GARDNER DENVER®

SB–7–628
1st Edition
September, 1998

Sutorbilt™

WET VACUUM PUMPS

8000 SERIES

10” – 22” GEAR DIAMETER

OPERATING AND SERVICE MANUAL

Gardner Denver

MAINTAIN WET VACUUM PUMP RELIABILITY AND PERFORMANCE WITH GENUINE GARDNER DENVER PARTS AND SUPPORT SERVICES

Factory genuine parts, engineered to original tolerances, are designed for optimum dependability —— specifically for your pump. Design and material innovations are born from years of experience with hundreds of different pump 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 pump 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 pump industry.

Your local **AUTHORIZED DISTRIBUTOR** maintains a large inventory of genuine parts and is also backed by direct access to our Master Distribution Center (MDC) in Memphis, Tennessee, for immediate emergency response.

Your **AUTHORIZED DISTRIBUTOR** can support your pump 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 pump lubricants specifically formulated for optimum performance in all pumps.
4. Authorized Distributor service technicians are factory-trained and skilled in pump maintenance and repair. They are ready to respond and assist you by providing fast, expert maintenance and repair services.

For the location of your local authorized Gardner Denver pump distributor refer to the yellow pages of your phone directory or contact:

Distribution Center:
Gardner Denver
Master Distribution Center
5585 East Shelby Drive
Memphis, TN 38141
Phone: (901) 542–6100
(800) 245–4946
Fax: (901) 542–6159

Factory:
Gardner Denver
1800 Gardner Expressway
Quincy, IL 62301
Phone: (217) 222–5400
Fax: (217) 224–7814

INSTRUCTIONS FOR ORDERING REPAIR PARTS

For pricing and ordering information, contact your nearest AUTHORIZED FACTORY DISTRIBUTOR.

When ordering parts, specify pump **MODEL** and **SERIAL NUMBER** (see nameplate on unit).

Use this Parts List to select the parts you require. Where NOT specified, quantity of parts required per pump is one (1); where more than one is required per unit, quantity is indicated.

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

INSTRUCTIONS FOR DETERMINING PUMP CONFIGURATION

1. Face the pump 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 pump. A **TOP HAND** exists when the drive shaft is above the horizontal center line of the pump.
5. In a horizontal configuration, a **RIGHT HAND** exists when the drive shaft is to the right of the vertical center line of the pump. A **LEFT HAND** exists when the drive shaft is to the left of the vertical center line of the pump.

FOREWORD

Sutorbilt® pumps 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.

For Part List information, see:

Gear Diameter	Parts List
10”	SB–7–535
12”	SB–7–536
14”	SB–7–537
16”	SB–7–538
18”	SB–7–539
20”	SB–7–540
22”	SB–7–541

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 pump 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 pump air or oil system until the unit is shut down and the air pressure has been relieved.**
- **Electrical shock can and may be fatal.**
- **Pump unit must be grounded in accordance with the National Electrical Code.**
- **Open main disconnect switch, tag and lockout before working on the control.**
- **Disconnect the pump unit from its power source, tag and lockout before working on the unit – the machine may be 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 pump are required.**
- **Disconnect the pump unit from its power source, tag and lockout before working on the unit – the machine may be automatically controlled and may start at any time.**
- **Do not exceed the rated maximum speed shown on the nameplate.**
- **Do not operate unit if safety devices are not operating properly. Check periodically. Never bypass safety devices.**

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INTRODUCTION
YOUR KEY TO TROUBLE FREE SERVICE

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

Your Sutorbilt pump is a precision engineered pump 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 pump performance. There is no guesswork in the manufacture of your highly advanced Sutorbilt pump and there must be none in preparing the pump to get the job done in the field.

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

OPERATING PRINCIPLES – The 8000 Series rotary pumps are the positive displacement type with two figure–eight shaped impellers rotating in opposite directions inside the casing. As each lobe of an impeller passes the pump inlet, it traps a quantity of air equal to exactly one–fourth the displacement of the pump. This entrapment air is forced around the case to the pump outlet. Timing gears accurately position the impellers in relation to each other to maintain the minute clearances so vital to the high volumetric efficiency of the rotary positive pump. See FIGURE 1.

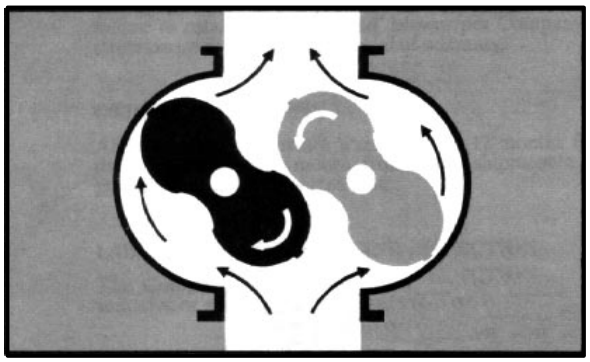


FIGURE 1 – OPERATING PRINCIPLES

WHERE TO CALL FOR SUTORBILT PUMP ASSISTANCE:

For prompt professional Sutorbilt service always contact your authorized Sutorbilt Distributor first. If you do not know your authorized Sutorbilt Distributor, contact the numbers below for immediate assistance.

SUTORBILT CUSTOMER SERVICE		(217) 224–8800
SUTORBILT FACTORY SERVICE DEPARTMENT		(217) 222–5400
SUTORBILT HEADQUARTERS:	GARDNER DENVER 1800 GARDNER EXPRESSWAY QUINCY, IL 62301 (217) 224–8800	

IMPORTANT SUTORBILT TELEPHONE NUMBERS

YOUR AUTHORIZED SUTORBILT DISTRIBUTOR

NAME: _____

TELEPHONE: _____

FAX: _____

CONTACT: _____

THANKS . . . FOR THE PRIVILEGE OF SERVING YOU WITH DEPENDABLE SUTORBILT 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 Sutorbilt pump 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 pump 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 pump internal surfaces.
6. To prevent rusting of gears, bearings, etc., the oil reservoirs may be filled with normal operating oil.

⚠ CAUTION

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

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

REMOVING PROTECTIVE MATERIALS

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

⚠ CAUTION

Follow the safety directions of the safety solvent manufacturer.

Pump 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 Sutorbilt units are mist sprayed with a rust preventative to protect the machine during shipment. Remove this film upon initial startup, using any commercial safety solvent.

Vertical pumps are provided with holes top and bottom. The solvent is to be sprayed into the cylinder through the top hole and the bottom hole will act as a drain. For horizontal pumps the solvent can be sprayed into the top part. Place a shallow pan on the under side of the unit. With the pump disconnected from power, spray the solvent in the cylinder, 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 pump inlet and discharge ports.

SECTION 2
INSTALLATION

LOCATION

If possible, install the pump 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 pump 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 pump feet after final tightening of foundation anchor bolts to remove strain from the pump 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.

Refer to grouting instructions.

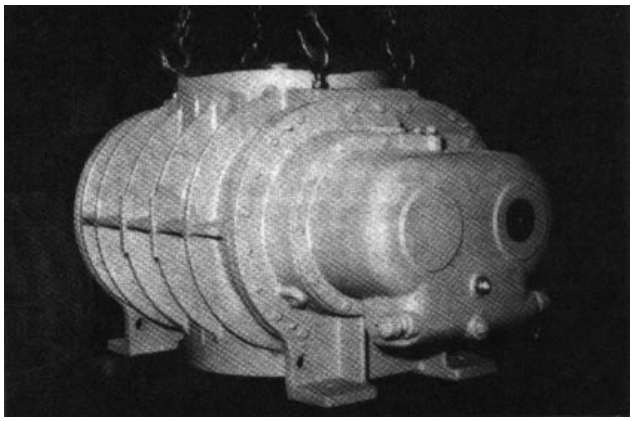


FIGURE 2 – LIFTING THE PUMP

LIFTING AND HANDLING

Reasonable care should be taken during unloading and moving to insure against undue strain on the pump.

Eye bolts and lifting lugs are designed to support the weight of the pump only. They are not intended to be used to lift packages or components. See FIGURE 2.

