

ROOTS**DRESSER****WHISPAIR** MAX

BLOWER

1 3/4 - 3 1/2 inch gear diameter

INSTRUCTIONS

ROTARY LOBE BLOWERS

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NUMBERS IN () ARE METRIC EQUIVALENTS

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DO THESE THINGS**To Get The Most From Your Roots Blower**

- 1** Check shipment for damage in transit. After filing claim with carrier, notify nearest Roots Sales Office or factory.
- 2** Unpack shipment carefully and check contents against Packing List. Notify Sales Office or factory if a shortage appears.
- 3** Store in a clean, dry location if immediate installation is not to be made. Keep covers on all openings and protect against weather and corrosion.
- 4** Read LIMITATIONS and INSTALLATION sections in this book and plan the complete installation accordingly.
- 5** Provide adequate safeguards against accidents to persons working on or near the blower. See PRECAUTIONS.
- 6** Install correctly, using recommended accessories to protect blower during regular operation.
- 7** Lubricate blower and driving equipment before operating. See LUBRICATION.
- 8** Read starting check points under OPERATION, then operate blower briefly to check for obvious faults. Make corrections before proceeding with a trial run under normal operating conditions.
- 9** In event of trouble during installation or operation of a new unit, do not attempt repairs. Notify nearest Sales Office, or factory giving all blower nameplate information and operating conditions.
- 10** Unauthorized attempts at equipment repair may void Manufacturer's warranty. Units out of warranty may be repaired or adjusted by the owner. It is recommended that such work be limited to the operation described in this manual, using Factory Parts. Good inspection and maintenance practices should reduce the need for repairs. See Distributor List on last page for parts and service after warranty period.

NOTE — Information in this manual is correct as of the date of publication. The Manufacturer reserves the right to make design or material changes without notice, and without obligation to make similar changes on equipment of prior manufacture.

Bulletin IRB-131-778

OPERATING CHARACTERISTICS

The Roots rotary lobe blower is a positive displacement type unit, whose pumping capacity is determined by size, operating speed, and pressure conditions. It employs two double-lobe impellers mounted on parallel shafts and rotating in opposite directions within a cylinder closed at the ends by headplates. As the impellers rotate, air is drawn into one side of the cylinder and forced out the opposite side against the pressure existing there. The pressure developed, therefore, depends on the resistance of the discharge system.

Effective sealing of the blower inlet area from the discharge area is accomplished by use of very small operating clearances. Resulting absence of moving contacts eliminates the need for any internal lubrication. Clearances between the impellers during rotation are maintained by a pair of accurately machined timing gears, mounted on the two shafts extended outside the air chamber.

The proprietary Whispair blower design provides a chamber on the discharge side of the cylinder. From this chamber two or more slots open back into the two alternately closed pocket areas of the cylinder, shown as A and B in Figure 1. These slots, at certain impeller positions, allow discharge pressure to bleed into the normally low pressure pockets. They also provide a jet action on the impellers in the direction of rotation. Gradual pressure build-up in the pockets, to a level almost equal to the discharge pressure, reduces backflow rate at the instant of pocket discharge so that pulsing and shock noise are minimized. This permits operation at higher speeds with conservative noise levels, and in most cases enables use of a smaller unit to produce required capacity.

In Figure 1, flow is left to right from blower inlet to discharge. The lower impeller is mounted on the driving shaft, and rotates *counterclockwise*. As shown in **Position 1**, it is delivering a measured volume (A) into the discharge pressure chamber. At the same time, space (B) between the upper impeller and cylinder wall is filling with another and equal volume at atmospheric or inlet pressure. It is about to be sealed off by the *clockwise* rotation of this impeller, for delivery to the discharge.

Position 2 shows the inlet area sealed, but some discharge pressure is now entering space (B) through the slot passage, as indicated by the small arrows. Force of this jet gives a rotative assist to the impeller, while also building pressure in sealed space (B). Rotation continues to **Position 3**, where volume (B) is delivered to the discharge chamber in the same manner as volume (A) in Position 1.

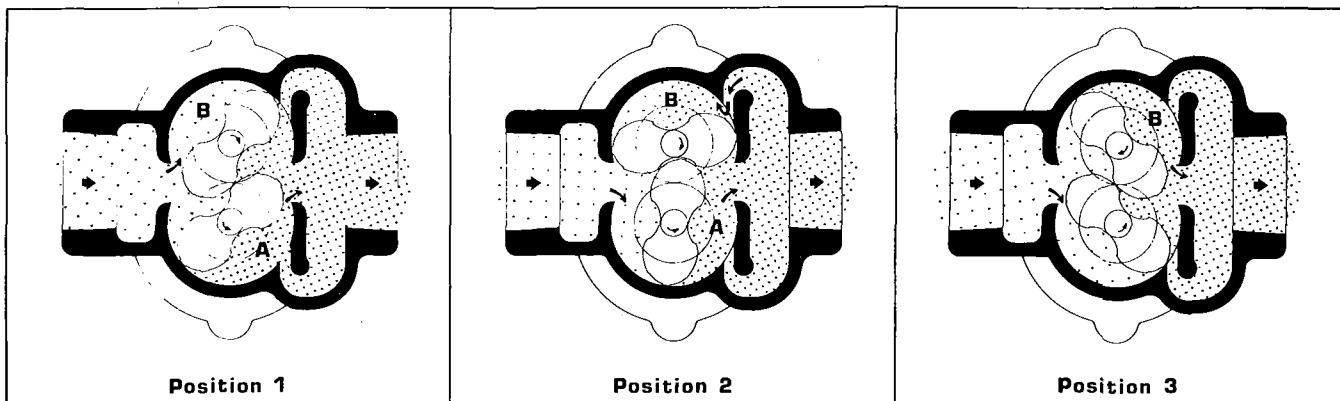


Figure 1. Air Flow Through A Whispair Blower

Because of the almost complete pressure equalization through the slot, no sudden shock occurs at this point.

One complete revolution of the driving shaft alternately traps four fixed and equal volumes of air (two by each impeller) and pushes them through to the discharge. The pumping capacity of a lobe blower operating at a constant speed therefore remains relatively independent of reasonable inlet or discharge pressure variations. *To change capacity, it is necessary to change speed of rotation.*

No attempt should ever be made to control capacity by means of a throttle valve in the intake or discharge piping. This will not only increase the power load on the driver, but can also overload and seriously damage the blower. Likewise, if a possibility exists that flow to the blower inlet may be cut off during normal operation of a process, then an adequate vacuum relief valve **must** be installed near the blower. A pressure type relief valve in the discharge line near the blower is also strongly recommended for protection against cut-off or blocking in this line.

