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Changing Bearings in your Centrifugal Cast Iron Air Blower

National Turbine®, Lamson® and Gardner Denver Lamson® grease lubricated AIR blowers and exhausters- Also, H.S.I models 031,051,052,061,081 and 082

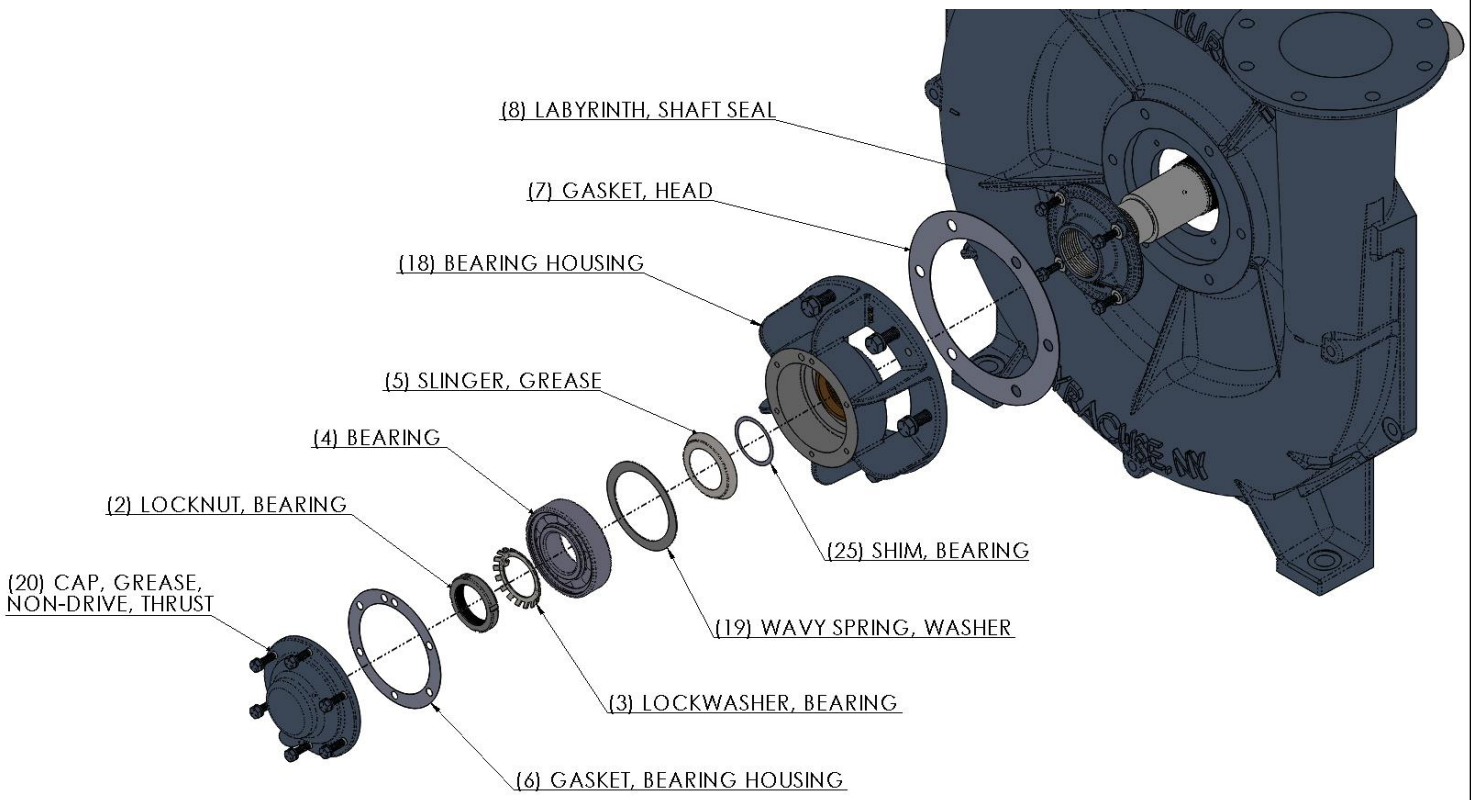
Bearing changes are the most common maintenance performed on cast iron blowers. While this procedure is not difficult for any person with general levels of mechanical skills, there are a few tips and tricks that will help make the process go smoother.

