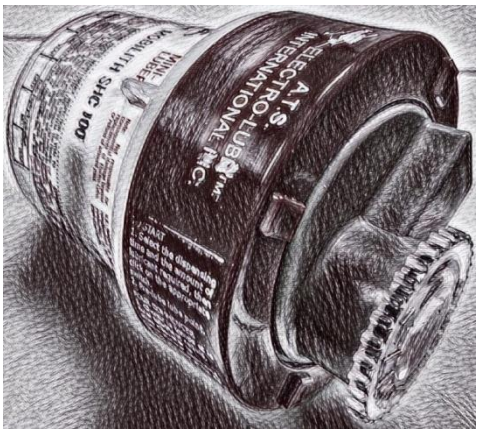
Force - _____

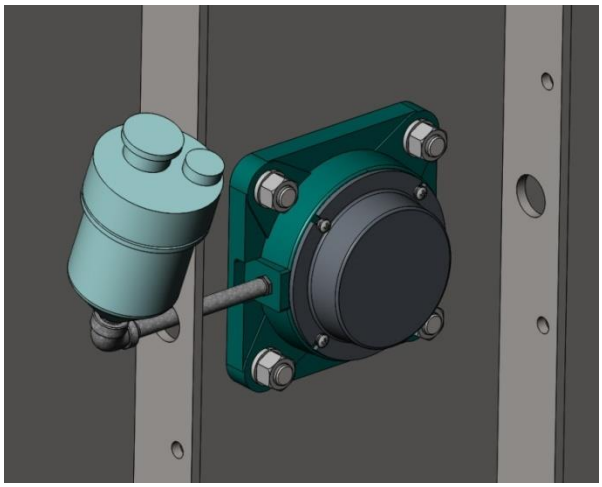
Always lockout starter or motor control center when working on or near any rotating equipment

X. LUBRICATOR INSTALLATION

Your **NATIONAL TURBINE** unit is supplied with an electronic lubricator. When the selector switches are moved from the off to the on position an electro-chemical reactor cell is activated. This begins an electro-chemical reaction whereby electrical energy is converted into nitrogen gas. As the gas is generated and captured in a set of bellows, the pressure is used to move a piston. The piston forces the grease out of the end of the lubricator. The electronic lubricator is not designed to be recharged or refilled and is one time use part.

These are shipped loose to prevent any possible damage in transit. **INSTALLATION OF THESE MUST BE DONE BEFORE START-UP OF EQUIPMENT.**



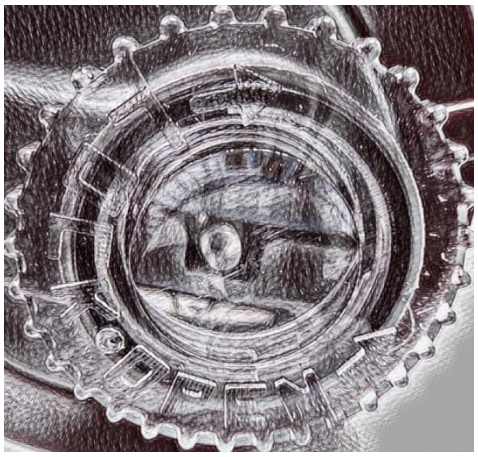


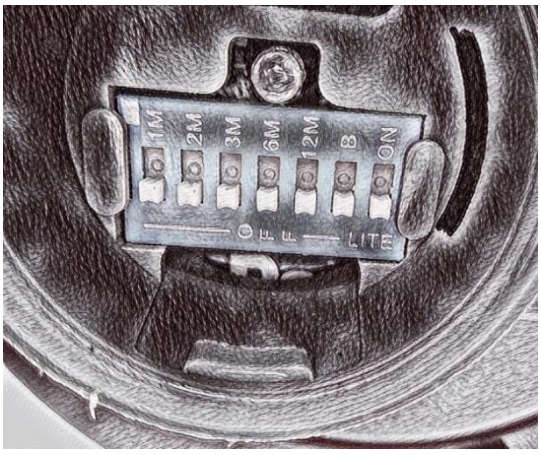
INSTALLATION:

When you receive your National Turbine Millennium Series blower/exhauster it will be necessary to install the automatic lubricator to provide the proper amount of lubrication to the bearings.

