

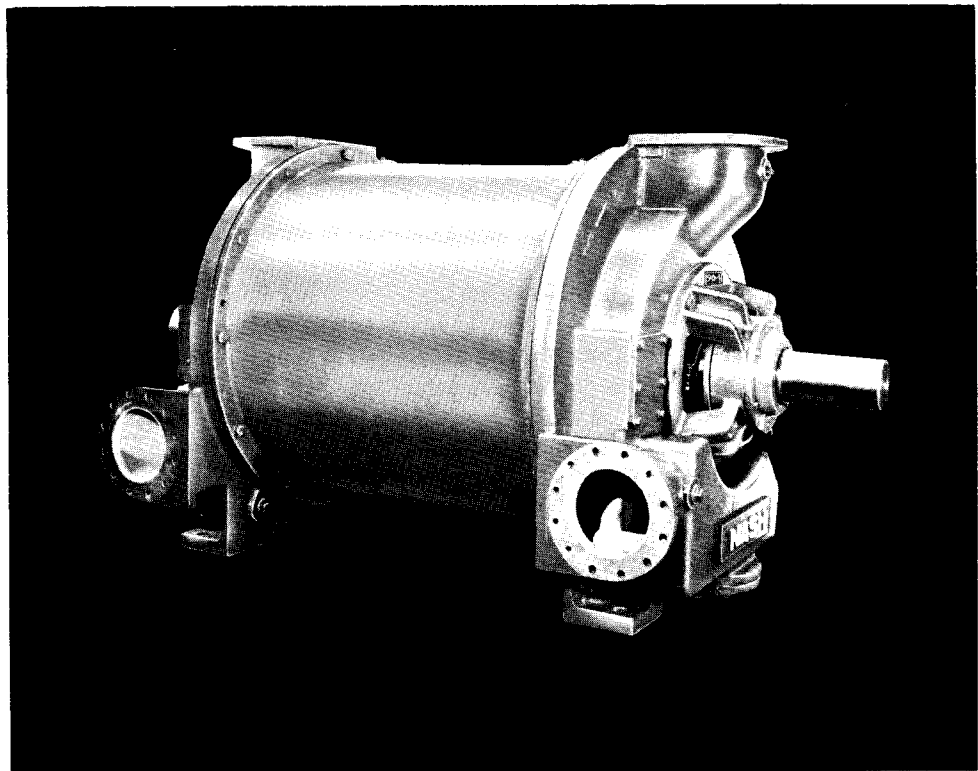
BULLETIN NO. 705-D

OPERATION

AND

MAINTENANCE

**NASH® 904® VACUUM PUMPS
AND COMPRESSORS
MODELS L, M, P, R, S, T, U**



NASH® U.S.

A Division of
THE NASH ENGINEERING COMPANY
TRUMBULL, CT 06611-1330

The Performance Meets The Promise®

WARNING

Do not operate until pump is initially primed and connected to constant supply of clean compressant liquid. **IF RUN DRY, PUMP WILL BE DAMAGED.** Always use strainer to prevent sand and scale from entering the pump with liquid.

Certain operating conditions in combination with water hardness may result in excessive lime deposits within the pump, causing it to bind. Should this condition be evident, flush pump with a solvent at regular intervals.

This pump has been drained and flushed with a water-soluble preservative oil prior to shipment. After pump has been in service, do not store without draining as specified within this Bulletin. Pump can be damaged by freezing.

USE CAUTION when removing inlet screens. Any foreign material on screen may fall into pump and cause extensive damage at start-up.

Base must be mounted to a leveled foundation and final coupling alignment done during installation. (Refer to Bulletin No. 642, Installation Instructions, Nash Vacuum Pumps and Compressors.)

NOTICE

SERVICE AND PARTS

SERVICE AND PARTS FOR NASH PUMPS ARE ASSURED THROUGH A WORLDWIDE NETWORK OF SALES AND SERVICE OFFICES LISTED ON THE BACK COVER OF THIS BULLETIN. ANY REQUEST FOR INFORMATION, SERVICE AND PARTS SHOULD BE DIRECTED TO THE NEAREST NASH FIELD OFFICE.

WHEN ORDERING REPLACEMENT AND SPARE PARTS, TEST NUMBERS AND PUMP SIZES MUST BE PROVIDED. Test number and pump size are located on nameplate fastened to body of pump. If nameplate has been destroyed, test number will be found stamped on the body. Parts must be identified by index number and name. Refer to pump exploded view and legend, found within this Bulletin.

If the location of the nearest office is unknown, information may be secured directly from Nash U.S., Trumbull, Connecticut 06611-1330, U.S.A. Telephone number is 203-459-3900, Fax No. 203-459-3988.

WARRANTY

Nash warrants that (i) the goods will be of the kind described on its acceptance of Buyer's order as modified by any subsequent mutual agreement of the parties, (ii) it will convey to Buyer good title to such goods, (iii) such goods will be delivered free of any lawful security interest or lien or encumbrances unknown to Buyer, and (iv) such goods will be of merchantable quality and free from defects in material or workmanship under normal use and prescribed maintenance for a period of two (2) years from the date of shipment. The warranties specified shall also extend to goods manufactured by others and supplied by Nash, unless such goods have been separately stated and quoted by Nash, in which case only the warranties in clauses (i), (ii), and (iii) shall apply. **NASH MAKES NO WARRANTY, EXPRESS OR IMPLIED, AS TO THE MERCHANTABILITY OF GOODS MANUFACTURED BY ITS SUPPLIERS AND SEPARATELY STATED AND QUOTED HEREIN.** Nash's warranty in clause (iv) above shall not apply to goods of standard construction when handling corrosive gases or using corrosive liquid compressants nor will clause (iv) apply to goods which have been damaged, altered or negligently maintained after delivery. Buyer's exclusive remedy for Nash's breach of the warranties set forth in clauses (i), (ii) and (iii) above shall be the replacement by Nash of non-conforming goods with conforming goods, without extra costs to Buyer, F.O.B. point of manufacture, with transportation prepaid to U.S. destination or domestic port, and Buyer's exclusive remedy for Nash's breach of the warranty contained in clause (iv) above shall be the repair by Nash without charge, or the furnishing by Nash, F.O.B. point of manufacture, with transportation prepaid to U.S. destination or domestic port of a part or item of equipment to replace any part or item of equipment which is proved to have been defective; provided that (i) Buyer shall have notified Nash of any such breach not later than 10 days after the expiration of two (2) years from the date of shipment of the goods, and that (ii) Nash shall have the option of requiring the return of any defective material transportation prepaid to establish a claim. Nash shall in no event be liable for Buyer's manufacturing costs, lost profits, goodwill, expenses, or any other consequential or incidental damages resulting from a breach by Nash of any warranty. **THERE ARE NO OTHER WARRANTIES, EXPRESS OR IMPLIED, WHICH EXTEND BEYOND THE WARRANTIES SET FORTH HEREIN.**

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Section 1 DESCRIPTION

1-1 ABOUT THIS BULLETIN

This bulletin contains information for owners and operators of NASH 904® Vacuum Pumps and Compressors, Models L, M, P, R, S, T and U. This information includes a description of how to operate and maintain the units.

Note

1. For installation information, refer to Bulletin No. 642, Installation Instructions, Nash Vacuum Pumps and Compressors.
2. The terms "pump" and "vacuum pump" in this Bulletin apply to both vacuum pumps and compressors unless otherwise noted.

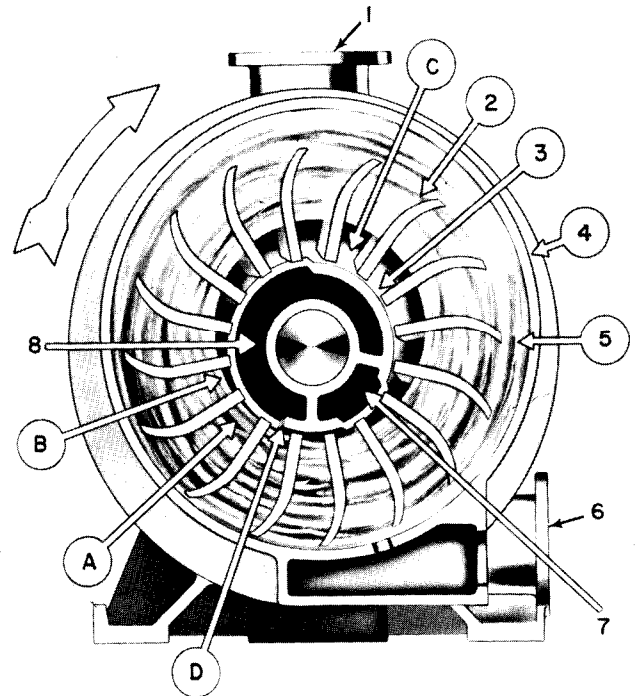
1-2 HOW THE UNIT WORKS

The operation of the pump is shown in Figure 1-1. A rotor (2) revolves without metallic contact in a circular casing (4) that contains a liquid compressant (usually water)(5). The rotor (2) is a casting consisting of a series of blades that project from a hollow cylindrical hub through which the shaft has been pressed. These blades are shrouded at the sides and form a series of chambers. The curvature of these blades is in the direction of rotation indicated by the arrow.

Starting at point A, Figure 1-1, the chambers of the rotor are filled with water. This water rotates with the rotor, but follows the contour of the casing (4). The water (5), which entirely fills the rotor chamber at point A, recedes into the casing as the rotor advances, until at point C, the rotor chamber is empty.

The converging casing forces the water back into the rotor chamber until at point D, the chamber is again full. This cycle occurs once during each revolution of the rotor. As water recedes from the rotor chamber at point B, the water is replaced by air drawn through an inlet port (8) in the stationary conical casing (3) that connects to the pump inlet (1). As the rotor turns through 360 degrees and water is forced by the casing back into the rotor chamber, the air that has filled the chamber is forced through discharge ports (7) in the conical casing (3) to the pump discharge (6).

The water used as the liquid compressant also serves to seal clearances between the rotor and the cone and is referred to as seal water.