In general, all of the instructions here are applicable to all of the standard grease lubricated units, but the individual components may differ by manufacturer.

We recommend that you obtain a copy of the specific manufacturer's service instruction for your unit.

The diagrams shown are generic and do not reflect any special modifications that may exist.

OUTLET END BEARING ARRANGEMENT NATIONAL TURBINE & LAMSON UNITS



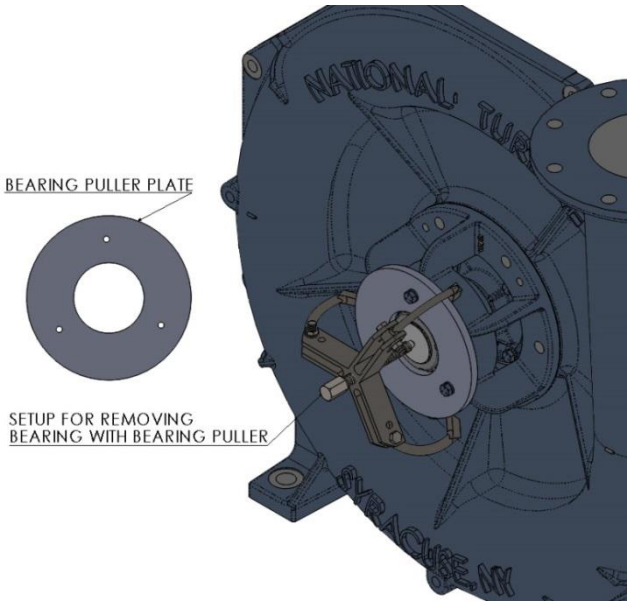
Recommended Tools

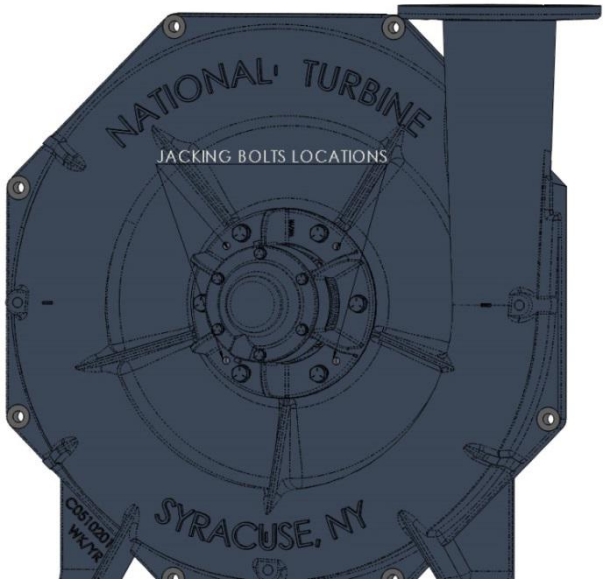
Changing the bearings on your centrifugal blower can be made much easier with a few uncommon tools you might want to have before staring your bearing change.

1. Bearing Puller Plate or Jacking Bolts –

   Bearing Puller Plate - This is a simple round plate ¼" – 3/8" thick with a the same bolt hole pattern as the cap (20), and a clearance hole in the center. The plate is bolted in place of the cap to create a lip for the bearing puller to pull the bearing straight off the shaft.

   Jacking Bolts - On most units the bearing housings (18) have holes drilled and tapped in the flange for using jacking bolts used to push the bearing off the shaft. Jacking bolts can be made by install 2 nuts on one end (double nutting) or welding a nut on to the end of a piece of threaded rod approximately 8" long. The table on the next page lists 2 standard thread sizes for both National Turbine & Lamson equipment.



