GARDNER DENVER
HeliFlow

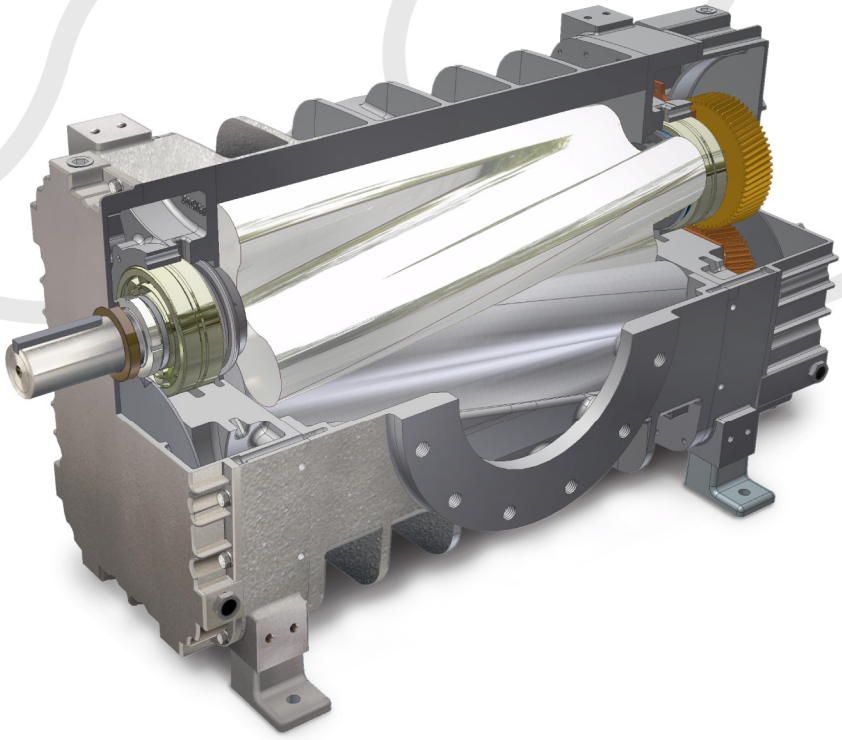
PARTS LIST OPERATING AND SERVICE MANUAL

HELIFLOW

INDUSTRIAL SERIES BLOWERS

6” GEAR DIAMETER

Models
HYFL_BA
HYFM_BA



ENERGY STAR PARTNER

HF-7-601
Version 02
September 28, 2009

MAINTAIN BLOWER RELIABILITY AND PERFORMANCE WITH GENUINE GARDNER DENVER PARTS AND SUPPORT SERVICES

Factory genuine parts, manufactured to design tolerances, are developed for optimum dependability - - - specifically for your blower. Design and material innovations are born from years of experience with hundreds of different blower applications. When you specify factory genuine parts you are assured of receiving parts that incorporate the most current design advancements manufactured in our state-of-the-art blower factory under exacting quality standards.

Your AUTHORIZED DISTRIBUTOR offers all the backup you require. A worldwide network of authorized distributors provides the finest product support in the blower industry.

Your AUTHORIZED DISTRIBUTOR can support your blower investment with these services:

1. Trained parts technical representatives to assist you in selecting the correct replacement parts.

2. Complete inventory of new machines and new, genuine factory parts.

3. A full line of factory tested AEON™ PD Series blower lubricants specifically formulated for optimum performance in all blowers.

4. Authorized distributor service technicians are factory-trained and skilled in blower maintenance and repair. They are ready to respond and assist you by providing fast, expert maintenance and repair service.

INSTRUCTIONS FOR DETERMINING BLOWER CONFIGURATION

1. Face the blower drive shaft.
2. In a **VERTICAL** configuration, air flow is horizontal.
3. In a **HORIZONTAL** configuration, air flow is vertical.
4. In a vertical configuration, a **BOTTOM HAND** exists when the drive shaft is below the horizontal center line of the blower. A **TOP HAND** exists when the drive shaft is above the horizontal center line of the blower.
5. In a horizontal configuration, a **RIGHT HAND** exists when the drive shaft is to the right of the vertical center line of the blower. A **LEFT HAND** exists when the drive shaft is to the left of the vertical center line of the blower.

INSTRUCTIONS FOR ORDERING REPAIR PARTS

For pricing, and ordering information contact your nearest AUTHORIZED FACTORY DISTRIBUTOR. When ordering parts, specify Blower **MODEL** and **SERIAL NUMBER** (see nameplate on unit).

Rely upon the knowledge and experience of you AUTHORIZED DISTRIBUTOR and let them assist you in making the proper parts selection for your blower.

For the location of your local authorized Gardner Denver blower distributor refer to the yellow pages of your phone directory, check the Web site at www.gardnerdenverproducts.com or contact:

Gardner Denver Incorporated
1800 Gardner Expressway
Quincy, IL 62305
Phone: (217) 222-5400
Fax: (217) 221-8780

FOREWORD

Gardner Denver® blowers are the result of advanced engineering and skilled manufacturing. To be assured of receiving maximum service from this machine, the owner must exercise care in its operation and maintenance. This book is written to give the operator and maintenance department essential information for day-to-day operation, maintenance and adjustment. Careful adherence to these instructions will result in economical operation and minimum downtime.

⚠ DANGER

Danger is used to indicate the presence of a hazard which will cause severe personal injury, death, or substantial property damage if the warning is ignored.

⚠ WARNING

Warning is used to indicate the presence of a hazard which can cause severe personal injury, death, or substantial property damage if the warning is ignored.

⚠ CAUTION

Caution is used to indicate the presence of a hazard which will or can cause minor personal injury or property damage if the warning is ignored.

NOTICE

Notice is used to notify people of installation, operation or maintenance information which is important but not hazard-related.

SAFETY PRECAUTIONS

Safety is everybody's business and is based on your use of good common sense. All situations or circumstances cannot always be predicted and covered by established rules. Therefore, use your past experience, watch out for safety hazards and be cautious. Some general safety precautions are given below:

⚠ DANGER

Failure to observe these notices could result in injury to or death of personnel.

- **Keep fingers and clothing away from blower inlet and discharge ports, revolving belts, sheaves, drive coupling, etc.**
- **Do not use the air discharge from this unit for breathing – not suitable for human consumption.**
- **Do not loosen or remove the oil filler plug, drain plugs, covers, or break any connections, etc., in the blower air or oil system until the unit is shut down and the air pressure has been relieved.**
- **Electrical shock can and may be fatal.**
- **Blower unit must be grounded in accordance with the National Electrical Code. A ground jumper equal to the size of the equipment ground conductor must be used to connect the blower motor base to the unit base.**
- **Open main disconnect switch, tag and lockout before working on the control.**
- **Disconnect the blower from its power source, tag and lockout before working on the unit – this machine is automatically controlled and may start at any time.**

⚠ WARNING

Failure to observe these notices could result in damage to equipment.

- **Stop the unit if any repairs or adjustments on or around the blower are required.**
- **Disconnect the blower from its power source, tag and lockout before working on the unit – this machine is automatically controlled and may start at any time.**
- **Do not exceed the rated maximum speed values shown on the nameplate.**
- **Do not operate unit if safety devices are not operating properly. Check periodically. Never bypass safety devices.**
- **Ensure proper rotation of blower prior to start-up. Failure to do so may result in damage to the blower.**

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GARDNER DENVER HELIFLOW INDUSTRIAL SERIES BLOWERS
MATRIX/MENU

NOTICE TO CUSTOMER – To find the construction options for Your blower unit, FILL IN THE BALANCE OF LETTERS OR NUMBERS FROM YOUR UNIT NAMEPLATE

	H	Y	F			B	A
COLUMN NUMBER:	1	2	3	4	5	6	7

FOLLOW THE LINE DOWN AND OVER FROM EACH SPACE THUS FILLED IN TO FIND THE APPROPRIATE CONSTRUCTION OPTION WITH WHICH YOUR MACHINE IS EQUIPPED.

COLUMN 1 – BASIC DESIGNATOR

COLUMN 2 – PRODUCT FAMILY

COLUMN 3 – GEAR DIAMETER

A.		F.	6”
B.		G.	
C.		H.	
E.			

COLUMN 4 – CASE LENGTH

L - Low Pressure (HF 624)
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E. Std Blower – Vertical-Bottom Hand-Right Discharged Timed, CCW
F. Std Blower – Vertical-Bottom Hand-Left Discharge Timed, CW
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J. Std Blower – Horizontal-Right Hand-Bottom Discharge Timed CW
K. Std Blower – Horizontal-Right Hand-Top Discharge Timed CCW
L. Std Blower – Horizontal-Left Hand-Top Discharge Timed CW
M. Std Blower – Horizontal-Left Hand-Bottom Discharge Timed CCW

COLUMN 6 – DESIGN VERSION

COLUMN 7 – ADDITIONAL DESCRIPTION

A. Lip Seal

INTRODUCTION
YOUR KEY TO TROUBLE FREE SERVICE

Thank your for investing in Gardner Denver quality. The Gardner Denver reputation for rugged dependability has been earned by over 50 years of service in demanding, industrial operations where downtime cannot be tolerated and efficient blower performance is expected.

Your Gardner Denver blower is a precision engineered blower that has been carefully manufactured and thoroughly tested at the state-of the-art Gardner Denver Blower Factory in Sedalia, Missouri.

As with other precision machinery, there are several relatively simple installation, operation and maintenance procedures that you must observe to assure optimum blower performance. There is no guesswork in the manufacture of your highly advanced Gardner Denver blower and there must be none in preparing the blower to get the job done in the field.

The purpose of this manual is to help you properly install, operate and maintain your Gardner Denver blower. It is essential that you review all sections of this manual in preparation for installing your blower. Follow the instructions carefully and you will be rewarded with trouble-free Gardner Denver service… year in and year out.

IMPORTANT GARDNER DENVER TELEPHONE NUMBERS

YOUR AUTHORIZED GARDNER DENVER DISTRIBUTION

NAME: _____

TELEPHONE: _____

FAX: _____

CONTACT: _____

THANKS…FOR THE PRIVILEGE OF SERVING YOU WITH DEPENDABLE GARDNER DENVER QUALITY.

SECTION 1
EQUIPMENT CHECK

Before uncrating, check the packing slip carefully to be sure all the parts have been received. All accessories are listed as separate items on the packing slip, and small important accessories such as relief valves can be overlooked or lost. After every item on the packing slip has been checked off, uncrate carefully. Register a claim with the carrier for lost or damaged equipment.

⚠WARNING

Customers are cautioned to provide adequate protection, warning and safety equipment necessary to protect personnel against hazards involved in installation and operation of this equipment in the system or facility.

STORAGE

Your Gardner Denver Blower was packaged at the factory with adequate protection to permit normal storage for up to six (6) months.

If the unit is to be stored under adverse conditions or for extended periods of time, the following additional measures should be taken to prevent damage.

1. Store the blower in a clean, dry, heated (if possible) area.
2. Make certain inlet and discharge air ports are tightly covered to prevent foreign material from entering the air box.
3. All exposed, non-painted surfaces should be protected against rust and corrosion.
4. Provide adequate protection to avoid accidental mechanical damage.
5. In high humidity or corrosive environments, additional measures may be required to prevent rusting of the blower internal surfaces.
6. To prevent rusting of gears, bearings, etc., the oil reservoirs may be filled with normal operating oil.

⚠CAUTION

Before running the blower, drain the oil and replace to the proper operating level with clean, fresh lubricant.

7. Rotate the blower shaft (10 to 25 turns) monthly during storage. Inspect the blower shaft (near the shaft seal area) monthly and spray with rust inhibitor if needed.
8. For long term storage (over six (6) months), contact Gardner Denver Customer Service for recommendations.

REMOVING PROTECTIVE MATERIALS

The shaft extension is protected with rust inhibitor which can be removed with any standard solvent.

⚠ CAUTION

Follow the safety directions of the solvent manufacturer.

Blower inlet and outlet are temporarily capped to keep out dirt and other contaminants during shipment. These covers must be removed before start-up.

The internal surfaces of all HeliFlow blowers are mist sprayed with a rust preventative to protect the machine during shipment. Remove this film upon initial startup, using any commercial safety solvent. Position the blower so that the inlet and discharge connections are in the vertical position (vertical airflow). On vertically mounted units, it will be necessary to lay the unit on its side supporting the ends of the unit so as not to restrict the portion on the bottom side. Place a shallow pan on the under side of the unit. With the blower disconnected from power, spray the solvent in the top port, rotating the impellers by spinning the shaft manually. Continue this procedure until the unit is visibly clean.

⚠ WARNING

Rotating components will cause severe injury in case of personal contact. Keep hands away from blower inlet and discharge ports.

SECTION 2
INSTALLATION

LOCATION

If possible, install the blower in a well lit, clean, dry place with plenty of room for inspection and maintenance.

FOUNDATIONS

For permanent installations we recommend concrete foundations be provided, and the equipment should be grouted to the concrete. It is necessary that a suitable base be used, such as a steel combination base under blower and motor, or a separate sole plate under each. Before grouting, equipment must be leveled, free of all strains, and anchored so no movement will occur during setting of grout. After grout has completely hardened, a recheck is necessary to compensate for shrinkage, etc. If required, add shims under blower feet after final tightening of foundation anchor bolts to remove strain from the blower housing. Where jack screws or wedges are used during grouting, they must be backed off or removed before final tightening of anchor bolts.

Where a concrete foundation is not feasible, care must be taken to insure that equipment is firmly anchored to adequate structural members.

MOUNTING CONFIGURATIONS

The blower flex-mounting design enables horizontal and vertical mounting configurations with top or bottom hand, right or left hand shaft positioning. The units are discharge timed allowing rotation in only one direction (refer to FIGURE 2-1A, 1B, 1C, 1D). If converting a blower from vertical bottom hand drive to vertical top hand drive or vice versa, the oil slinger on each end must be moved to the lower rotor.