The process is as follows:

1. Remove to cap on the electronic lubricator that protects the ¼" NPT thread.
2. The bearing has been plugged to prevent any foreign material from entering the grease during shipment. Remove the plug in the elbow.
3. Thread the automatic lubricator into the elbow, hand tight, being careful not to overtighten.
4. Once the lubricators have been installed in both bearings it will be necessary to set the rate that they dispense the lubricant.



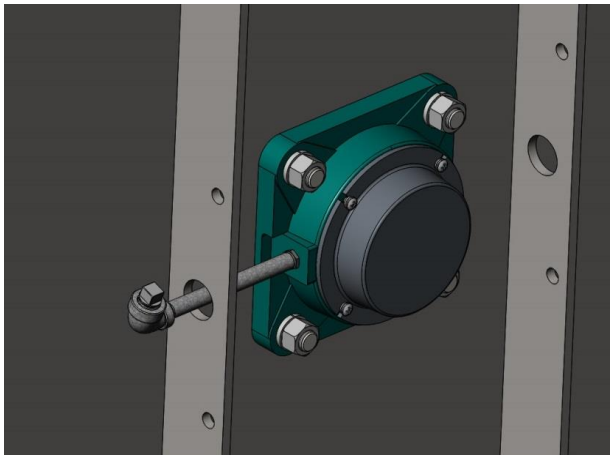


STARTING AND SETTING:

After installation of the automatic lubricator remove the switch cover by rotating the cover in the direction the arrow next to the word "OPEN" indicates. With a pencil slide **ONLY** the switch marked "12M" from the "OFF" position to the "ON" position. The 12M setting will provide you with a 1-year supply of lubricant.

If a visual indicator of operation is desired then you can slide the switch marked "LITE" from the off position to the on position. This will activate a LED light that will flash every 15 seconds and indicate that the unit is in operation and producing the required gas to displace the grease. It will take about 10 days for the lubricant to begin to flow. Your unit has been provided with pre-lubricated bearing to allow for this time lag.

MANUAL LUBRICATION:



National Turbine provides automatic lubricators for all MILLENIUM series blowers and exhausters equipped with 4 bolt flange bearing. The manufacture of these bearings has stated “a small amount of grease at frequent intervals is preferable to a large amount at infrequent intervals”.

If lubricating manually, install a zerk grease fitting where the automatic lubricators is screwed into the elbow. The bearing should be greased at the interval outlined in the section below.

Do not mix greases. This series of blowers uses National Turbine Centron B grease. Mixing grease types can cause the grease to break down due to chemical incompatibility and will result in rapid bearing failure. BEARING FAILURE DUE TO THE USE OF INCORRECT GREASE IS NOT COVERED BY YOUR EQUIPMENT WARRANTY

MANUAL LUBRICATION INTERVAL

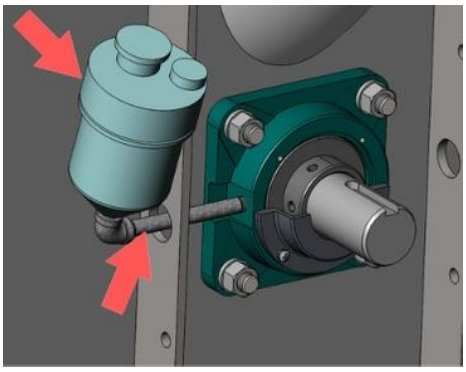
Model	Interval	Grease Amount
M24B	Weekly	3.5 CC

Model	Interval	Grease Amount
M30B	Weekly	4.0 CC

GREASE SPECIFICATIONS - FOR 4 BOLT FLANGE BEARING

NGLI GRADE ..... NO. 2
THICKENER TYPE ..... LITHIUM COMPLEX
OIL ..... SYNTHETIC OIL
VISCOSITY ..... 445 cSt @ 40° C
VISCOSITY INDEX 150
DROPPING POINT (ASTM D2265) ..... .509°F (265°C)
CORROSION PROTECTION ..... .PASS
TEMPERATURE RANGE ..... -40°F (-40°C) TO 302°F (150°C)
TEXTURE ..... SMOOTH
COLOR ..... RED