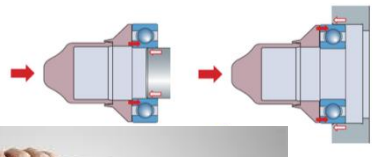


2. Spanner Wrench –

   Having the correct size or an adjustable spanner wrench can make removing and installing the lock nut much easier. The table below lists the outside diameter of the lock nuts to help size the appropriate wrench. If a spanner wrench unavailable a blunt nose chisel or other tool can be used to remove or install the lock nut.

3. Bearing Driver –

   When replacing the bearing it is very important that the bearing is driven on the shaft squarely. If the bearing is cocked to one side or the other it may damage the bearing journal of the shaft or the bore of the housing. We recommend using a bearing driver similar the ones pictured below. SKF sells "Bearing fitting tool kits" that accommodate a range of bearings. If a driver is unavailable a wide drift made of soft steel may be used. The drift must cover both the inner and outer race of the bearing. Damage to the balls, ball path, or cages may occur if the bearing is driven on by only the outer or inner race.



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Service Instructions

Grease lubricated Units for Air Handling

Blower Hardware Data

Model		HSI	Bearing Size	Labyrinth (8) & Cap (20)		Bearing Housing (18)			Bearing Nut	
Lamson	NTC			Hardware	Tool	Hardware	Tool	Jacking Bolts	Nut	O.D.
310	NT331	031	308	5/16"-18 X 3/4" LG Required Torque 6-8 FT-LB	1/2" Hex	3/8"-16 X 3/4"LG Required Torque 10-11 FT-LB	9/16" Hex	3/8"-16 UNC	N-08 18 TPI	2-7/8"
510	NT551	51	310	5/16"-18 X 1" LG Required Torque 6-8 FT-LB		1/2"-13 X 1-1/4" LG Required Torque 37-39 FT-LB	3/4" Hex		N-10 18 TPI	3-3/8"
550	NT552	52								
	NT553									
	NT554									
600		61	312	3/8"-16 X 1" LG Required Torque 10-11 FT-LB	9/16" Hex			1/2"-13 UNC	N-12 18 TPI	3 -13/16"
810	NT881	81								
850	NT882	82								
	NT883									
	NT884									
860			313						N-13 18 TPI	4"
1210	NT1221		312						N-12 18 TPI	3 -13/16"
1250	NT1222									
	NT1223		313						N-13 18 TPI	4"
1260	NT1226									

Outlet End Bearing Removal

Always start on the outlet end.

The standard design is for the outlet end to be opposite the drive. However, on some modified units, the units are outlet driven. The procedure is the same**,** but you will need to move the motor and remove the coupling (see Changing Inlet Bearing Section for more on the coupling and hub)

1. Remove the bolts from the cap (20), clean all the old grease and set aside.

2. Unbend the tab on the lock washer (3) that will be bent into a notch in the lock nut (2).

3. Use spanner wench or a blunt nose chisel, and hammer to loosen and remove the lock nut and lock washer. Take care not to damage the threads!

4. Unbolt the bearing housing for the outlet head and install the bearing puller plate or jacking bolts into the bearing housing. If you are using the jacking bolts tighten each bolt evenly in a star pattern to jack the bearing housing assembly from the head. Be careful using the jack bolt method as excessive jacking pressure can crack the bearing housing mounting flange.