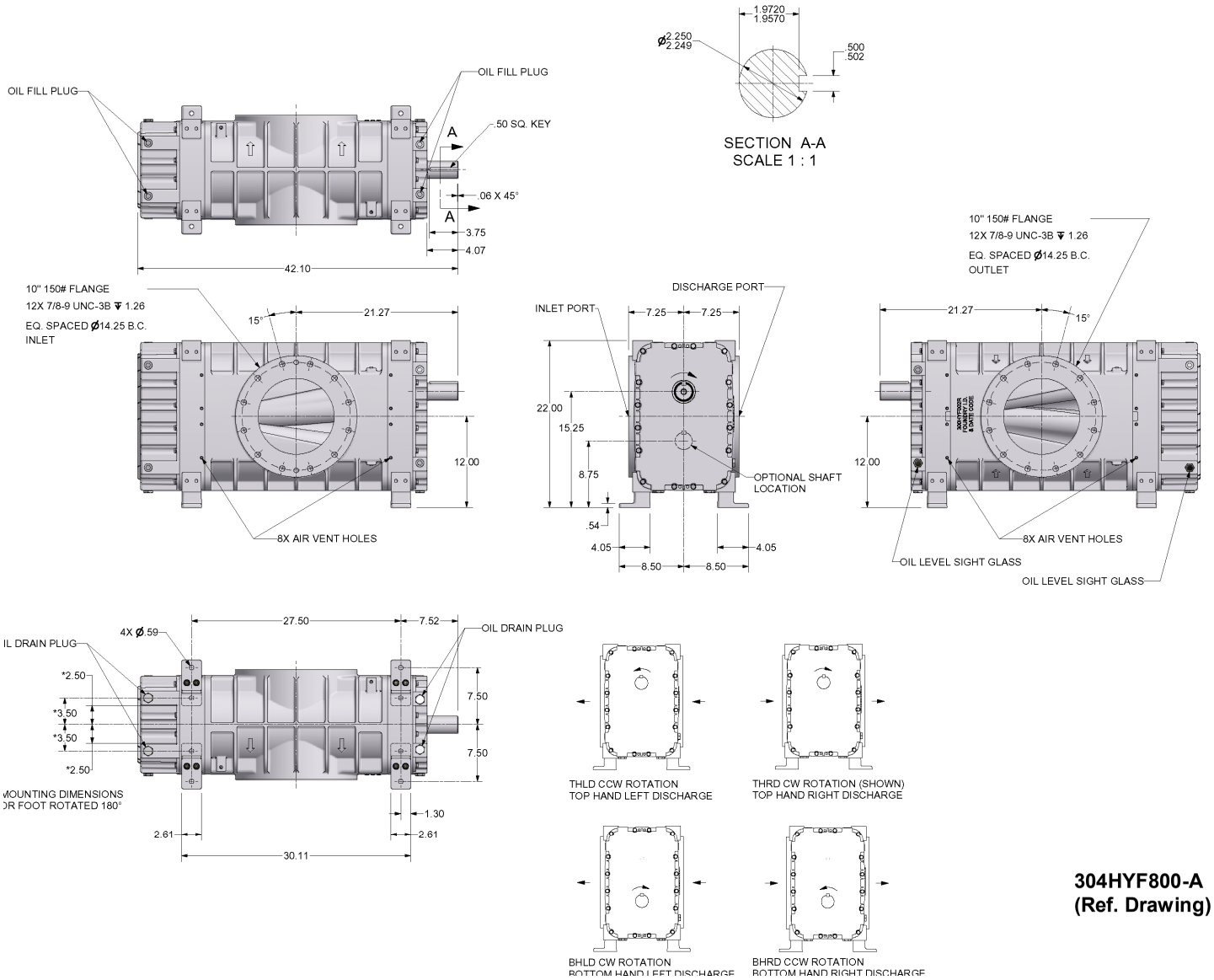
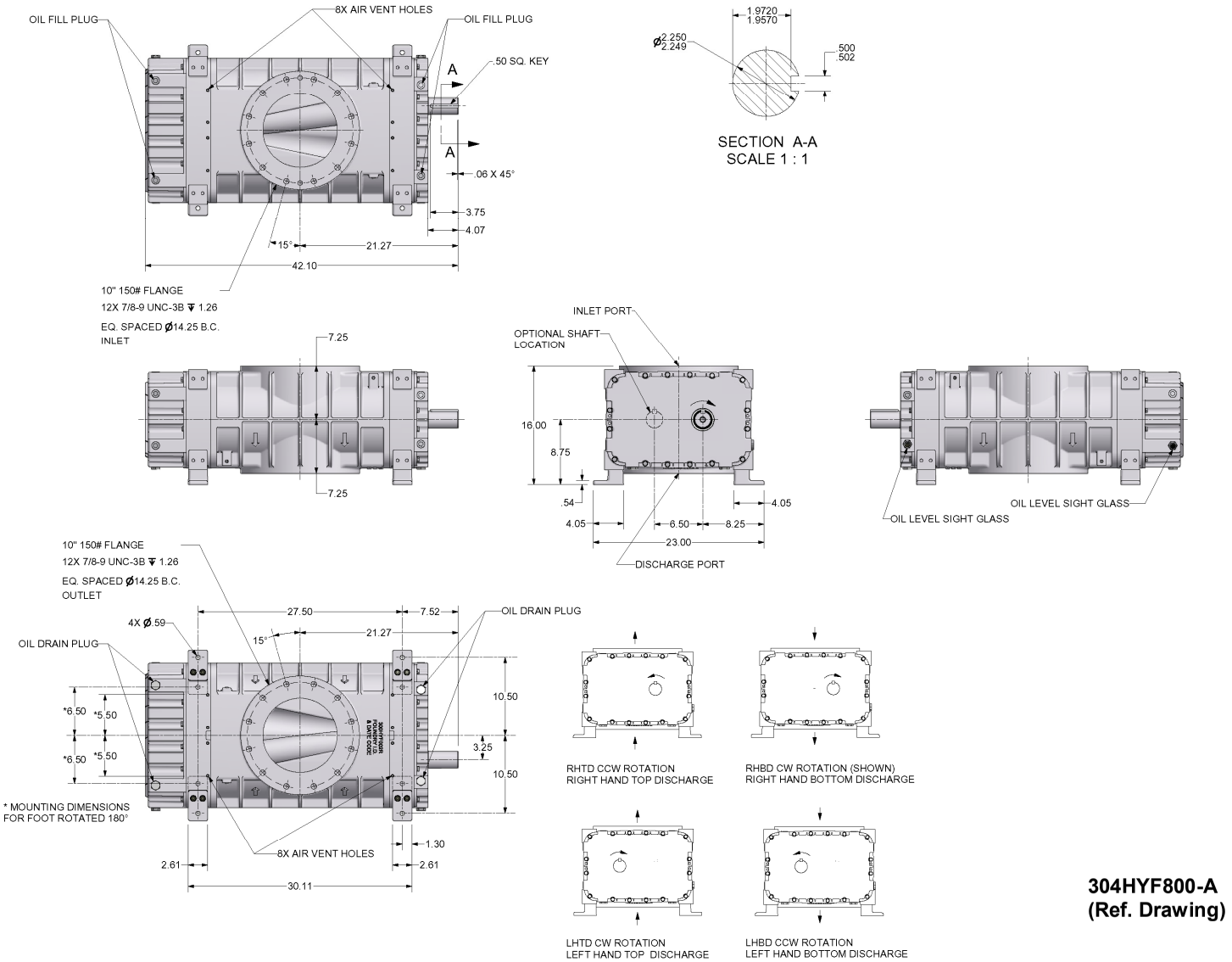
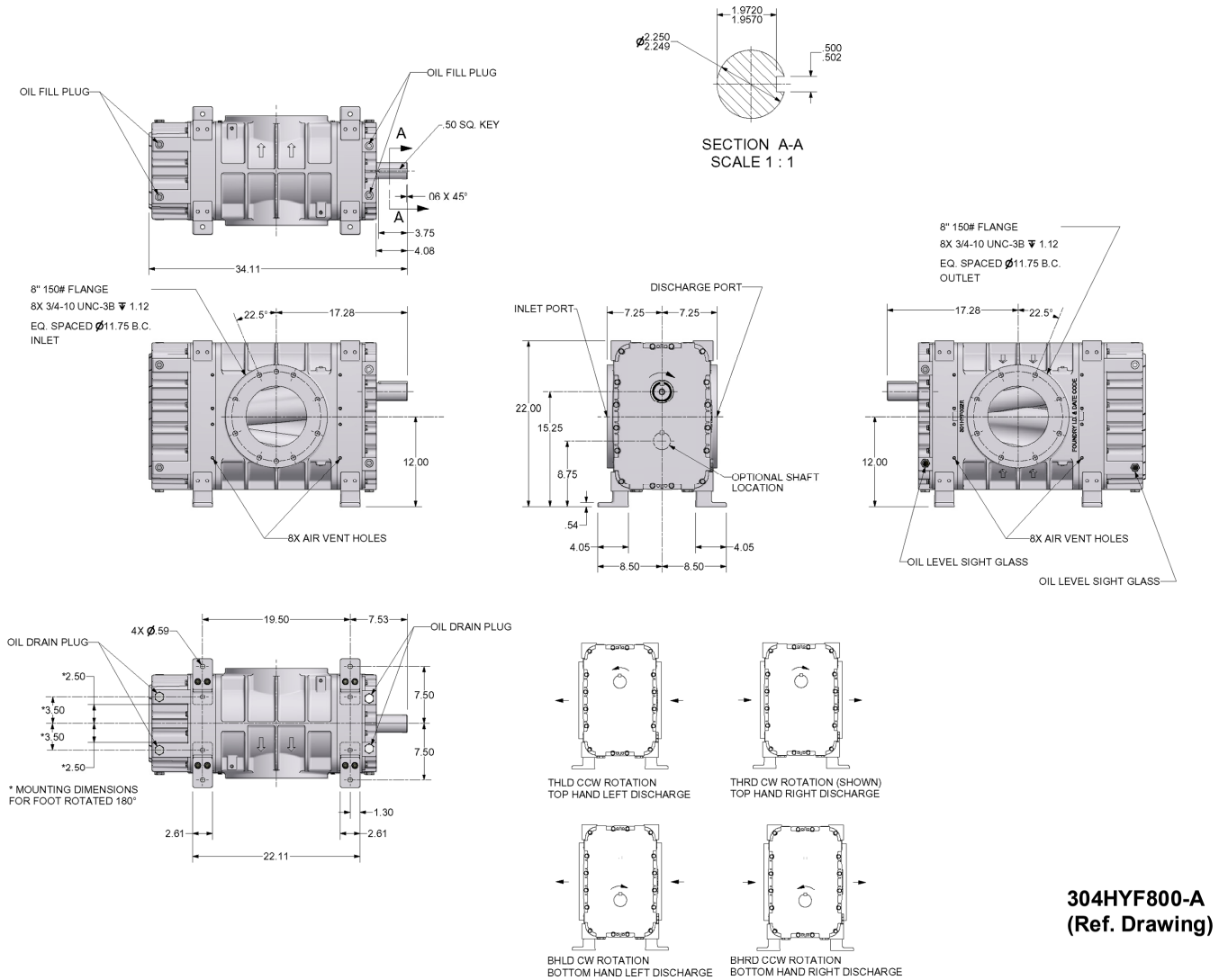


FIGURE 2-1A – 624 VERTICAL BLOWER MOUNTING CONFIGURATIONS AND OUTLINE



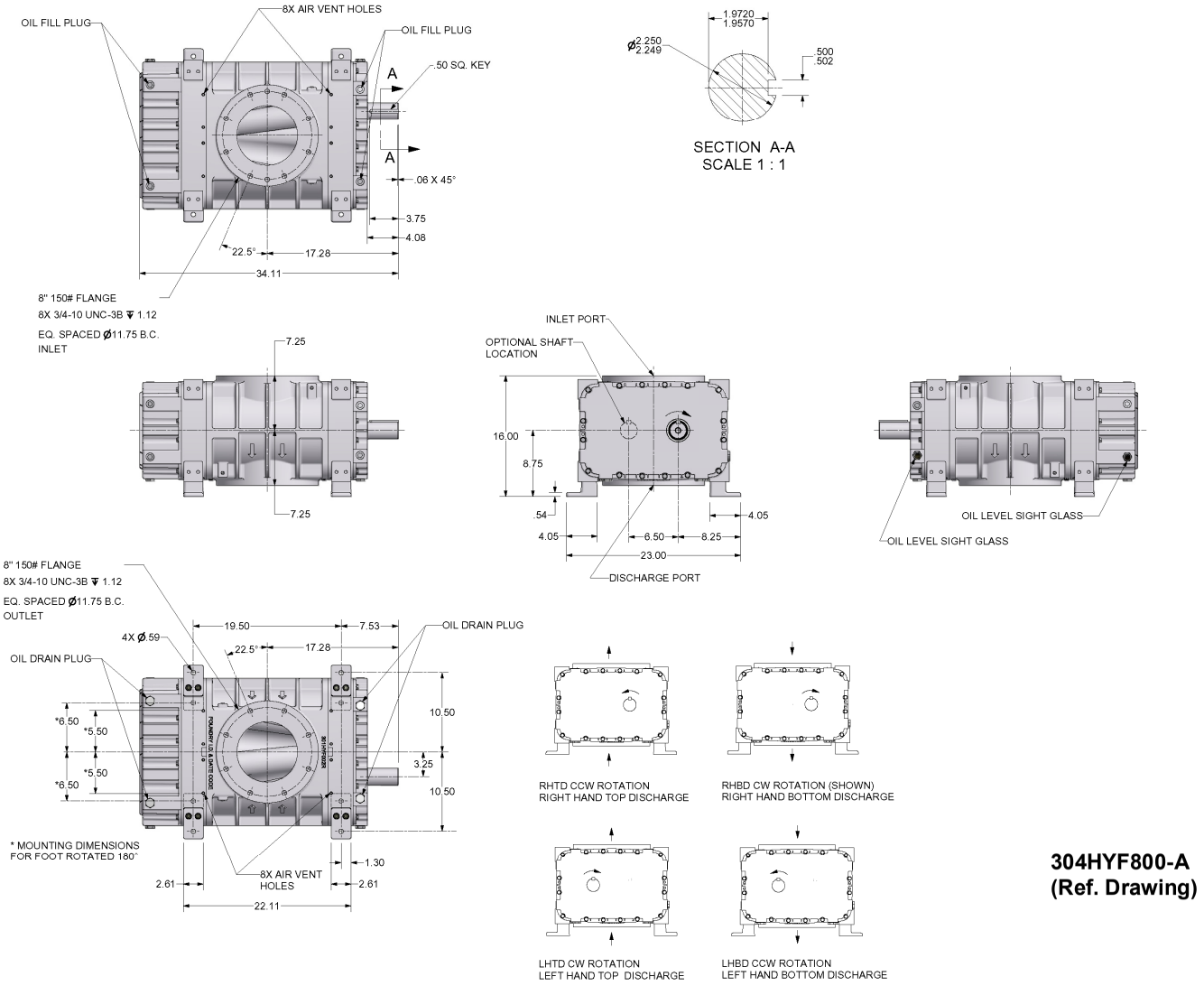
304HYF800-A
(Ref. Drawing)

FIGURE 2-1B – 624 HORIZONTAL BLOWER MOUNTING CONFIGURATIONS AND OUTLINE



304HYF800-A
(Ref. Drawing)

FIGURE 2-1C – 616 VERTICAL BLOWER MOUNTING CONFIGURATIONS AND OUTLINE



304HYF800-A
(Ref. Drawing)

FIGURE 2-1D – 616 HORIZONTAL BLOWER MOUNTING CONFIGURATIONS AND OUTLINE

NOTICE

When changing mounting configuration, it will be necessary to reposition oil level gauge (H), and drain plug (A). Refer to FIGURE 3-1, page 18, for correct location.