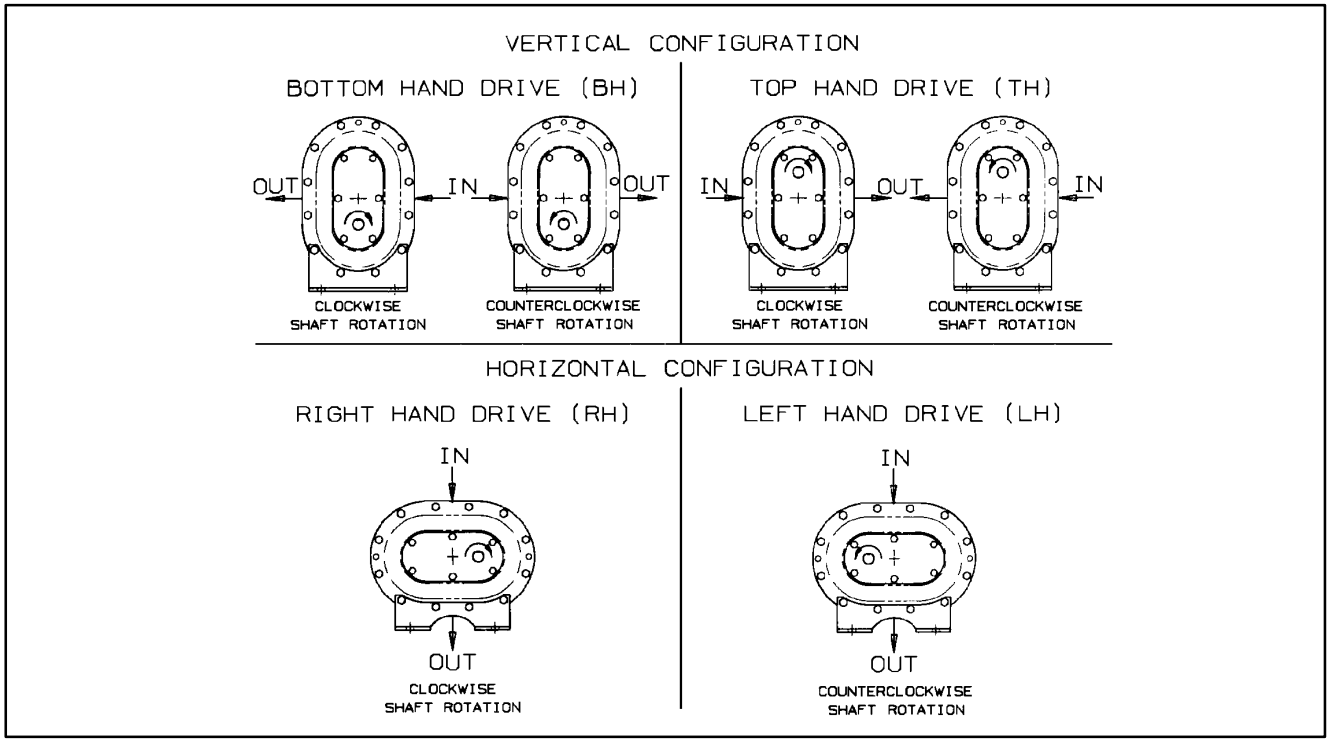


FIGURE 3 – PUMP MOUNTING CONFIGURATIONS

Protective covers and rust preventatives should be left in place until just prior to installation.

DRIVE INSTALLATION

Large pumps are generally driven by a coupling. On the direct connected units, adjustments and lubrication of couplings to the specifications of the coupling manufacturer are 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. To reduce vibration, the coupling must be aligned to 0.003"/0.005" for both parallel and angular alignment.

⚠ WARNING

Overtightening belts leads to heavy bearing loads and premature failure.

When selecting a V–belt drive, check to be sure the shaft overhung load limitation is not exceeded. Refer to FIGURE 6, page 8, for overhung load calculations and limitations.

Belt drives must be carefully aligned. Motor and pump 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

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

The location of the sheave on the pump shaft greatly affects the stress in the shaft. The optimum pump sheave positioning is as close as possible to the pump drive cover, not to exceed dimension "C" in Drive Shaft Illustration, FIGURE 6, page 8.

The calculated shaft moment must not exceed the maximum allowable moment listed in Maximum Allowable Moment Chart, FIGURE 6, page 8. 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 6, page 8, to calculate belt pull. Refer to Arc of Contact Factor Chart, FIGURE 6, page 8.
2. Insert the calculated belt pull into the formula for Calculation of Shaft Moment, FIGURE 6, page 8, to arrive at the calculated shaft moment.

PIPING

Inlet and discharge connections on all pumps are large enough to handle maximum volume with minimum friction loss.

Excessive weight of piping and fittings will cause internal misalignment and premature wear. Never allow the pump 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. Expansion joints must be designed for vacuum service. Where a flexible connection is not practical, the weight of the rigid connection must be separately supported. Be sure that system piping is clean and free from scale or debris before connecting to the pump. Pieces of weld rod or rags can cause serious damage to the machine if drawn into rotors during operation.

Provisions must be made to supply seal water to the globe valve provided ahead of the flowmeter as part of the water injection system. On vertical pumps, a check valve is attached to the bottom of the inlet port, and a solenoid operated valve is fitted to the bottom of the impeller case to automatically drain off all water when the pump is idle. On horizontal two–stage vacuum pumps, automatic drain valves must be provided at the low point of the inter–stage piping. Adequate piping must be provided from these valves to a sump below the level of the pump.

Refer to FIGURE 4, page 6 and FIGURE 5, page 7 which show typical arrangements of single and 2–stage vacuum pumps. It is important to keep the back–pressure to a minimum, and avoid water flooding of the pump when idle. The discharge separator–silencer is to be set vertically as shown, with its outlet piped outdoors.

When the suction of the vacuum pump is taken from a process which contributes a significant volume of liquid, there should be a continuous down slope to the

vacuum pump to avoid accumulation of liquid slugs. A minimum slope of 1/4" per foot is recommended. If vertical loops in the suction piping are unavoidable, separators should be provided at the low points, with automatic removal of liquid by extractor pumps or barometric legs.

SAFETY PRECAUTION

All rotating parts should be protected by guards to eliminate hazards to operating personnel. All inlet openings should be protected by screens to prevent the entrance of foreign objects. Wherever possible, interlock systems should be employed to prevent startup when a hazardous condition exists.

Relief valves should be installed in the system to prevent excessive load from being applied on the unit during operation. Initial and periodic checks should be made to insure that the relief valves are properly set so that the maximum vacuum rating of the unit and maximum load on the driver cannot be exceeded.

⚠ WARNING

Sutorbilt pumps are shipped dry from the factory. Do not attempt to operate the pump before following proper lubrication instructions. Permanent damage to the gears, bearings and seals will occur.