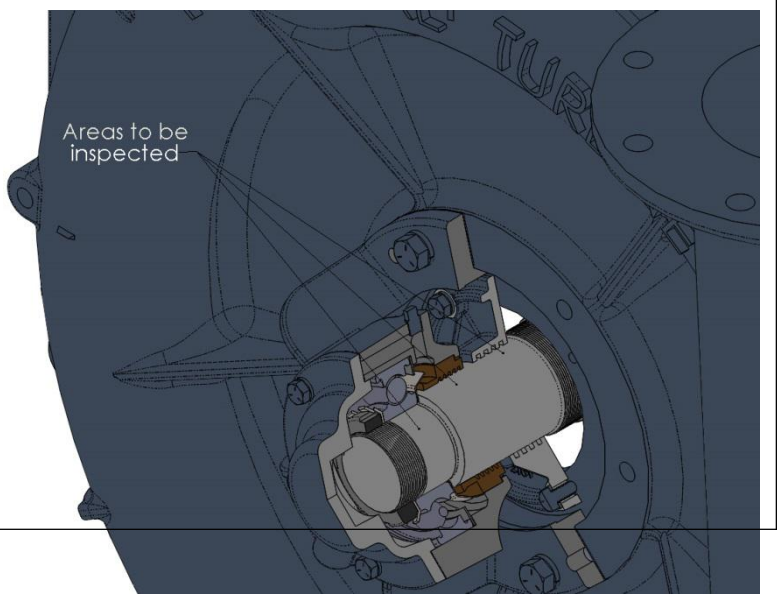
In cases of severe bearing failure (such as the race and balls displaced) it may be necessary to heat the bearing or even cut it off the shaft with a torch. In the case of a failure to this magnitude the should blower should be completely disassembled and inspected for other internal damage.

5. Remove the bearing (4), cup shaped slinger (5), wavy washer (19) and bearing shims (25) from the housing. Remove all old gaskets, being sure the metal surfaces are cleaned of any pieces. We recommend that all old gaskets be replaced. If you do not have replacement gaskets take care not to damage the existing ones and they can be reused. **The use of jacking bolts will damage the head gasket (7) and it will need to be replaced.**

6. Clean the housing of all old grease. Inspect the bearing housing for wear (a groove) where the bearing sits. If it is deeply grooved, it probably is not usable, because the bearing outer race will be too loose and spin in the housing. The housings have a bronze labyrinth insert pressed into the rear of the housing that needs to be inspected for damage.

If the housing is damaged, it is recommended that it be replaced.

7. If you bought a bearing kit, you can discard the old parts mentioned in step 5. Note how many bearing shims (25) were in the machine because you will need to put the same number back in during reassembly. If you bought just a bearing locally, clean all the old parts, and replace any that are damaged.



8. Now, air machines have a non contact labyrinth seal (8) bolted to the head on Lamson and National Turbine units. Remove the bolts and slide the labyrinth seal off the shaft – it is very close tolerance, so it may need to be “wiggled” off the shaft.

Inspection

Inspect both diameters on the shaft where the bearing and the seal where located. Clean any build up off with fine emery cloth. Inspect the labyrinth seal, and if there is any damage visible, it should be replaced.

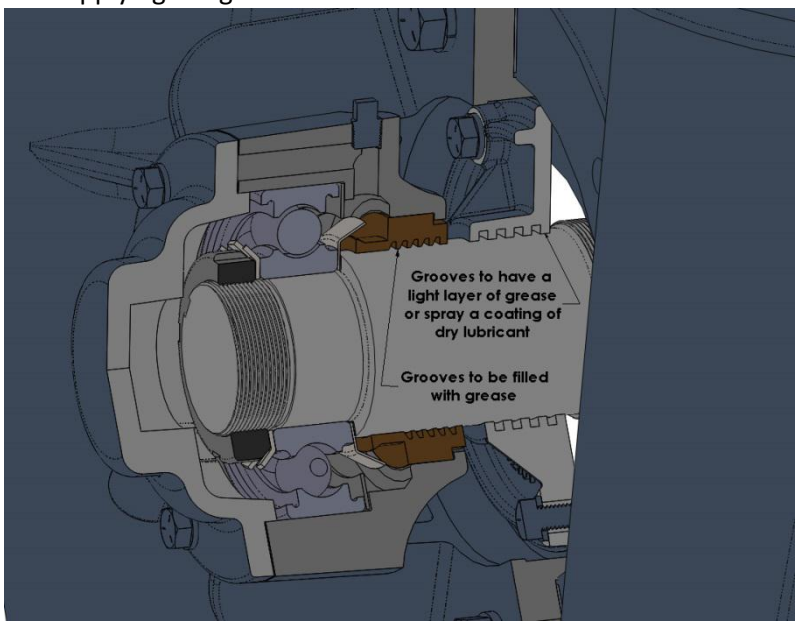
If your Lamson machine is very old, the labyrinth will be cast iron with a babbit insert poured into the cast iron. Newer machines and all National Turbine units have the labyrinth made out of a zinc/aluminum alloy, they are interchangeable.