⚠WARNING

For Vertical Models, the oil slinger must be on the lower rotor or blower failure is immediate.

DRIVE INSTALLATION

When selecting a V-belt drive, check to be sure the shaft overhung load limitation is not exceeded. Refer to FIGURE 2-2, page 15, for overhung load calculations and limitations.

Belt drives must be carefully aligned. Motor and blower pulleys must be parallel to each other and in the same plane within 1/32 inch. Belt tension should be carefully adjusted to the belt manufacturer's recommendation using a belt tension gauge. Check tension frequently during the first day of operation.

⚠WARNING

Overtightening belts leads to heavy bearing loads and premature failure.

On the direct connected units, alignment and lubrication of couplings to specifications of the coupling manufacturer is very important. When mounted drives are supplied from the factory, proper alignment has been established before shipment. However, during shipping, handling and installation, it is likely that the alignment has been disturbed and final adjustment must be made before startup.

⚠WARNING

Exceeding overhung load limitations leads to unwarrantable premature bearing failure and shaft breakage.

The location of the sheave on the blower shaft greatly affects the stress in the shaft. The optimum blower sheave positioning is as close as possible to the blower drive cover, not to exceed dimension "C" in Drive Shaft Illustration, FIGURE 2-2, page 15.

The calculated shaft moment must not exceed the maximum allowable moment listed in Maximum Allowable Moment Chart, FIGURE 2-2, page 15. If the calculated shaft moment exceeds the maximum allowable moment:

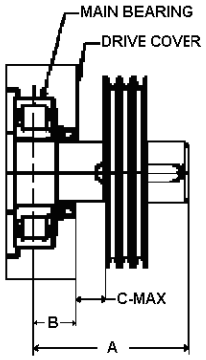
- Increase Sheave Diameters to Reduce Belt Pull
- Use Jackshaft Drive
- Use Direct Coupled or Gearbox Drive

To calculate shaft moment for a given V-Belt Drive Arrangement:

1. Use the formula for Calculation of Belt Pull, FIGURE 2-2, page 15, to calculate belt pull. Refer to Arc of Contact Factor Chart, FIGURE 2-2, page 15.
2. Insert the calculated belt pull into the formula for Calculation of Shaft Moment, FIGURE 2-2, page 15 to arrive at the calculated shaft moment.

Gear Diameter (Inches)	Dimensions (Inches)			Maximum Allowable Moment (LB-IN)
	A	B	C (Max)	
6	6.8	2.727	0.50	13500

MAXIMUM ALLOWABLE MOMENT



DRIVE SHAFT ILLUSTRATION

Z	Ac	Z	Ac	Z	Ac	Z	Ac	Z	Ac	Z	Ac
0.000	1.000	0.250	0.966	0.500	0.926	0.750	0.879	1.000	0.823	1.250	0.751
0.025	0.997	0.275	0.962	0.525	0.922	0.775	0.874	1.025	0.816	1.275	0.742
0.050	0.994	0.300	0.958	0.550	0.917	0.800	0.869	1.050	0.810	1.300	0.734
0.075	0.990	0.325	0.954	0.575	0.913	0.825	0.864	1.075	0.803	1.325	0.725
0.100	0.987	0.350	0.951	0.600	0.908	0.850	0.858	1.100	0.796	1.350	0.716
0.125	0.983	0.375	0.947	0.625	0.904	0.875	0.852	1.125	0.789	1.375	0.706
0.150	0.980	0.400	0.943	0.650	0.899	0.900	0.847	1.150	0.782	1.400	0.697
0.175	0.977	0.425	0.939	0.675	0.894	0.925	0.841	1.175	0.774	1.425	0.687
0.200	0.973	0.450	0.935	0.700	0.889	0.950	0.835	1.200	0.767		
0.225	0.969	0.475	0.930	0.725	0.884	0.975	0.829	1.225	0.759		

ARC OF CONTACT FACTORS

$$\text{Belt Pull} = \left[\frac{2.5 - Ac}{Ac}\right]\left[\frac{125954 \times Hp \times S.F.}{D \times RPM}\right]$$

Key:
- Ac = Arc of Contact Factor (Refer to Arc of Contact Factor Chart above)
- Hp = Blower Horsepower for Operating Conditions
- S.F. = Actual Drive Service Factor
- D = Blower Sheave Pitch Diameter in Inches
- RPM = Blower Sheave Speed

$$Z = \left[\frac{\text{Large Sheave Pitch Diameter (in)} - \text{Small Sheave Pitch Diameter (in)}}{\text{Sheave Center Distance (in)}}\right]$$

CALCULATION OF BELT PULL

$$\text{Shaft Moment (LB-IN)} = \text{Belt Pull} \times \left[B + C + \left(\frac{\text{Sheave Width}}{2}\right)\right]$$

CALCULATION OF SHAFT MOMENT

FIGURE 2-2 – BELT DRIVE OVERHUNG LOAD CALCULATIONS

PIPING

Inlet and discharge connections on all blowers are large enough to handle maximum volume with minimum friction loss. Reducing the pipe diameter on either inlet or discharge will only create additional line loss and increase the overall pressure differential.

Excessive weight of piping and fittings will cause internal misalignment and premature wear. Never allow the blower to carry the weight of the pipe. If possible, a spool or sleeve-type expansion joint should be installed between the unit and the piping. Where a flexible connection is not practical, the weight of the rigid connection must be separately supported. All system piping must be cleaned internally before connecting to the blower.

Gardner Denver blowers are shipped dry from the factory. Do not attempt to operate the blower before following proper lubrication instructions. Permanent damage to the gears, bearings and seals will occur.

SECTION 3
MAINTENANCE

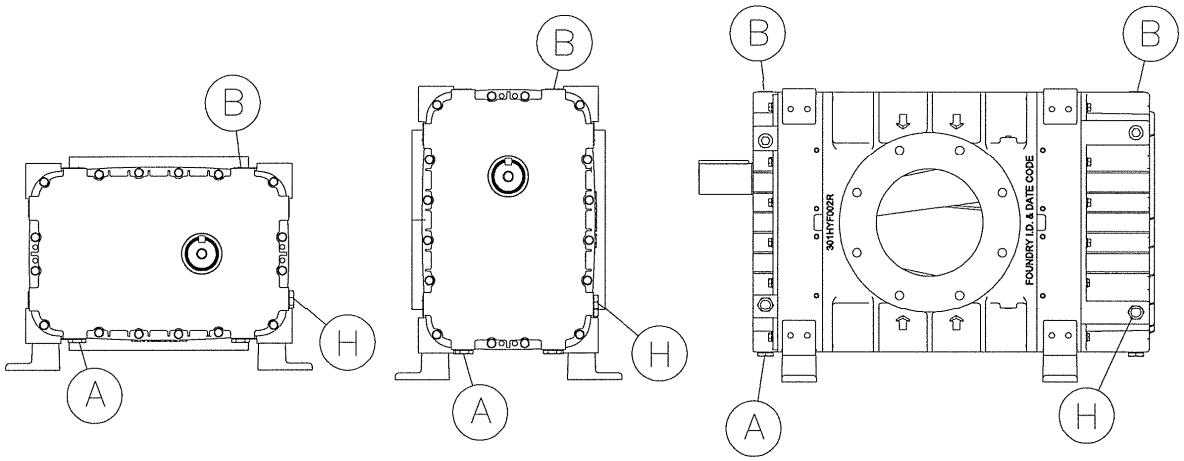


FIGURE 3-1 - LUBRICATION

A. Oil Drain Plug
B. Plug/Oil Fill
H. Oil Level Sight Gauge

GENERAL

Blower efficiency and life depend on the quality of maintenance the blower receives. Maintenance must be done regularly and with care. Clean work space, tools, solvents and wiping rags are necessary to avoid transferring dirt into the unit. Scheduling regular maintenance of the blower will insure long trouble-free service.

LUBRICATION

Gears and bearings are splash lubricated by an oil slinger in each sump. Check the oil level in both sumps daily. Do not operate the blower if the oil level is not in the middle of the sight gauge for each sump when the blower is not running. An overfill or excess of oil can cause oil leaks. **DO NOT OVERFILL OIL.**

FILLING PROCEDURE

Refer to FIGURE 3-1. **While the blower is not running** remove the plug (B) from each sump. Add oil to each sump until it reaches the **middle** of each oil level sight gauge (H). After adding oil wait for oil level to stabilize. Add or remove oil to maintain oil level at middle of oil level sight gauge. Secure the plug (B) in each end.

LUBRICATION SERVICE

Add fresh oil as required to maintain proper level. The oil change period is governed by operating conditions such as load, temperature, dirt, humidity, fumes and the quality of the oil used. The oil drain plug is located at (A). With AEON PD Series synthetic blower lubricant, perform the above oil-change maintenance after 4500 to 7500 hours.

⚠WARNING

Do not overfill oil as this will tend to cause excessive heating of the gears and may damage the unit. An overfill of oil can cause oil leaks.

RECOMMENDED LUBRICANT

Oil Fill Ports	Vertical	Horizontal
Shaft End	4.0	5.6
Gear End	5.6	9.0

FIGURE 3-2 – APPROXIMATE OIL CAPACITIES (PINTS)

GARDNER DENVER LUBRICANT ORDER INFORMATION

Re-order Part Numbers for AEON PD Series Factory-Recommended Synthetic Lubricants.

AEON PD Synthetic Lubricant

Description	Part Number
1 Quart	28G23
Case/ 12 Quarts	28G24
1 Gallon	28G40
5 Gallon Pail	28G25
55 Gallon Drum	28G28

AEON PD-Food Grade Synthetic Lubricant

Description	Part Number
1 Quart	28H97
Case/ 12 Quarts	28H98
1 Gallon	28H333
5 Gallon Pail	28H99
55 Gallon Drum	28H100

AEON PD-XD Extreme Duty Synthetic Lubricant

Description	Part Number
1 Quart	28G46
Case/ 12 Quarts	28G47
1 Gallon	28G42
5 Gallon Pail	28G44
55 Gallon Drum	28G45

Call your local Gardner Denver distributor to place your order for Gardner Denver Lubricants. Your Authorized Gardner Denver Distributor is:

AEON PD Series Lubricant is formulated especially for positive displacement blower service to provide maximum blower protection at any temperature. One fill of AEON PD Series Lubricant will last a minimum of 4 times longer than a premium mineral oil. Refer to FIGURE 3-3, page 20.

		Ambient Temperatures				
		Less than 10^0 F *	10^0 F to 32^0 F **	32^0 F to 60^0 F	60^0 F to 90^0 F	Greater than 90^0 F
Blower Discharge Temperatures	Less than 32^0 F	AEON PD AEON PD FG	AEON PD AEON PD FG			
	32^0 F to 100^0 F	AEON PD AEON PD FG	AEON PD AEON PD FG	AEON PD AEON PD FG	AEON PD AEON PD FG	
	100^0 F to 200^0 F	AEON PD AEON PD FG	AEON PD AEON PD FG	AEON PD AEON PD FG	AEON PD XD	AEON PD XD
	200^0 F to 300^0F	AEON PD AEON PD FG	AEON PD AEON PD FG	AEON PD AEON PD FG	AEON PD XD	AEON PD XD
	Greater than 300^0 F			AEON PD XD	AEON PD XD	AEON PD XD

* For ambient temperatures less than 10^0 F, but not less than -20^0 F, the use of oil sump heaters or heated enclosures is required.

** For ambient temperatures 10^0 F to 32^0 F, the use of oil sump heaters or heated enclosures is recommended.

FIGURE 3-3 – SYNTHETIC LUBRICANT CHART

AIR FILTERS AND FILTER SILENCERS

⚠WARNING

Servicing the air filters is one of the most important maintenance operations to be performed to insure long blower life.

Servicing frequency of filter elements is not time predictable. A differential pressure indicator, with a continuous gauge reading, should be installed across the inlet filter. It will tell how much of the service life of the filter element has been used. It will also eliminate both premature filter servicing and premature blower failure due to a plugged filter when the filter pressure drop is used to establish maintenance points.

In all cases refer to the filter manufacturer's service instructions. Due to the many types of filters, it is not practical to give specific instructions covering all models.

NOTICE

No matter what type of filter is used, always make sure all seats, gaskets, clamps and hose connections on the filter and inlet line are absolutely air tight. Each time the filter is serviced, inspect interior of the blower for dirt.

PERIODIC INSPECTIONS

A good maintenance program will provide for periodic inspections of the blower and drive components. The following inspections may prevent major repairs and downtime:

1. Observe the blower for vibration, heating, noise, oil leaks and excessive air leaks.

2. Check for proper operation of the filters, silencers, couplings, drive belts, motor (or power unit), relief valve, check valve, gauges and other controls.

3. Disconnect the drive and turn the blower by hand to check for drag, tight spots, bearing wear and gear backlash. Rotation should be free with no indication of drag or metallic interference.

4. Inspect the interior of the blower through the inlet or discharge port for cleanliness, corrosion and contact of internal parts.