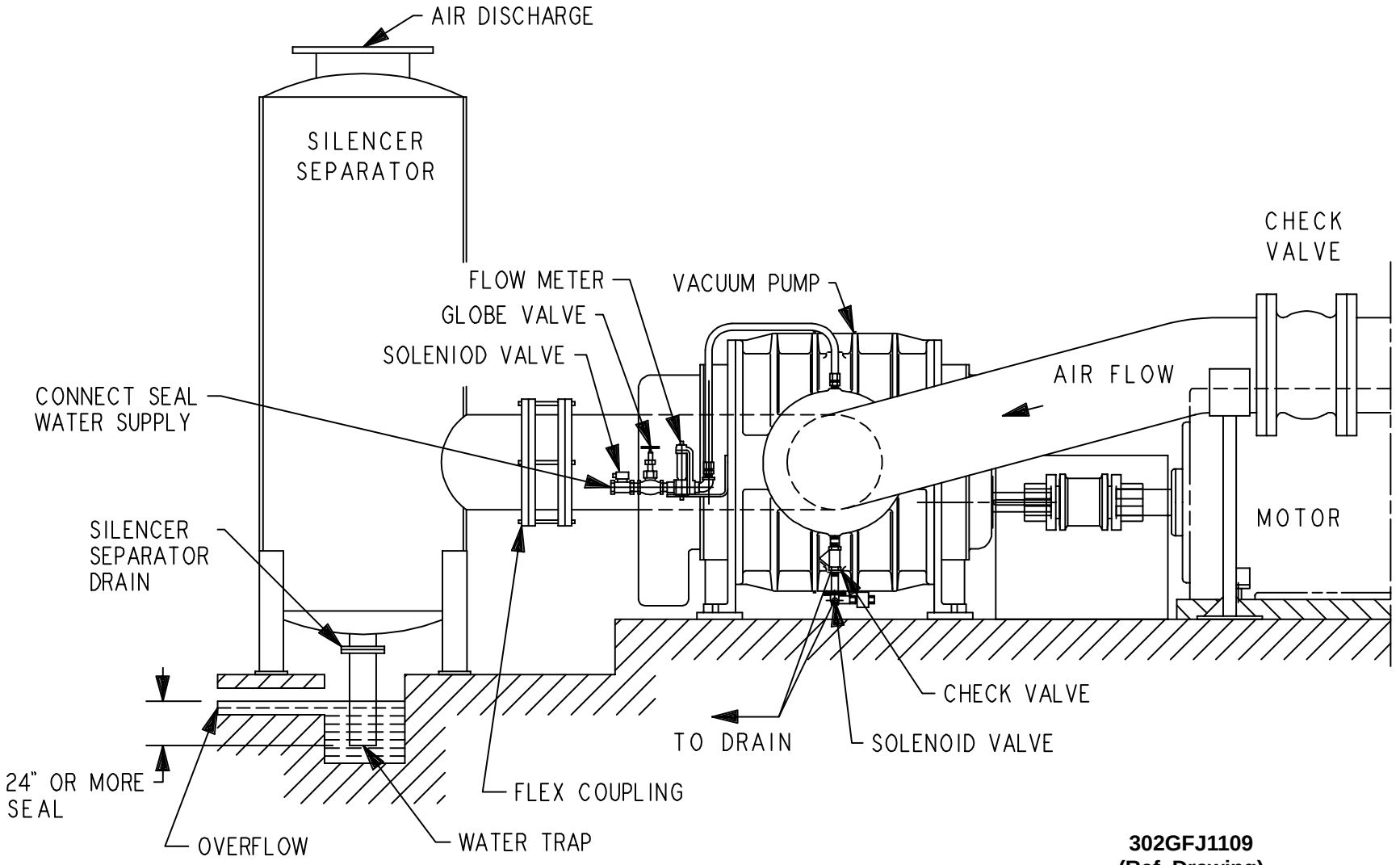


FIGURE 4 – SINGLE STAGE INSTALLATION

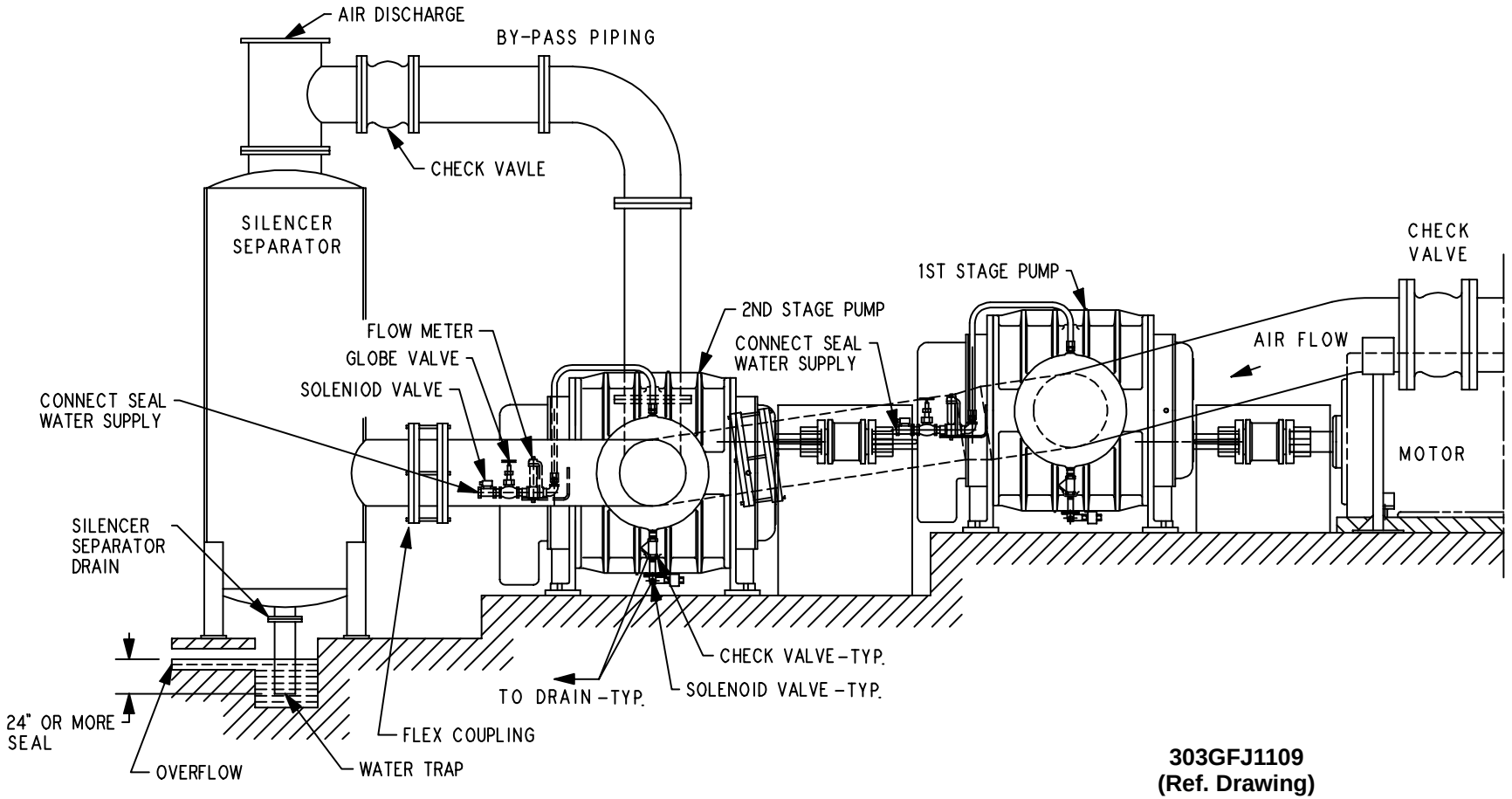
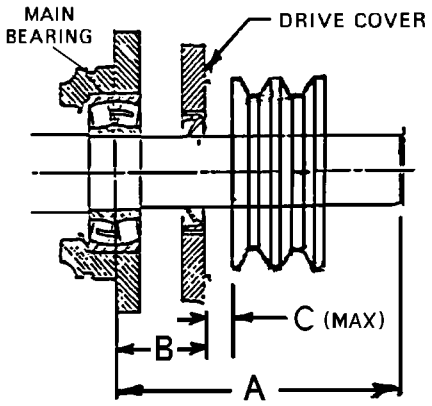


FIGURE 5 – TWO STAGE INSTALLATION

Gear Diameter (Inches)	Dimensions (Inches)			Maximum Allowable Moment	
	A	B	C (Max)	(LB–IN)	Kg M
10	11.50	3.50	.75	16065	185,1
12	12.81	3.81	.75	25789	297,1
14	14.19	4.19	.75	38824	447,3
16	15.38	4.38	.75	65280	752,1
18	17.00	5.00	.75	91975	1059,7
20	18.75	5.25	.75	118673	1367,2
22	20.19	5.19	.75	137269	1581,5

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 Factors Chart above)
- Hp = Pump Horsepower for Operating Conditions
- S.F. = Drive Service Factor (use 1.4 S.F. for continuous duty applications)
- D = Pump Sheave Pitch Diameter in Inches
- RPM = Pump Sheave Speed
- Z = $\dfrac{\text{Large Sheave Pitch Diameter (in)} - \text{Small Sheave Pitch Diameter (in)}}{\text{Sheave Center Distance (in)}}$

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 6 – BELT DRIVE OVERHUNG LOAD CALCULATIONS

SECTION 3
PRE–START

LUBRICATION

Force Feed Lubrication – Timing gears and bearings are lubricated by a pressure system which features large diameter piping. A reversible oil pump brings oil from an oversize sump which is large enough to eliminate the need for an oil cooler at discharge temperatures up to 160° F. (Oil coolers are available as optional equipment.) An oil filter is located in the sump.