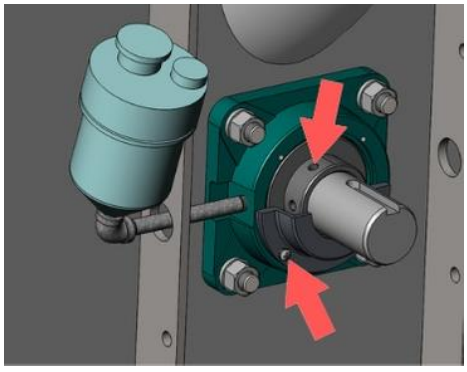
XI. BEARING REMOVAL & REPLACEMENT

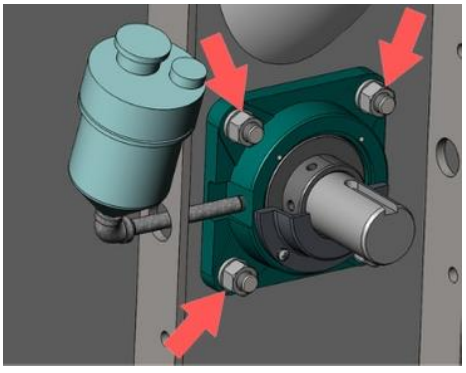


When a bearing becomes noisy it should be changed at once. You should change only one bearing at a time. **NEVER REMOVE BOTH BEARINGS AT THE SAME TIME. THIS WILL CHANGE INTERNAL SETTINGS AND DAMAGE TO ROTOR ASSEMBLY MAY RESULT.**

Procedure to replace bearing:

1. Remove the automatic lubricator and piping from the bearing.
2. Remove the 4 screws that hold the bearing cap to the flange bearing. The cap covers 2 set screws (internal hex head) located in the inner race of the bearing. These set screws hold the rotor in axial alignment.
3. Remove the 4 nuts holding the bearing to the head. With the hardware removed pull the bearing off shaft.
4. Install new bearing on the shaft and replace the 4 nuts





that hold the bearing to the head and tighten them down to the required torque.

5. Remove the set screws from the inner race of the bearing and apply a small amount of medium strength threadlocker. Reinstall the set screws in the inner race and tighten them down to the required torque.
6. Install the bearing cap to cover the set screws.
7. Before reinstalling the automatic lubricator piping National Turbine recommends cleaning out any old grease from the piping and refilling the piping with the lithium grease recommended for the 4 bolt flange bearing.

NOTE: Bearings are approximately 33% filled with lubricant at the factory. No grease should be pumped into the bearing.

XII. SETTING THE BUTTERFLY INTAKE VALVE (IF EQUIPPED)

BUTTERFLY VALVE DESCRIPTION

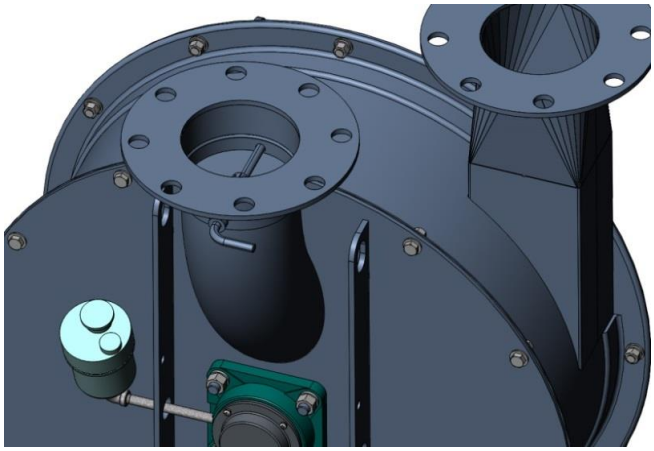
The butterfly valve is used to regulate the air flow thought the blower/exhauster. For a blower the butterfly valve may be used to regulate or reduce the volume of air exiting the blower. The inlet butterfly valve may be a necessary tool to protect the motor from drawing more than the full load amps for both blowers and exhausters.