5. Check the tightness of all screws, bolts and nuts.

SECTION 4
OPERATION

Future operating problems can be avoided if proper precautions are observed when the equipment is first put into service.

NOTICE

Machines are shipped without oil in the sumps. Do not operate before adding lubricant.

Before starting under power, the blower should be turned over by hand to make certain there is no binding, or internal contact.

Each size blower has limits on pressure differential, running speed and discharge temperature which must not be exceeded. These limits are shown in the following tabulation. Refer to FIGURE 4-1, page 22.

⚠WARNING

Operating beyond the specified operating limitations will result in damage to the unit.

It is important that the pressures and temperatures are measured directly at the ports of the blower to avoid error that may be caused by intervening pipe runs, fittings, etc.

Relief valves should be used to protect against excessive pressure or vacuum conditions. These valves should be tested at initial startup to be sure they are adjusted to relieve at or below the maximum pressure differential rating of the blower.

NOTICE

Relief valves should be placed as close as possible to the blower inlet or discharge.

In some instances, pressure may be relieved at a lower point than the blower maximum in order to protect the motor or the equipment served by the blower.

Discharge temperature switches are recommended to protect against excessive inlet restriction or inlet temperatures. Check valves in the discharge line on pressure blowers and in the inlet line on vacuum blowers are recommended to protect the blower from motoring backwards when shut down under load.

LIMITATIONS

For information regarding limitations, refer to FIGURE 4-1, page 22.

MAXIMUM OPERATING LIMITATIONS

SIZE	RPM	PRESSURE PSI	VACUUM IN HG	TEMPERATURE RISE ° F	DISCHARGE TEMPERATURE ° F
HF 624	3300	12	16	250	350
HF 616	3300	15	16	250	350

DO NOT EXCEED THESE LIMITS

NOTICE

Blower speed, line losses, elevation, and increased inlet temperatures will affect the maximum operating limitations.

FIGURE 4-1 – MAXIMUM OPERATING LIMITATIONS

BLOWER STARTUP CHECKLIST

This startup procedure should be followed during the initial installation and after any shutdown periods or after the blower has been worked on or moved to new location. It is suggested that the steps be followed in sequence and checked off (√) in the boxes provided.

- ☐ 1. Check the unit and all piping for foreign material and clean if required.
- ☐ 2. Check the flatness of the feet and the alignment of the drive. Feet that are bolted down in a bind can cause housing distortion and internal rubbing. Misaligned V-drives can cause the impellers to rub against the headplates and cause a reduction in the volumetric efficiency of the unit. Misaligned couplings can ruin bearings.
- ☐ 3. If the blower is V-belt driven, check the belt tension and alignment. Over-tensioned belts create heavy bearing loads which lead to premature failure.
- ☐ 4. Be sure adequate drive guards are in place to protect the operator from severe personal injury from incidental contact.
- ☐ 5. Check the unit for proper lubrication. Proper oil level cannot be over-emphasized. Too little oil will ruin bearings and gears. Too much oil will cause overheating and can ruin gears and cause other damage. To much oil can cause oil leaks.
- ☐ 6. With motor electrical power locked out and disconnected, turn the drive shaft by hand to be certain the impellers do not bind.
- ☐ 7. “Jog” the unit with the motor a few times to check that rotation is in the proper direction, and to be certain it turns freely and smoothly.
- ☐ 8. The internal surfaces of all Gardner Denver units are mist sprayed with a rust preventive to protect the machine during the shipping and installation period. This film should be removed upon initial startup.
- ☐ 9. Start the unit and operate 15 minutes at no load. During this time, check for hot spots and other indications of interference.
- ☐ 10. Apply the load and observe the operation of the unit for one hour. Check frequently during the first day of operation.
- ☐ 11. If malfunctions occur, do not continue to operate. Problems such as knocking rotors can cause serious damage if the unit is operated without correction.

SAFETY PRECAUTIONS

1. Do not operate blower with open inlet or outlet port.
2. Do not exceed specified vacuum or pressure limitations.
3. Do not operate above or below recommended blower speed range.
4. Blower is not to be used where non-sparking equipment is specified.
5. Do not operate without belt guard or coupling shield.

⚠WARNING

Do not exceed sheave or coupling manufacturer's rim speed limit.

6. The blower and blower discharge piping may be extremely hot and can cause skin burns on contact.

TROUBLE SHOOTING

No matter how well the equipment is designed and manufactured, there may be times when servicing will be required due to normal wear, the need for adjustment, or various external causes. Whenever equipment needs attention, the operator or repairman should be able to locate the cause and correct the trouble quickly. The Trouble Shooting Chart below is provided to assist the mechanic in those respects.

PROBLEM	POSSIBLE CAUSE	SOLUTION
Knocking	1. Unit out of time. 2. Distortion due to improper mounting or pipe strains. 3. Excessive pressure differential. 4. Worn gears. 5. Worn bearings.	1. Retime impellers. 2. Check mounting alignment and relieve pipe strains. 3. Reduce to manufacturer's recommended pressure. Examine relief valve, re-set if necessary. 4. Replace timing gears. 5. Replace bearings.
Excessive blower temperature.	1. Too much oil in gear case. 2. Too low operating speed. 3. Clogged filter or muffler. 4. Excessive pressure differential. 5. Worn impeller clearances. 6. Internal contact.	1. Reduce oil level. 2. Increase blower speed. 3. Remove cause of obstruction. 4. Reduce pressure differential across the blower. 5. Replace impeller. 6. Correct clearances.
Impeller end or tip drag.	1. Insufficient assembled clearances. 2. Case or frame distortion. 3. Excessive operating pressure. 4. Excessive operating temperature.	1. Correct clearances. 2. Check mounting and pipe strain. 3. Remove causes. 4. Remove causes.
Lack of volume.	1. Slipping belts. 2. Worn clearances. 3. Dirty air filter	1. Tighten belts. 2. Re-establish proper clearances. 3. Clean or replace air filter
Excessive bearing or gear wear.	1. Improper lubrication.	1. Correct lubrication level. Replace dirty oil.
Loss of oil.	1. Bearing housing vents plugged. 2. Worn seal.	1. Clean vents. 2. Replace seals.

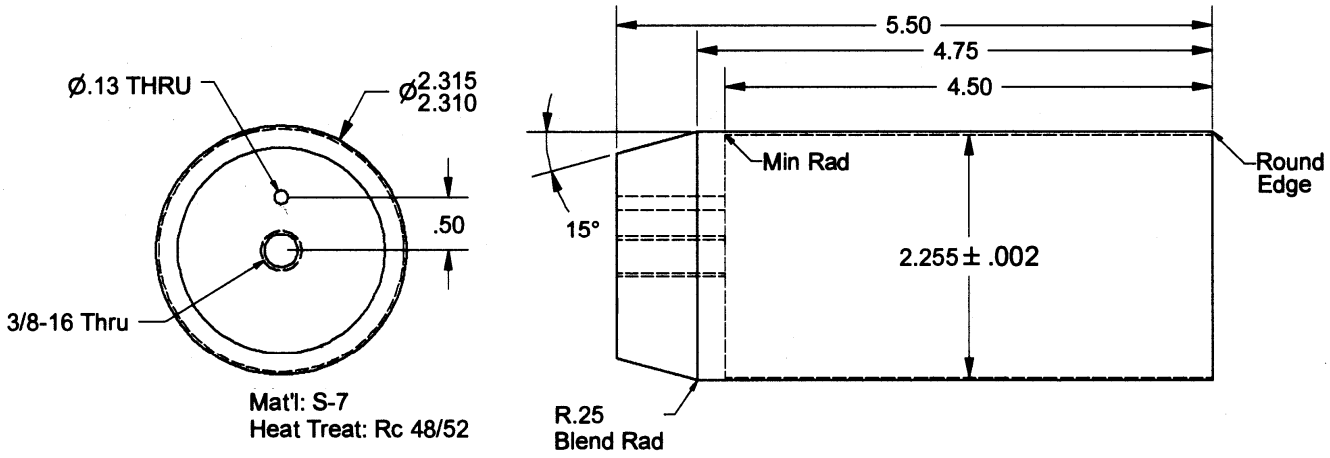


FIGURE 5-1 – INSTALLATION TOOL (EQ144021-06)

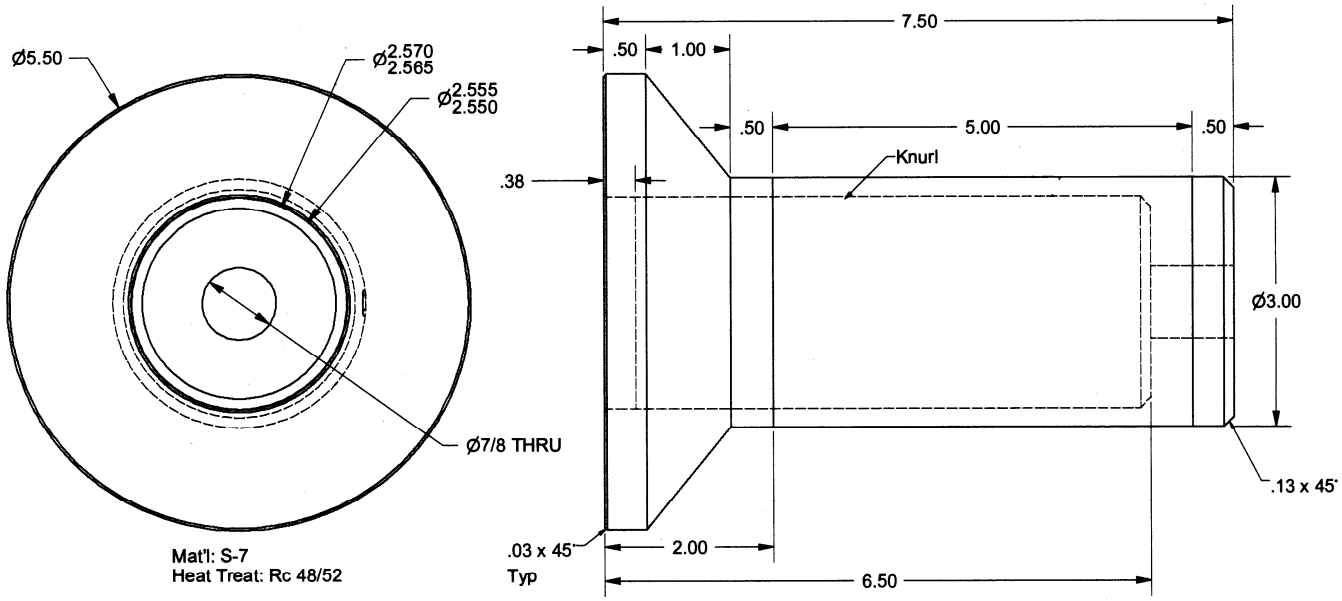


FIGURE 5-2 – BEARING DRIVER (EQ144021-03)

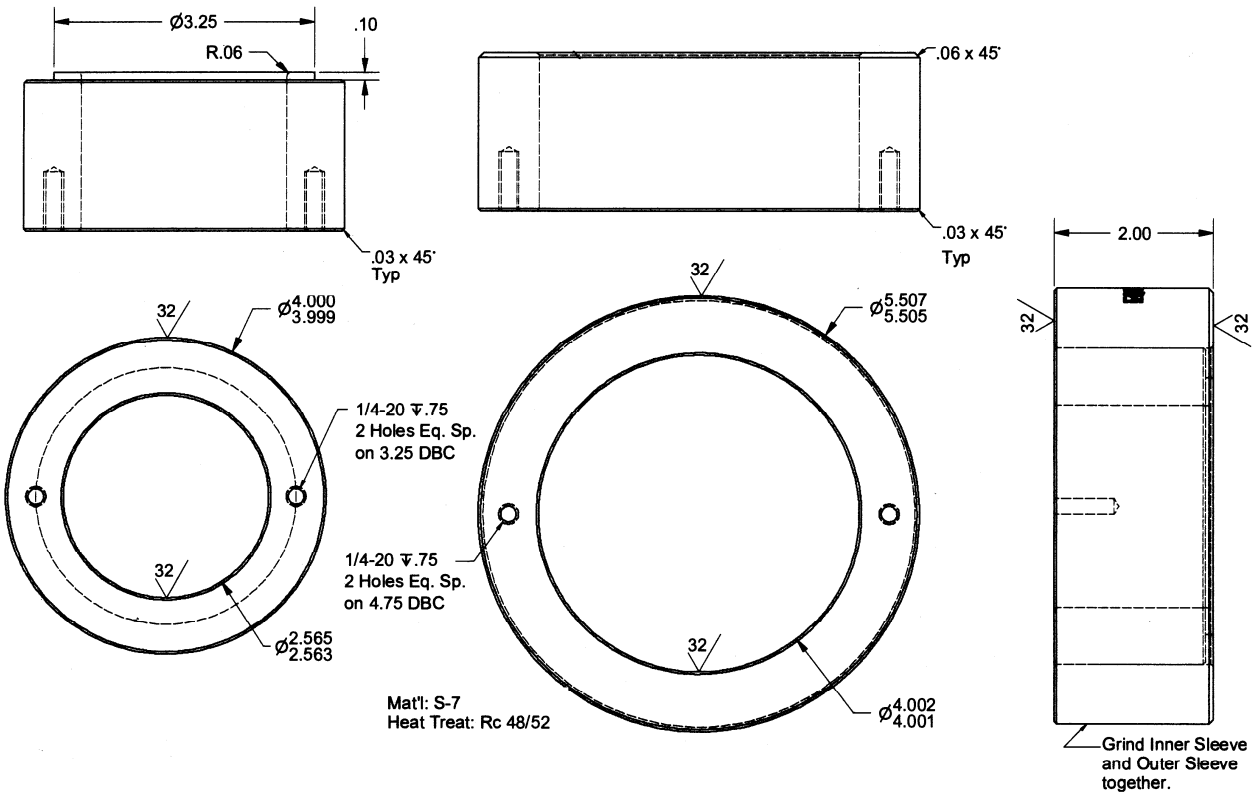


FIGURE 5-3 – FALSE BEARING (EQ1440221-07)