After one minute of operation, there should be a register of pressure on the gauge (D) (FIGURE 7) of 10 to 15 PSI. If there is none, prime the oil pump (E) (FIGURE 7). During initial operation, it will be necessary to add oil to the sump to compensate for filling of passages and distribution lines. Maintain oil level at the mid point of the sight glass during operation. Use AEON PD or the grade lubricant specified on the instruction plate attached to the pump (see chart, FIGURE 9, page 11). Drain oil at the drive headplate and gear sump. The mesh–type strainer (G) (FIGURE 7), located in the sump should be cleaned each time the oil is changed. There are two perforated brass screens located at the oil line connection to the headplates (F). These should be removed and cleaned or replaced as necessary.

Oil pressure is controlled by the relief valve (J) in the by–pass line from the pump to the oil sump. If it is necessary to change the pressure adjustment, remove lower cap and gasket from the relief valve. Loosen the locking nut and turn the adjusting screw clockwise to increase, and counter–clockwise to decrease the oil pressure. Tighten locknut and replace gasket and cap.

Mount the oil pressure gauge (D) (FIGURE 7) on a vibration free panel to prevent gauge damage and inaccurate reading.

Splash–Lubrication – The gear and drive end of the vacuum pump are lubricated by the splash method by oil being picked up from the sump and thrown out by the gears on the gear end and oil slingers on the drive end. Both gears and bearings are lubricated in this manner.

NOTICE

Units are shipped without oil in the sumps (A) (FIGURE 7). Do not operate before lubricating.

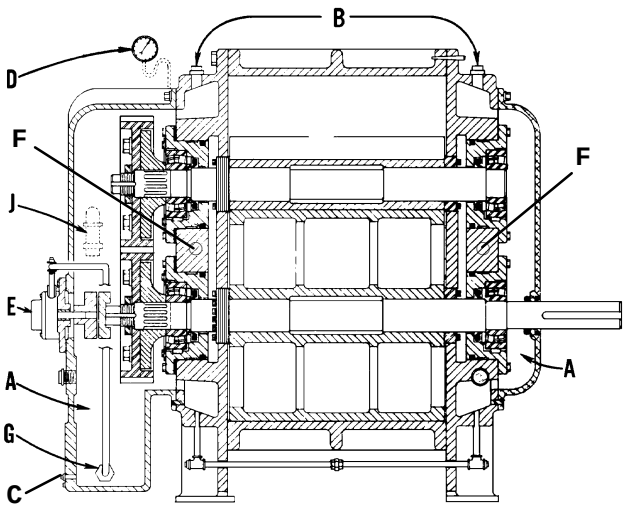


FIGURE 7 – LUBRICATION LOCATION

SUMP FILLING PROCEDURE – Use the following steps to fill the sumps.

1. Remove the vented fill caps (B) (FIGURE 7).
2. Fill the sumps until the oil level reaches the center of the sight glass. Use AEON PD or the grade of lubricant specified on the instruction plate attached to the pump. See chart, FIGURE 9, page 11.
3. When filling housing with oil, stop filling as soon as the oil appears in the sight glass and allow a few minutes for the level to stabilize.
4. Once level has stabilized, add or drain as necessary to adjust the level.
5. It may be necessary to add oil during initial operation as oil should be maintained at mid point of the sight glass during operation. See oil level tag.
6. Be sure fill caps are secured in place once proper oil level is obtained.

LUBRICATION SERVICE

Add fresh oil as required to maintain proper level. If premium grade mineral oil is used, the oil should be drained, the gearbox flushed and the oil replaced every 1500 hours or more frequently if inspection so indicates. The oil drain plug is located at (C) (FIGURE 7).

With AEON PD synthetic pump lubricant, perform the above oil–change maintenance after 4500 to 7500 hours.

⚠ WARNING

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

Order AEON PD from your Sutorbilt Distributor or call Sutorbilt direct at 800-245-4946.

AEON PD	1 Quart Bottle	Part No. 28G23
AEON PD	12 Quart Case	Part No. 28G24
AEON PD	5 Gal. Pail	Part No. 28G25
AEON PD	55 Gal. Drum	Part No. 28G28

Pump Discharge Temperature *		Factory Tested Recommended and Approved Lubricant
° F	° C	AEON PD
32°	0°	Synthetic Pump Lubricant
100°	38°	One Superior Lubricant
275°	135°	For
350°	177°	All Operating Temperatures

* OPERATION BELOW 32° F. REQUIRES A SUMP HEATER.

FIGURE 8 – TEMPERATURE CHART

GEAR AND DRIVE END LUBRICATION

AEON PD is formulated especially for positive displacement pump service to provide maximum protection at any temperature. One filling of AEON PD will last a minimum of 4 times longer than a premium mineral oil. Refer to FIGURE 8.

If not using AEON PD synthetic pump lubricant, use oils with rust and oxidation inhibitors, anti–foam additives and the viscosities listed in FIGURE 9, page 11.

AIR FILTERS, START–UP SCREENS AND TEST COUPON

⚠ WARNING

If used on Wet Vacuum, servicing the air filters is one of the most important maintenance operations to be performed to insure long pump life.

1. Filters in the system should be checked and replaced periodically.
2. Start–up screens are recommended to be installed at the inlet side of the pump.
3. Test coupon is recommended downstream of the last pump to monitor any corrosion or scaling in the system.

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 pump for dirt.

SYSTEM CHECK

Insure that the piping and air system are clean and free of debris or obstruction. Inlet and discharge air valves should be open during start.

Follow necessary safety precautions to make certain that the system is ready for operation. Check operation of safety devices to see that they are adjusted and functioning properly.

ROTATION

Operate driver before connecting to the vacuum pump to be sure the direction of rotation is correct.

Turn the shaft manually at least one or two full turns to make certain rotors are clear and that no internal binding occurs.

Pump Discharge Temperature	Oil Grade ISO	Oil Viscosity SUS @ 100° F
32° to 100° F (0° to 38° C)	100	465
100° to 225° F (38° to 105° C)	150	700
225° to 300° F (105° to 149° C)	220	1000
Over 300° F (149° C)	*	*

* The oil viscosity must be 70 SUS minimum at discharge temperature minus 50° F.

FIGURE 9 – LUBRICATION RECOMMENDATION

SECTION 4
WATER SPECIFICATION – WATER–INJECTED PUMP

The quality of the seal water injected into the pump should meet the requirements shown in FIGURE 10, below.

The purpose of the seal water is to seal around and provide cooling to the impeller. During normal operation, the cooling takes place by an evaporative process. With specified water flowrates, the impellers do not evaporate to dryness except at shut down, which does not cause a problem unless frequent shut downs are required. The major concerns about the water quality are corrosion and/or deposits of foreign material to the internal wetted parts. Foreign deposits experienced have been calcium from the water and phosphate from injected corrosion inhibitors. It is recommended that a removable test coupon be inserted downstream of the last blower to monitor corrosion and foreign material deposits.

If the proposed water supply is questionable, or does not meet the above water specification, a reputable water treatment service company should be contacted. They can recommend treatment and equipment to satisfy this specification.

pH Range at 25° C	6.5 – 8.0
Conductivity at 25° C (MICROMHO/cm	Less than 250
Total hardness as $CaCO_3$ (ppm)	Less than 100
Total Alkalinity as $CaCO_3$ (ppm)	Less than 70
Chloride ion; Cl^- (ppm)	Less than 30
Sulfate ion SO_4^{-2} (ppm)	Less than 50
Total iron; Fe (ppm)	Less than 0.3
Silica; SiO_2 (ppm)	Less than 20
Sulfide ion S^{-2} (ppm)	0
Ammonium ion; NH_4^+ (ppm)	0

FIGURE 10 – WATER QUALITY REQUIREMENTS

Gear Diameter (in)	Single Stage Unit		
	Nominal (gpm)	Maximum (gpm)	Minimum (gpm)
10	5	10	3.75
12	6	12	4.5
14	7	14	5.25
16	8	16	6
18	9	18	6.75
20	10	20	7.5
22	11	22	8.25

Gear Diameter (in)	Multiple Stage Unit (See Note 2)								
	1st Stage Unit			2nd Stage Unit			3rd Stage Unit		
	Nominal (gpm)	Maximum (gpm)	Minimum (gpm)	Nominal (gpm)	Maximum (gpm)	Minimum (gpm)	Nominal (gpm)	Maximum (gpm)	Minimum (gpm)
10	4	6	3	2	3	1.5	2	3	1.5
12	4	6	3	2	3	1.5	2	3	1.5
14	5	7.5	3.75	3	4.5	2.25	3	4.5	2.25
16	6	9	4.5	3	4.5	2.25	3	4.5	2.25
18	6	9	4.5	3	4.5	2.25	3	4.5	2.25
20	7	10.5	5.25	4	6	3	4	6	3
22	8	12	6	4	6	3	4	6	3

NOTES:
1. The Nominal is the recommended water flowrate.
2. This table only applies when all stages are the same gear diameter; for different gear diameters Consult Quincy Engineering.