- | | |
|------------------------------|----------------------------|
| 1. Pump Inlet | 5. Liquid Compressant |
| 2. Rotor | 6. Pump Discharge |
| 3. Stationary Conical Casing | 7. Internal Discharge Port |
| 4. Circular Casing | 8. Internal Inlet Port |

Figure 1-1. Vacuum Pump and Compressor Operation

Section 2 OPERATION

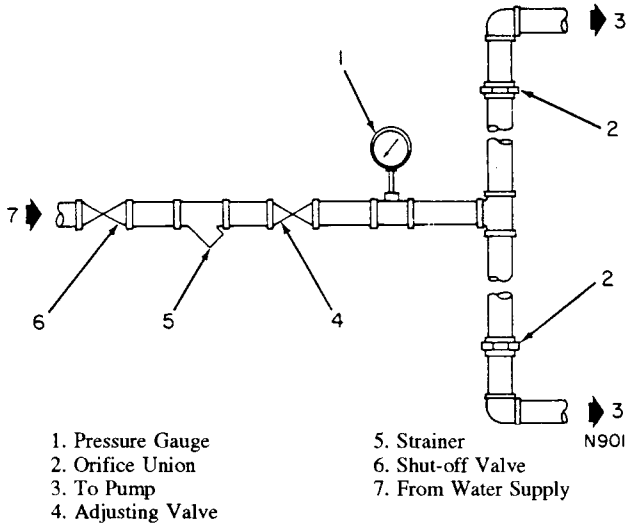
2-1 PREPARATION FOR INITIAL STARTUP

Note

Contact your Nash Representative for startup assistance.

2-2 Liquid Compressant (Seal Water)

Proper operation of the pump requires that liquid compressant (seal water) be provided at the proper pressure and rate of flow. The recommended flow rates are listed in Table 2-1. The flow rate for compressors is approximately 1/4 US GPM per brake horsepower at the minimum supply pressure listed in Table 2-2.



- 1. Pressure Gauge
- 2. Orifice Union
- 3. To Pump
- 4. Adjusting Valve
- 5. Strainer
- 6. Shut-off Valve
- 7. From Water Supply

Pump Model	Orifice Diameter--in.*	Orifice Union--ips
L1	15/32	1-1/2
L2	9/16	1-1/2
L3	5/8	1-1/2
M1	1/2	1-1/2
M2	11/16	1-1/2
M3	23/32	1-1/2
P1	17/32	1-1/2
P2	3/4	1-1/2
P3	25/32	1-1/2
R1	19/32	1-1/2
R2	25/32	1-1/2
R3	27/32	1-1/2
S1	21/32	2
S2	7/8	2
S3	15/16	2
T1	11/16	2
T2	31/32	2
T3	1	2
U1	7/8	3
U2	1-5/16	3

*For recommended seal water flow rates.

Figure 2-1. Typical Seal Water Flow Rate Control Arrangement for Cone Seal Flow Only

Variations in the quantities of seal water flowing to the pump affect the performance of the pump. The quantity supplied should be regulated to produce the best results under individual operating conditions. Regulation can be provided by an orifice union, adjusting valve, and pressure gauge combination as shown in Figure 2-1. A strainer should be connected in the upstream piping.

ORIFICE UNIONS provide a flow rate that is dependent upon pressure differential. Flow is regulated by the control of upstream pressure at 10 psig whether one or two orifice unions are used. The orifice unions listed in Figure 2-1 are recommended for the flow rates specified.

A WATER METER (or flow indicator) can be installed to indicate the actual seal water flow rate to the unit.

Table 2-1. Recommended Seal Water Flow Rates, Vacuum Pumps Only

	Flow Rate - GPM for Vacuum Range	
	0 to 15 in. Hg	15 to 20 in. Hg
L1	24	32
M1	28	38
P1	35	42
R1	45	53
S1	55	65
T1	60	72
U1	84	100
Model	0 to 15 in. Hg	15 to 24.5 in. Hg
L2	36	44
M2	46	62
P2	53	70
R2	60	80
S2	75	100
T2	85	115
U2	118	160
Model	0 to 20 in. Hg	20 to 27.5 in. Hg
L3	30	70
M3	35	85
P3	48	112
R3	50	130
S3	56	150
T3	60	170

2-4 Draining and Flushing

Before starting the pump upon completion of alignment (as specified in Bulletin No. 642, Installation Instructions, Nash Vacuum Pumps and Compressors), remove the drain plugs shown in Figure 2-2 or Figure 2-2A from the floating and fixed bearing end heads, and remove the drain plugs from the body. Open the shut-off valve for the liquid compressant supply. Although the pump is flushed with an inhibiting, water-soluble oil prior to shipment, a light film of rust may form before installation is complete. This film will disappear after the pump has been running for a few minutes. Close the shut-off valve for the liquid compressant supply. Replace the drain plugs using a pipe thread compound. If after draining and flushing, the pump will not be in continuous service for three weeks or more, refer to Paragraph 4-6 for preservation procedures.

Pump Model	Seal Supply Pressure PSIG
L1	30
M1	30
P1	35
R1	35
S1	35
T1	35

Table 2-2. Recommended Seal Supply For Compressors

Compressor Size	†Valve and Line Size*	Start-up Bypass Interval (Minutes)
904 L1	6	3
904 M1	6	3
904 P1	8	3
904 R1	8	3
904 S1	10	3
904 T1	10	3

*Dimensions are in inches with millimeters shown in parentheses.

†Valve sizes below 2 inches (51 mm) are ball valves, 2 inches (51 mm) and above are butterfly valves.

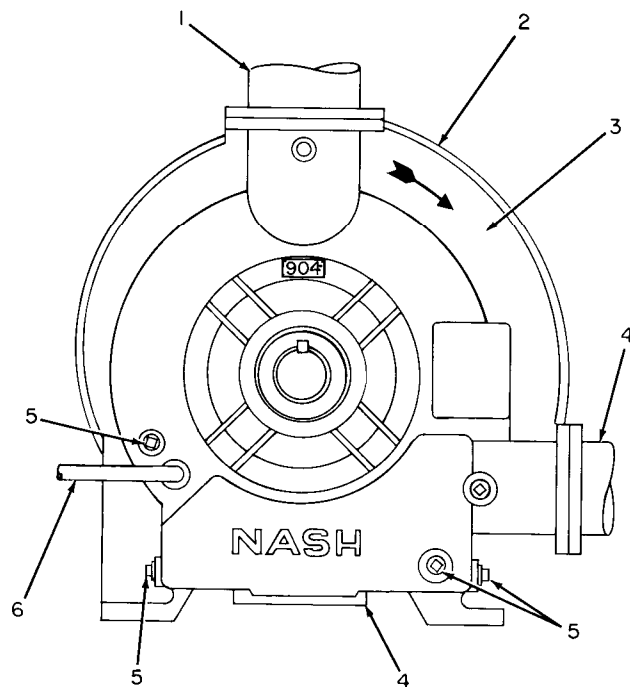
Table 2-3. Startup Bypass Intervals, Compressors Only

CAUTION

DO NOT ENERGIZE THE DRIVER FOR THE PUMP UNTIL THE SEAL WATER SUPPLY HAS BEEN TURNED ON. THE SEAL WATER MUST BE PROVIDED TO THE UNIT BEFORE THE UNIT IS STARTED, EVEN IF THE PUMP IS ONLY BEING OPERATED TO CHECK THE DIRECTION OF DRIVER SHAFT ROTATION OR FOR ANY OTHER TEST PURPOSES.

2-3 Lantern Gland Liquid

Lantern glands are installed in a pump as an optional item upon request by the customer. If the leakage of compressant liquid from the pump shaft packing is to be minimized, the lantern gland connection should be piped to the pump inlet. Lantern glands installed to control air leakage into the pump through the shaft packing, shall be connected to a clean liquid source (usually water). When piping the liquid source to the lantern gland, a strainer, adjusting valve, and a pressure gauge calibrated from 0 to 15 psig are required for the proper control of the pressure to the lantern gland. With the pump operating, adjust the lantern gland pressure to a value of 2.5 to 3.5 psig. *Excessive pressure on lantern glands will cause excessive packing wear and external leakage.*



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Figure 2-2. Typical Piped Vacuum Pump L, M, P, R, S, T & U

2-5 Preliminary Inspection

Perform the following preliminary inspections before starting the pump:

WARNING

PERFORM ALL OF THE FOLLOWING STEPS IN ORDER TO ENSURE PERSONNEL SAFETY AND EQUIPMENT PROTECTION.

- a. Isolate all power sources to the driver unit in order to be certain that no accidental starting occurs.
- b. Inspect the pump and the recirculation pump (if used) to make certain that all drain plugs have been properly installed.
- c. Prime the pump with a liquid compressant.
- d. Inspect the separator, the receiver, and the heat exchanger (if used) to make certain that all shipping plug protectors have been removed and that all shipping plug protectors have been removed and that all open connections have been plugged or piped.
- e. Inspect all piping to make certain that proper connections have been made to the pump and its basic system in accordance with the Nash installation drawing(s) that have been supplied with the pump. Make certain that all piping is the correct size, securely connected, and properly supported.
- f. Inspect all other major operational component (recirculation pump, dryer, turbine, etc.) connections, associated with the pump, to make certain that they are in accordance with the recommendations of their respective equipment manufacturers.
- g. Inspect all pump control components (control valves, flow metering devices, check valves, strainers, gauges, etc.) to make certain that they have been allocated in accordance with the Nash installation drawing(s). Make certain that these components are correctly oriented in the piping scheme in order to achieve the proper direction of flow and functional operation.
- h. Inspect the pump inlet to make certain that the inlet screen and clean-out connections have been properly made and are free of tools, equipment and debris. (Refer to Bulletin No. 642, Installation Instructions, Nash Vacuum Pumps and Compressors.)
- i. Remove the coupling or V-belt guard(s) and rotate the pump shaft by hand in the specified direction of rotation. The specified direction of rotation is indicated by an arrow cast on the pump and is illustrated on the installation drawing. THE PUMP SHAFT MUST ROTATE FREELY. If the pump shaft is bound and cannot be freed by rotating it manually, **contact your Nash Representative** for assistance.