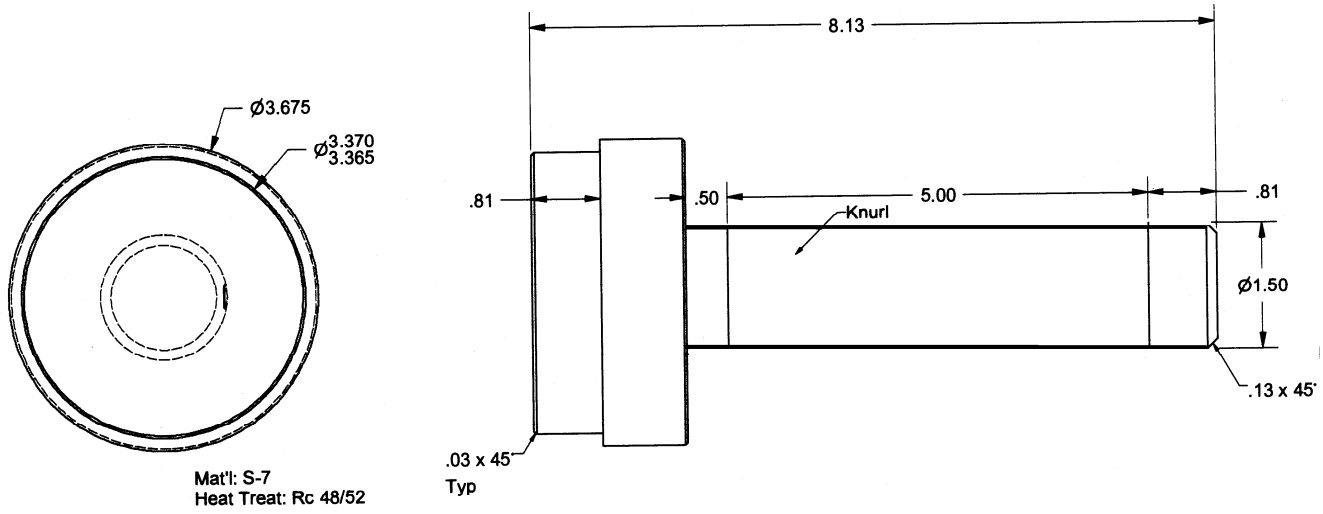


FIGURE 5-4 – INSERT DRIVER (EQ144021-02)

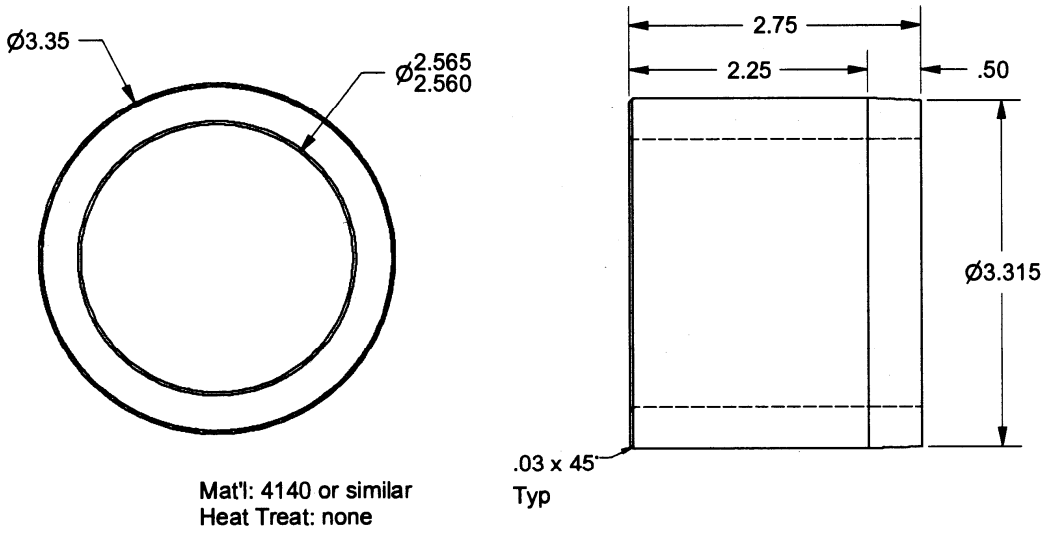


FIGURE 5-5 – ASSEMBLY GUIDE FOR RINGS (EQ144021-05)

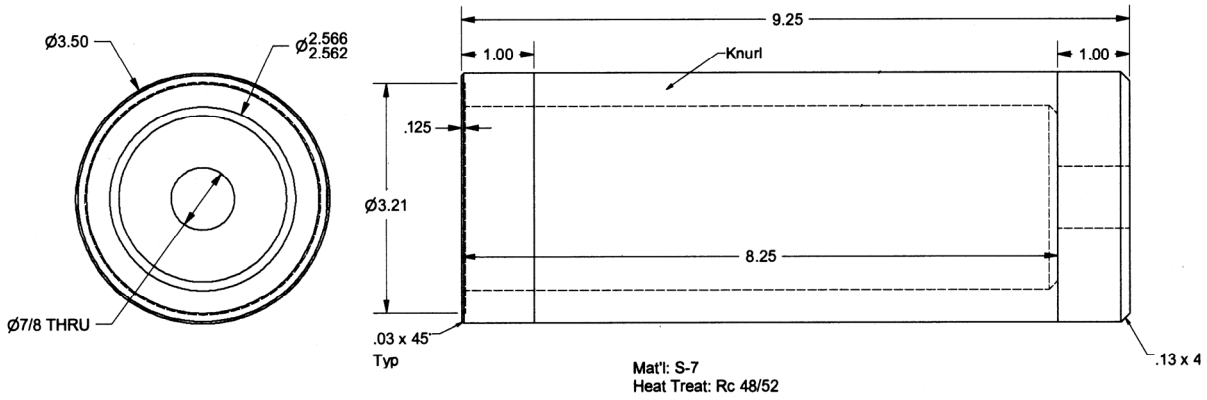


FIGURE 5-6 – SLINGER/CARRIER DRIVER (EQ144021-01)

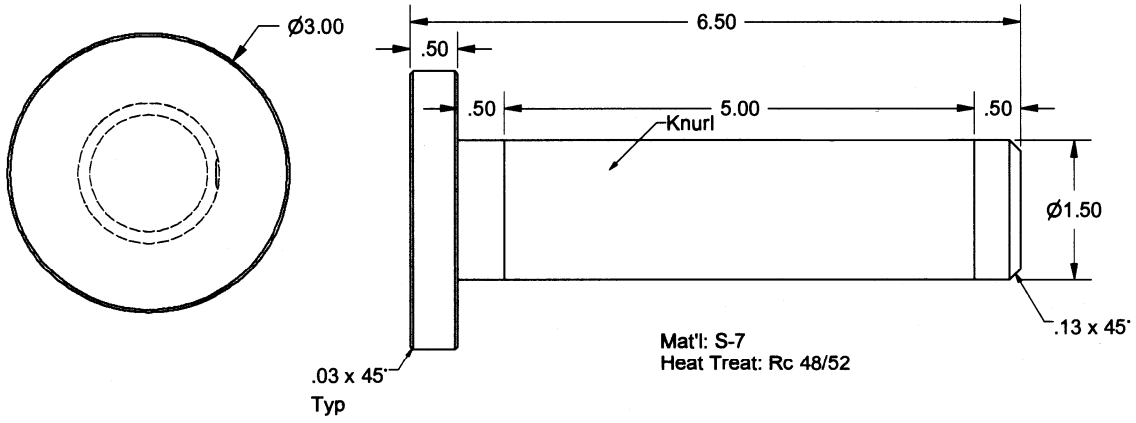


FIGURE 5-7 – SEAL DRIVER (EQ144021-04)

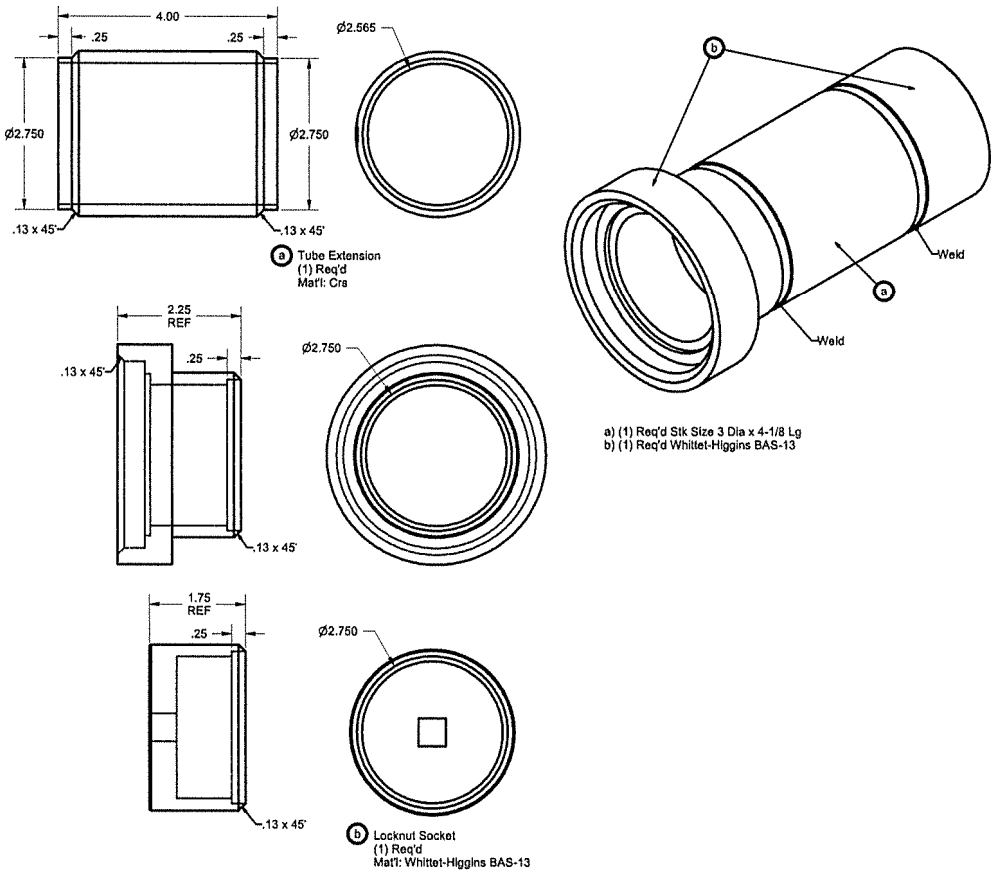


FIGURE 5-8 – NUT DRIVER (EQ144021-12)

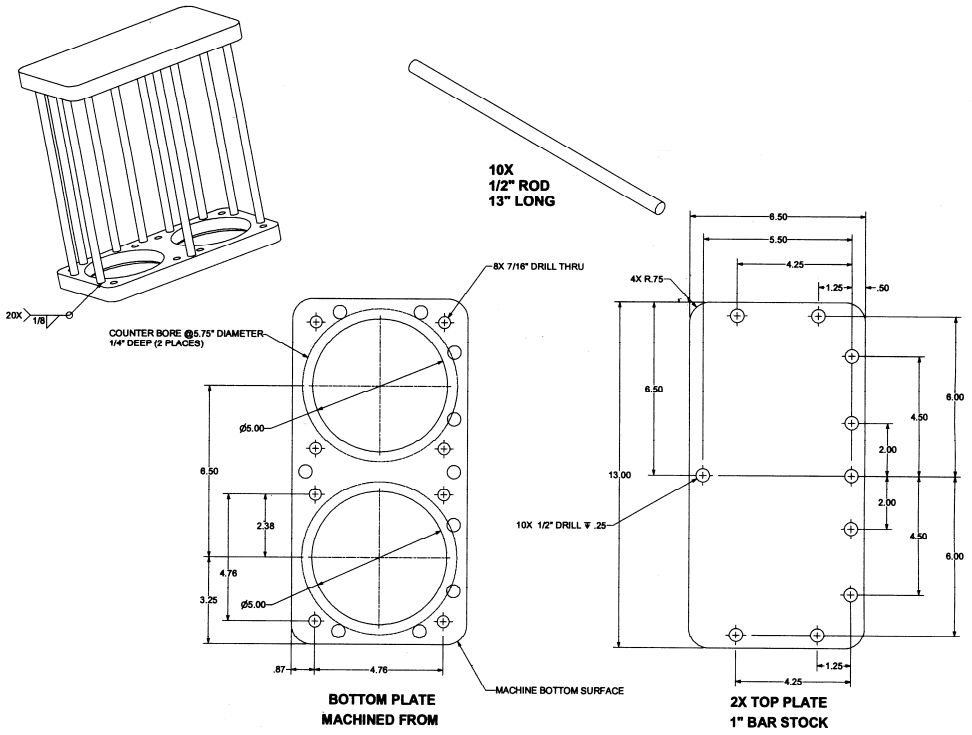


FIGURE 5-9 – DISASSEMBLY FIXTURE

SECTION 6
DISASSEMBLY INSTRUCTIONS

1. Inspect the interior of the blower for any signs of rotor contact (rotor to rotor, rotor tip to case, rotor end to bearing housing). If there are signs of contact then the various clearances should be measured with feeler gauges prior to any disassembly.
2. Inspect the areas around the drive shaft seal and vent passages in the bearing housing and air cylinder for any signs of oil leaks.
3. Drain the oil from the gear end and drive end sumps by removing their drain plugs (37). A small amount of oil from each sump should be saved in the event that an oil analysis will be required.
4. Remove the screws (29) from the drive end sump cover (5). Remove the sump cover by sliding it off the drive shaft.
5. Inspect the drive shaft in the area of the oil seal for damage and wear. Inspect the oil seal (26).
6. Support the external surface of the drive end sump cover near the oil seal with blocks of wood. Drive the oil seal from the cover using the seal driver tool (EQ144021-04) and a press or small hammer.
7. Remove the screws (29) from the gear end sump cover (4). Remove the gear end sump cover.
8. Remove the locknut (23), washer (22), oil slinger (21), and spacers (20) from the gear end of its rotor shaft. Using nut driver tool (EQ144021-12).
9. If it appears the gears can be reused their backlash should be measured. Lock the idler rotor from turning by wedging a shop rag between the tip of a lobe and the air cylinder. Measure the backlash of the gears using a dial indicator and a magnetic base. The backlash should be measured in 3 places (every 1/3 turn).
10. Match mark the gears by making small punch marks on the ends of 2 meshing teeth.
11. Remove the 3 set screws from the gear locking assembly (17) that have washers added under the screw head. Insert 3-7/16”-14 screws into tapped holes in assembly. Loosen remaining screws in ring assembly and use 7/16” screws as jackbolts to break the assembly loose once it is loose remove all screws.
12. Remove the gears (18) from both rotor shafts. One gear will require a gear puller to remove.
13. Remove the 8 bearing retaining screws (14) and washers (15) from the bearing housing.
14. Remove the locknuts (23) from both of the rotor shafts on the drive end using nut driver tool (EQ144021-12).
15. Remove the oil slinger (21) from its rotor shaft.
16. Remove the spacer (19) from each rotor shaft.
17. Mount blower trunnion and install disassembly fixture, reference Figure 5-9. Set up cylinders per FIGURE 6-1 and pressing against fixture, pull the bearing housing off.
18. Remove the socket head screws (31) that attach the bearing housing (24) to the air cylinder (22).

