



NATIONAL TURBINE CORPORATION

**INSTALLATION, OPERATION AND MAINTENANCE
INSTRUCTIONS**

**MILLENNIUM™ SERIES MULTISTAGE CENTRIFUGAL
BLOWERS AND EXHAUSTERS**

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TABLE OF CONTENTS

Introduction	3
Inspection	3
Handling	3
Storage	3
Installation	4
Pre-startup Checks	4
Alignment	5
Lubrication	7
Bearing Removal & Replacement	7
Warranty	7
Product Safety	8
Surge	9

I. INTRODUCTION

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

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

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.

Equipment description

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

II. 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.

III. HANDLING

Your blower/exhauster is provided with 2 lifting eyes located on the inlet 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 !

IV. 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.

V. INSTALLATION

The installation site should be clean and should have adequate space to allow personnel to service and repair the equipment if and when it is required.

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

Boltholes are provided for shipping and positioning purposes. If floor bolts are used the nuts should be only **HAND TIGHTENED. EXCESSIVE TIGHTENING MAY DISTORT THE BASE AND CAUSE EXCESSIVE 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.

VI. PRE-STARTUP CHECKS

1. A visible inspection should be done to insure unit is on a solid foundation and vibration pads are 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 manufacture'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 alimnet. 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 if necessary. Refer to coupling alignment sheet on page 5.
5. Lubrication. Your blower/exhauster has been pre-lubricated at the factory. The automatic lubrication system for the blower/exhauster bearings should be installed per the attached instruction sheets. Motor bearings should be lubricated per manufactures instructions.
6. 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.
7. Bump the motor to insure that the direction of rotation is correct. **NOTE: CAUTION SHOULD BE OBSERVED TO KEEP HANDS, FEET AND ANY LOOSE CLOTHING AWAY FROM THIS ROTATING EQUIPMENT. THE COUPLING GUARD IS ONLY REMOVED TO CHECK ALIGNMENT AND ROTATION. NEVER OPERATE THIS EQUIPMENT WITHOUT THE COUPLING GRARD SECURELY BOLTED IN PLACE.**
8. To start the blower/exhauster close the butterfly valve on the inlet of the unit and start the unit. It will take about 15 seconds for the unit to come up to full speed. By the use of a clamp on ammeter the amps with the unit running under no load should be recorded.
9. Slowly open butterfly valve to increase the airflow until the full load amps of the motor has been reached. Lock the butterfly valve at this point.
10. Allow the unit to run until it has reached full operating temperature. This should take about 15 minutes.
11. Now that the blower/exhauster is running check for unusual noises and vibration. **NOTE: IF ANY DETECTION OF NOISE OR VIBRATION SHUT UNIT DOWN IMMEDIATELY.**
12. 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.

VII. ALIGNMENT

The following procedure is applicable to direct driven machines only. Correct alignment will ensure a long life and trouble free operation of you blower/exhauster.

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 manufacturer recommended alignment tolerance is +/- .005 inches parallel and .250 degree angular.

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.

Alignment can be done by several different methods. A laser alignment is the most accurate and quickest method.

An acceptable, but not as accurate as the laser alignment, can be done by reverse dial indicator. This method involves the use of 2 brackets and measuring directly off the shafts.

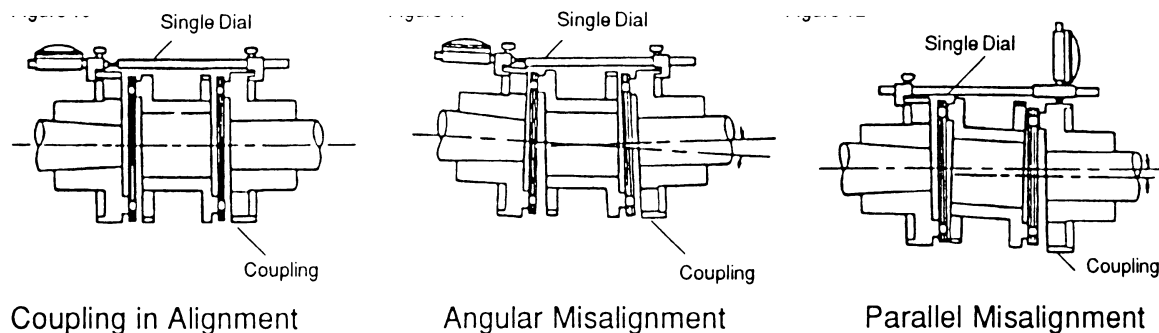
Other methods of coupling alignment would be: single dial indicator method, caliper method and straight edge method. Each of these is outlined below.