When a belt drive is employed, blower speed can usually be adjusted to obtain desired capacity by changing the diameter of one or both sheaves, or by using a vari-speed motor pulley. In a direct coupled arrangement, a variable speed motor or transmission is required, or excess air may be blown off through a manually controlled unloading valve and silencer. See Figure 3. If returned to the blower inlet, air must be cooled to 100°F (38°C) through a by-pass arrangement.

Before making any change in blower capacity, or operating conditions, contact the nearest Roots Sales Office for specific information applying to your particular blower. In all cases, operating conditions must be maintained within the approved range of pressures, temperatures and speeds as stated under LIMITATIONS. Also, the blower must not be used to handle air containing liquids or solids. Serious damage to the rotating parts will result.

OPERATING LIMITATIONS

To permit continued satisfactory performance, a blower must be operated within certain approved limiting conditions. The manufacturer's warranty is, of course, also contingent on such operation. Maximum limits for pressure, temperature and speed are specified here for various blower sizes when operated under standard atmospheric conditions. *Do not exceed any one of these limits.*

Example: The listed maximum allowable temperature rise (increase in air temperature between inlet and

discharge) for any particular blower may occur well before the maximum speed or maximum pressure rating is reached. **Temperature rise then is the limiting condition.** In other words, the operating limit is always to be determined by the maximum rating reached first, and it can be any one of the three: pressure, temperature or speed.

Be sure to arrange connection or taps for thermometers and mercury type pressure or vacuum gauges near the inlet and discharge connections of the blower. These, along with a good tachometer, will enable periodic checks of operating conditions to be made easily.

Note — specially ordered blowers with non standard construction, or with impeller end clearances greater than shown in Table 6, will not have the operating limits specified here. Contact your Roots Sales Office for specific information.

PRESSURE — On pressure service, the pressure differential in pounds per square inch, (kPa) between blower inlet and discharge, must not exceed the figure listed below for the specific blower frame size concerned. Also, in any system where the blower inlet is at a positive pressure above atmosphere, the discharge pressure must never exceed 25 PSI (172 kPa) gauge regardless of blower size.

On vacuum service, with the discharge going to atmospheric pressure, the inlet suction or vacuum in inches of mercury (kPa) must not be greater than the values listed for the specific frame size.

Table 1 - Allowable Pressure Conditions

Frame Size	Max. Differential Pressure - PSI (kPa)	Max. Inlet Vacuum - Ins. Hg. (kPa)
1701	5 (34)	N/A
1704	6 (41)	8 (27)
1702J	10 (69)	14 (47)
1702,2504J,3505J	10 (69)	12 (40)
1704J,2506J,3509J	6 (41)	12 (40)
1707,1707J	4 (28)	6 (20)
2510J	4 (28)	8.5 (29)
3514J	4 (28)	8 (27)

TEMPERATURE — Various blower frame sizes are approved only for installations where the following temperature limitations can be maintained in service.

A. Maximum temperature rise (T.R.) in Fahrenheit degrees (C°) must not exceed listed values when the inlet is at ambient temperature and not higher than 100°F (38°C). Ambient is considered as the general temperature of the space around the blower. This is not outdoor temperature unless the blower is installed outdoors.

Table 2 - Allowable Temperature Rise

Frame Size	T. R. F. ° (C°)	Frame Size	T. R. F. ° (C°)
1701	90 (50)	2504J	250 (139)
1702	320 (178)	2506J	140 (78)
1704	125 (69)	2510J	90 (50)
1707	60 (33)	3505J	190 (105)
1702J	320 (178)	3509J	135 (75)
1704J	125 (69)	3514J	90 (50)
1707J	60 (33)		

Note — If inlet temperature is higher than 100°F (38°C), the above allowable temperature rise values

must be reduced by 2/3 of the difference between ambient and the actual measured inlet temperature.

B. Average of inlet plus discharge temperature should not exceed 250°F. (121°C), except that frame 1701 is limited to 145° (63°C) average.

C. Maximum discharge temperature for frame 1701 is 190°F. (88°C). For J-series frames the maximum is 320°F. (160°C).

SPEED RANGE — Whispair blowers may be operated at speeds up to the maximums listed here for the various frame sizes. They may be direct coupled to 3550 RPM motors, or to 1750 motors if pressure/temperature conditions are within limits. At lower speeds, excessive temperature rise may be the principle consideration.

Table 3 - Maximum Speeds

Frame Size	Maximum RPM
1701	3500
1702, 1704, 1707	4360
1702J, 1704J, 1707J	7100
2504J, 2506J, 2510J	4970
3505J, 3509J, 3514J	3550

INSTALLATION

Roots blowers are internally treated at the factory to protect against normal atmospheric corrosion before installation. Maximum period of protection is one year under average conditions, *if plugs or seals are not removed.* Protection against chemical or salt water atmosphere is not provided. Do not remove seals until ready to start installation, as protection will be lost by evaporation.

NOTE — If there is to be an extended period between installation and startup, the following steps should be taken to insure corrosion protection:

1. Coat internals of cylinder and gearbox with Motorstor or equivalent. Repeat once a year or as conditions may require. Motorstor is oil soluble and does not have to be removed before lubricating. If desired, Motorstor may be removed from within the cylinder shortly before startup by spraying a fine mist of petroleum solvent through the blower while it is running at a slow speed with open inlet and discharge, or it can remain in the blower if it is not harmful to the operation of the connected system. Motorstor is a product of Daubert Chemical Co., 2000 Spring Rd., Oak Brook, Ill. 60521.
2. Fill drive end bearing cavities with grease as specified in lubrication section.
3. Paint shaft extension and all other exposed machined surfaces with Nox-Rust X-145 or equivalent.
4. Seal inlet, discharge, and all vent openings with tape. It is **not** recommended that the unit be set in place, piped to the system, and allowed to remain idle for extended periods. If any part is left open to atmosphere, the Motorstor vapor will escape and lose its effectiveness.
5. Units are not to be subjected to excessive vibration during storage. If stored outdoors, provide coverage such as a tarpaulin or lean-to.