Inspect the threads on the shaft for any damage that may have while occurred removing the bearing. Damaged threads may be fixed by using a thread file with the correct pitch. The table above outlines the pitch in threads per inch (TPI) for each machine.

Installation of Labyrinth Seal and Bearings

When changing the bearings the weight of the shaft will push the labyrinth downward and out of position. Using the proper procedure to center and install you new labyrinth seals will insure that they provide the maximum protection against air leakage. If not properly installed, the seal will wear on the shaft and increase these tolerances, resulting in excessive air leakage. Please follow the instructions carefully!

9. On the lands (surface of the grooves) put either a light layer of grease (do NOT fill the grooves) or spray a coating of dry lubricant such as moly lube. A tooth brush works well for applying the grease.



10. Install the seals on the blower, but leave the mounting bolts **finger tight**. If you tighten the bolts, when the bearing housing and bearing are installed, the shaft will lift and press against the seal, damaging the seal.

11. NTC and older Lamson™ bearing housings have a brass insert pressed into the back side of the bearing housing. The grooves in the insert need to be fill with grease to create a dirt seal before the head gasket (7) and bearing housing (18) and bolt in place. Newer Gardner Denver Lamson™ machines may have replaced the bronze insert with a lip seal.

USE CARE NOT TO DAMAGE THE THREADS ON THE SHAFT!!

12. Slip the bearing shims (25) and slinger (5) back on the shaft up against the step in the shaft. The shims go under the slinger.

13. Place wavy washer (19) into the housing.

14. **Installing the Bearing -** It will be necessary to drive the bearing onto the shaft using one of the bearing driver tools in the **Recommended Tool** section above. If you are using a wide drift made of soft steel be sure to tap around the bearing to drive it squarely onto the shaft.

A. Hand pack the bearing with the proper grease and slide into the housing as far as it will go.
B. Using a bearing driver, drive the bearing until it "kicks back" when you hit it. This means that the wavy spring washer is compressed and the bearing is fully driven into the housing.
   Note: Some blowers with larger or multiple wavy spring washers will not be compressed when driving the bearing on. The bearing will be moved into location when the locknut is tightened.

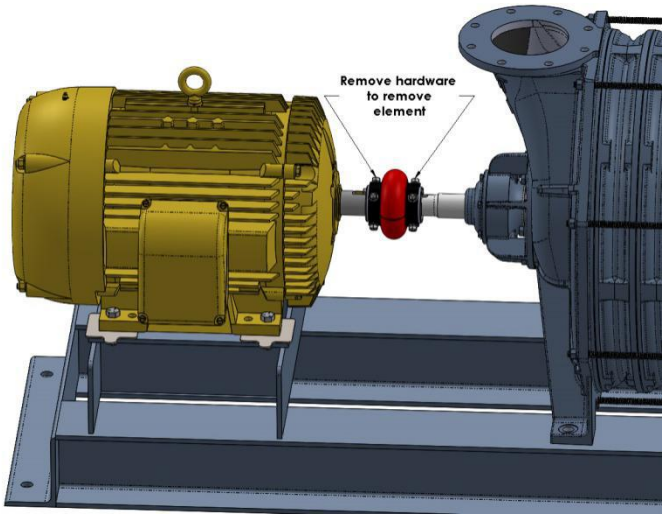
15. Install lock washer (3) on the shaft and then the locknut(2) (be sure the threads on the shaft are clean and not damaged).