CAUTION

DO NOT ATTEMPT TO FREE A PUMP SHAFT FROM A BINDING OR BOUND CONDITION BY APPLYING POWER TO THE DRIVER. SEVERE DAMAGE MAY RESULT.

CAUTION

NEVER OPERATE THE PUMP WITHOUT ADEQUATE PRIME AND LIQUID SEAL FLOW. HIGH LIQUID SEAL SUPPLY PRESSURES DO NOT NECESSARILY INDICATE THAT THE FLOW IS ADEQUATE. CHECK FOR FLOW FROM VACUUM PUMP DISCHARGE (OR WATER TRAP SILENCER).

- j. With main supply valves open and the pump primed, as in step c, momentarily start the driver for the pump in order to check for the proper direction of shaft rotation and for proper operation of recirculating pump (if used).

2-6 STARTUP AND OPERATING CHECKS, VACUUM PUMPS ONLY

When the preliminary inspection and the preoperational check procedures have been completed, start the pump and check pump operation as follows:

WARNING

IF THE PUMP IS TO BE CHECKED IN A SYSTEM, NOTIFY THE APPROPRIATE PLANT PERSONNEL BEFORE PLACING A PUMP ON LINE, PARTICULARLY WHEN PLACING THE PUMP ON LINE FOR THE FIRST TIME. STARTING UP A SYSTEM UNEXPECTEDLY MAY CAUSE PERSONNEL INJURY.

Note

Refer to Troubleshooting, section 3, if any operating difficulties arise when performing the following steps.

- a. Check the pump and the system for adequate prime and then turn on all main water supply sources to the pump or heat exchanger.
- b. With the water supply sources turned on and all personnel and equipment clear of the pump system, apply power to the driver.

Note

If pump operation becomes unstable, pump vibration levels will increase and the pumping volume will decrease. IF THE PUMP DOES NOT STABILIZE, SHUT DOWN THE SYSTEM IMMEDIATELY, AND DETERMINE THE CAUSE.

- c. While the pump is being stabilized at the required inlet vacuum, check the flow of liquid seal (water) to the pump. In *once-through* systems, make certain that the liquid seal is flowing out of the water trap silencer drain. In *recirculated* systems, make certain that the recirculation pump (if used) is operating.
- d. Maintain a constant check on the temperature of the pump casing during the start-up procedure. If the temperature rises rapidly or is 25°F (14°C) or more above the liquid compressant temperature, shut down the unit immediately and determine the cause.
- e. After starting the pump, monitor the temperature of the bearing housing until the bearing housing temperature stabilizes and begins to drop. This may take several hours and should level out at about 30°F (17°C) greater than the casing or ambient temperature.

CAUTION

DURING START-UP, IF THE BEARING HOUSING TEMPERATURE EXCEEDS 180°F (82°C), OR IF ABNORMAL BEARING NOISE, VIBRATION, ODOR OR SMOKING OCCURS, SHUT DOWN THE PUMP IMMEDIATELY AND DETERMINE THE CAUSE.

- f. Excessive bearing temperatures may be caused by several reasons, excessive v-belt drive pull, coupling misalignment, excessive piping loads or improper greasing of bearings. The primary cause is over greasing. Pull the outer bearing housing cap back and check the quantity of grease in the cap and housing. If more than 1/3 full, remove excess grease and reassemble cap. If minimal or no grease in cap or housing, add grease through the grease fitting until grease extrudes from the face of the bearing, add grease to the cap to 1/3 full and reassemble cap.
- g. Check the pump for vibration and noise. Excessive vibration and noise is an abnormal condition on a Nash pump. Shut down the pump immediately and determine the cause.
- h. Check the speed (RPM) of the pump shaft rotation. On pumps with single extended shaft, pry the access plug from the fixed bearing outer cap and insert a tachometer with a shaft extension, if necessary. Compare the measured speed with the rated speed for the pump. The rated operating speed and capacity can be determined from the purchase specifications or by **consulting with your Nash Representative**.
- i. After the pump has been running for ten minutes with steady leakage from the stuffing box, tighten the gland nuts evenly through 30 degrees. Repeat at ten minute intervals until there is a drip leakage from the gland with no overheating. Subsequent tightening of the gland nuts through 30 degrees should be done with the pump operating at normal working temperature and vacuum.

2-7 STARTUP AND OPERATING CHECKS, COMPRESSORS ONLY

When the preliminary inspection and the pre- operational check procedures have been completed, start the compressor and check compressor operation as follows:

WARNING

IF THE COMPRESSOR IS TO BE CHECKED IN A SYSTEM, NOTIFY THE APPROPRIATE PLANT PERSONNEL BEFORE PLACING A COMPRESSOR ON LINE, PARTICULARLY WHEN PLACING THE COMPRESSOR ON LINE FOR THE FIRST TIME. STARTING UP A SYSTEM UNEXPECTEDLY MAY CAUSE PERSONNEL INJURY.

Note

Refer to Troubleshooting, Section 3, if any operating difficulties arise when performing the following steps.

- a. Check the compressor and the system for adequate prime and then turn on all main water supply sources to the compressor and the heat exchanger.
- b. Open the separator bypass valve to the maximum position.
- c. With the water supply sources turned on and all personnel and equipment clear of the compressor system, apply power to the driver. Close the separator bypass valve until the separator pressure gauge indicates 3 psig maximum.

CAUTION

THE PRESSURE READ AT THE SEPARATOR PRESSURE GAUGE MUST NOT EXCEED 3 PSIG FOR THE TIME SPECIFIED IN TABLE 2-3 IN ORDER TO PREVENT UNSTABLE OPERATION AND POSSIBLE COMPRESSOR DAMAGE.

CAUTION

IN ONCE-THROUGH SYSTEMS, IF THE SEPARATOR WATER LEVEL RISES ABOVE THE GAUGE GLASS, SHUT DOWN THE COMPRESSOR IMMEDIATELY AND CHECK FOR RESTRICTION IN THE WATER DISCHARGE FROM THE SEPARATOR. IF THE SEPARATOR PRESSURE IS BELOW 3 PSIG, THROTTLE A DISCHARGE VALVE AND RECHECK. DURING NORMAL OPERATION, THE SYSTEM BACK PRESSURE WILL BE SUFFICIENT TO PRESSURIZE THE SEPARATOR. IF THE SYSTEM BACK PRESSURE IS NOT SUFFICIENT TO PRESSURIZE THE SEPARATOR, A DISCHARGE ORIFICE MAY BE REQUIRED. **CONSULT YOUR NASH REPRESENTATIVE FOR RECOMMENDATIONS.**

Note

If the compressor is turbine driven, the separator bypass valve may have to be readjusted (opened) in order to maintain the 3 psig value while the turbine is coming up to speed. If compressor operation becomes unstable, compressor vibration levels will increase and the pumping volume will decrease. Open the separator bypass valve gradually in order to attempt to restabilize the compressor. If the compressor stabilizes, partially close (throttle) the separator bypass valve. **IF THE COMPRESSOR DOES NOT STABILIZE, SHUT DOWN THE SYSTEM IMMEDIATELY, AND DETERMINE THE CAUSE.** If the compressor is being checked out in the system, the discharge isolation valve may have to be throttled (partially closed) in order to achieve the required 3 psig separator back pressure.

- d. While the compressor is being stabilized at the discharge pressure setting, check the flow of liquid seal (water) to the compressor. In *once-through* systems, make certain that the liquid seal is flowing out of the ball float. In *recirculated* systems, make certain that the recirculation pump (if used) is operating.
- e. Maintain a constant check on the temperature of the compressor casing during the start-up procedure. If the temperature rises rapidly or is 25° F or more above the liquid compressant temperature, shut down the unit immediately and determine the cause.
- f. After starting the compressor, monitor the temperature of the bearing housing until the bearing housing temperature stabilizes and begins to drop. This may take several hours and should level out at about 30°F (17°C) greater than the casing or ambient temperature.

CAUTION

DURING START-UP, IF THE BEARING HOUSING TEMPERATURE EXCEEDS 180°F (82°C), OR IF ABNORMAL BEARING NOISE, VIBRATION, ODOR OR SMOKING OCCURS, SHUT DOWN THE COMPRESSOR IMMEDIATELY AND DETERMINE THE CAUSE.

- g. Check the compressor for vibration and noise. Excessive vibration and noise is an abnormal condition on a Nash compressor. Shut down the compressor immediately and determine the cause.
- h. Check the speed (RPM) of compressor shaft rotation by prying the access plug from the fixed bearing outer cap and inserting a tachometer with a shaft extension, if necessary. Compare the measured speed with the rated speed for the compressor. The rated operating speed and capacity can be determined from the purchase specifications or by consulting with your Nash Representative.
- i. When the compressor has completed the stabilization interval specified in Table 2-3 for operation at 3 psig, gradually throttle (close) the separator bypass valve until the normal discharge operating pressure is obtained. Observe that no abnormal noise or vibration is produced as the separator bypass valve is throttled. If abnormal noise or vibration is observed, gradually open the separator bypass valve until the abnormal condition disappears. Thereafter, throttle the separator bypass valve again to obtain the normal discharge operating pressure. If noise or vibration is observed again, shut down the compressor and determine the cause.
- j. With the compressor stabilized at the normal discharge operating pressure, repeat steps d through h.
- k. After the compressor has been running for ten minutes with steady leakage from the stuffing box, tighten the gland nuts evenly one flat at a time. Repeat at ten-minute intervals until there is a leakage of approximately 45 to 60 drops per minute from the gland with no overheating. Subsequent tightening of the gland nuts one flat at a time should be done with the compressor operating at normal working temperature and pressure.