PROCEDURE FOR VACUUM SYSTEM:

VACUUM SYSTEM LEAK TEST:

Purpose: To identify leaks in the vacuum system and establish a no flow amperage baseline for future service inquires.

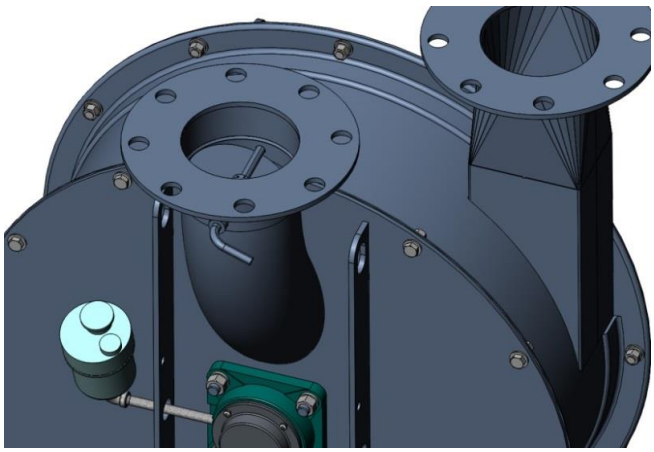
1. Position the handle on the valve to the closed position (perpendicular to the inlet tube).
2. Place an amp meter on the incoming power leads to measure the amp draw. Note: A true RMS meter will be needed to measure 3 phase current.
3. Start the exhauster with all the vacuum hoses in their holders and the surge control disabled. Position the handle on the valve to the open position (parallel to the inlet tube).
4. Record the no load amps on the cover of this manual. If the system is tight the exhauster will be in surge and should not be run in this condition for more than 5 minutes.
5. Shut the exhauster down



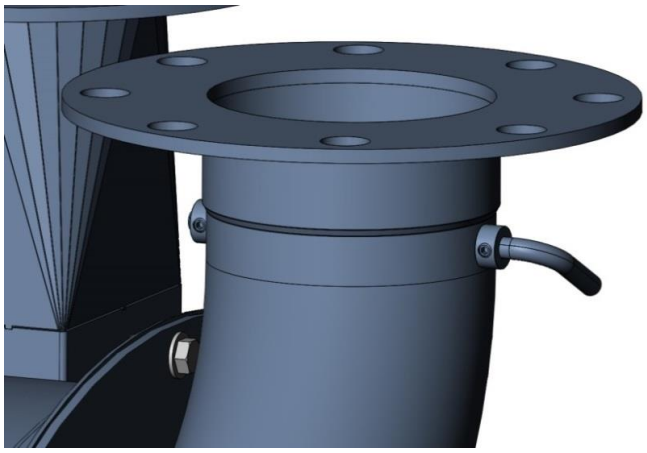
SETTING THE BUTTERFLY INTAKE VALVE ON A VACUUM SYSTEM:

Purpose: To establish the maximum volume of air the exhauster can handle within the constraints of the motor.

1. With the vacuum leak test completed and the amp meter still on the incoming power leads reposition the handle on the valve to the closed position (perpendicular to the inlet tube).
2. Then open the valve about 15 degrees (the handle should be around the 4 o'clock position).
3. Remove all the vacuum hoses from their holders and re-enable the surge control.
4. Start the exhauster and allow it to come up to full speed (it should take about 15 seconds).



5. Slowly open the butterfly valve while watching the amp meter. As the exhausters valve is opened the amperage will climb until:
    a. The motor reaches the full load amps on the name plate of the motor
    OR
    b. The valve is completely open and the exhauster is at its maximum flow.
6. Once either condition “a” or “b” is met in step 5 tighten the set screw on the collar at the base of the valve to lock it in place.



Note: This procedure may require periodic adjustment if small leaks develop and certainly if more hose drops are added.

NEVER EXCEED THE MOTOR F.L.A.!!

PROCEDURE FOR BLOWER SYSTEM:

SETTING THE BUTTERFLY INTAKE VALVE ON A BLOWER SYSTEM:

Purpose: To establish the correct volume of air required by the application supplied by the blower within the constraints of the motor.