19. Install disassembly fixture, Reference Figure 5-9. Set up cylinders see Figure 6-1 and pressing against fixture and both rotor shafts, pull the bearing housing off evenly. Removing bearings and slingers in the process.

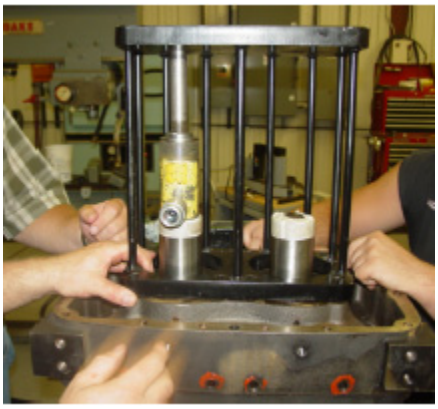


FIGURE 6-1 – CYLINDER SET UP ON BOTH SHAFTS

20. Reinstall headplate with 2 screws and rotate the unit over so that the drive end is up.

21. Repeat step 19 and remove drive end and bearing housing including bearings and slingers.

22. Match mark the rotors by making small punch marks on the end of meshing lobes. Remove both rotors from cylinder.

23. Rotate unit so gear end is up, remove 2 screws and remove bearing housing.

24. Position the blower assembly horizontally.

25. Inspect the 3 piston rings (8) on both ends of both rotors for signs of damage and abnormal wear. Remove the piston rings from each of the 4 ring carriers (7).

26. Inspect the ring carriers for signs of damage and abnormal wear. Normally it is not required to replace the ring carriers.

27. If a ring carrier is damaged it may be removed by heating with a torch. The rotor should be placed in a vertical position and continuously rotated while the ring carrier is being heated. Caution should be used when performing this procedure as the rotor can be damaged by uneven and extreme heating.

28. Inspect the inserts (6) in the 4 bearing bosses (2 in each bearing housing) for signs of damage and abnormal wear. Normally it is not required to replace the inserts.

29. If an insert is damaged it may be removed by using a hydraulic press and suitable driver tool. It must be removed from the air side of the bearing housing or air cylinder after removing the insert retaining rings.

SECTION 7
ASSEMBLY INSTRUCTIONS

1. Pick up the drive (long) rotor (2A) using an eyebolt (3/4 in.) threaded into the end of the rotor shaft. Support the rotor in a vertical position.
2. Apply Loctite 620 to both ends of the drive rotor shaft (on the largest diameter next to the rotor body).
3. Heat two piston ring carriers (7) to 275 degrees F. After heating use a gauss meter to check the ring carriers for magnetism. The magnetic flux density must be less than one gauss. The carriers must be orientated so that their stepped face does not contact the rotor body. Drive piston ring carriers up against the face of the rotor body at both locations using driver tool EQ 144021-1. Continue to apply pressure with driver tool during cooling process. After the ring carriers have cooled ensure that they are still tight against the face of the rotor body. Reference FIGURE 7-1.

FIGURE 7-1 – INSTALL PISTON RINGS

FIGURE 7-2 – INSTALL RETAINING RING

4. Repeat steps 1 through 3 for the idler (short) rotor (2B).
5. Install the piston rings (8) into the piston ring carrier on the gear end and drive end of both rotors, one at a time, starting with the ring closest to the rotor body. Ensure that the ring ends are hooked together properly. Offset the gaps in the rings 180 degrees.
6. Place one of the bearing housings (3) in a horizontal position in a hydraulic press with the air side facing down. Support the bearing housing on blocks of wood.
   - 6a. Apply a small bead of Loctite 620 to bearing bore lips (chamfer & I.D.) in bearing housing as shown in Figure 7-3. Run bead all the way around. (NO GAPS)
   - 6b. Apply a bead of Loctite 620 to bearing housing insert edges as shown in Figure 7-4. Run bead all the way around. (NO GAPS)

   Place an insert (6) in one of the insert bores in the bearing housing. The end of the insert with holes in it should face toward the air side of the bearing housing.
   - 6c. Orient inserts with holes in the 12:00 and 6:00 o'clock positions as shown in Figure 7-5.

   Press the insert into the bearing housing using the insert driver tool EQ144021-02. After the insert is installed verify that it does not extend above the air side surface of the bearing housing.
7. Install a retaining ring (48) into the groove in the bearing housing to secure the insert. Install the retaining ring by inserting one end of it into the groove and then pushing down around the circumference until the entire ring is in the groove. Reference FIGURE 7-2.

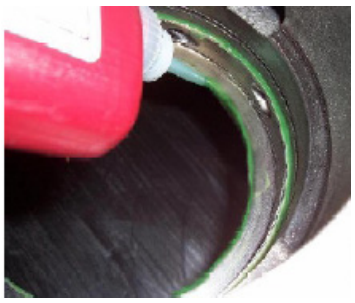


FIGURE 7-3 – LOCTITE 620 BEARING HOUSING

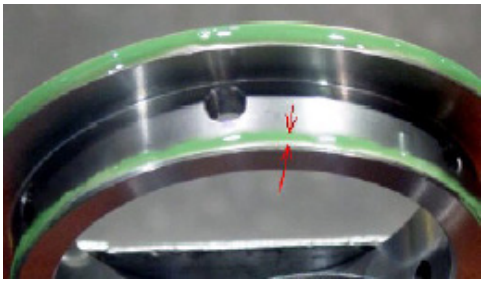


FIGURE 7-4 – LOCTITE 620 INSERT EDGES

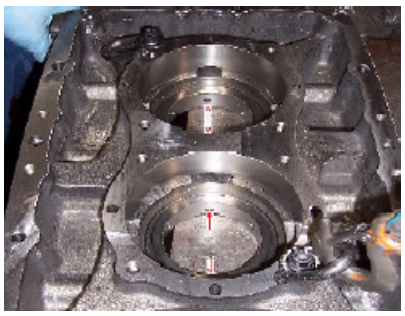


FIGURE 7-5 – 12:00 & 6:00 O'CLOCK

8. Install the second insert and retaining ring into the second seal bore following the procedure given in steps 6 and 7.
9. Install two inserts and retaining rings into the second bearing housing by repeating steps 6 through 8.
10. Attach mounting bracket to the inlet port of the air cylinder (1) and mount the air cylinder on a trunnion. Refer to the arrows cast into the air cylinder to determine the air flow direction. The discharge port has two feedback slots adjacent to the triangular opening. If a trunnion is not available an overhead hoist and work table may be used in the assemble the blower. The feedback slots should be up.
11. From the blower model designation determine drive shaft (long rotor) location and the direction it rotates.
12. Position the air cylinder vertically with the drive end on the top.
13. Apply Loctite Gasket Eliminator 515 to the sealing surface of the air cylinder on the drive end. Use a roller to spread the gasket eliminator to an even coat. Keep gasket eliminator back from inside edge of cylinder by 3/4".
14. Install two dowel pins (27) into the drive end of the air cylinder.
15. Install the drive end bearing housing onto the air cylinder.

⚠ CAUTION

Bearing housing must be oriented so that dowel holes in bearing housing lines up with dowels in air cylinder.

16. Attach the drive end bearing housing to the air cylinder using 2 socket head screws (31) in the counter bored holes in the bearing housing. Tighten the bolts to a torque of 44 – 58 foot - pounds.
17. Position the air cylinder vertically with the drive end on the bottom. Ensure there is adequate clearance for the rotor shafts to extend through the bearing housing.
18. Apply light coat of oil to the inside diameter of the 2 inserts in the drive end bearing housing. Do not apply oil to the outside diameter of the piston rings.
19. Install both rotors into the air cylinder. Verify that the long end of the drive rotor extends through the drive end bearing housing and that it is in the correct bore. Ensure that the rotation of each rotor matches the arrows on the outside of the air cylinder. Ensure that the rotor lobes match the triangular shape of the discharge port. Reference FIGURE 7-6.

FIGURE 7-6 – PORT / ROTOR GEOMETRY

20. Measure and record the total rotor to bearing housing end clearance for each rotor. This is accomplished by using a depth micrometer to measure the distance from the top edge of the air cylinder to the top of the rotor lobe while the rotor is supported by the bottom bearing housing and held as vertically as possible.

21. Apply light coat of oil to the inside diameter of the 2 inserts in the gear end bearing housing. Do not apply oil to the outside diameter of the piston rings.

22. Apply Loctite Gasket Eliminator 515 to the sealing surface of the air cylinder on the gear end. Use a roller to spread the gasket eliminator to an even coat. Keep gasket eliminator back from inside edge of cylinder by 3/4".

23. Install two dowel pins (27) into the gear end of the air cylinder.

24. Install the gear end bearing housing over the shafts of the rotors and onto the air cylinder.

⚠ CAUTION
Bearing housing must be oriented so that dowel holes in bearing housing line up with dowels in air cylinder.

25. Attach the gear end bearing housing to the air cylinder using 2 socket head screws (31) in the counter bored holes in the bearing housing. Draw down bearing housing using bolts onto the dowels so as not to damage the piston rings. Tighten the bolts to a torque of 44 – 58 foot - pounds.

26. Apply Loctite 620 to slinger ID as shown in FIGURE 7-7. Run bead of Loctite all the way around (NO GAPS). Use assembly tool EQ144021-01 to drive the slingers into position on the ends of the piston ring carriers on the gear end of both rotors. Ensure each slinger is seated against the shoulder on the ring carrier and that it is recessed below the end of the ring carrier.

FIGURE 7-7 – LOCTITE 620 TO SLINGER

27. Put the false bearing EQ 144021-07 into the bearing bore for the idler (short) shaft. Reference FIGURE 7-8. Thread an eyebolt into the end of the idler rotor and lift the rotor until the ends of the rotor lobes contact the bearing housing. Using a depth micrometer, measure and record the distance from the top surface of the outer ring of the false bearing to the top surface of the inner ring. The inner ring of the false bearing should be above the outer ring.

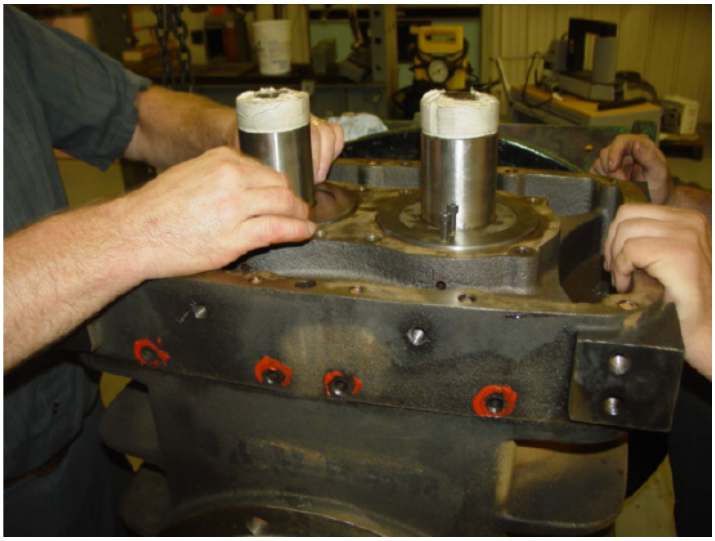


FIGURE 7-8 – INSTALL FALSE BEARINGS IN BOTH BEARING BORES

28. The number measured in step 28 should be .009 - .010“. If it is less than this then shims equal to the difference must be installed on the shaft of that rotor.
29. Lower the rotor and remove the eyebolt. Remove the false bearing. Install the required amount of shims (10) as determined in step 28 onto the idler rotor shaft.
30. Repeat steps 27 through 29 for the drive (long) rotor.
31. Locate the 2 spherical roller bearings (11) that are to be installed on the gear end of both rotors. The gear end bearings and the drive end bearings are the same physical size and appear to be the same part. It is important that the correct bearings are installed on the gear end as they have tighter internal clearances that the drive end bearings. The part number for the gear end bearing is 12BA157. C2 should also be marked on these bearings.

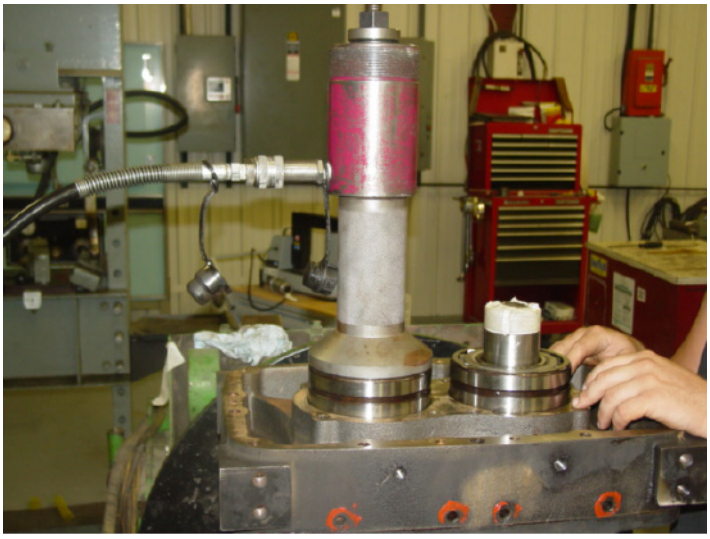


FIGURE 7-9 – ATTACH HYDRAULIC CYLINDER HOSE

32. Apply oil to the drive and idler rotor bearing bores in the gear end bearing housing. Lubricate internal surfaces and rollers of bearings with oil. Drain excess oil from bearing before installation. Oil should not be dripping from bearing in mounted position.