Section 3 TROUBLESHOOTING

3-1 LOCATING TROUBLES

NASH 904® pumps require little attention other than periodic checking of V-belt tension (when applicable), and checking the ability of the pump to obtain full volume, or maintain constant vacuum. If an operating difficulty arises, make the following checks:

- a. Check for proper liquid compressant flow rate by reading the correct flow rate that has been established for the unit. (Refer to Paragraph 2-2.)
- b. Check for the correct direction of shaft rotation as cast on the body of the pump.
- c. Check that the pump is operating at the correct rpm, not necessarily the test rpm stamped on the pump nameplate. (Refer to the instructions in Paragraph 2-6, step g.)
- d. Check for an obstruction in the discharge piping. Back pressure at the discharge port reduces capacity, reduces vacuum level (vacuum pump) or discharge pressure (compressor), and increases the driving horsepower that is required.
- e. Check for restriction in the gas inlet line by reading the vacuum or pressure gauge in the inlet piping at the pump and at the process. Undersize piping and line obstructions produce a higher vacuum at the pump than the readings obtained at the work or process. Inlet throttling should not be used in compressor system.
- f. If the pump is shut down because of a change in temperature, noise and/or vibration from the normal operating conditions, check the bearings lubrication, bearings condition, and coupling or V-belt drive alignment. Refer to Bulletin No. 642, Installation Instructions, Nash Vacuum Pumps and Compressors, for alignment procedures and V-belt tensioning.

Note

If the trouble is not located through these checks, call your Nash Representative before dismantling the pump. He will assist in locating and correcting the trouble.

Section 4 PREVENTIVE MAINTENANCE

4-1 PERIODIC MAINTENANCE

Note

The following schedules should be modified as necessary for your specific operating conditions.

4.2 Six-Month Intervals

- a. If the drive coupling is lubricated, it should be filled with oil or grease in accordance with the coupling

- manufacturer's instructions.
- b. Lubricate the pump bearings as specified in Paragraph 4-4.
- c. Relubricate the drive motor bearings according to the motor manufacturer's instructions.

4-3 Twelve-Month Intervals

- a. Replace the stuffing box packing as specified in Paragraph 4-5.

4-4 BEARING LUBRICATION

The pumps described in this Bulletin have grease lubricated bearings. Bearings are lubricated before shipment and require no further lubrication for approximately six months.

Note

Lubricate the bearings every 6 months, unless the pump is being operated in a corrosive atmosphere or with a liquid compressant other than water, in which case the interval should be shortened. Lubrication should be done while the pump is running.

Lubricate the bearings as follows:

CAUTION

WHEN LUBRICATING THE BEARINGS, IT WOULD NOT BE UNUSUAL FOR THE BEARING TEMPERATURE TO RISE 40°F (22°C) OR MORE. DO NOT BE ALARMED. THE BEARING TEMPERATURE WILL SLOWLY DECREASE TO ORIGINAL TEMPERATURE.

- a. Check slots at bottom of floating and fixed bearing inner and outer caps (115, 116, 117 and 118, Figure 5-21, 5-22, or 5-23) to make sure that slots are not plugged with old dried-out grease.
- b. Apply grease as specified in Table 4-1 to grease fittings (23) in floating and fixed bearing brackets (108 and 109) until grease flows from slots in inner and outer caps.
- c. Check condition of grease after initial flow from slots for contamination or presence of water.
- d. If grease is contaminated, remove inner and outer caps, thoroughly clean caps, bearing housing and bearing of contaminated grease. Inspect bearing. If bearing is not damaged, reinstall caps and add fresh grease as specified in Paragraph 5-25, steps a and b. If bearing is damaged, replace with new bearing specified in Table 5-1 in accordance with procedures in Section 5.

CAUTION

TOTAL THICKNESS OF SHIMS (4) AND SHIM GASKETS (4-1) EQUAL TO THICKNESS REMOVED FROM FIXED BEARING END OF PUMP MUST BE REINSTALLED TO MAINTAIN REQUIRED END TRAVEL

- e. Monitor bearing operation and temperature during normal operation.

Table 4-1. General Grease Specifications

<p>GENERAL REQUIREMENTS:</p> <p>A. <i>Premium quality</i> industrial bearing grease.</p> <p>B. <i>Consistency grade</i>: NLGI #2</p> <p>C. <i>Oil viscosity (minimum)</i>: @100° (38°C) - 500 SSU (108 cSt) @210° (99°C) - 58 SSU (10c St)</p> <p>D. <i>Thickener (Base)</i>: Lithium or Lithium Complex for optimum WATER RESISTANCE.</p> <p>E. <i>Performance characteristics</i> at operating temperature: 1. Operating temperature range; at least 0° to 250° (18° to 121°C) 2. "Long-Life" performance 3. Good mechanical and chemical stability.</p> <p>F. <i>Additives - Mandatory</i>: 1. Oxidation inhibitors 2. Rust inhibitors</p> <p>G. <i>Additives - Optional</i>: 1. Anti-wear agents 2. Corrosion inhibitors 3. Metal deactivators 4. Extreme Pressure (EP) agents</p> <p>H. <i>Additives - Objectionable</i>: 1. Molybdenum disulfide 2. Tackiness agents</p>																					
<p>NASH STANDARD GREASE RECOMMENDATIONS: The following is a list, by manufacturer, of some greases that exhibit the desired characteristics required by Nash.</p> <table border="0"> <tr> <td colspan="2"><i>Grease Manufacturer Product</i></td> </tr> <tr> <td>AMOCO</td> <td>Super Pernalube or Amolith 2EP</td> </tr> <tr> <td>BP Oil</td> <td>Energrease LS-EP2</td> </tr> <tr> <td>Castrol Oil</td> <td>Spheerol SW 2 EP</td> </tr> <tr> <td>Chevron Oil</td> <td>Ulti-Plex Synthetic EP2</td> </tr> <tr> <td>Exxon</td> <td>Unirex N2 or Unirex EP2</td> </tr> <tr> <td>Mobil Oil</td> <td>Mobilith SHC 100 or Mobilith AW2</td> </tr> <tr> <td>Shell Oil</td> <td>Alvania 2 or Alvania EP2</td> </tr> <tr> <td>Texaco Oil</td> <td>Starplex 2 or Marfak MP2</td> </tr> <tr> <td>Thames</td> <td>Lithium EP2</td> </tr> </table> <p>Note: This list is not an endorsement of these products and is to be used only for reference. Have your local lubricant supplier cross reference these greases for an equivalent, as long as it meets the General Requirements.</p> <p>Grease Compatibility Note: The above greases are the Nash Standard Grease. To maximize grease performance it is recommended that intermixing of different greases be kept to a minimum.</p>		<i>Grease Manufacturer Product</i>		AMOCO	Super Pernalube or Amolith 2EP	BP Oil	Energrease LS-EP2	Castrol Oil	Spheerol SW 2 EP	Chevron Oil	Ulti-Plex Synthetic EP2	Exxon	Unirex N2 or Unirex EP2	Mobil Oil	Mobilith SHC 100 or Mobilith AW2	Shell Oil	Alvania 2 or Alvania EP2	Texaco Oil	Starplex 2 or Marfak MP2	Thames	Lithium EP2
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Texaco Oil	Starplex 2 or Marfak MP2																				
Thames	Lithium EP2																				

4-5 STUFFING BOX PACKING

A preventative maintenance schedule should be established for the tightening and replacement of the packing in the stuffing boxes of the pump. The packaging in the stuffing boxes in pumps used in continuous process systems should be replaced at annual shutdown. More frequent replacement may be required on severe process applications in which liquid compressant in the pump is contaminated by foreign material or is incompatible with the existing packing material. The packing

consists of six rings with the dimensions listed in Table 5-1. In some cases, a different packing material may be required because of the liquid compressant used.

When replacing the packing in a stuffing box, remove the old packing as follows:

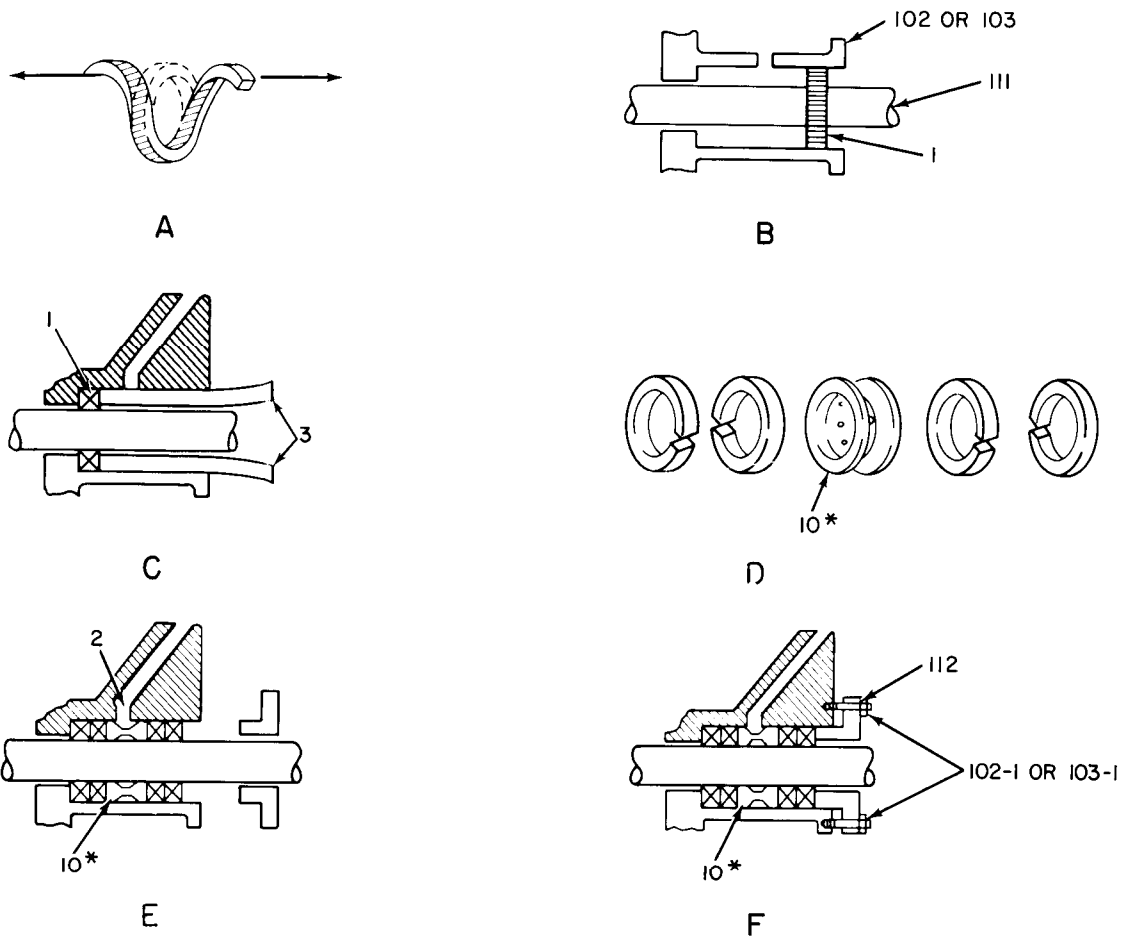
Note

If lantern glands are used, record position and number of packing rings on each side of lantern gland. This information is used during reassembly to make certain that lantern gland is correctly aligned.