1. Place an amp meter on the incoming power leads to measure the amp draw. Note: A true RMS meter most accurately measures 3 phase current.
2. Position the handle on the valve to the closed position (perpendicular to the inlet tube).
3. Then open the valve about 15 degrees (the handle should be around the 4 o’clock position).
4. Start the blower and allow it to come up to full speed (it should take about 15 seconds).
5. Slowly open the butterfly valve while watching the amp meter. As the blower valve is opened the amperage will climb until –
    a. The motor reaches the full load amps on the name plate of the motor
    b. The desired pressure or flow of air to the process is achieved.
    OR
    c. The valve is completely open and the blower is at its maximum flow.
6. Once condition “a”, “b” or “c” is met in step 5 tighten the set screw on the collar at the base of the valve to lock it in place.

NEVER EXCEED THE MOTOR F.L.A

XIII. SURGE IN CENTRIFUGAL COMPRESSORS (BLOWERS AND EXHAUSTERS)

A centrifugal blower is normally connected to a piping system and delivers air through that system for ultimate use on some required operation. If the demand of this operation (and consequently of the piping system) gradually or suddenly decreases, the pressure from the blower and in the piping system will increase until it reaches the highest pressure peak of which the blower is capable.

If the load or volume requirement (demand) decreases still further, the blower delivery pressure tends to decrease from its peak, resulting in the pressure in the piping system becoming greater than the pressure from the blower. Air then tends to reverse its direction and flow back into the blower until both pressures become equalized and the blower can again resume its normal function of pumping air into the system.

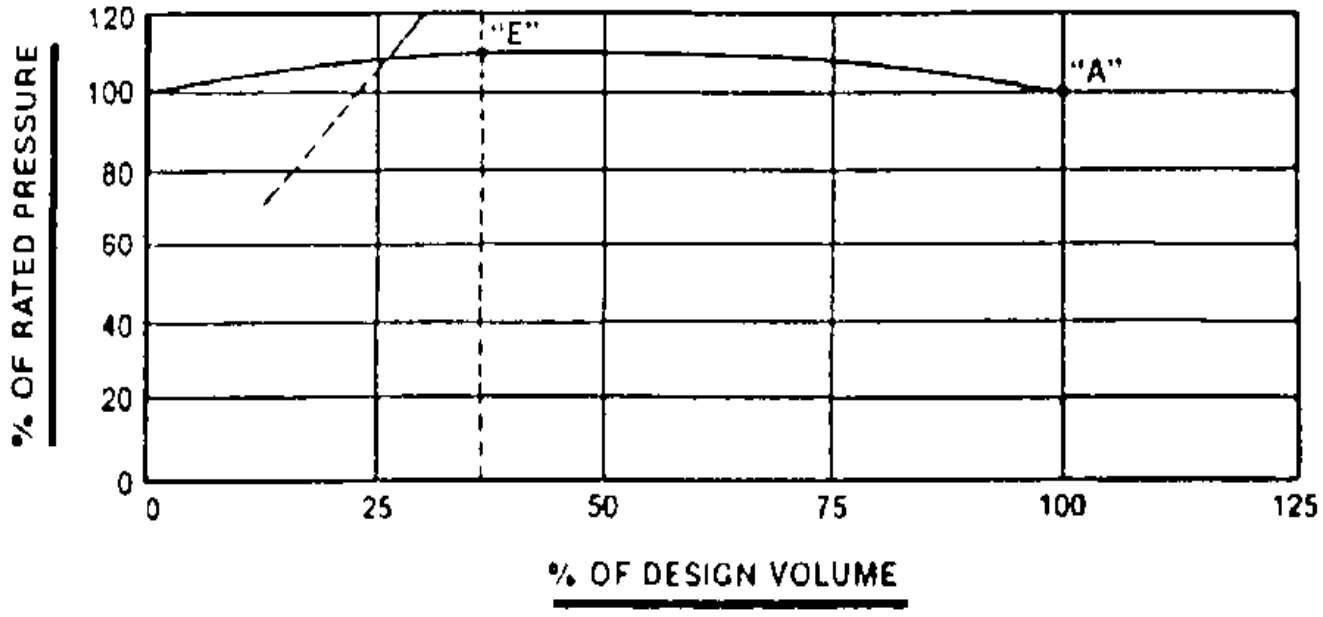
Until demand requirements increase, this backward and then forward flow of air – this pulsation or surge – will continue. It can cause undue strains on the blower and possibly failure of bearings and/or rotating assembly due to repetitive thrust strain and overheating. It is costly and dangerous to permit volume (load) requirements to drop so low as to cause surge.