FIGURE 11 – WATER FLOW RATE FOR SUTORBILT WET VACUUM PUMPS

SECTION 5
OPERATION

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

It is desirable that all starts be made with essentially atmospheric inlet pressure and then apply the load gradually. If the connected system is already under vacuum, then a valve should be provided, branching to atmosphere from the line between the pump and inlet check valve. This valve should be open to start, then closed gradually after full speed is attained. This avoids imposing a starting torque load on the motor, higher than its capabilities.

These pumps are designed to operate only with a water seal. The water flow rate for each gear size is given in FIGURE 11, page 13, and this flow should be established by manual adjustment of the globe valve ahead of the indicating flow meter. The seal water should be started after full speed has been attained and prior to applying the load.

After the seal water supply globe valve has been adjusted to allow the proper flow rate, it is recommended that the hand wheel be either locked in position, or removed from the valve. When the vacuum pump is running, the water supply solenoid valve will open wide and allow water flow at the rate controlled by the globe valve setting. When the pump is stopped, the water supply solenoid will shut off the water completely. When the vacuum pump is running, the cylinder drain solenoid or solenoids will close to prevent seal water from draining out of the cylinder. When the pump is stopped, the cylinder solenoid will open to prevent water from accumulating in the case.

The quality of the seal water should be such that the buildup of scale does not progress rapidly enough to affect the vacuum pump operation. For water specifications, see Section 4, page 12.

For best control of seal water quality, remove contaminated water that might be entrained with the air from some processes, such as vacuum filtering certain corrosive products.

These vacuum pumps are rated at speeds for efficient handling of air when supplied with the proper quantity of seal water. Excessive water flow through the unit requires extra power, and may overload the driver. If the process served by the vacuum pump contributes a greater quantity of water than required for sealing, even though its quality is acceptable, the water should be separated and removed with a liquid extraction pump. In some installations a barometric leg is feasible.

To guard against overheating from loss of injection water or other reasons, high air temperature switches should be installed in the discharge air stream. Normal switch settings are as follows:

1st Stage	140° F
2nd Stage	160° F
Single Stage	160° F

Each size pump has limits on vacuum, running speed and discharge temperature which must not be exceeded. For information regarding limitations, refer to “Maximum Operating Limitations,” FIGURE 12, page 16.

⚠ WARNING

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

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

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

NOTICE

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

In some instances, vacuum may be relieved at a lower level than the pump maximum in order to protect the motor and/or the system components.

LIMITATIONS

For information regarding limitations, refer to “Maximum Operating Limitations,” FIGURE 12, page 16.

⚠ WARNING

Do not operate equipment without adequate silencing devices installed since high noise level may cause hearing damage. (Reference OSHA standards.)

After the unit has been started, the load should be applied gradually. A bleed valve for unloaded starting is recommended.

The first few minutes of operation are the most critical, in so far as potential problems are concerned, so all equipment should be observed closely for excessive heat, noise or vibration during this period. Speeds, pressures, temperatures, vacuums and other operating conditions should be checked to insure that specified limits are not exceeded. See FIGURE 12, page 16.

ROUTINE OPERATION

Since the unit is a positive displacement type, the volume flow is fixed for constant speed. The vacuum level may be controlled by a vacuum breaker valve on the inlet which will allow atmospheric air to enter the pump inlet. Volume flow is essentially proportional to the speed and this offers a method of flow adjustment with V–belt driven machines.

Although these units are extremely rugged and are designed with adequate factors of safety, it is possible to cause serious damage by exceeding the manufacturer’s limits.

Periodically the gauges, instruments, and safety devices used to monitor the pump should be checked for calibration and functioning.

NOTICE

Full rated pressure is full pressure differential from the inlet flange to the discharge flange.

SHUT DOWN

The pump should be unloaded before shut down. Consideration should be given to possible backflow and reverse rotation of the equipment as a result of pressure on the discharge side of the unit. A check valve is recommended on the inlet.

⚠ CAUTION

Precaution should be taken to insure that the unit cannot be started accidentally and cause injury to personnel or damage to equipment.

If the unit is to be shut down for extended periods of time, it is recommended that steps be taken to prevent rust forming inside the casing. Condensation, gas vapors, or seal water can close up internal clearances and cause the unit to bind.

1. By–pass the intake to atmospheric pressure or no more than 8” HG. vacuum.

2. Shut off seal water and run the unit for approximately five minutes or until the internal surfaces are completely dry. Open cylinder solenoid drains and keep open until next start–up.

Care must be taken to insure adequate seal water flow when operation is resumed.

MAXIMUM OPERATING LIMITATIONS – 8000 WET VACUUM PUMP

Size	MAX. RPM	VACUUM IN.HG	VACUUM mm HG	DISCHARGE TEMP. ° F.	Size	MAX. RPM	VACUUM IN.HG	VACUUM mm HG	DISCHARGE TEMP. ° F.
1008	1800	24	610		1818	1000	24	610	
1011	1800	24	610		1821	1000	24	610	
1013	1800	24	610		1824	1000	24	610	
1016	1800	24	610		1830	1000	24	610	
1018	1800	24	610	160	1833	1000	24	610	160
1021	1800	24	610		1836	1000	24	610	
1024	1800	21.2	539		1842	1000	21.8	554	
1030	1800	17	431		1845	1000	20.4	517	
					1848	1000	19.1	485	
					1854	1000	17	431	
1213	1500	24	610		2020	900	24	610	
1216	1500	24	610		2024	900	24	610	
1218	1500	24	610		2031	900	24	610	
1220	1500	24	610		2034	900	24	610	
1223	1500	24	610	160	2037	900	24	610	160
1226	1500	23.5	597		2040	900	24	610	
1230	1500	20.4	517		2048	900	21.2	539	
1236	1500	17	431		2055	900	18.5	470	
					2060	900	17	431	
					2080	900	12.7	323	
1415	1285	24	610		2224	800	24	610	
1419	1285	24	610		2231	800	24	610	
1421	1285	24	610		2236	800	24	610	
1423	1285	24	610		2242	800	24	610	
1426	1285	24	610	160	2248	800	23.3	593	160
1431	1285	23	584		2254	800	20.7	527	
1437	1285	19.3	489		2260	800	18.7	474	
1442	1285	17	431		2266	800	17	431	
					2280	800	14	356	
					2288	800	12.7	323	
1617	1125	24	610						
1623	1125	24	610						
1626	1125	24	610						
1630	1125	24	610	160					
1636	1125	22.6	575						
1640	1125	20.4	517						
1643	1125	18.9	481						
1648	1125	17.0	431						

DO NOT EXCEED THESE LIMITS

⚠ CAUTION

The maximum speed at which an 8000 series unit can be safely operated varies as listed on the above chart. Be certain of the size and series before applying these maximum speeds.

NOTICE

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

FIGURE 12 – MAXIMUM OPERATING LIMITATIONS

PUMP STARTUP CHECKLIST

This startup procedure should be followed during the initial installation and after any shutdown periods or after the pump has been worked on or moved to a 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 case 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 pump is V–belt driven, check the belt tension and alignment. Over-tensioned belts create heavy bearing loads which leads 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 overemphasized. Too little oil will ruin bearings and gears. Too much oil will cause overheating and can ruin gears and cause other damage.

☐ 6. With motor locked out, 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 rotation and to be certain it turns freely and smoothly.

☐ 8. The internal surfaces of all Sutorbilt 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 start–up.

☐ 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 impellers can cause serious damage if the unit is operated without correction.