33. Place a bearing over the idler rotor shaft with the numbers on the bearing facing up. Screw pull bar (threaded rod) into the end of the idler rotor shaft. Place bearing driver EQ 144021-03 over pull bar. Place a portable hydraulic cylinder with a hollow center over the pull bar and onto the driver tool. Screw a nut onto the pull bar and tighten it up against the hydraulic cylinder. Reference FIGURE 7-9. Press the bearing onto the rotor shaft using the hydraulic cylinder.

Note: The threaded rod (pull bar) must be a grade 5 fastener. The maximum load applied to this threaded rod must NEVER EXCEED 5 TONS.

34. Repeat step 34 to install the bearing on the gear end of drive rotor shaft.

35. Mount the bearing retainer plate (13) onto the gear end bearing housing with eight screws (14) and lock washers (15). Torque the screws to 38-41 foot-pounds. Reference FIGURE 7-10.

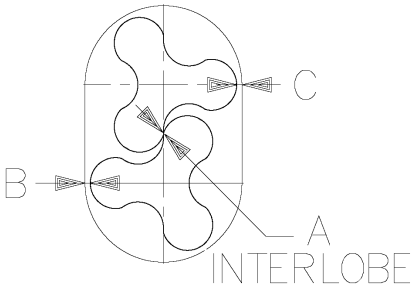
FIGURE 7-10 – TORQUE THE SCREWS 38-41 FT. LBS.

36. Position the assembly vertically with the drive end on the top.

37. Install three 0.030 inch shims (25) onto the idler (short) rotor shaft.

38. Install three 0.030 inch shims (25) onto the drive (long) rotor shaft. Install slinger on drive end similar to Step 26.

39. Locate the 2 spherical roller bearings (12) that are to be installed on the drive end of both rotors. The gear end bearings and the drive end bearings are the same physical size and appear to be the same part.



CLEARANCES	HF616	HF624
IMPELLER TO DRIVE HEADPLATE	0.019" Min.	0.026" Min.
IMPELLER TO GEAR HEADPLATE	0.006/0.008"	0.007/0.009"
IMPELLER INTERLOBE TIMING Min. (A)	0.007" Closed / 0.010" Open	0.007" Closed / 0.010" Open
TIP TO CASE CLEARANCE INLET (B)	0.011" Min.	0.018" Min.
TIP TO CASE CLEARANCE DISCH. (C)	0.005" Min.	0.005" Min.
GEAR BACKLASH	0.001" / 0.0045"	0.001" / 0.0045"

FIGURE 7-11 - CLEARANCES

40. Apply oil to the drive and idler rotor bearing bores in the drive end bearing housing. Lubricate internal surfaces and rollers of bearings with oil. Drain excess oil from bearing before installation. Oil should not be dripping from bearing in mounted position.

41. Place a bearing over the idler rotor shaft with the numbers on the bearing facing up. Screw pull bar (threaded rod) into the end of the idler rotor shaft. Place bearing driver EQ 144021-3 over pull bar. Place a portable hydraulic cylinder with a hollow center over the pull bar and onto the driver tool. Screw a nut onto the pull bar and tighten it up against the hydraulic cylinder. Press the bearing onto the rotor shaft using the hydraulic cylinder. Reference FIGURE 7-9.

Note: The threaded rod (pull bar) must be a grade 5 fastener. The maximum load applied to this threaded rod must NEVER EXCEED 5 TONS.

42. Repeat step 41 to install the bearing on the drive rotor.

43. Measure the fixed end (gear end) axial clearance for both rotors (with the assembly in the vertical position and the drive end on top). This can be accomplished by inserting feeler gauges between the end of the rotor lobe and the inner surface of the bearing housing. This clearance should be measured and recorded for all 3 lobes on both rotors. Compare these clearances to the requirements for the clearance shown in FIGURE 7-11.
Do not proceed with the assembly if these measurements are not equal to or greater than the minimum specified.

44. Position the assembly vertically with the gear end on the top.

45. Repeat step 43 (with gear end on top) to measure and record the floating end (drive end) axial clearance.

46. With the gear end on top measure and record the gear end axial clearance for all 3 lobes on both rotors. Note there are no specifications on the clearance drawing for this measurement. This measurement will be used to determine the axial movement of the bearings.

47. Based or model configuration install oil baffle plate (49) with 2 bolts and lockwashers (50) so that baffle is on the same side the oil slinger will be on.

48. Determine which shaft the pinion gear goes on. The pinion gear must be installed on the rotor with a right hand helix (which could be an idler or a drive rotor). Only one rotor shaft will have a keyway for a gear.

49. Check the fit of the key (24) in the pinion gear (18B). Check the rotor shaft on the gear end for burrs. Install the key into the shaft. Ensure that it is a snug fit.

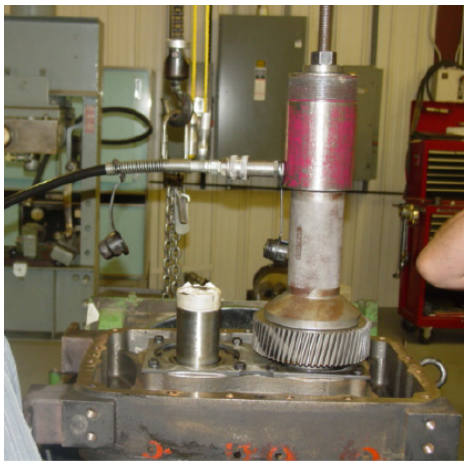


FIGURE 7-12 –PRESS GEAR ONTO SHAFT

50. Screw pull bar into the end of the rotor shaft that the pinion gear is to be installed on.

51. Heat the pinion gear to 350 deg F. After heating use a gauss meter to check the gear for magnetism. The magnetic flux density must be less than one gauss.

52. Place the heated gear onto the rotor shaft (over pull bar) and align the keyway with the key in the shaft. Place driver tool EQ144021-03 over pull bar. Reference FIGURE 7-11. Place a portable hydraulic cylinder with a hollow center over the pull bar and onto the driver tool. Screw a nut onto the pull bar and tighten it up against the hydraulic cylinder. Press the gear onto the rotor shaft until it is tight against the bearing inner race. The piston ring carrier, bearing inner race, and pinion gear must be clamped tight against the rotor. After the gear has cooled ensure that it is still tight against the bearing inner race.

53. Remove the assembly from the trunnion and place in a horizontal position on a work table.

54. Using feeler gauges measure the clearance between the rotor tips and the air cylinder. This measurement should be taken for the drive rotor and the idler rotor. The first measurement for both rotors should be taken on the inlet side of the air cylinder (by going through the inlet port). The second measurement should be taken on the discharge side of the air cylinder (by going through the discharge port). The clearance should be measured along the entire length of the lobe and for all 3 lobes on each rotor. Record these clearances and verify that they are equal to or greater than the minimum specified on the clearance drawing. Note the required clearance on the inlet side and the discharge side are different. Reference FIGURE 7-11.

55. Obtain the timing gear (17). Clean the inside diameter and outside diameter (where locking assembly mates) of gear hub and outside diameter of rotor shaft. Lightly oil these surfaces. DO NOT USE MOLYBDENUM DISULFIDE, MOLYKOTE, OR ANY OTHER SIMILAR LUBRICANTS.

56. Obtain the gear locking assembly (17). Lightly oil the screw threads, screw head bearing areas and tapered surfaces of the inner ring.

57. Slide the inner ring and collar over the gear hub projection. Insert the locking screws (metric) through the collar and loosely screw them into the threaded holes in the gear. Slide the gear assembly onto the rotor shaft and push it firmly up against the bearing inner race. Hand tighten the 7 locking screws but leave them loose enough that the gear can be rotated on the shaft.

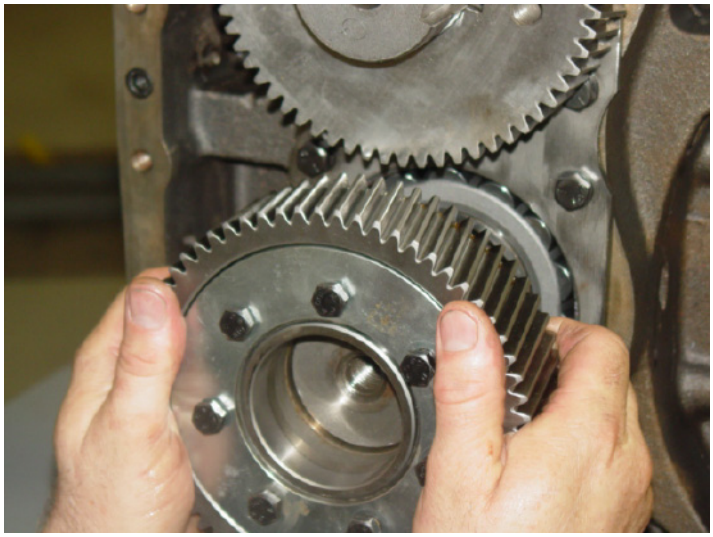


FIGURE 7-13 – HOLDING GEAR ASSEMBLY TOGETHER SLIDE ON SHAFT

58. The first step in setting the interlobe clearance is to measure the total clearance between two meshing lobes. This is accomplished by determining the maximum feeler gauge thickness that will fit between the rotor lobes near the pitch diameter. The pitch diameter is just above the transition point from the flank of the lobe profile to the hub diameter. The clearance should be measured along the entire length of the meshing lobes. This measurement should be taken for each of the 3 interlobe meshes. The location of the smallest (tightest) total interlobe clearance should be marked on the rotor lobes.

59. The total clearance between rotor lobes is to be divided with two thirds of the clearance on the leading side of the drive (long) rotor lobe and one third of the clearance on the trailing side of the drive rotor lobe. The leading side of the drive rotor lobe is determined by looking through either the inlet or discharge port and rotating the rotor in the correct direction (as indicated by the arrows cast into the air cylinder). The first drive rotor lobe surface that meshes with an idler (short) rotor lobe is the leading side. As the drive rotor continues to rotate the trailing side of this same lobe will mesh with a different lobe on the idler rotor. Divide the total measured clearance by 3. Refer to FIGURE 7-11. If this number is less than the minimum clearance (on the closed side) specified in the chart use the number FIGURE 7-11, otherwise use the total clearance divided by 3.

60. Rotate the rotors until the two lobes that have the smallest total clearance (as determined in step 58) are visible through the discharge port. Lock the idler rotor from turning by wedging a feeler gauge or shop rag between the tip of a lobe and the air cylinder.

61. Insert a feeler gauge with a thickness equal to one third of the total clearance (or number from clearance chart) between the drive rotor lobe trailing surface and the idler rotor lobe. Pull the drive rotor tight against the feeler gauge (drive rotor, shims, and idler rotor must be tight against each other). While holding the drive rotor tight against the shims rotate the timing gear until a tooth on it contacts a tooth on the pinion gear. If the timing gear is mounted on the drive rotor rotate the gear in the direction that the rotor turns (refer to arrows on air cylinder). If the timing gear is mounted on the idler rotor rotate the gear in the direction opposite to what the rotor turns. Ensure that the gear is tight against the bearing inner race. Hand tighten the 7 locking screws in a diametrically opposite sequence.

62. Use a torque wrench to tighten the locking screws to 88 in-lbs in sequence all the way around. Ensure that none of the screws will turn when 88 in-lbs is applied to them a second time.

63. Tighten the screws further to 176 in-lbs in sequence all the way around. Ensure that none of the screws will turn when 176 in-lbs is applied to them a second time.

64. Tighten the screws to a final torque of 264 in-lbs (22 ft.lbs) in sequence all the way around. Ensure that none of the screws will turn when 264 in-lbs is applied to them a second time.

65. Measure and record the interlobe clearance on both sides of each drive rotor lobe. The clearances must be measured along the entire length of the lobes. Verify that these clearances are within the range specified on the clearance drawing.

66. Lock the idler rotor from turning by wedging a feeler gauge or shop rag between the tip of a lobe and the air cylinder. Measure the backlash of the gears using a dial indicator and a magnetic base. Gear backlash is the distance (in the circumferential direction) a gear tooth can freely move when the mating gear is fixed. This should be measured in 3 places (every 1/3 turn) and recorded. Verify that the backlash is within the range specified in FIGURE 7-11.

67. Install a spacer (20) onto both of the rotor shafts on the gear end. Note the gear end spacers and the drive end spacers are not the same size. The gear end spacer is 0.60“ thick.

68. Install the oil slinger (21) on the gear end of the appropriate rotor shaft. You must know the blower model designation to determine which is the appropriate rotor shaft. For models with a fifth column that is a G, H, J, or K the oil slingers are mounted on the idler rotor. For models with a fifth column that is an E, F, L, or M the oil slingers are mounted on the drive rotor.

69. Install a bearing locknut (23) and lock washer (22) on the gear end of both rotor shafts. Apply Loctite 246 to the locknut threads prior to screwing it onto the shaft. Use locknut tool EQ 144021-12 and a torque wrench to tighten the locknut to 131 - 175 foot-pounds. Bend one of the tabs on the lock washer into a slot in the locknut.

70. Repeat steps 67 through 69 to install the spacers (19), oil slinger (21), and bearing locknuts (23) onto the drive end of the rotor shafts. Note no lock washers are used with the drive end bearing locknuts.

71. Using a pump type oil can apply oil (AEON PD) to all four bearings. Turn the rotors to distribute the oil throughout the bearings. This will ensure that the bearings are lubricated when the blower is first started.

72. Check that the oil seal bore in the drive end sump cover (5) is clean, dry, and free of nicks or burrs. Lay the cover flat with the external surface facing up. Support the area under the seal bore with a block of wood. Determine the proper orientation of the seal (26). The seal has two lips. The outer lip is shorter and when installed should point toward the keyway end of the drive rotor shaft. The inner lip is longer and should point toward the oil inside of the sump.

73. Drive the oil seal into the sump cover from the external surface using tool EQ144021-4 and a press or small hammer. After installation the seal case should be flush with the external surface of the sump cover. Apply oil to both of the seal lips.