- a. Slide slinger spring (3-1, Figure 5-21, 5-22, or 5-23) and slinger (3) away from stuffing box on shaft.
- b. Loosen and remove gland nuts (102-1 or 103-1, Figure 4-1) from studs.
- c. Slide packing gland assembly (112) as far from stuffing box as it will go or loosen two packing gland nuts

holding halves of packing gland assembly (112) together and remove two halves.

- d. Screw tips of packing pullers (2, Figure 4-2) into packing (1).
- e. Pull packing (1) out of stuffing box.
- f. If lantern gland (10, Figure 4-1) is used, form two lantern gland pullers from 1/8-inch diameter steel wire as shown in Figure 4-3.
- g. Work bent tip of each lantern gland puller around outer diameter of lantern gland in stuffing box until pullers are felt catching in slots in lantern gland on opposite sides.
- h. Pull lantern gland out of stuffing box.
- i. Screw tips of packing pullers (2, Figure 4-2) into remaining packing in stuffing box and pull packing out as shown in Figure 4-2.
- j. Thoroughly clean stuffing box before installing new packing.



Note: View F rotated 90 degrees to show gland studs and nuts

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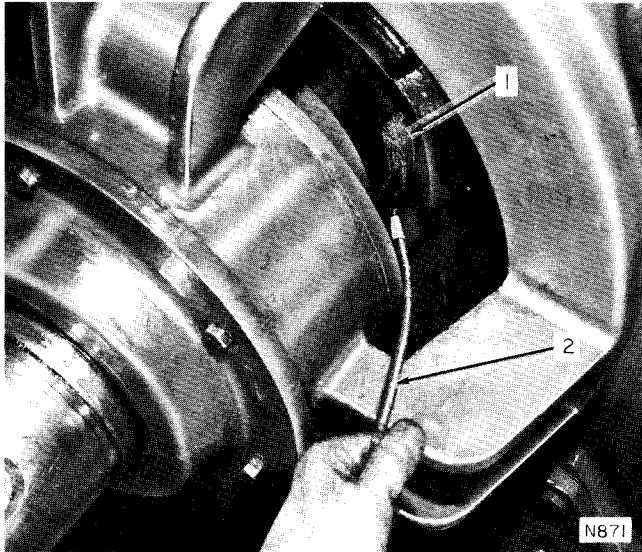
- 1. Packing Ring
- 2. Lantern Gland Supply Connection*
- 3. Packing Ring Pusher

- 10. Lantern Gland*
- 102. Floating Bearing End Head
- 102-1. Gland Nut
- 103. Fixed Bearing End Head

- 103-1. Gland Nut
- 111. Shaft
- 112. Packing Gland Assembly

*When used

Figure 4-1. Packing Stuffing Boxes



1. Packing Ring 2. Packing Pullers

Figure 4-2. Removing Stuffing Box Packing

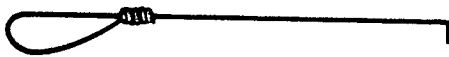


Figure 4-3. Stuffing Box Lantern Gland Puller

Install the new packing in the stuffing boxes as follows:

- a. Fabricate two hard rubber strips to fit between OD of shaft (111) and ID of stuffing box, as shown in Figure 4-1, Part C, to use as packing ring pushers.
- b. Lubricate inside diameter of packing rings with Molykote G-n past or equivalent.
- c. Open packing ring into spiral by pulling ends axially apart as shown in Figure 4-1, Part A.
- d. Turn shaft (111) to make certain that shaft turns freely.
- e. Work each packing ring into shaft and into stuffing box area as shown in Figure 4-1, Part B.
- f. Using pushers (3) fabricated in step a, push first packaging ring into stuffing box as firmly as possible. Make certain that packing ring is seated against end of stuffing box as shown in Figure 4-1, Part C. As each additional packing ring is installed, stagger location of butted ends of ring so that each successive ring is offset (by 180 degrees when two packing rings are used or 120 degrees when three packing rings are used). (See Figure 4-1, Part d.) Make certain that each packing ring is firmly seated.

Note

When lantern gland (10) is used, install correct number of packing rings as recorded at disassembly to ensure that lantern gland will be correctly positioned axially below supply connection for stuffing box.

- g. When used, install lantern gland. (See Figure 4-1, Part E.)
- h. Install remaining packing rings as specified in step f.
- i. Slide packing gland (112) on shaft so that it is flush against last packing ring installed. Install and tighten the gland nuts (102-1 or 103-1) evenly, finger tight (See Figure 4-1, Part F).
- j. Start up pump and adjust stuffing box leakage as specified in Paragraph 2-6.

4-6 SHUTDOWN PERIODS

If the pump is shut down for 2 to 3 weeks, rotate the vacuum pump and recirculating pump (if used) by hand at least once every week to prevent rust buildup between cast iron parts which may result in seizing. If the pump must be taken out of service for more than 3 weeks up to one year, proceed as follows to prevent seizing during the storage due to rust formation:

Note

These preservation procedures apply to standard cast iron or all-cast iron pumps only, maintained in covered storage.

- a. Remove drain plugs from pump as specified in Paragraph 2-4, and drain all liquid compressant. Replace drain plugs.
- b. Blank off pump discharge flanges.
- c. Fill pump one quarter full of water-soluble preserving oil, J. L. Quimby NRP100 or equivalent, through inlet flanges.
- d. Start pump and rotate for 5 to 15 seconds and shut down. Start pump again and rotate for 5 to 15 seconds and shut down.
- e. Drain all preserving oil from pump for reuse by removing drain plugs as specified in Paragraph 2-4. Replace drain plugs using pipe compound.
- f. Remove all packing as specified in Paragraph 4-5 and flush out stuffing boxes with rust inhibitor.
- g. Touch up any areas where paint has chipped and apply Houghton's Rust Veto #344 coating compound, or equivalent to external surfaces as necessary.
- h. Blank off pump inlets.

Note

For long term preservation procedures for storage periods of more than 1 year, **contact your Nash Representative.**

- i. When pump is to be put back in service, repack stuffing boxes with new packing as specified in Paragraph 4-5; drain and flush as specified in Paragraph 2-4; check condition of bearing grease as specified in Paragraph 4-4; and start as specified in paragraphs 2-5 and 2-6.
- j. After preserving oil has been flushed from pump, rotate vacuum pump and recirculating pump (if used) at weekly intervals until pump is back in continuous use.

Section 5
DISASSEMBLY, INSPECTION
AND REASSEMBLY

5-1 DISMANTLING PUMP

Before disassembling the pump, isolate the electrical input and disconnect the seal liquid connections, coupling to drive motor or V-belt drive, and inlet and outlet connections.

To move the pump from the base to a work area, remove the foundation bolt nuts and washers. Lift the pump using a chain hoist, chains and spreader bars as shown in Figure 5-1 or 5-1a.

WARNING

MAKE CERTAIN THAT LIFTING EQUIPMENT HAS CAPACITY FOR HANDLING PUMP. REFER TO TABLE 5-2 FOR APPROXIMATE WEIGHTS OF PUMPS. ON MODEL U PUMPS, *DO NOT* USE LUGS AT TOP OF BODY (101, Figure 5-22) TO LIFT PUMP.

Lower the pump onto 6-inch pads, on a level surface, leveled to keep the pump feet aligned in the same plane for disassembly and reassembly. Mark all parts as they become accessible during disassembly to ensure correct positioning for reassembly as shown in Figure 5-1 or 5-1a.

Before starting disassembly, collect the parts, materials and standard tools, and fabricate the special tools listed in the following paragraphs, which are required for disassembly and reassembly of the pump.

Parts and Materials

- a. Minimum recommended spares specified in Legend for Figure 5-21, 5-22, or 5-23 (which should be kept on hand at all times).

Note

It is not advisable to disassemble a pump unless the following replacement items are available for reassembly; one set of stuffing box packing (1); one set of adjusting shims (4 and 4-1); one set of gaskets; and floating and fixed bearings (119 and 120). (Refer to Table 5-1.)

- b. Molykote G-n paste or equivalent.
- c. Grease as specified in Table 4-1.
- d. Solvent such as kerosene.
- e. Three high tensile steel threaded rods with washers and nuts as specified in Paragraph 5-2, step k.
- f. Two 7/8-9 (Model L, M, P and R pumps) or 1-8 (Model S, T and U pumps) eyebolts to remove and install heads (102 and 103).
- g. Wood blocks to support body (101) and end of rotor (110).
- h. Two 3/4-10 (Model L and M pumps) or 1-8 (Model P, R, S, T and U pumps) by 4-inch long studs or threaded rods to assemble body gaskets (101-3) and body (101) to heads (102 and 103).
- i. Two 1/2-13 (Model L, M, P and R pumps), 5/8-11 (Model S and T pumps) or 3/4-10 (Model U pumps) jackscrews as shown in Figure 5-17 to set end travel.
- j. One 1/2-13 (Model L, M, P and R pumps), 5/8-11 (Model S and T pumps) or 3/4-10 (Model U pumps) by 30 inches long threaded rod with nuts to mount dial indicator as shown in Figure 5-19 to measure end travel.