Tools Needed For Alignment:

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

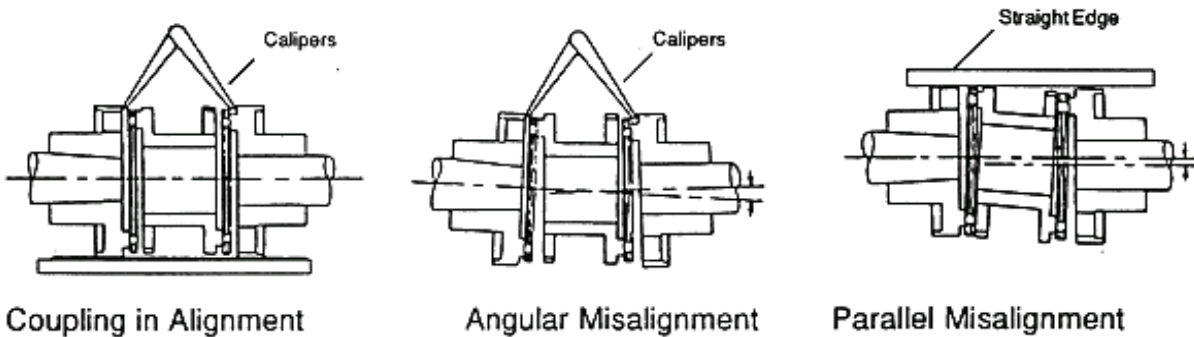
DIAL INDICATOR METHOD

Clamp dial indicator on driving (Motor) side of coupling. Locate indicator probe on the O.D. of the driven (Blower) half. Rotate shaft and take reading at 90-degree revolutions. Misalignment of coupling is $\frac{1}{2}$ of total run-out. Locate indicator probe at the extreme point on the coupling face, rotate shaft and take readings at 180-degree revolutions.



STRAIGHT EDGE METHOD WITH TAPER GAUGE

Place a straight edge across the O.D.; rotate shaft and measure at 90-degree revolution. Insert feeler gauge and measure gap. (Misalignment will be equal to feeler gauge reading.) Use gauge to check the alignment at 180 degrees.



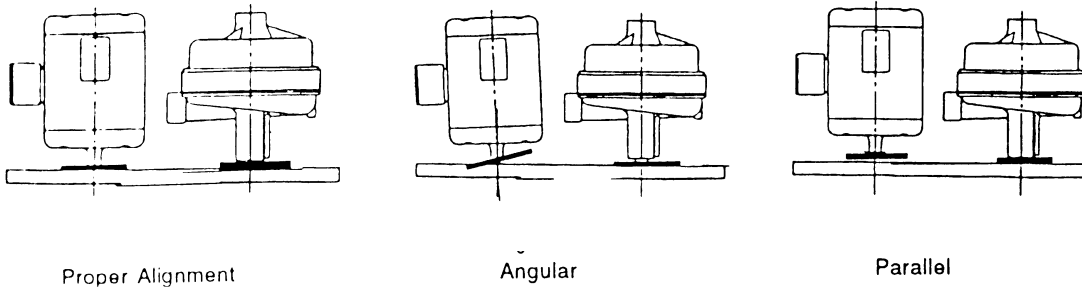
BELT DRIVEN ALIGNMENT:

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

Placing a straight edge across the faces of both sheaves does alignment. 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.

Proper belt tension is important. This will ensure maximum belt and bearing life. 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.



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

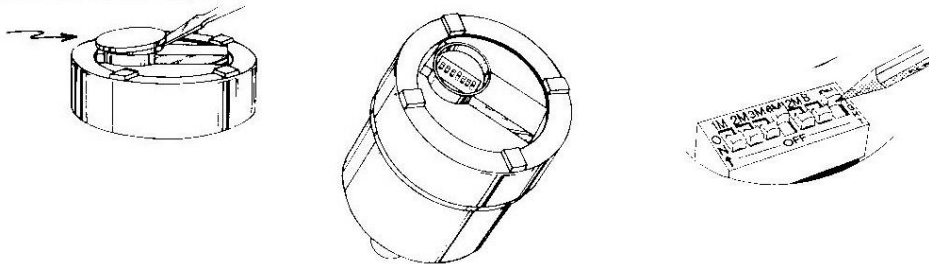
VIII. LUBRICATION

Your **NATIONAL TURBINE UNIT** is supplied with an electronic lubricator. These are shipped loose to prevent any possible damage in transit. **INSTALLATION OF THESE MUST BE DONE BEFORE START-UP OF EQUIPMENT.**

STARTING AND SETTING:

After installation of the automatic lubricator remove the switch cover. With a pencil turn on **ONLY** the switch marked 12. (The 12 setting will provide you with a 1-year supply of lubricant. This is based on 8 hours a day, 5 days a week operation.)

If a visual indicator of operation is desired then you can turn on the switch marked Light. This will provide a flashing LED light. The LED will flash every 15 seconds that the unit is in operation. 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.



IX. 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.**

To remove bearing you must first loosen the two allen set screws located on bearing collar. Next remove the 4 nuts and pull bearing off shaft. Install new bearing on shaft, replace the 4 holding nuts and tighten down the allen set screws. **NOTE: AT THIS TIME YOU MUST LUBRICATE THE BEARING WITH HIGH TEMPERATRUE GREASE. GENERALLY 2 TO 3 PUMPS OF A GREASE GUN WILL DO. DO NOT RUN UNIT WITHOUT GREASE IN BEARINGS.**

X. 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.

XI. 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.

XII. 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.