6. Rotate drive shaft three or four revolutions every two weeks.
7. Prior to startup, remove flange covers on both inlet and discharge and inspect internals to insure absence of rust, check all internal clearances. Also, at this time, remove gear cover and inspect gear teeth for rust.

Install blower in a protected indoor location, if possible. However, an unprotected outdoor installation will be satisfactory if correct lubrication for expected temperatures is provided. Just before starting the installation, remove plugs or covers from inlet and discharge connections. Inspect for dirt or foreign objects inside the blower, then turn drive shaft by hand to make sure that it rotates freely.

Mount blower in a level position. Use of a rigid, solidly supported, smooth flat plate is recommended. Make sure blower feet rest evenly on the plate before fastening down. Twisting or cramping the blower in mounting will cause impeller contact and binding during operation. On blowers having two feet, loosening the the screws (Item 123) into the headplate flanges should permit adjusting the feet for even contact with the plate. Then fasten both feet to the plate with screws and lockwashers, and retighten the headplate screws carefully. On blowers with four feet, this procedure may not be successful. Shimming under one or more feet may then be required to produce a solid mounting.

A blower factory-mounted on a base should not require the above adjustments. The assembly can become twisted in shipping, however, and it might be wise to loosen the foot hold-down screws to check foot contact with the mounting surface. The base should then be mounted on a solid foundation or heavy flooring, using shims as necessary at bolting points to prevent warping the assembly.

Transmission of small operating vibrations to a supporting structure in some cases may be objectionable. Use of vibration isolators, or vibration absorbing materials, can be effective in overcoming this problem. To avoid blower casing distortion, the treatment used should be applied under the motor-blower common mounting plate or base, rather than directly under the blower feet alone.

Blower feet are detachable to allow converting a unit having side connections to one with top and bottom connections. Smaller units (1700 and 2500 series) have only one foot on each end. These must be unbolted and transferred individually to the opposite ends when making this conversion. On larger blowers having four feet, the two at each end are unbolted and moved 90° to new positions on the same end. Units arranged for flange mounting directly to C-Frame electric motors are available only with side connections.

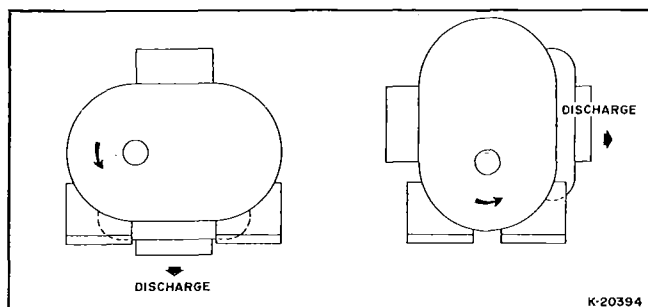


Figure 2. Rotation and Discharge For Standard Blower

Whispair blowers normally have a flattened bulge on one side of the cylinder with a pipe connection extending from it, as shown in Figure 1. These units **must** be driven with the correct rotation to make this connection the discharge. Figure 2 shows the standard drive shaft locations as viewed from the drive end, and the correct *counterclockwise* direction of rotation. For special construction (drive shaft at the top or right), correct rotations would be opposite or clockwise. An arrow near the shaft indicates the rotation to be used. Some few blowers (1701, 1702, 1704, 1707) do not have cylinder bulge. These may be operated in either direction, as necessary to produce discharge at the more convenient connection.

Piping should be accurately squared with the blower, supported independently, and sized no smaller than the connections on the blower. Use only clean, new pipe and make certain it is free of scale, cuttings, weld beads, dirt or any other foreign material. To guard against damage to blower, especially when an inlet filter is not used, install a screen of 16 mesh backed with hardware cloth at or near the inlet opening. Make provisions to clean the screen of collected debris after a few hours operation, and periodically thereafter. Install an inlet filter in dusty or sandy locations.

Figure 3 shows a typical complete installation of blower and accessories where quietest operation is wanted. Note the absence of throttle or shut-off valves in either discharge or intake piping. If it is possible for air flow to be cut off in either of these lines, make provisions to add a pressure and/or vacuum relief valve as discussed under OPERATING CHARACTERISTICS.

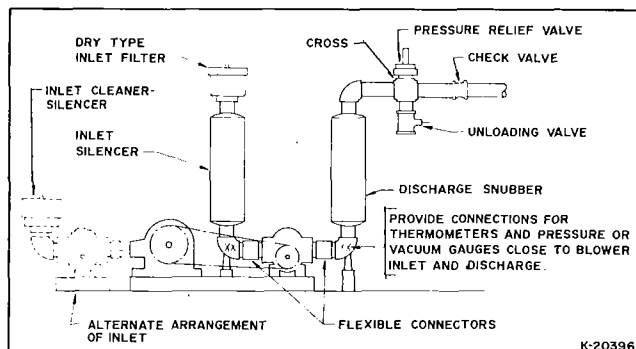


Figure 3. A Complete Blower Installation, With Alternate Inlet Arrangement

In some installations it may be desirable to use only an inlet silencer-cleaner supported directly from the blower connection. This is shown as an alternate arrangement in Figure 3. Weight must be kept to a minimum to prevent blower casing distortion when the inlet is on the side.

A blower may be driven by direct coupling to the driver, or by V-belt to obtain other speeds within the approved range. Refer to LIMITATIONS before selecting the drive speed. Also, be sure to arrange for suitable protective guards as discussed in PRECAUTIONS.

Lubricated couplings are the preferred type, but Lovejoy Type L or similar non-lubricated type may also be used. Coupling halves must correctly fit blower and driver shafts, so that only light tapping is required to install each half. The two shafts must be as accurately aligned as possible, both horizontally and vertically, to limit operating strain on either shaft. Proper gap between coupling halves must be established with the motor armature on its electrical center. This will minimize the chance for end thrust on the blower shaft.

In a V-belt drive, the blower sheave must fit its shaft accurately, run true, and be mounted not more than 1/4" (7 mm) from bearing housing. A tight or driving fit will force the blower impeller out of its normal position and cause internal damage. A loose fit will probably result in shaft damage or breaking. The motor sheave must also fit correctly, and be properly aligned with the blower sheave. Failure to accomplish this will result in the blower impeller being forced against one of the headplates during operation, causing serious damage to the blower.