16. Hand tighten the nut and then use a spanner wench or a blunt nose chisel and hammer to tighten the locknut. You should have 2-3 threads showing beyond the locknut when it is tight.

17. Tighten the nut until a slot on the nut aligns with one of the tabs on the lock washer, and peen over the tab into the slot.
You will come back to this end and finish installing the cap later

Inlet End Bearing Removal Prep

Now, on to the inlet end.
Assuming your machine is inlet driven, you will need remove the coupling guard, uncouple the motor from the blower, and move the motor out of the way.



Coupling Removal-
The most common coupling is a 2 part tire shaped element, which will be fastened to 2 coupling hubs. Once the element is removed the motor can be unbolted from the pedestal and moved out of the way. The coupling hub on the blower will need to be removed to complete the bearing change. It is held on the shaft with 2 set screws, one over the key, and one 90 degrees from the key.

Some of the smaller blowers are equipped with flexible sleeve type coupling, which is held in place by 2 coupling hubs. The sleeve element is removed by loosening 2 set screws on the blower hub, one over the key, and one 90 degrees from the key, and sliding the hub back. Once the element is removed the motor can be moved out of the way and the coupling hub on the blower can be removed as well.

Field Service Advise/Experience

Since the discharge end of the blower generates heat due to compression, the bearing on this end is the free bearing allowing for thermal expansion. The cap (20) has a short lip on it, creating a space between the cap and the bearing. When you begin changing the bearing on the inlet end, the wavy spring washer will push the bearing, and rotating

assembly towards the outlet until the bearing outer race contacts the outlet cap (20). With the shaft and rotating assembly out of position it will make driving and seating the bearing on the inlet much more difficult.

Here are some tricks to prevent that issue:

- **Take the cap (20) off the inlet bearing and install it on the outlet bearing. The inlet bearing cap has a long lip on it and will keep the bearing in place. Note: The cap will have a space between it and face of the bearing housing. Do not over tighten the cap bolt!**