SAFETY PRECAUTIONS

1. Do not operate pump with open inlet or outlet port.
2. Do not exceed specified vacuum.
3. Do not operate above or below recommended pump speed range.
4. Pump 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 manufacturers' rim speed limit.

6. The pump and pump 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 CAUSES	SOLUTION
Knocking	1. Unit out of time.	1. Retime impellers.
	2. Distortion due to improper mounting or pipe strains.	2. Check mounting alignment and relieve pipe strains.
	3. Excessive vacuum differential.	3. Reduce to manufacturer's max. recommended vacuum. Examine relief valve, re-set if necessary.
	4. Worn gears.	4. Replace timing gears.
	5. Worn bearings.	5. Replace bearings.
	6. Worn bearing cartridges.	6. Replace cartridges.
Excessive pump temperature.	1. Too much oil in gear case or drive cover.	1. Reduce oil level.
	2. Too low operating speed.	2. Increase pump speed.
	3. Clogged filter or muffler.	3. Remove cause of obstruction.
	4. Excessive vacuum differential.	4. Reduce vacuum differential across the pump.
	5. Worn impeller clearances.	5. Replace impellers.
	6. Internal contact.	6. Correct clearances.
	7. Insufficient seal water.	7. Increase water rate.
Impeller end or tip drag.	1. Insufficient assembled clearances.	1. Correct clearances.
	2. Case or frame distortion.	2. Check mounting and pipe strain.
	3. Excessive operating vacuum.	3. Remove cause.
	4. Excessive operating temperature.	4. Remove cause.
	5. Scale Build–up.	5. Remove and treat injection water.

TROUBLE SHOOTING (Continued)

PROBLEM	POSSIBLE CAUSES	SOLUTION
Lack of volume.	1. Slipping belts.	1 Tighten belts.
	2. Worn clearances.	2. Re-establish proper clearances.
Excessive bearing or gear wear.	1. Improper lubrication.	1. Correct lubrication level. Replace dirty and/or improper oil.
Loss of oil.	1. Headplate, gear case or drive cover vents plugged.	1. Clean vents.
	2. Worn seal.	2. Replace seals.
Lack of oil pressure.	1. Dirty suction screen.	1. Clean suction screen.
	2. Leak in suction line.	2. Repair leak.
	3. Lubrication pump losing its prime.	3. Reprime, by removing pipe plug and priming.

GEAR INSPECTION

Inspection of the timing gears may be accomplished by removing the gear case. Refer to FIGURE 13. Prior to removing the gear case the oil should be drained from the gear case sump. On units with force feed lubrication, remove the oil pump adaptor plate with the oil pump attached using the tapped jacking holes in the plate. After removing gear case flange bolts, the gear case may be removed. Be sure to support the gear case adequately while removing. Timing gears and gear end bearings are now exposed.

On completion of maintenance work, be certain that the oil pump and/or the gear case is returned to the original position. Use a gasket eliminator type sealant on the mating surfaces. Always relubricate before starting.

IMPELLER INSPECTION

Series 8000 impellers can be inspected through the intake and discharge ports. This will reveal such conditions as out of time, excessive or insufficient clearances, abrasion of parts from passing foreign material, etc.

REPAIR

Assembly

⚠ WARNING

When rotation of the impellers is required in the assembly process, insure that all personnel are clear of lobes and gears to guard against serious injury.

TIMING

The impellers of the unit are separated by pre–determined minute clearances built into the machine. The timing of a unit is the setting of one impeller with respect to the other so they do not touch or knock during normal operation. The impellers are held 'in time' by timing gears which are bolted to a timing hub, which in turn is secured to the serrated impeller shaft by a lock washer and locknut. Retiming is necessary to restore proper impeller clearances after a unit has been jammed and the removal of the strain or foreign material does not stop the knocking or pounding during operation.

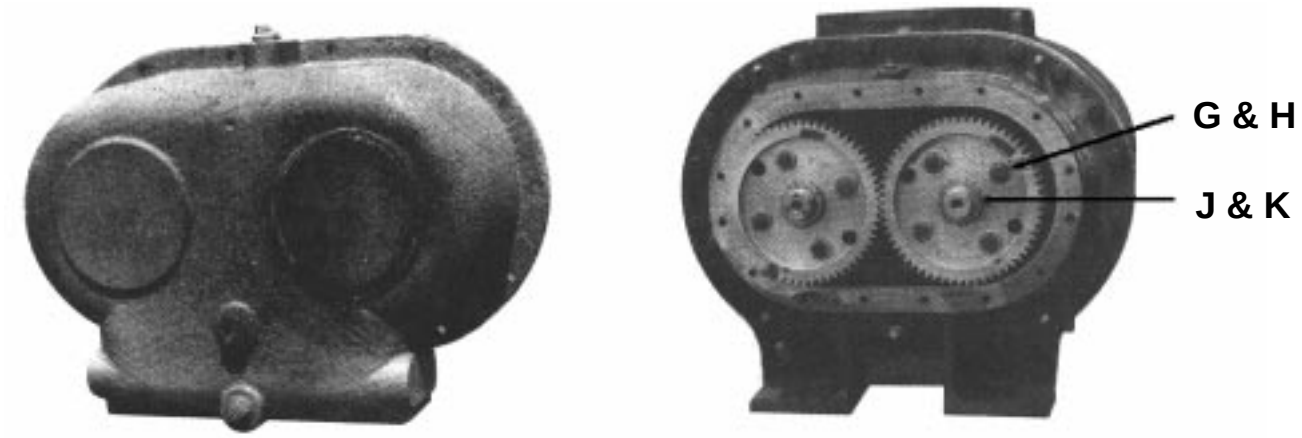


FIGURE 13 – LOCATION OF TIMING GEAR BOLTS

Gear End Clearance		
Gear Dia. In.	Min.	
	In.	CM
1008	.004	.010
1011	.005	.013
1013	.005	.013
1016 to 1030	.006	.015
12	.006	.015
14	.006	.015
16	.006	.015
18	.008	.020
20	.008	.020
22	.008	.020

FIGURE 14 – GEAR END CLEARANCE

Torque Requirements Timing Gear Cap Screws		
Gear Dia.	Ft. Lbs. Torque	Nm Torque
10	70 – 100	95 – 136
12	160 – 225	217 – 305
14	210 – 350	285 – 475
16	250 – 350	339 – 475
18	250 – 350	339 – 475
20	400 – 500	542 – 678
22	400 – 600	542 – 813

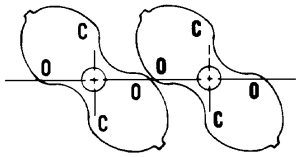
FIGURE 15 – TORQUE REQUIREMENTS – TIMING GEAR CAP SCREWS

Determining Proper Impeller Clearances (FIGURE 16) – The clearances between impellers are measured at points 0–0 and c–c when the impellers are in the positions shown. Note that the impellers are shown viewed from the drive end of the pump; always face the drive shaft end when determining clearance. Select the illustration from the sketches which is applicable to your unit.

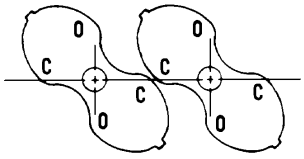
If the drive shaft is on the right side of centerline, it is a 'right hand' unit; if it is on the left, it is a 'left hand' unit. For vertical units: if the drive shaft is on the bottom side of the center line, it is a 'bottom hand' unit. Check above the drive shaft for a rotational arrow. If the arrow appears, the unit is timed for rotation only in that direction.

To determine total clearance, place the impellers in the 0–0 position. Measure the distance between 0–0 with a feeler gauge. Rotate the impellers 90° to position c–c and repeat the measurement between c–c. Add these figures together for total clearance.

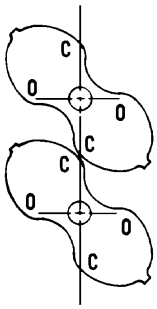
To determine correct clearances for a unit originally timed for rotation in one direction only, return the impellers to position 0–0. Divide the total clearance figure into three parts. Two parts (2/3) will be the clearance setting between points 0–0 and the remaining part (1/3) will be set between points c–c.