Adjust motor position on its sliding base so that belt tension is in accordance with the drive manufacturer's instructions. Avoid excessive belt tension at all times. Recheck tension after the first ten hours of operation, and periodically thereafter, to avoid slippage and loss of blower speed.

Check blower after installation, and before applying power, by rotating the drive shaft by hand. If it does not rotate freely, look for uneven mounting, piping strain, excessive belt tension or coupling misalignment. Do not operate the blower at this time because there is no oil supply in the gear house. Read LUBRICATION section.

LUBRICATION

Shaft bearings at the gear end of the blower are splash lubricated by one or both gears dipping into an oil sump formed in the headplate. Before starting the blower, fill this sump as instructed below:

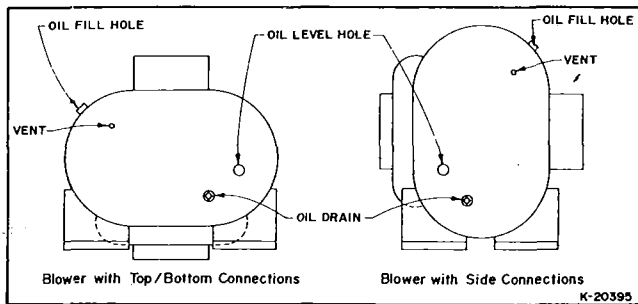


Figure 4. Gearhouse Oil Filling

1. Remove oil fill plug (item 140, Fig. 6, 7, and 8) from the gear end headplate. Also remove oil level plug from the gear cover.
2. Pour oil through fill hole slowly till the oil starts to run out of oil level hole.
3. After the oil has stopped running out of oil level hole, replace the oil fill and level plugs. Apply Permatex No. 2 or an equivalent sealant on oil level plug threads prior to installation.

Recommended oil grades for various operating conditions are listed in Table 4. Quantities required to fill sumps in the different blower frame sizes for either vertical or horizontal piping arrangements are listed in Table 5.

Table 4 - Recommended Oil Grades

Ambient Temperature	Discharge Pressure-PSIG (kPaG)	Viscosity SSU 100°F. (38°C)	Approx. SAE No.
Below 90°F (32°C)	Below 2.0 (14)	500-700	30
Over 90°F (32°C)	Below 2.0 (14)	700-1000	40
Below 90°F (32°C)	Over 2.0 (14)	700-1000	40
Over 90°F (32°C)	Over 2.0 (14)	1000-1200	50

Check gear house oil level every week and add oil if needed. Do not check or fill oil while the blower is running.

The oil change interval will depend on the oil operating temperature and the type of oil. For a good grade industrial type non-detergent oil with a blower discharge temperature of less than 250°F, (121°C) oil change should be made every 1,000 operating hours. For blower discharge temperatures of higher than 250°F (121°C), more frequent oil changes will be required.

Shaft bearings at drive end of blower are grease lubricated. All Whispair Max blowers have pressure type grease fittings in the bearing housings. Only greases

Table 5 - Oil Sump Capacities

Blower Frame Series	Top and Bottom Connections (liters)	Side Connections (liters)
1700	2-7/8 fl. oz. (.085)	3-1/8 fl. oz. (.092)
2500	8-1/2 fl. oz. (.251)	6-5/8 fl. oz. (.196)
3500	11 fl. oz. (.325)	8-5/8 fl. oz. (.255)

classified as NLGI Group II high temperature greases with synthetic bases should be used. Among these are Aero Shell 16 and Mobil Grease 28. Mixing of soap base and synthetic base greases destroys the lubricity of both with resultant failure of the bearings. Drive end bearings must be greased prior to initial start-up. A regular greasing schedule should be maintained per Table 6.

Table 6

Blower Size	Greasing Interval
1701, 1707, 1707-J 2510-J, 3514-J	700 operating hours
1704, 1704-J, 2506-J 3509-J	300 operating hours
1702, 1702-J, 2504-J 3505-J	150 Operating hours

OPERATION

Before starting the blower for the first time under power, recheck the installation thoroughly to reduce the likelihood of troubles. Use the following check list as a guide, but also consider any other special conditions in your installation.

1. **Be certain** no bolts, rags or dirt have been left in the blower casing.
2. **Be certain** that inlet piping is free of debris. If an open outdoor air intake is used, be sure the opening is clean and protected by a strong screen.
3. If installation is not recent, check blower leveling, drive alignment, belt tension, and tightness of all mounting bolts.
4. **Be certain** the proper quantity of oil is in the gear house.
5. **Be certain** the driving motor is properly lubricated, and that it is connected through suitable electrical overload devices.
6. Rotate blower shaft several times by hand to make sure impellers are free at all points, with no rubbing or bumping.
7. Check motor rotation by momentarily pushing the start button. If not in accordance with arrow on blower, reverse the motor connections.

Initial operation should be carried out under "no load" conditions by opening all valves and venting the discharge to atmosphere, if possible. Then start motor briefly, listen for unusual noises, and check the blower coasts freely to a stop. If no problem appears, repeat this check and let

the motor run a little longer. If any questions exist, investigate before proceeding further.

Now operate the unit for about 10 minutes. During this run feel cylinder and headplates for development of hot spots that indicate rubbing contacts. Also listen for knocking sounds (contact between impellers), and watch for any change or increase in vibration. At the end of this run, check the inlet screen near the blower for collected debris.

After above tests are completed and any necessary corrections made, a final check run of a least one hour should be performed under normal operating conditions. Start unloaded as above, and apply the system pressure load gradually by closing the discharge atmospheric vent. Use a mercury manometer connected to the discharge piping to see that the pressure rating of the blower is not exceeded. Also use good thermometers to determine the temperature rise through the blower. Both figures should satisfy the conditions listed under **LIMITATIONS**. Check the unit frequently during this run. Shut down immediately

if excessive noise or heating develops and refer to **TROUBLE SHOOTING CHECK LIST**.

Assuming all tests are satisfactory, the blower will now be ready for continuous full load operation. During the first several days, make periodic checks to determine that all conditions remain acceptable and steady. These checks may be particularly important if the blower is part of a process system where conditions may vary. At the first opportunity, stop the blower and clean or remove the inlet screen. Also recheck leveling, coupling alignment or belt tension, and mounting bolts for tightness.