Standard Tools

- a. Socket wrench set with shaft extension. In most cases, open-end or box wrenches can be substituted for socket wrenches.
- b. Hexagonal (Allen) wrenches.
- c. Spanner wrench for bearing locknuts.

Note

Machinist's hammer and brass drift can be substituted if spanner wrench is not available.

- d. Hydraulic jack, 20 ton capacity.
- e. Press: approximately 150-ton capacity for Model L, M, P and R pumps; approximately 200-ton capacity for Model S, T and U pumps. Press must indicate amount of force applied and is only required if rotor or shaft requires replacement.
- f. Spirit level.
- g. Grab hooks.
- h. Leaf (feeler) gauge.
- i. Metal straightedge.
- j. Rawhide hammer.
- k. Soft-faced (brass) ram.
- l. Machinist's dial indicator with suitable clamps and mounts.
- m. Needle-nosed pliers.
- n. Induction heater and 250°F (121°C) temp stick. Used to heat bearings (119 and 120) for installation.
- o. Asbestos gloves.
- p. Floor jack.
- q. Hoists and slings.

WARNING

MAKE PROVISIONS FOR HANDLING HEAVY PARTS DURING DISASSEMBLY TO AVOID INJURY TO PERSONNEL OR DAMAGE TO PARTS. REFER TO TABLE 5-2 FOR APPROXIMATE WEIGHTS OF PARTS.

Fabricated Tools

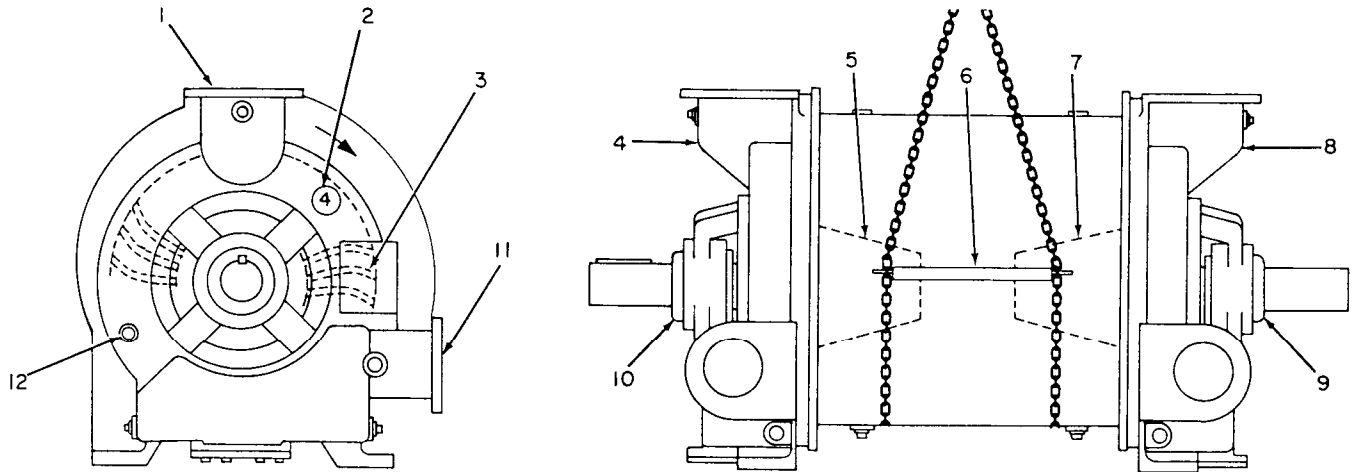
- a. Jack backup plate (Figure 5-3).
- b. Split ring (Figure 5-3).
- c. Six spacers (Figure 5-3).
- d. Shaft sleeve tool (Figure 5-6 or 5-6A).

Note

Do not disassemble the pump beyond the point required to remedy the trouble that has been observed. Before disassembling the pump, drain all liquid from the pump by removing the drain plugs (22, Figure 5-21, 5-22, or 5-23) from the floating and fixed bearing end heads (102 and 103) and the body (101), and the drain plugs (22-1) from the floating and fixed bearing end heads.

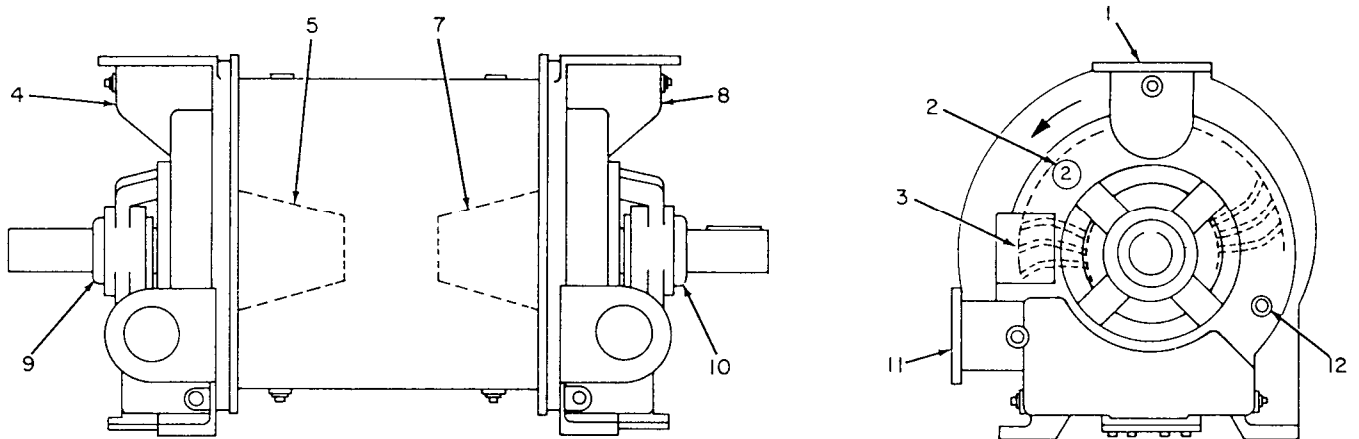
5-2 Removing Fixed Bearing

Remove the fixed bearing and associated parts as follows:



NO. 4 FLOATING BEARING END—AT LEFT WHEN FACING PUMP OUTLETS
 ROTATION—CLOCKWISE FACING FLOATING BEARING END OF PUMP

NOTE: PUMPS NORMALLY SUPPLIED IN POSITION NO. 4.



NO. 2 FLOATING BEARING END—AT RIGHT WHEN FACING PUMP OUTLETS
 ROTATION—COUNTERCLOCKWISE FACING FLOATING BEARING END OF PUMP

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- | | | |
|--|-----------------|--|
| 1. Inlets | 5. Cone No. 2 | 9. Fixed Bearing End (Adjusting Shims
Located between Cap and Head) |
| 2. Assembly Position Plate | 6. Spreader Bar | 10. Floating Bearing End |
| 3. Position of Rotor Blades Facing
Floating Bearing End of Pump | 7. Cone No. 1 | 11. Outlets |
| 4. Head No. 2 | 8. Head No. 1 | 12. Seal Water Connection |

**Figure 5-1. Assembly Positions and Hoisting Arrangement
 904 L, M, P, R, S, T & U**

- Remove key (111-2), Figure 5-21, 5-22, or 5-23) from shaft.
- Remove three outer cap screws (117-1), three outer cap screws (117-2) and lockwashers (117-4) from fixed bearing outer cap (117).
- remove fixed bearing outer cap, shim gaskets (4-1) and

shims (4). Measure and record total thickness of shim gaskets.

Note

If disassembly is to replace fixed bearing only, retain shim gaskets (4-1) and shims (4) for use at reassembly to maintain correct end travel. Discard any torn shim gaskets

Table 5-1. Pump Data

NOTE: All dimensions are in inches

Part Name (See Figure 5-21, 5-22 or 5-23)				
	L,M	P,R	S,T	U
Packing (1) - Dimensions	3/4 square x 7 ID x 8-1/2 OD	3/4 square x 8-3/4 ID x 10-1/4 OD	3/4 square x 9-3/4 ID x 11-1/4 OD	3/4 square x 11-1/4 ID x 12-3/4 OD
No. of Rings per Stuffing Box*	6	6	6	6
Lip Seal (5), Floating and Fixed Bearing Inner Caps	Johns Manville Clipper Seal Type LPD or LUP Mould No. 3892 Style H1/L5 302 or 316 St. Steel Spring 8-3/4 ID x 10 OD x 5/8 wide	Johns Manville Clipper Seal Type LPD or LUP Mould No. 9557 Style H1/L5 302 or 316 St. Steel Spring 8-3/4 ID x 10 OD x 5/8 wide	Johns Manville Clipper Seal Type LPD or LUP Mould No. 13809 Style H1/L5 302 or 316 St. Steel Spring 9-3/4 ID x 11-1/4 OD x 3/4 wide	Johns Manville Clipper Seal Type LPD or LUP Mould No. 10697 Style H1/L5 302 or 316 St. Steel Spring 11-1/4 ID x 12-3/4 OD x 5/8 wide
Lip Seal (5-1), Floating and Fixed** Bearing Outer Caps	Johns Manville Clipper Seal Type LPD or LUP Mould No. 9333 Style H1/L5 302 or 316 St. Steel Spring 5 ID x 5-3/4 OD x 7/16 wide	Johns Manville Clipper Seal Type LPD or LUP Mould No. 10027 Style H1/L5 302 or 316 St. Steel Spring 7-1/4 x 8-1/2 OD x 5/8 wide	Johns Manville Clipper Seal Type LPD or LUP Mould No. 9973 Style H1/L5 302 or 316 St. Steel Spring 7-1/2 ID x 8-1/2 OD x 1/2 wide	Johns Manville Clipper Seal Type LPD or LUP Mould No. 13809 Style H1/L5 302 or 316 St. Steel Spring 9-3/4 ID x 11-1/4 OD x 3/4 wide
Body Gasket (101-3), 0.010 thick† Qty. Floating Bearing End	4	5	5	7
Qty. Fixed Bearing End	6	7	7	10
Cone Gaskets (104-3 and 105-3), 0.010 thick, Qty.	1 each	1 each	1 each	1 each
Floating Bearing (119) and Fixed Bearing (120)	Timken Assy. No. 46780, matched set consisting of: 2 cones No. 46780 1 cup No. 46720D 1 spacer No. X1S46780 Bench Play - 0.016	Timken Assy. No. 90130, matched set consisting of: 2 cones No. 67983 1 cup No. 67920CD 1 spacer No. X1S67983 Bench End Play - 0.012	Timken Assy. No. 90205, matched set consisting of: 2 cones No. 93825 1 cup No. 93127CD 1 spacer No. X1S93825 Bench End Play - 0.012	Timken Assy. No. 902A2 matched set consisting of: 2 cones No. LM451345 1 cup No. LM451310CD 1 spacer No. LM451345XA Bench Play - 0.012

*If lantern glands (10) are used, one less packing ring is required.