Perhaps the foregoing will be more easily understood by reference to the sketch below, which is a typical pressure volume curve of a centrifugal blower. Point “A” indicates the normal operating point of a blower. Point “E” is the high point on the curve. Stable conditions will always be experienced when the volume demand is to the right of this point. Under actual operation, surge is not a factor until the volume demand of the system drops to a point to the left of point “E”, and until pressure consequently drops below that at point “E”.

The frequency and intensity of pulsation or surge depend upon the slope of the characteristic curve of the blower involved, the rate at which the air is being removed, the pressure in the blower, and the volume of the piping system to which the blower is delivering air. Backward curved impellers have a lower volume than units with radial vane impellers. Occasionally a blower will deliver air to a system so balanced that resonance occurs; in this case, even a slight surge will build up forces to significant amounts.

These same principles apply whether a centrifugal unit is operating as a blower or an exhauster.

The approximate surge point is commonly shown on blower and exhauster performance curves as the first data volume point.



XIV. PRODUCT SAFETY

Products designed and manufactured by National Turbine are capable of being used in a safe manner, but National Turbine cannot warrant their safety under all circumstances. Purchaser must install and use the products in a safe and lawful manner in compliance with applicable health and safety regulations and laws and general standards of reasonable care.

XV. WARRANTY

National Turbine warrants products manufactured by it to be free from defects in materials and workmanship under normal use and proper maintenance for a period of one (1) year from date of shipment, unless otherwise noted. If within that period any such products shall be proved to National Turbine's reasonable satisfaction to be defective, such products shall be repaired or replaced at National Turbine's option.

National Turbine's obligation and Purchasers exclusive remedy shall be limited to such repair and replacement following Purchasers written notice of any defect no later than ten (10) days after its discovery, and at National Turbine's option, the return of such products to National Turbine, F.O.B. factory. National Turbine reserves the right to satisfy its warranty obligation in full by reimbursing the Purchaser for the equipment's full purchase price.

Components manufactured by others are not warranted by National Turbine, however, to the extent possible, the Company shall provide Purchaser with such other manufacturers' warranties as are available. National Turbine makes no warranty with respect to wear or use items, such as belts, filters, bearings, or gaskets, which are sold strictly as is.

THESE WARRANTIES ARE EXPRESSLY IN LIEU OF ANY OTHER EXPRESS OR IMPLIED WARRANTY, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OR MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AND ANY OTHER OBLIGATION ON THE PART OF NATIONAL TURBINE.

XVI. MILLENNIUM SD (SEVERE DUTY) SERIES BLOWERS AND EXHAUSTERS

National Turbines Millennium SD series incorporate several advanced features for applications in extreme conditions.

Cast iron bearing housings and hardware from our cast iron multi stage Centurion Series
Special running seals in the housings to prevent intrusion of liquid into the bearings

SEVERE DUTY BEARING HOUSING:
National Turbine Millennium SD Series blowers/exhausters are built for applications that require a more robust bearing housing. The lubrication procedure is not the same for these blowers/exhausters. Please follow the procedure outlined below when greasing is required.