If operation proves that blower capacity is a little too high for the actual air requirements, a small excess may be blown off through the manual vent valve. It is not good practice to use the pressure relief valve as an automatic vent. Such use may cause the discharge pressure to become excessive, and can also result in failure of the valve itself. If the blower capacity is low, it may be possible to increase the drive speed. Before attempting this change, contact the

TROUBLE SHOOTING CHECKLIST

TROUBLE	ITEM	POSSIBLE CAUSE	REMEDY
No Air Flow	1	Speed too low	Check by tachometer and compare with speed shown on Roots Order Acknowledgment. Compare actual rotation with Figure 2. Change driver if wrong. Check piping, screen, valves, silencer to assure an open flow path.
	2	Wrong rotation	
	3	Obstruction in piping	
Low Capacity	4	Speed too low	See item 1. If belt drive, check for slippage and readjust tension. Check inlet vacuum and discharge pressure, and compare these figures with specified operating conditions on Order. See item 3. Check inside of casing for worn or eroded surfaces causing excessive clearances.
	5	Excessive pressure rise	
	6	Obstruction in piping	
	7	Excessive slip	
Excessive Power	8	Speed too high	Check speed and compare with Roots Order. See item 5. Inspect outside of cylinder and headplates for high temperature areas, then check for impeller contacts at these points. Correct blower mounting, drive alignment.
	9	Pressure too high	
	10	Impellers rubbing	
Overheating of Bearings or Gears	11	Inadequate lubrication	Check oil sump level in gearhouse, and try to inject grease in drive end bearings. Check gear oil level. If incorrect, drain and refill with clean oil of recommended grade. See item 5. Check carefully. Realign if questionable. Readjust for correct tension.
	12	Excessive lubrication	
	13	Excessive pressure rise	
	14	Coupling misalignment	
	15	Excessive belt tension	
Vibration	16	Misalignment	See item 14. See item 10. Check gear backlash and condition of bearings, and replace as indicated. Scale or process material may build up on casing and impellers, or inside impellers. Remove build-up to restore original clearances and impeller balance.
	17	Impellers rubbing	
	18	Worn bearings/gears	
	19	Unbalanced or rubbing impellers	

nearest Roots Sales Office for recommendations based on actual requirements and operating pressure/temperature conditions.

SAFETY PRECAUTIONS

For equipment covered specifically or indirectly in this instruction book, it is important that all personnel observe safety precautions to minimize the chances of injury. Among many considerations, the following should particularly be noted:

- Blower casing and associated piping or accessories may become hot enough to cause major skin burns on contact.
- Internal and external rotating parts of the blower and driving equipment can produce serious physical injuries. Do not reach into any opening in the blower while it is operating, or while subject to accidental starting. Cover external moving parts with adequate guards.
- Disconnect power before doing any work, and avoid By-passing or rendering inoperative any safety or protective devices.
- If blower is operated with piping disconnected, place a strong coarse screen over the inlet and avoid standing in the discharge air stream.
- Stay clear of the blast from pressure relief valves and the suction area of vacuum relief valves.
- Avoid extended exposure in close proximity to machinery with high intensity noise levels.
- Use proper care and good procedures in handling, lifting, installing, operating and maintaining the equipment.
- Casing pressure must not exceed 25 PSI (172 kPa) gauge. Do not pressurize vented cavities from an external source, nor restrict the vents.
- Do not use air blowers on explosive or hazardous gases.
- Other potential hazards to safety may also be associated with operation of this equipment. All personnel working in or passing through the area should be warned by signs and trained to exercise adequate general safety precautions.

MAINTENANCE & REPLACEMENTS

Regular inspection of the blower and its installation, along with complete checks on operating conditions, will pay dividends in added life and usefulness. Particular attention should be paid to lubrication of timing gears and bearings in accordance with comments under **LUBRICATION**. Also service the driver per manufacturer's instructions, and lubricate the coupling or check belt drive tension. By use of thermometers and gauges, make sure that blower operating temperature and pressure remain within allowed limits.

When a blower is taken out of service it may require internal protection against rusting or corrosion. The need for such protection must be a matter of judgement based on existing conditions as well as length of down-time. Under atmospheric conditions producing rapid corrosion, the blower should be protected immediately. Treatment

consists of spraying or flushing the interior with a mixture of light oil and keroesene. Before restarting, check internal condition visually and rotate the drive shaft by hand.

Should adjustments or replacements eventually be needed, these can often be performed locally as described in this book, after obtaining required parts. Personnel should have a good background of mechanical experience and be thoroughly familiar with these instructions. Major repairs not covered in this book should be referred to the nearest Sales Office or Distributor.

When ordering parts, give all blower nameplate information, plus the Item Numbers and Names as taken from the appropriate assembly drawing in this book. Numbers shown in brackets () in the following repair procedures correspond to Item Numbers in the drawings.

REPLACEMENT OF GEARS BEARINGS, SEALS, IMPELLERS AND SHAFTS

1. Remove sheave or coupling from blower drive shaft.
2. Drain oil from gear house by removing lower pipe plug (111).
3. Remove gear cover plate (6), being careful not to damage gasket (11).
4. Remove both gear clamping nuts (102). Lock impellers by wedging between lobes to prevent rotation while loosening nuts.
5. Loosen all cap screws (107) and (124) in drive end headplate. Insert jack screws in threaded holes and pull headplate away from cylinder about 1/4" (7 mm).
6. At gear end, drive both impeller shafts toward headplate to loosen gears from taper fits, and remove gears. Avoid damaging shaft threads by using a soft metal, plastic or wood mallet.
7. Remove drive end headplate (1) and cylinder (3), and pull both impellers (4) and (5) out of the gear end headplate.
8. Remove all bearings (100, 101) from both headplates. They should be easily removable by inserting a finger or an expanding tool in the shaft hole. Bearings at the gear end can be damaged during gear removal, and it is advisable that all four bearings be replaced when a blower is torn down.
9. Remove all shaft seals (117, 118) from both headplates by driving out with a wood dowel inserted through the shaft holes from the rear.
10. Install new replacement seals in one or both headplates, as required by the design. After lubricating the outer edge, position seal over its recess with the shaft sealing lip facing out as shown in assembly drawing. Then press evenly into place until the seal face is even with face of recess. Lubricate seal lip with light grease.
11. Assemble gear end headplate (2) to cylinder (3). Make sure dowel sleeves (108) are in place in the two alignment holes in flange ears, then insert short screws in these holes and tighten. On 1700 Series blowers these two screws will be removed when gear cover is installed with long screws.