**For double extended shaft only.

†Quantities listed are for trial assembly with extra gaskets at the fixed bearing end to allow removal of gaskets to obtain the final correct rotor (end) travel.

Table 5-2. Approximate Weights of Parts

Figure 5-21, 5-22 or 5-23 Index No.	Part Name							
		L	M	P	R	S	T	U
101	Body	1512	1742	2400	2650	3800	4140	7540
102, 103	Floating and Fixed Bearing End Head	1373	1373	2000	2000	3300	3300	3540
104, 105	Floating and Fixed Bearing End Cone	180	180	440	440	450	450	750
108, 109	Floating and Fixed Bearing Bracket	183	183	425	425	525	525	760
110	Rotor	1800	2240	3500	4900	5800	6800	9180
111	Shaft	882	1118	1730	1870	2675	3070	5000
119, 120	Floating and Fixed Bearing (each)	25	25	40	40	85	85	73
--	Total Pump	8055	9025	14248	16213	22965	24705	33000

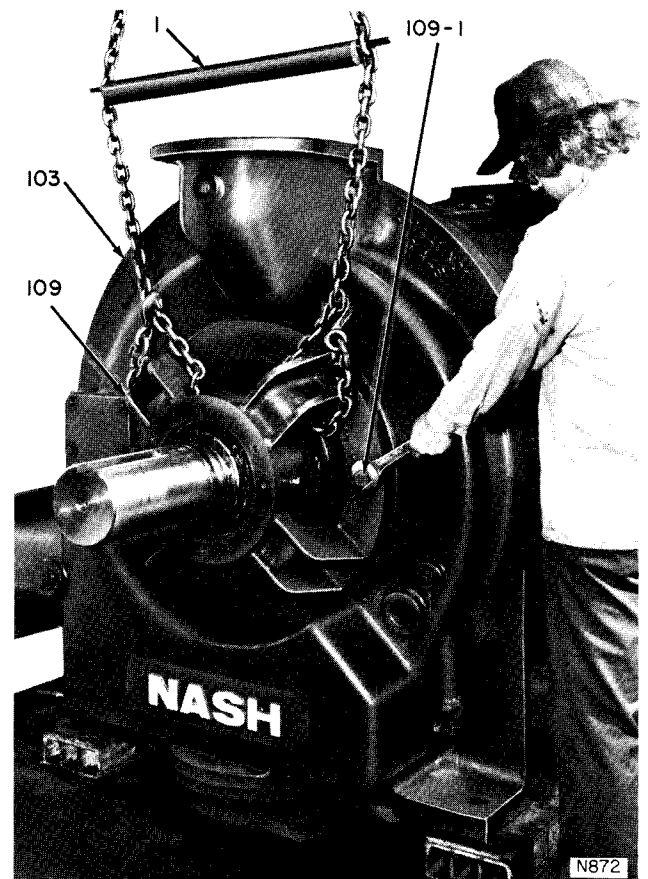
and replace with proper quantity to maintain recorded total thickness. If pump requires further disassembly to remove heads and adjust end travel, discard all shim gaskets and shims.

- d. Remove lip seal (5-1) from outer cap and discard lip seal.
- e. Remove four fixed bearing bracket screws (109-1).
- f. Install chains with spreader bar and chain hoist around two top ribs of fixed bearing bracket as shown in Figure 5-2. Support but do not lift bearing bracket.
- g. Install two bearing bracket screws (109-1) in tapped holes in flange of fixed bearing bracket (109) to serve as jackscrews. (See Figure 5-2.)
- h. Tighten both jackscrews installed in step g evenly until bearing bracket flange is free of head. Using chain hoist, carefully slide bearing bracket off fixed bearing (120) and shaft. Remove two jackscrews.
- i. On Model L, M, P, R, S and T pumps, bend tab of fixed bearing lockwasher (120-2, Figure 5-21) out of notch in fixed bearing locknut (120-1). Using spanner wrench or punch and hammer, loosen and remove locknut and washer.
- j. On Model U pumps, remove lockwire, two screws (120-3, Figure 5-22) and locknut lockplate (120-2) from fixed bearing locknut (120-1). Using spanner wrench or punch and hammer, loosen and remove locknut.
- k. Fabricate jack backup plate, three spacers and split ring as shown in Figure 5-3.
- l. Thread one inner nut (5, Figure 5-4) each onto three 1/2-13 by 36-inch long (Model L, M, P and R pumps), 5/8-11 by 40-inch long (Model S and T pumps) or 3/4-10 by 44-inch long (Model U pumps) high-tensile steel rods approximately 3 1/2 inches from end of rod and install flat washers (3) against nuts.
- m. Slide fixed bearing inner cap (118) back to gland studs (103-2) far enough to insert split ring (7) between fixed bearing (120) and inner cap.
- n. Align three holes in split ring with tapped holes in fixed bearing inner cap; insert three spacers between split ring and inner cap; insert three threaded rods (end with nuts installed) through split ring and spacers, and thread through tapped holes in inner cap until flat washers bear against split ring. Secure threaded rods with flat washers (3) and outer nuts (1) tightened against inner cap flange. Tighten inner nuts (5).
- o. Install jack backup plate (9), fabricated in step j, on threaded rods and secure with flat washers (3), lockwashers (2) and nuts (1) on ends of rods. Support backup plate until hydraulic jack applies sufficient pressure in step o to hold plate in place.

CAUTION

MAKE CERTAIN THAT HYDRAULIC JACK, BACKUP PLATE, SPLIT RINGS AND CAP ARE SQUARE AND THAT FORCE IS APPLIED EVENLY TO AVOID DAMAGE TO INNER CAP.

- p. Place hydraulic jack between jack backup plate and end of shaft. Apply pressure to remove bearing. Discard bearing and gaskets (117-3 and 118-3, Figure 5-21, 5-22, or 5-23).
- q. Remove jack backup plate, threaded rods, spacers and split ring.
- r. Remove fixed bearing inner cap.



1. Spreader Bar
103. Fixed Bearing End Head
109. Fixed Bearing Bracket
- 109-1. Bearing Bracket Screw (Jackscrew)

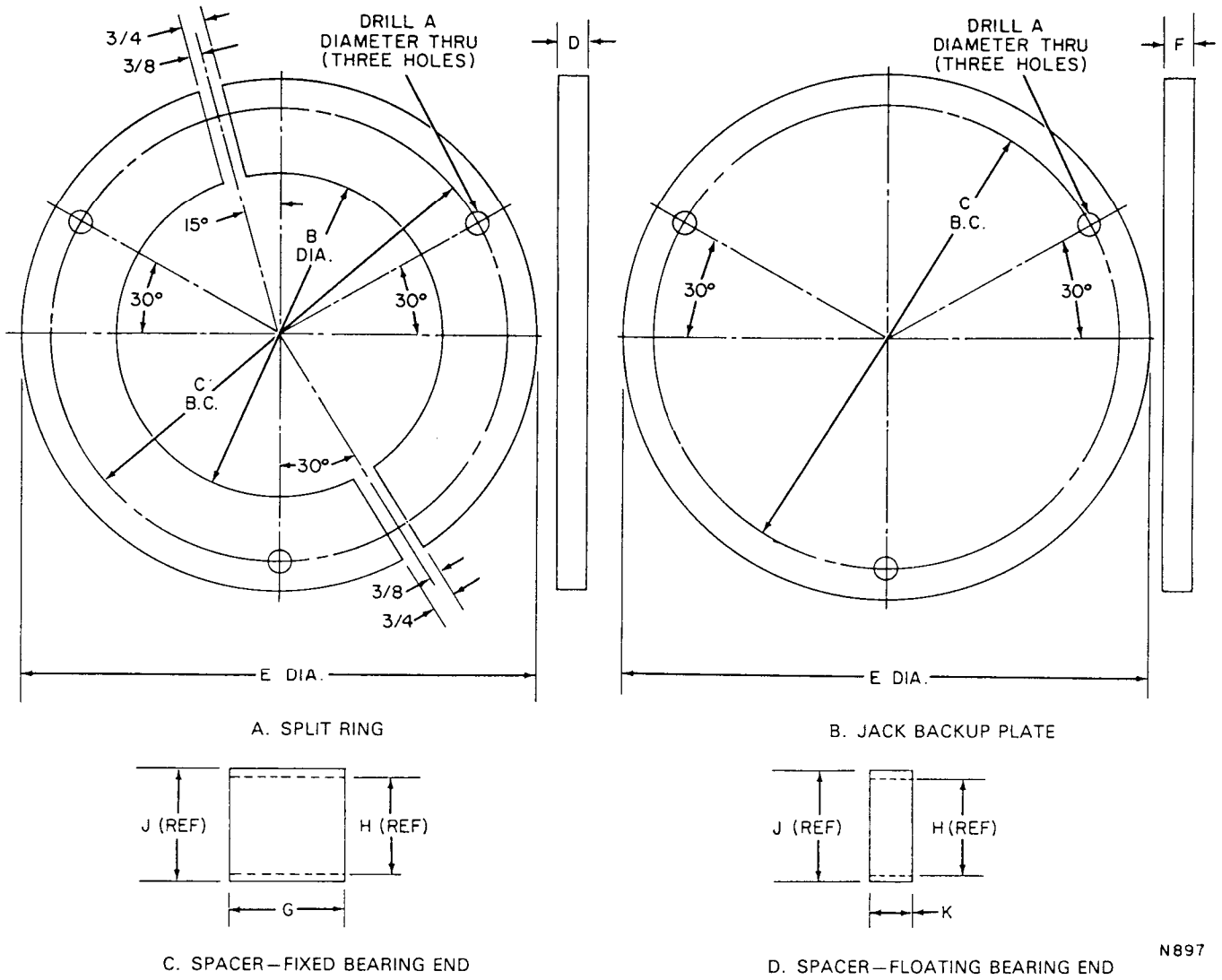
Figure 5-2. Removing Fixed Bearing Bracket

- s. Remove lip seal (5) from inner cap and discard lip seal.
- t. Remove slinger spring (3-1) and slinger (3) from shaft.