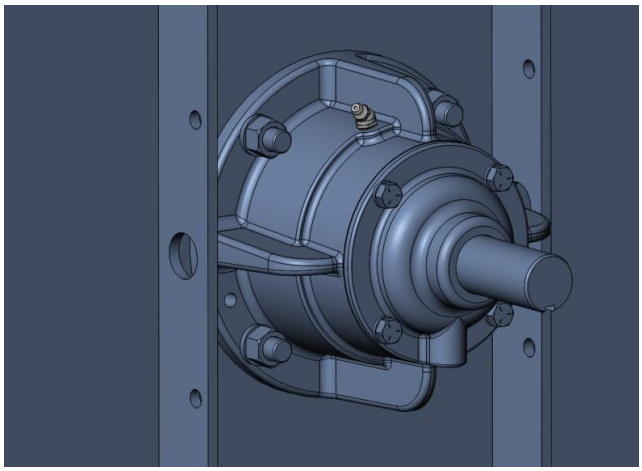
For this bearing housing design, the greatest cause of bearing failure is over greasing rather than under greasing. For this reason, National Turbine does not recommend use of permanently installed grease fittings as they invite over greasing.

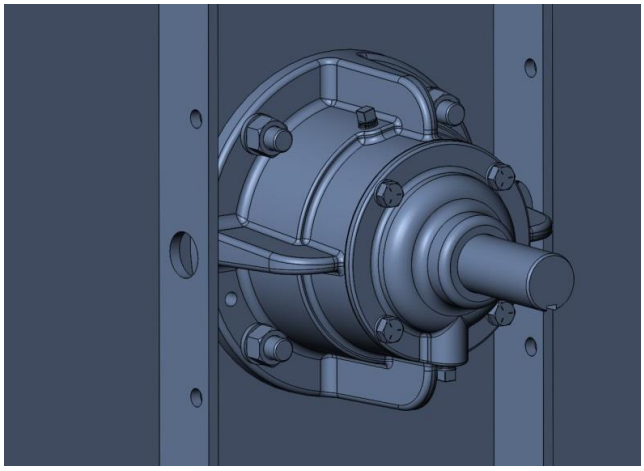
A special high speed grease is required for these machines and is outlined on the following page. Use of any other type of grease without explicit approval of National Turbine will automatically **VOID THE MACHINERY WARRANTY.**

Prior to shipment, blower/exhauster bearings are adequately lubricated for 1500 hours of operation under normal operating conditions. If three months or more have elapsed since shipment from the factory, remove bearing housing covers and inspect for moisture due to condensation.

To add grease during operation:

1. Remove plugs from top of bearing housing and the bottom of the cap. Install grease fitting into the top of the bearing housing. (see illustrations below)
2. Bring blower/exhauster up to a stabilized operating temperature.
3. Add grease through the zerk fitting installed in step 1to the specified amount at the bottom of the page.
4. Reinsert plug in top opening.
5. After thirty minutes wipe off expelled grease and reinstall bottom plug.





SEVERE DUTY LUBRICATION PERIODIC INTERVAL

Model	Interval	Grease Amount
M24SD	3 Months	1 oz. (28g)

Model	Interval	Grease Amount
M30SD	3 Months	2 oz. (28g)

BIENNIAL GREASING PROCEDURES:

Recommended every two years of normal operation or six months of abnormal operating conditions such as:

- high speed operating V-belt drives above 3550 RPM
- dirty environment
- high pressure
- temperature

1. With the machine fully stopped, remove bearing cover and plugs.
2. Remove all old grease from bearings, housing and cover by flushing with a clean solvent.
3. Repack face of bearing by hand and add remainder of specified amount to bottom half of bearing cover.
4. Reinstall plugs and bearing cover and start unit.

SEVERE DUTY LUBRICATION - BIENNIAL INTERVAL

Model	Interval	Grease Amount
M24SD	2 years	1.6 oz. (45g)

Model	Interval	Grease Amount
M30SD	2 years	3.1 oz. (87g)

GREASE SPECIFICATIONS - FOR SEVERE DUTY BEARING HOUSING

NGLI GRADE .....NO. 2
THICKENER TYPE .....POLYUREA
THICKENER % 9.5
OIL ..... MINERAL OIL
VISCOSITY .....11O cSt @ 40° C
VISCOSITY INDEX 90
DROPPING POINT (ASTM D2265) ..... .470°F (243°C)
ADDITIVES ..... .OXIDATION & RUST INHIBITORS
TEMPERATURE RANGE..... -22°F (-30°C) TO 347°F (175°C)
TEXTURE.....SMOOTH, BUTTERY
COLOR .....BLUE - GREEN