12. Set this assembly on a flat surface plate, with the open end of the cylinder up. Insert both impellers, taper end of shafts first, being careful to avoid damage to seal lips. Make sure the longer (driving) shaft is in either the bottom or left hole in relation to blower feet. See Figure 2.

13. Assemble drive end headplate (1) to the cylinder over its dowel sleeves (108). Insert and tighten all cap screws in both headplates.

14. To install bearings correctly in both headplates, first determine how back clearance "X" shown in the assembly drawing is to be provided. To do this, measure the thickness of the bearing and add dimension "X," 1/32" or 1/16" (.08 or .16 mm) depending on blower size. Then measure the depth of the headplate recess. Any difference between these two figures will be the amount the bearing face should project beyond the headplate face. If there is no difference, the bearing should be flush. Apply a light film of oil on bearing fits prior to pressing bearings on shafts.

15. Press bearings into the headplates as determined above, using an aligning tool that will pass over the shaft and push on both inner and outer races at the same time. This will keep the bearings square with the headplate. Note that open bearings are used only in the gear end headplate. The drive end requires bearings sealed on one side, with the sealed face placed on the outside. Degrease shaft and gear tapers.

16. Install new driven gear (upper shaft or left shaft when facing gear end of a standard unit.) Oil shaft threads lightly and tighten gear clamping nut with a torque wrench to the value listed in Table 7. A small hardwood wedge between impeller lobe and cylinder opening will prevent shaft from turning.

Table 7 - Gear Nut Torque

Frame Series	Nut Torque (Kg-m)
1701 (only)	10 lb.-ft. (1.5)
1700	25 lb.-ft. (3.5)
2500	75 lb.-ft. (10)
3500	190 lb.-ft. (26)

17. Install new driving gear after first positioning impellers correctly in relation to each other as shown in Figure 5. With both impellers at 45°, insert a long metal feeler gauge between the two adjacent lobes and clamp it there by pushing small hardwood wedges between the back sides of these lobes and the cylinder openings. Feeler gauge thickness should be a middle value taken from the last column in Table 8. Now install the gear, observing tooth match marks if present, and tighten the nut lightly.

18. Remove wedges and feeler gauge, then rotate impellers to determine lobe clearances at all (four)

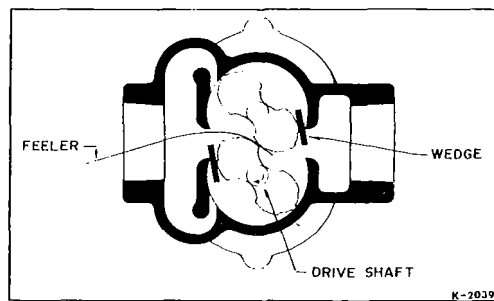


Figure 5. Wedging of Impellers, Viewed From Gear End

45° positions. They should be approximately equal, and within the range listed for the blower size. Adjust gear position if necessary, then insert the corrected feeler and wedges and tighten the gear nut to full torque. Spin the drive shaft by hand to make sure there are no gear tight spots or impeller contacts.

19. Install gear cover plate (6) with gasket (11). Use the original special gasket if in good condition, or a factory replacement, positioning it to match the headplate shape. If it is necessary to *make* a replacement, *be sure* to use material of the original thickness and cut it to duplicate the original shape exactly. This will produce the oil metering orifice required between outer and inner sections of the oil sump, without which gears and bearings will run dry.

20. Replace oil drain plug (111) and refill gear house with proper grade of oil as discussed under LUBRICATION.

21. Reinstall drive sheave or coupling half, and remount blower in correct alignment with driver. Refer to discussion under INSTALLATION.

Table 8 - Standard Whispair Blower Clearances - Inches (mm)

Frame Size	Impeller End To Headplate Total Both Ends	Impeller Tip To Cylinder	Impeller Lobes at 45° see Fig. 5
1701	.002-.005 (.05-.13)	.0015-.003 (.04-.08)	.006-.008 (.15-.20)
1702J	.004-.008 (.10-.20)	.003 -.005 (.08-.13)	.006-.008 (.15-.20)
1704J	.007-.010 (.18-.25)	.003 -.005 (.08-.13)	.006-.008 (.15-.20)
1707J	.007-.010 (.18-.25)	.003 -.005 (.08-.13)	.006-.008 (.15-.20)
2504J	.007-.010 (.18-.25)	.004 -.006 (.10-.15)	.008-.010 (.20-.25)
2506J	.007-.010 (.18-.25)	.004 -.006 (.10-.15)	.008-.010 (.20-.25)
2510J	.007-.010 (.18-.25)	.004 -.006 (.10-.15)	.008-.010 (.20-.25)
3505J	.005-.009 (.13-.23)	.005 -.007 (.13-.18)	.009-.012 (.23-.30)
3509J	.007-.010 (.18-.25)	.005 -.007 (.13-.18)	.009-.012 (.23-.30)
3514J	.007-.010 (.18-.25)	.005 -.007 (.13-.18)	.009-.012 (.23-.30)

Note — Clearances listed above are used in assembly at the factory. They may change in service, but should never be less than the minimum values. Only well qualified personnel should attempt to measure clearances.