OR

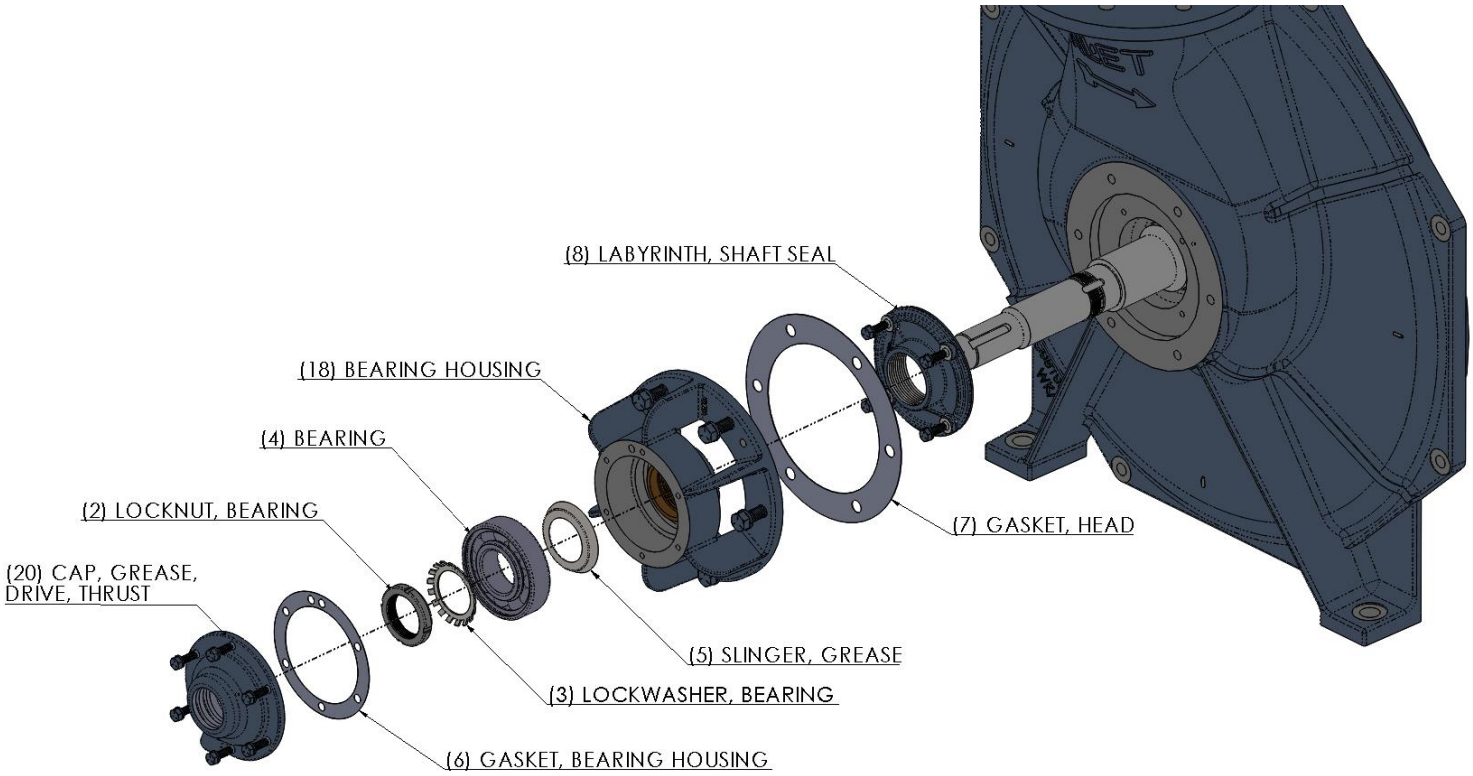
- **If you used a bearing puller as shown in the Recommended Tools section above, it can be used as shown to hold the shaft/rotating assembly in the correct position.**

OR

- **Take 2 small nuts and place them between the bearing and the cap (20), install the cap bolts and hand tighten. An easy way to hold the nuts in place is to put a blob of grease on the bearing to hold them in place while you install the cap. Note: *DO NOT TIGHTEN* bolts with a wrench, as you can crack the cap.**

Any of these tricks will hold the bearing and rotating assembly in place when it's time to drive the bearing on.

INLET END BEARING ARRANGEMENT NATIONAL TURBINE & LAMSON UNITS



Inlet End Bearing Removal

1. All of the parts are the same on the inlet end **EXCEPT** there are no bearing shims under the grease slinger and there is no wavy thrust washer.
2. Remove and replace the labyrinth seal and bearing as you did on the outlet end, and remember to leave the labyrinth seal bolts finger tight.
3. The bearing race should be packed with grease before it is installed.
4. Tighten the locknut until a slot on the nut aligns with one of the tabs on the lock washer, and peen over the tab into the slot.
5. Pack the **lower 1/3** of the drive end cap (20) with grease, and bolt the cap gasket (6) and cap (20) in place.

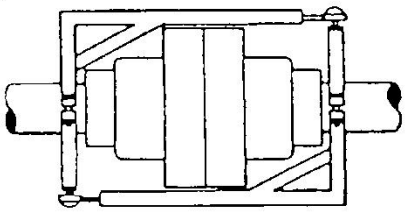
Finishing Up the Outlet Bearing Change

1. You are nearly done, but you need to go back to the outlet end.
2. Remove whatever cap or nuts you used to keep the rotor in place during the inlet bearing change.
3. Pack the **lower 1/3** of the non-drive end cap (20) with grease, and bolt the cap gasket (6) and cap (20) in place.
4. Reinstall the coupling hub, realign the coupling hubs and install the flexible element. The section below describes best alignment methods and practices!
5. That's it – the bearing change is done.
6. Go to the last section for the startup procedure after a bearing change.