74. Apply Loctite Gasket Eliminator 515 to the flange surface of the drive end sump cover.

75. Slide the protective sleeve EQ144021-06 over the drive shaft. Apply oil to the outside surface of the sleeve. Gently slide the drive end sump cover over the drive shaft. Reference FIGURE 7-14.

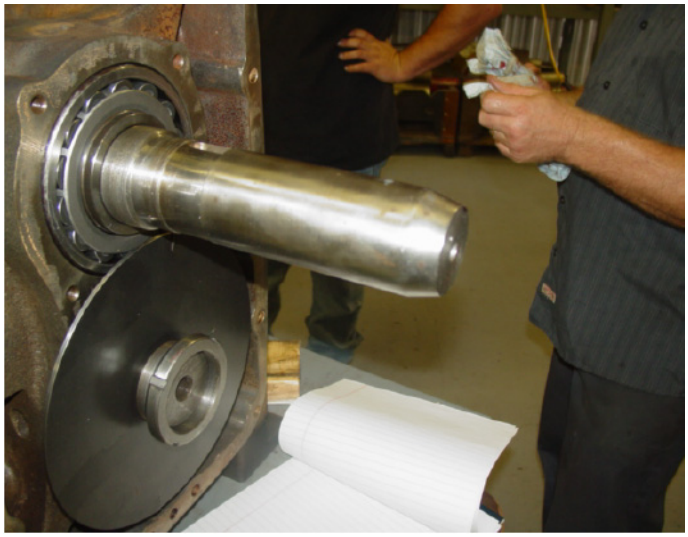


FIGURE 7-14 – INSTALL DRIVE AND COVER OVER SHAFT

76. Attach the cover to the bearing housing using four hexagonal head bolts (30) (1.00“ long) and lock washers (32) in the two center holes on each long side of the cover. Install bolts (29) (4.25“ long) and lock washers (32) in the remaining 12 holes. Tighten all sixteen bolts in three steps to 31 – 41 foot-pounds.

77. Remove the protective sleeve from the drive shaft.

78. Apply Loctite Gasket Eliminator 515 to the flange surface of the gear end sump cover (4).

79. Attach the sump cover to the gear end bearing housing using four hexagonal head bolts (30) (1.00“ long) and lock washers (32) in the two center holes on each long side of the cover. Install bolts (29) (4.25“ long) and lock washers (32) in the remaining 12 holes. Tighten all sixteen bolts in three steps to 31 – 41 foot-pounds.

80. Install plugs (16) in the four instrument holes in the air cylinder near the inlet and discharge ports.

81. Determine the appropriate hole in each sump cover for the oil level gauge (35). The oil level will be in the lower part of the oil sump. Apply Loctite 243 to the threads of each gauge. Install one oil level gauge in each sump.

82. Determine the location of the two drain holes in each sump cover. Install a magnetic plug (37) in each of these 4 holes.

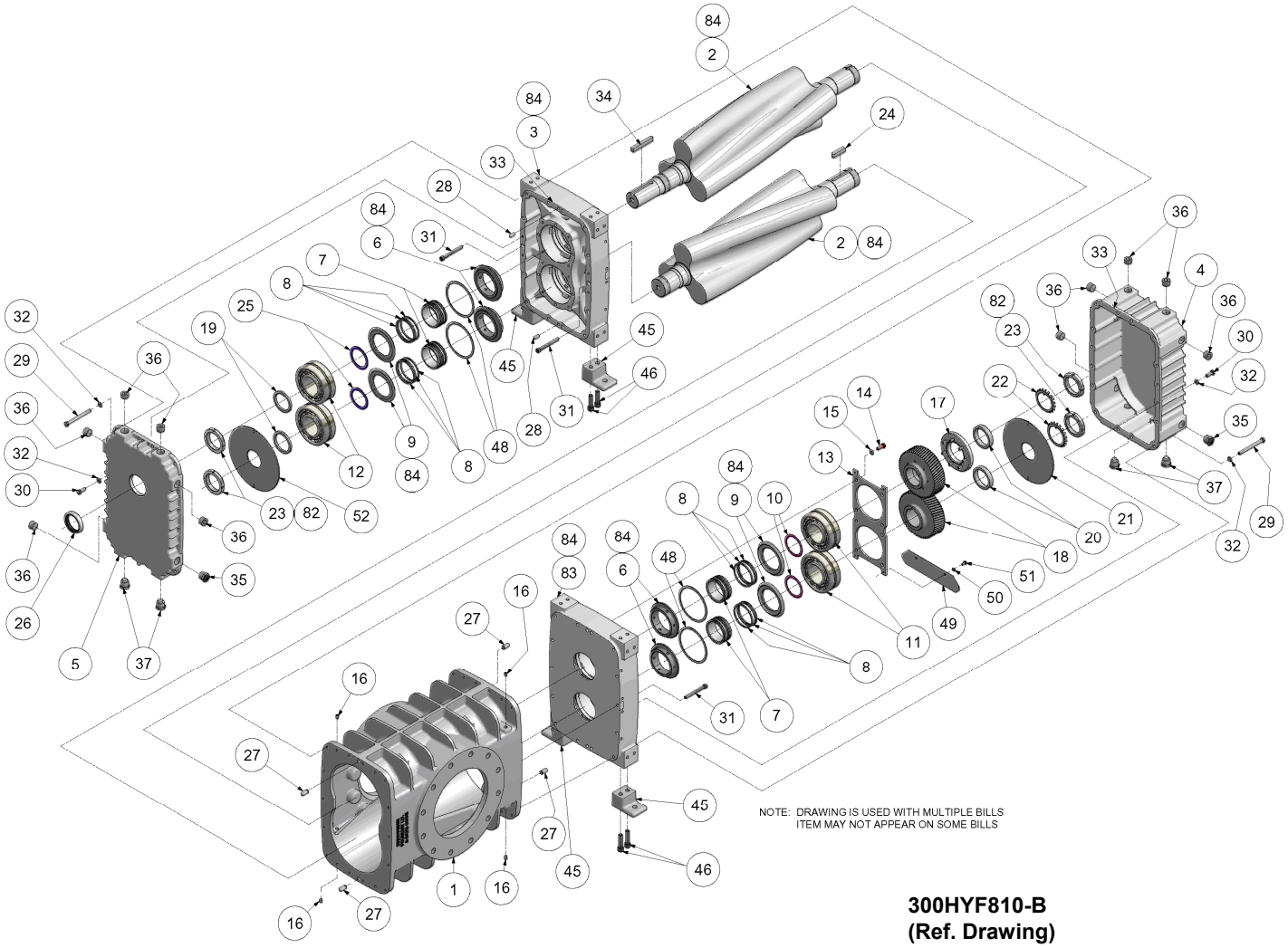
83. Install plugs (36) in the 5 remaining holes in each sump cover. Note there are no external sump breathers used on this blower.

84. Install the four mounting feet (45) to the blower with eight bolts (46). The feet should be pointing outward from the blower centerline. Tighten the bolts in three steps to 100 – 115 foot-pounds.

85. Measure the run out of the end of the drive shaft using a dial indicator and a magnetic base. Verify that the runout is less than 0.002 of an inch.

86. Check the keyway on the end of the drive rotor for burrs. Install the drive shaft key (34) into the drive rotor. Ensure that it is a snug fit. Tape the key to the shaft so that it does not get lost.

SECTION 8
PARTS LIST



300HYF810-B
(Ref. Drawing)

Order by Part Number and Description. Reference Numbers are for your convenience only.

Ref. No.	Description	No. Req.	MODEL 624 HYFL_BA	616 HYFM_BA
1	CYLINDER	1	300HYF002	301HYF002
2	ROTOR GROUP			
	CLOCKWISE DRIVE ROTATION	1	300HYF4028	302HYF4028
	COUNTER CLOCKWISE DRIVE ROTATION	1	301HYF4028	303HYF4028
3	HOUSING-BEARING DRIVE END	1	300HYF006	300HYF006
4	COVER-GEAR	1	300HYF602	300HYF602
5	COVER-DRIVE	1	300HYF477	300HYF477
6	INSERT	4	300HYF248	300HYF248
7	CARRIER, PISTON RING	4	300HYF1148	300HYF1148
** 8	RING-PISTON	12	300HYF163	300HYF163
9	SLINGER, INTERNAL SEAL	4	302HYF173	302HYF173
**10	SHIM-SET	2	300HYF732	300HYF732
**11	BEARING-SPHERICAL	2	12BA157	12BA157
**12	BEARING DRIVE END	2	903639090212	903639090212
13	PLATE-BEARING RETAINER	1	300HYF253	300HYF253
**14	SCREW	8	655ED04N	655ED04N
15	WASHER-LOCK	8	95B3	95B3
16	PLUG	4	64AC1	64AC1
17	HALF SHRINK DISC	1	22G42	22G42
18	KIT-GEAR	1	304HYF601	304HYF601
19	SPACER DRIVE END	2	300HYF144	300HYF144
20	SPACER GEAR END	2	301HYF144	301HYF144
21	SLINGER, OIL	1	303HYF173	303HYF173
**22	LOCKWASHER, WH-13	2	95W26	95W26
**23	LOCKNUT-BRG	4	50Z13	50Z13
24	KEY-SQUARE	1	8500116	8500116
**25	SHIM, 0.030” THICK	6	306HYF732	306HYF732
**26	SEAL-OIL	1	60DD513	60DD513
27	PIN-DOWEL	4	62M82	62M82
28	PIN-DOWEL	2	62M48	62M48
29	SCREW	24	75P67	75P67
30	SCREW	8	75P55	76P55
31	SCREW	4	75P64	75P64
32	WASHER-LOCK	32	95B3	95B3
**33	GASKET-ELIM	1	25BC256	25BC256
34	KEY-SQUARE	1	8500121	8500121
35	GAUGE-OIL LEVEL	2	40P45	40P45
36	PLUG	10	64AC5	64AC5
37	PLUG-MAGNETIC	4	64BJ4	64BJ4
45	FOOT	4	301HYF166	301HYF166
46	SCREW	8	75P77	75P77
48	RING-RETAINING	4	74D21	74D21
49	BAFFLE GEAR CASE OIL	1	300HYF840	300HYF840
50	WASHER-LOCK	2	95B1	95B1
51	SCREW	2	655EC020	655EC020
52	SLINGER, OIL	1	304HYF173	304HYF173
**82	ADHESIVE - LOCTITE 246	1	25BC877	25BC877
83	HOUSING – BEARING GEAR END	1	301HYF006	301HYF006
**84	ADHESIVE – LOCTITE 620	1	25BC886	25BC886
* 105	KIT – OVERHAUL	1	301HYF6010	301HYF6010

* NOT SHOWN
** INCLUDED IN OVERHAUL KIT

Gardner Denver

WARRANTY

HELIFLOW INDUSTRIAL SERIES BLOWERS

GENERAL PROVISIONS AND LIMITATIONS

Gardner Denver, Inc. (the "Company") warrants to each original retail purchaser ("Purchaser") of its products from the Company or its authorized distributor that such products are, at the time of delivery to the Purchaser, made with good material and workmanship. No warranty is made with respect to:

1. Any product which has been repaired or altered in such a way, in the Company's judgment, as to affect the product adversely.
2. Any product which has, in the Company's judgment, been subject to negligence, accident, improper storage, or improper installation or application.
3. Any product which has not been operated or maintained in accordance with the recommendations of the Company.
4. Components or accessories manufactured, warranted and serviced by others.
5. Any reconditioned or prior owned product.

Claims for items described in (4) above should be submitted directly to the manufacturer.

WARRANTY PERIOD

The Company's obligation under this warranty is limited to repairing or, at its option, replacing, during normal business hours at an authorized service facility of the Company, any part which in its judgment proved not to be as warranted within the applicable Warranty Period as follows.

BARE BLOWERS

Basic bare blowers, consisting of all parts within, are warranted for 24 months from date of initial use or 30 months from date of shipment to the first purchaser, whichever occurs first. Any disassembly or partial disassembly of the blower, or failure to return the "unopened" blower per Company instructions, will be cause for denial of warranty.

LABOR TRANSPORTATION AND INSPECTION

The Company will provide labor, by Company representative or authorized service personnel, for repair or replacement of any product or part thereof which in the Company's judgment is proved not to be as warranted. Labor shall be limited to the amount specified in the Company's labor rate schedule.

Labor costs in excess of the Company rate schedules caused by, but not limited to, location or inaccessibility of equipment, or labor provided by unauthorized service personnel is not provided for by this warranty.

Transportation of Company's choice, within the continental United States, is covered by this warranty for replacement of any blower which in the Company's judgment proved not to be as warranted. For user locations outside the continental United States, the Company will provide transportation, by the carrier of its choice, to and from the nearest Authorized Distributor and the Company's designated facility. The Company may require the return of any blower or part claimed not to be as warranted to one of its facilities as designated by the Company, transportation prepaid by Purchaser, to establish a claim under this warranty.

Replacement parts provided under the terms of the warranty are warranted for the remainder of the Warranty Period of the product upon which installed to the same extent as if such parts were original components thereof.

DISCLAIMER

THE FOREGOING WARRANTY IS EXCLUSIVE AND IT IS EXPRESSLY AGREED THAT, EXCEPT AS TO TITLE, THE COMPANY MAKES NO OTHER WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.

THE REMEDY PROVIDED UNDER THIS WARRANTY SHALL BE THE SOLE, EXCLUSIVE AND ONLY REMEDY AVAILABLE TO THE PURCHASER AND IN NO CASE SHALL THE COMPANY BE SUBJECT TO ANY OTHER OBLIGATIONS OR LIABILITIES. UNDER NO CIRCUMSTANCES SHALL THE COMPANY BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, EXPENSES, LOSSES OR DELAYS HOWSOEVER CAUSED.

No statement, representation, agreement, or understanding, oral or written, made by any agent, distributor, representative, or employee of the Company which is not contained in this Warranty will be binding upon the Company unless made in writing and executed by an officer of the Company.

This warranty shall not be effective as to any claim which is not presented within 30 days after the date upon which the product is claimed not to have been as warranted. Any action for breach of this warranty must be commenced within one year after the date upon which the cause of action occurred.

Any adjustment made pursuant to this warranty shall not be construed as an admission by the Company that any product was not as warranted.

Gardner Denver®

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