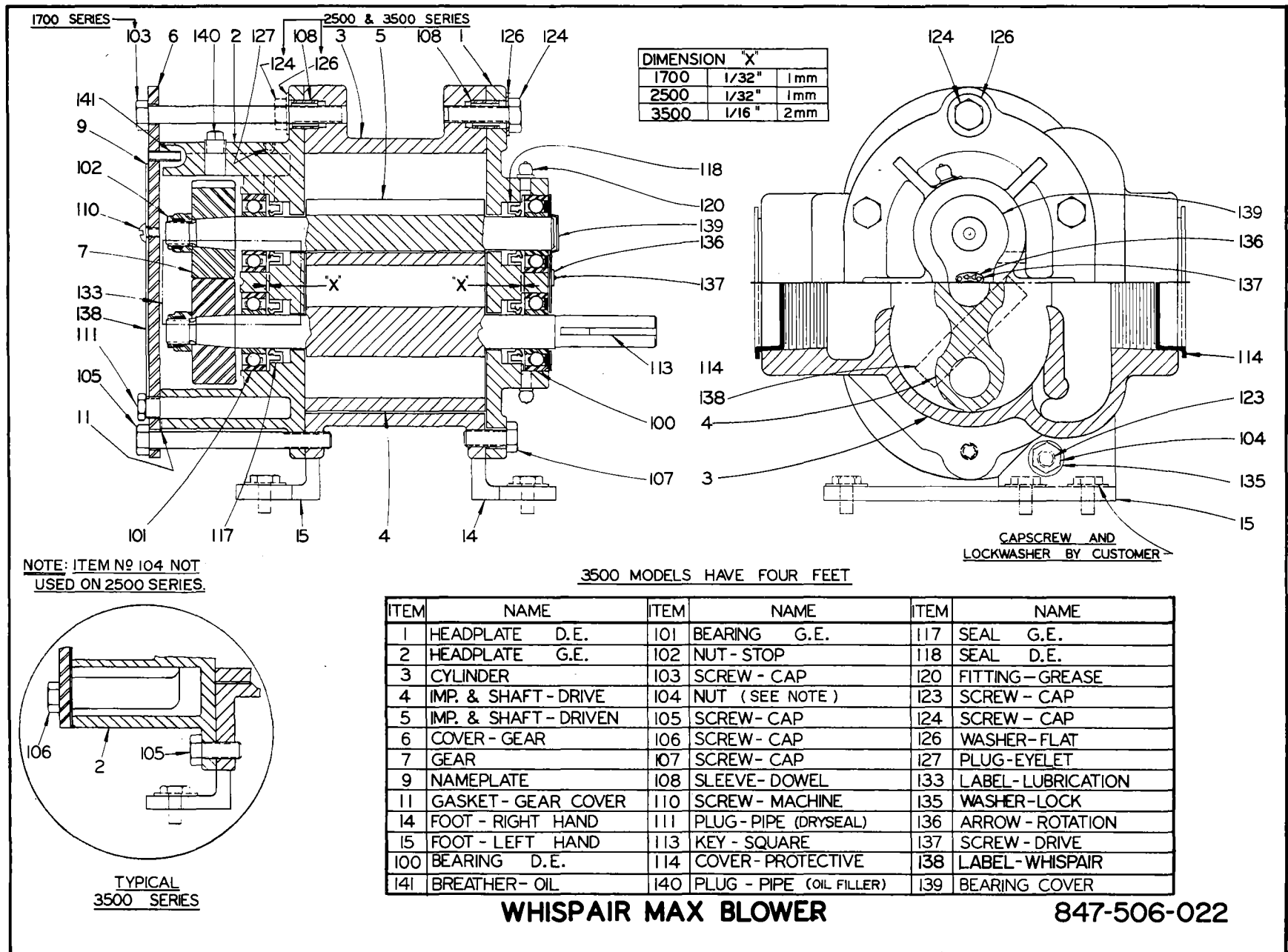
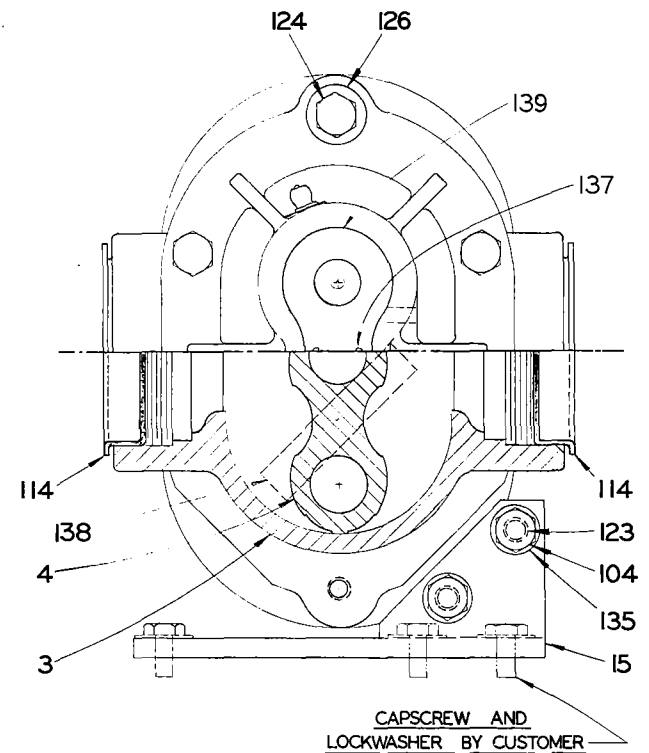
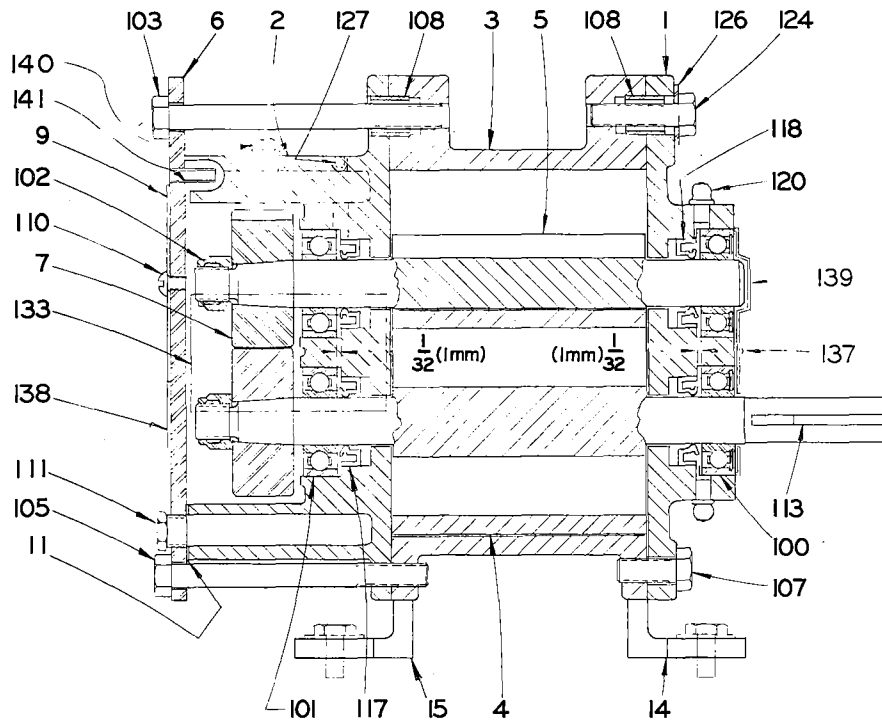