Aligning Your Blower Coupling

Alignment can be achieved using several methods.
Laser alignment is the most accurate and quickest method of shaft alignment.

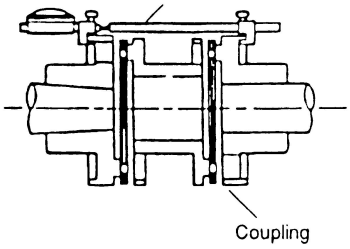
Figure 9



An alternate to laser alignment, **the reverse dial indicator** method is commonly used to achieve alignment. The reverse indicator method involves use of two brackets measuring directly off the shafts (see figure 9).
Single dial indicator method - used to measure parallel and angular misalignment. An alternative method is by use of a single dial indicator to measure both parallel and angular misalignment (see figures 10, 11 & 12).

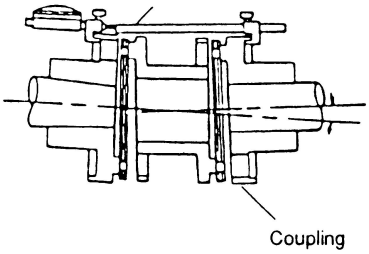
Caliper and straight edge method - is simple and effective if done correctly but cannot achieve desired tolerance (see figures 13, 14 & 15).

Figure 10



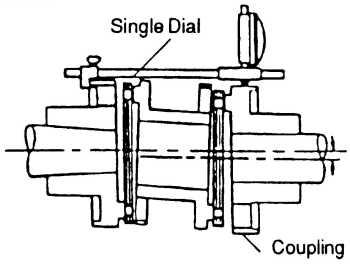
Coupling in Alignment

Figure 11



Angular Misalignment

Figure 12



Parallel Misalignment

After stabilization (when temperature rise has ceased), final alignment corrections should be made.

Recommended alignment tolerance is +/- .002 inches (.0508mm) parallel and ¼ degree angular.

Starting Up the Blower After a Bearing Change

The labyrinth seals will need to be tightened when the blower is up to speed.

When the machine is ready to run, start the unit and allow it to reach full speed-

1. Gently reach into the opening of the bearing housing and snug the labyrinth seal retaining bolts on both ends of the unit. We recommend tightening the bolts in a cross wise pattern (CAUTION – BE SURE ALL PROPER DRIVE GUARDS ARE IN PLACE TO PREVENT INJURY).
2. The movement of the free clearances of the bearing and the air pressure centers the seal out of contact with the shaft.
3. When the machine is fully stopped, tighten the labyrinth bolts as necessary,
4. The shaft should turn freely indicating that the seals are now properly adjusted and your unit is ready to operate.

That's it – your blower is ready to go back in operation.

Need help, parts or have questions??

Please do not hesitate to contact National Turbine for assistance, parts or if you run into any difficulty. We will make every effort to assist you , even on equipment not of our manufacture.

888-293-7434 for parts questions, orders or engineering assistance

jason@nationalturbine.com for parts orders

sales@nationaturbine.com for general help

The names Lamson and Gardner Denver are registered trade marks of Gardner Denver equipment company, and are used here for descriptive purposes.

There is NO relationship between Gardner Denver and National Turbine Corporation

The data presented in these instructions are accurate for blowers manufactured by National Turbine Corporation, and to the best of our knowledge, the majority of Gardner Denver and Lamson Blowers. However, the manufacturer may have made changes to their design that may make the machine different from those depicted here.

National Turbine makes NO guarantees as to the accuracy of this document when working on blowers not manufactured by National Turbine.