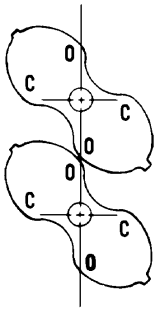
Right Hand – Top Discharge
Left Hand — Bottom Discharge



Right Hand – Bottom Discharge
Left Hand — Top Discharge



Bottom Hand – Right Discharge
Top Hand — Left Discharge



Bottom Hand – Left Discharge
Top Hand — Right Discharge

FIGURE 16 – IMPELLER LOBE CLEARANCES

RESETTING IMPELLER CLEARANCE

Impellers are held in time by gears which are bolted to a timing hub, which in turn is secured to the serrated impeller shaft by a locknut. The timing gear can be rotated in relation to the hub by loosening the cap screws. Because the cap screw holes in the gear are oversized, the gear will rotate – within limits – when the screws are loosened.

Refer to FIGURE 13, page 20, for the following instructions.

1. Remove the gear case.

2. To retime, remove the cap screws (G) and washers (H), loosen the locknut (J) and the lock washer (K) in one gear only.

3. Wedge the two impellers together against the exact amount of shim stock required to establish proper clearances as calculated in "Determining Proper Impeller Clearances," page 21.

4. Secure the gear in the new position with cap screws and washers (always reverse washers (H) when replacing) but do not tighten.

5. Rotate impellers by hand.

6. Recheck clearances. If proper timing has been re–established, tighten cap screws with a torque wrench. Refer to FIGURE 17 for correct torque values.

7. Tighten lock washer and locknut.

8. Obtain a piece of pipe of sufficient diameter to fit over the locknut and rest against the gear. Shock load the gear by striking the pipe with a sledge hammer, the retighten locknut. Repeat this procedure several times until all gear end components are drawn together and locknut is tight.

9. Check the end clearance before and after any work has been performed.

End Clearance – To check the gear end clearance, the locknut (J) (FIGURE 13, page 20) must be tight.

1. Remove two diametrically opposed timing bolts (G) and replace with long jack screws.

Torque Requirements Gear End Shaft Assembly		
Pump Size	**Ft. Lbs. Torque**	**Nm Torque**
10	30	41
12	50	68
14	50	68
16	115	155
18	115	155
20	225	304
22	330	446

FIGURE 17 – TORQUE REQUIREMENTS – GEAR END SHAFT ASSEMBLY

2. Tighten these against the bearing cartridge only enough to remove the axial play from the bearing.

3. Check the clearance inside the machine between the end of the impeller and the gear headplate. If the end clearance is less than that shown in the accompanying table, loosen the bearing cartridge (see "Bearing and Seal Replacement," page 25) and delete shims as required. Increase shims to reduce the clearance.

4. After completion of the work, replace the gear case and relubricate.

NOTICE

Follow Pump Startup Checklist on page 17 after every shutdown.

Shaft Replacement – One piece 4140 forged steel shafts are pressed through the impellers and bolted to them at the gear end. This advanced shaft design allows the diameter to be increased in the critical area between the impeller and gears without decreasing impeller strength with an enlarged bore, and avoids the use of the drive impeller to transmit power. By using a larger shaft at the gear end, torsional deflection of the shafts between timing gears and impellers is greatly reduced; therefore, increased pressure and horsepower ratings can be allowed with safety. The shafts can be removed from the impellers without removing the headplates from the case. One piece shafts permit normal working loads for V–belt drives without the addition of outboard bearings.

In rare instances, shaft replacement might be necessary. Although removal is somewhat involved, it is fairly simple if the following procedure is adhered to.

1. Remove any obstructing oil lines from both ends of the unit.

2. Remove the gear case (see “Gear Inspection,” page 20.

3. Check the fixed end impeller clearance. This clearance should be duplicated when repairs are completed.

4. Remove timing gears and hubs per instructions on page 24.

5. The impellers will now rotate freely in the case. Position both impellers so that one–half of the tip of the impellers can be seen when looking inside the unit from either the intake or discharge openings. Wedge a shim between the tips and the case on both the top and bottom of each impeller, locking them both in this position.

6. Unbolt and remove the cover on the drive end of the unit.

7. Unbolt and remove the bearing cartridges from both ends of the shaft being replaced as described in “Bearing and Seal Replacement,” page 25.

8. Remove the socket head cap screws on the gear end of the shaft.

9. The shaft can now be removed by driving it from the drive side of the unit with a hydraulic press.

10. Before installing a new shaft, remove all burrs and coat the new shaft with anti–seize compound. Slide the shaft in from the gear or fixed end toward the drive end.

11. Rebolt the shaft, using new cap screws, to the impellers and tighten with a torque wrench. See FIGURE 17, page 22, for torque values.

12. Replace bearing cartridge per instructions on page in “Bearing and Seal Replacement,” page 25.

13. Remove the shims that are locking the impellers inside the case.

14. Set the impellers in the timing position, making certain that the tip and throat match marks correspond. See “Determining Impeller Clearances,” page 21, and replace timing gears and hubs as outlined on page 24.

15. Retime the pump according to instructions on page 22.

16. Remove the seal from the seal retainer mounted on the drive cover.

17. Replace the cover on the drive end.

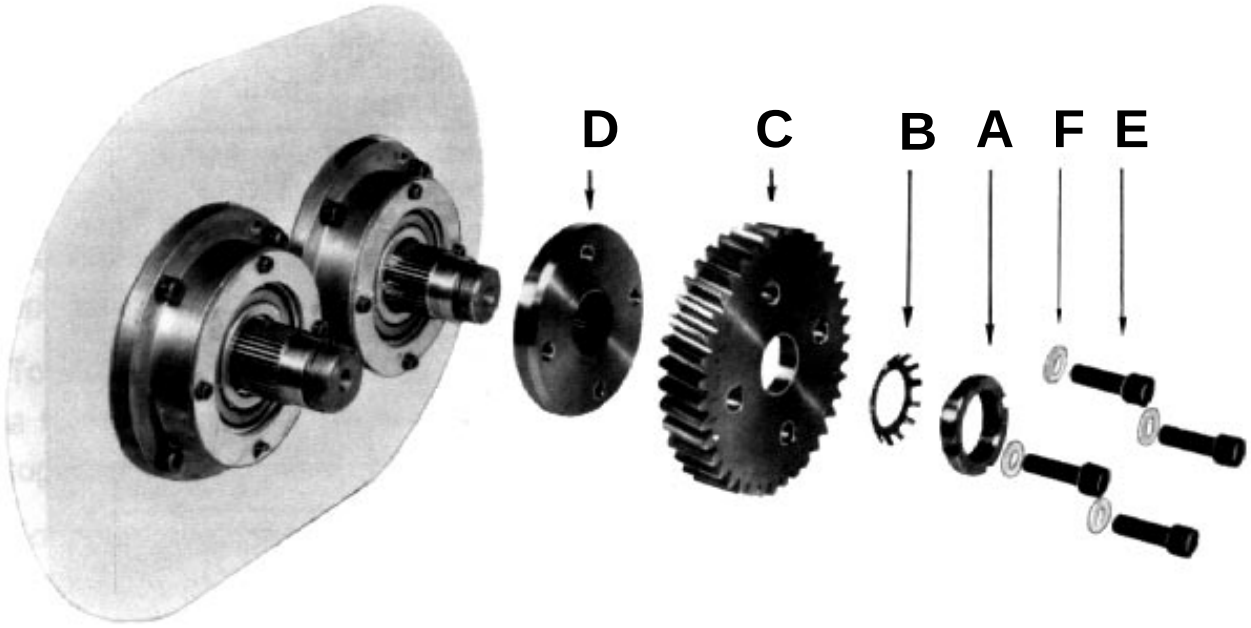
18. Install a new oil seal in the retainer that mounts to the drive cover. Carefully center the seal on the shaft.

19. Replace the gear case and any oil lines.

20. Relubricate and follow “Pump Startup Checklist,” page 17.

NOTICE

Follow Pump Startup Checklist on page 17 after every shutdown.



With proper maintenance and lubrication, normal life of bearings, gears and seals can be expected. To maintain the efficiency of your unit, however, these parts must be repaired or replaced when required.

Timing Gear and Hub Removal – Refer to FIGURE 18.

1. Remove the gear case (Gear Inspection, page 20).

2. Remove the cap screws (E), washers (F), lock nuts (A), and lock washers (B) from both shafts.

3. Match mark the shafts, gears and hubs to assure proper repositioning on completion of the work.

4. Remove gears (C) from hubs (D) and hubs from shafts. A gear puller may facilitate removal. Always match mark hubs in relation to shafts.