Figure 6. Assembly of J-Series Whispair Max Blowers

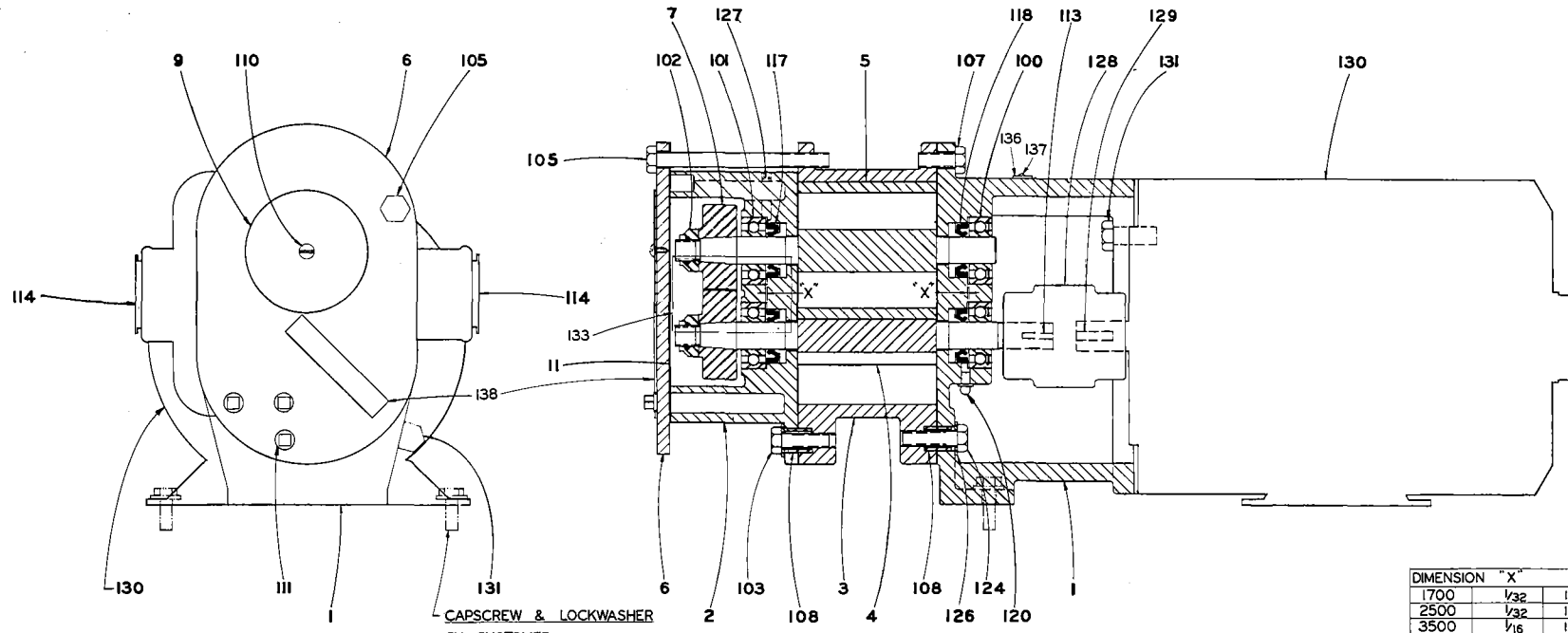


ITEM	NAME	ITEM	NAME	ITEM	NAME
1	HEADPLATE - D.E.	100	BEARING - D.E.	113	KEY - SQUARE
2	HEADPLATE - G.E.	101	BEARING - G.E.	114	COVER - PROTECTIVE
3	CYLINDER	102	NUT - STOP	117	SEAL - G.E.
4	IMP. & SHAFT - DRIVE	103	SCREW - CAP	118	SEAL - D.E.
5	IMP. & SHAFT - DRIVEN	104	NUT	120	FITTING - GREASE
6	COVER - GEAR	105	SCREW - CAP	123	SCREW - CAP
7	GEAR	138	LABEL - WHISPAIR	124	SCREW - CAP
9	NAMEPLATE	107	SCREW - CAP	126	WASHER - FLAT
11	GASKET - GEAR COVER	108	SLEEVE - DOWEL	127	PLUG - EYELET
14	FOOT - RIGHT HAND	110	SCREW - MACHINE	133	LABEL - LUBRICATION
15	FOOT - LEFT HAND	111	PLUG - PIPE (DRYSEAL)	135	WASHER - LOCK
140	PLUG - PIPE (OIL FILLER)	137	SCREW - DRIVE	139	BEARING COVER
141	BREATHER - OIL				

WHISPAIR MAX BLOWER

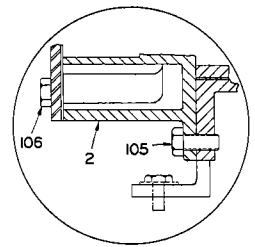
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Figure 7. Assembly of 1700 Series Conventional (162) Whispair Max Blowers



DIMENSION "X"		
1700	1/32	1mm
2500	1/32	1mm
3500	1/16	1mm

ITEM	NAME	ITEM	NAME	ITEM	NAME
1	HEADPLATE - D.E.	100	BEARING - D.E.	117	SEAL - G.E.
2	HEADPLATE - G.E.	101	BEARING - G.E.	118	SEAL - D.E.
3	CYLINDER	102	NUT - STOP	120	FITTING - GREASE
4	IMP. & SHAFT - DRIVE	103	SCREW - CAP	124	SCREW - CAP
5	IMP. & SHAFT - DRIVEN	105	SCREW - CAP	126	WASHER - FLAT
6	COVER - GEAR	107	SCREW - CAP	127	PLUG - EYELET
7	GEAR	108	SLEEVE - DOWEL	128	COUPLING
9	NAMEPLATE	110	SCREW - MACHINE	129	KEY - SQ. (MOTOR)
11	GASKET - GEAR COVER	111	PLUG - PIPE	130	MOTOR
106	SCREW - CAP	113	KEY - SQ. (BLOWER)	131	SCREW - CAP
133	LABEL - LUBRICATION	114	PROTECTIVE PLUG	138	LABEL - WHISP AIR
136	ARROW - ROTATION	137	SCREW - DRIVE		



TYPICAL
3500 SERIES
847-653-023

Figure 8. Assembly of Motor-Mounted Whispair Max Blowers