To reassemble:

1. Replace the hubs. When installing hubs, apply anti–seize compound on the splines. Do not use force to install hub. In most cases it will be necessary to heat the hub to about 175° to 200° F.

⚠ CAUTION

Take care that the hubs are assembled to their original position on the shafts.

2. Replace gears.
3. Replace cap screws, washers (always turn washers over when replacing), locknuts, and lock washers to each shaft.
4. Establish a position for one gear, tighten the cap screws and locknut on that gear only. Then proceed with retiming according to instructions outlined in “Resetting Impeller Clearances,” page 21.
5. Tighten the lock washers and nuts and use a torque wrench to tighten cap screws on the timing hub. Refer to FIGURE 17, page 22, for torque requirements.

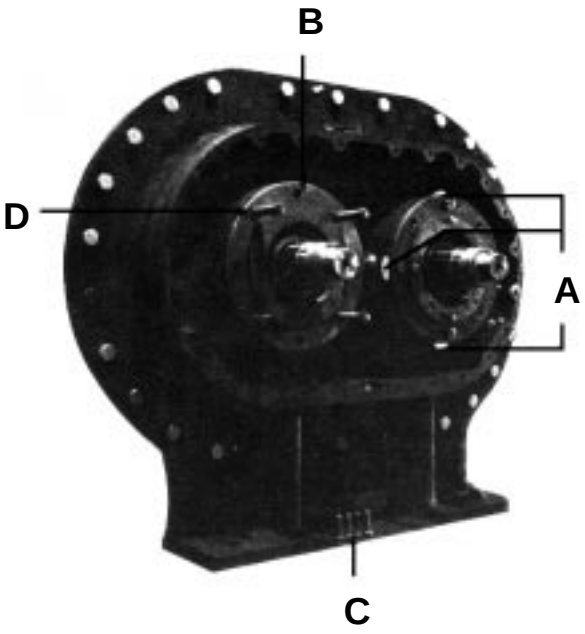


FIGURE 19 – BEARING CARTRIDGE REMOVAL

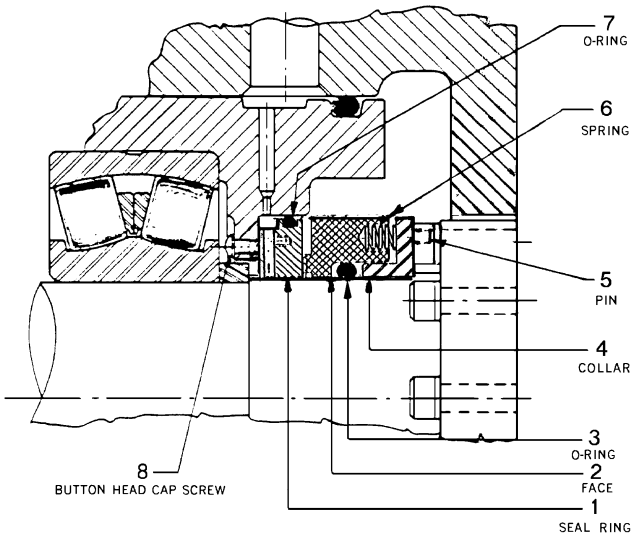


FIGURE 20 – MECHANICAL SEAL INSTALLATION

6. Check the gear end clearance.

7. Replace the gear case.

NOTICE

Follow Pump Startup Checklist on page 17 after every shutdown.

BEARING AND SEAL REPLACEMENT

Gear End

1. Remove the gear case. Refer to “Gear Inspection,” page 20.

2. Check the fixed gear end impeller clearance. This clearance must be duplicated when repairs are completed.

3. Remove the locknuts and washers from the ends of both shafts and match–mark the shafts, gears, hubs and bearing cartridges to assure repositioning during reassembly.

4. Remove gears and hubs using the procedure outlined in “Timing Gear and Hub Removal,” page 24.

Refer to FIGURE 19. Shim spacers (A) added during production will now be exposed behind the bearing cartridge (B) on the gear end of the unit. The spacers were installed to assure accurate positioning of the impellers between the headplates; hence, it is important that they be returned to their exact positions on reassembly.

NOTICE

The number of spacers fastened behind each bearing cartridge varies. It is essential that each set of spacers be identified with its respective position during withdrawal.

To remove spacers:

1. Loosen, but do not remove, the bearing cartridge attachment bolts (C) (FIGURE 19).

2. Insert the jack screws (D) and back out the bearing cartridge until the shim spacers are loose.

3. Remove one bolt at at time, taking out the shims and marking them for accurate repositioning.

4. On removal of all bolts, continue using the jack screws to complete the bearing and cartridge removal.

5. Remove the bearing retaining ring from the face of the cartridge.

A lip type oil seal or mechanical seal is located behind each bearing on a blower, and a mechanical seal on a pump.

Lip Type Oil Seal – Whenever a cartridge is removed for repair purposes, always install a new seal before re–assembly. This can best be accomplished by using a driving instrument having the same approximate O.D. as the seal; use caution not to damage the new seal during installation. Always install the seal with the lip facing the bearing. Extreme care must be taken to avoid damaging the sealing elements when they are moved over the shafts.

Mechanical Seal (FIGURE 20, page 25) – Whenever a mechanical seal must be replaced, the following procedure should be followed.

1. Remove the old seal components.

2. Clean the shaft thoroughly, especially where the face (item 2) is located.

3. Coat the shaft with light oil.

4. It is necessary to use a tapered assembly tool when installing seal assembly, consisting of items 2 through 6. Be sure that the spring holder (item 4) is pushed against the cap screws.

5. When installing the seat (item 1) and “O”–ring (item 7) in the bearing cartridge, it is also necessary to use a tapered assembly tool to prevent the “O”–ring from being damaged. Secure the seal ring (item 1) with three button head cap screws (item 8).

6. Tightened cap screws snugly.

⚠ WARNING

Do not overtighten capscrews. Overtightening will pull seal ring out of flatness.

On completion of repair or replacement work, replace the “O”–ring on the bearing cartridge. Return the bearing cartridges to their respective shafts and restore the shim spacers to their original positions.

Bearing backup rings are factory installed against a shaft shoulder behind each gear and bearing. If these were removed during bearing cartridge disassembly, reinstall making certain that the 45° Chamfer faces the shaft shoulder.

Return bearings and secure in position. On force feed lubricated units the bearing retainer ring must be installed so that the lubrication notch is at the top and aligned with the oil passage in the bearing cartridge. Replace the gears and hubs using the procedure outlined in “Timing Gear and Hub Removal,” page 24. Check the fixed end clearances. If necessary, add or delete shims behind the bearing cartridge flange as needed to restore original fixed gear end clearance.

Drive End – Remove the drive cover. A drive seal is located in the seal retainer on the drive cover. Always replace the drive seal when the drive cover is removed. Extreme care must be taken to avoid damaging the drive seal when moving it over the shaft keyway. Wrap a piece of light shim stock around the shaft to prevent keyway from cutting the seal element.

To replace the drive end bearings and seals follow the procedure as described for the gear end, page 25.

Gardner Denver

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WARRANTY

SUTORBILT BLOWERS
4500 SERIES
8000 SERIES

GENERAL PROVISIONS AND LIMITATIONS

Gardner Denver (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.

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 12 months from date of initial use or 18 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.

OTHER COMPONENTS

All other components are warranted for 12 months from date of initial use or 18 months from date of shipment to first purchaser, whichever comes first.

The Company reserves the right to withdraw the Warranty where evidence indicates application outside the stated performance area, or where there is evidence of abuse

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 by this warranty.

All costs of transportation of product, labor or parts claimed not to be as warranted and, of repaired or replacement parts to or from such service facilities shall be borne by the Purchaser. The Company may require the return of any 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.

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.

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

For additional information contact your local representative or
Gardner Denver Machinery Inc., Customer Service Department,
1800 Gardner Expressway, Quincy, Illinois 62301
Telephone: (800) 682-9868 FAX: (217) 224-7814

Sales and Service in all major cities.

For parts information, contact Gardner Denver,
Master Distribution Center, Memphis, TN
Telephone: (800) 245-4946 FAX: (901) 542-6159

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