5-3 Removing Floating Bearing

Remove the floating bearing and the associated parts as follows:

- a. Remove key (111-1, Figure 5-21, 5-22, or 5-23) from shaft (111).
- b. Remove three floating bearing outer cap screws (115-1), three outer cap screws (115-2) and lockwashers (115-4) from floating bearing outer cap (115-1).
- c. Remove floating bearing outer cap and gasket (115-3). Discard gasket.
- d. Remove lip seal (5-1) from outer cap and discard lip seal.
- e. Remove floating bearing bracket (108) in same manner as specified for fixed bearing bracket (9109) in Paragraph 5-2, steps e through h. Remove and discard floating bearing inner cap gasket (116-3).
- f. On Model L, M, P, R, S and T pumps, remove floating bearing locknut (119-1, Figure 5-21), lockwasher (119-2), and floating bearing (119) in same manner as specified in Paragraph 5-2, steps i and l through q.
- g. On Model U pumps remove floating bearing locknut lockplate (119-2, Figure 5-22), locknut (119-1) and floating bearing (119) in same manner as specified in Paragraph 5-2, steps j and l through q.



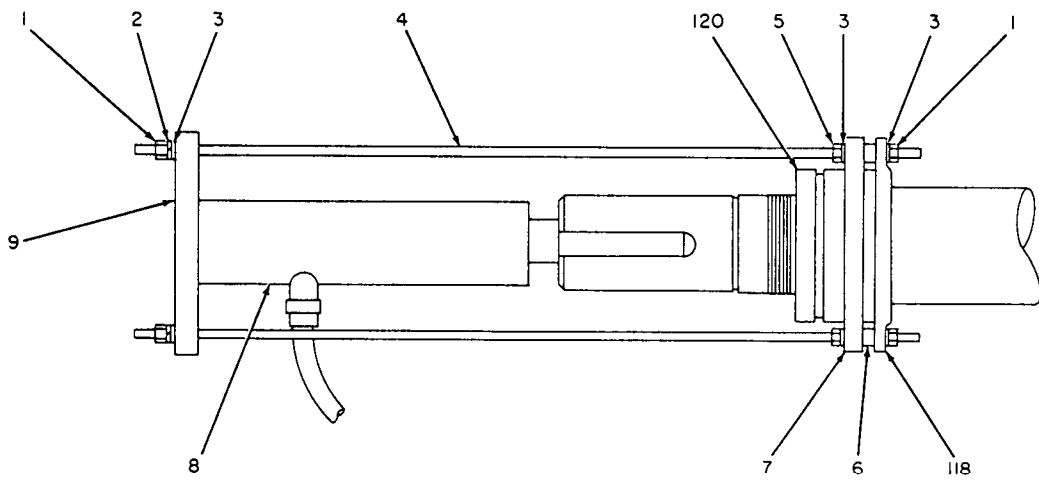
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Pump Model	A	B	C	D (Ref)	E	F (Ref)	G	H (Ref)	J (Ref)	K	Notes
L, M	9/16	7-9/32	10.562	1/2	12	1	0.75	0.622	0.84	0.24	2,3,4
P, R	5/8	8-25/32	13.375	1/2	15.63	1	0.94	0.622	0.84	0.38	2,3,4
S, T	3/4	9-25/32	15.500	1	18	1	1.13	0.824	1.05	0.38	2,3,5
U	7/8	11-1/2	17.00	1	20	1	1.08	0.824	1.05	0.27	2,3,5

NOTES:

1. Dimensions are in inches unless otherwise noted.
2. Dimension B, C and K tolerances: ± 0.010 inch.
3. Material: boiler plate for split ring and jack backup plate.
4. Make fixed and floating bearing end spacers from 1/2-inch steel pipe, 3 each.
5. Make fixed and floating bearing end spacers from 3/4-inch steel pipe, 3 each.

Figure 5-3. Bearing Pulling Tools



N898

- | | | | |
|----------------|-----------------|----------------------|------------------------------|
| 1. Outer Nut | 4. Threaded Rod | 7. Split Ring | 118. Fixed Bearing Inner Cap |
| 2. Lockwasher | 5. Inner Nut | 8. Hydraulic Jack | 120. Fixed Bearing |
| 3. Flat Washer | 6. Spacer | 9. Jack Backup Plate | |

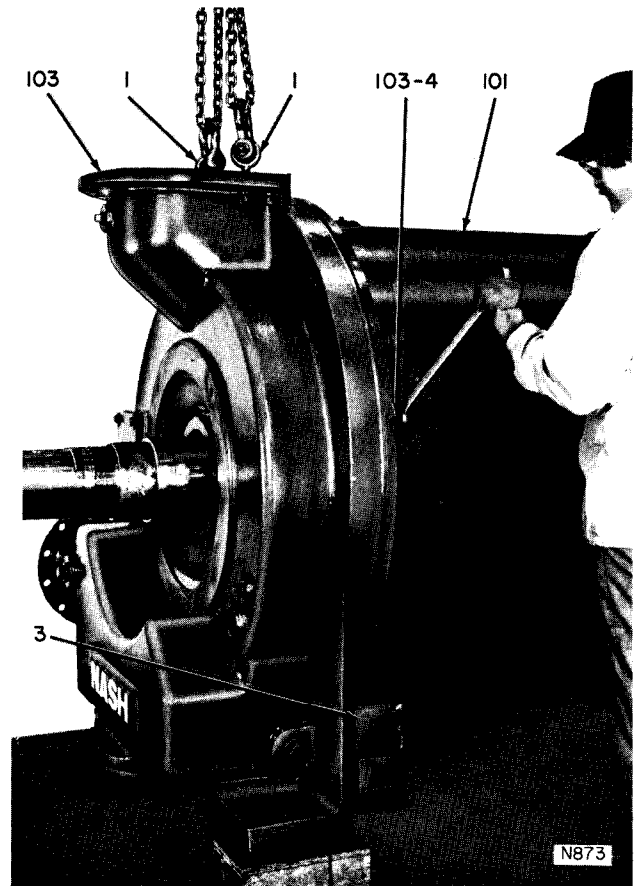
Figure 5-4. Pulling Fixed Bearing

- h. Remove floating bearing inner cap (116).
- i. Remove lip seal (5) from inner cap and discard lip seal.
- j. Remove slinger spring (3-1) and slinger (3) from shaft.

5-4 Removing Fixed Bearing End Head and Cone Assembly

Remove the fixed bearing end head and cone assembly and disassemble the associated parts as follows:

- a. Install two 7/8-9 (Model L, M, P and R pumps) or 1-8 (Model S, T and U pumps) eyebolts in two opposite tapped holes in inlet flange of fixed bearing end head (103, Figure 5-21, 5-22, or 5-23) as shown in Figure 5-5. Support but do not lift head with chain hoist. Support fixed bearing end of body (101) with wood blocks as shown in Figure 5-5.
- b. On Models L, M, P, R, S and T pumps, proceed as follows:
 1. Remove 12 fixed bearing end head screws (103-4, Figure 5-21).
 2. Install two head screws (103-4) in tapped holes in flange of body (101) to serve as jackscrews. (See Figure 5-22.)
- c. On Model U pumps, proceed as follows:
 1. Remove three fixed bearing end head screws (103-4, Figure 5-22).
 2. Remove 10 fixed bearing end head screws (103-5).
 3. Install two head screws (103-5) in tapped holes in flange of fixed bearing end head (103) to serve as jackscrews.
- d. Tighten two jackscrews evenly until head is free of body.
- e. Using chain hoist, carefully slide head and cone assembly off shaft. Lower head until feet contact two 6-inch blocks on level surface. Remove two gland nuts (103-1) and gland assembly (112). Remove packing rings from stuffing box. Discard packing rings.
- f. Lower head to floor with cone up, remove chain hoist and inspect fixed bearing end cone (105) as specified in Paragraph 5-10.

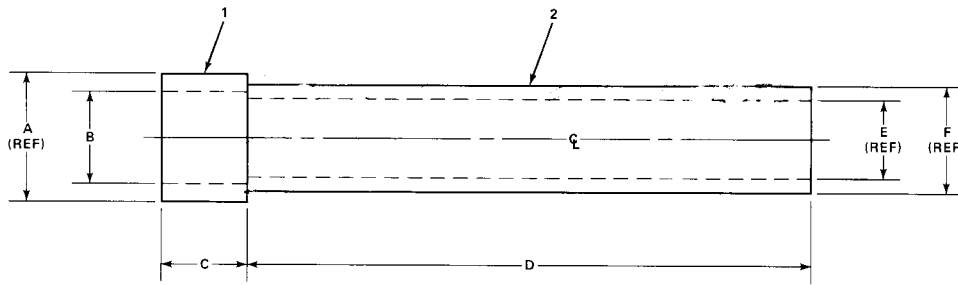


N873

- | | |
|----------------|---|
| 1. Eyebolt | 103. Fixed Bearing End Head |
| 3. Wood Blocks | 103-4. Fixed Bearing End Head Screw (Jackscrew) |
| | 101. Body |

Figure 5-5. Removing Fixed Bearing End Head and Cone Assembly

Figure 5-6 and 5-6A

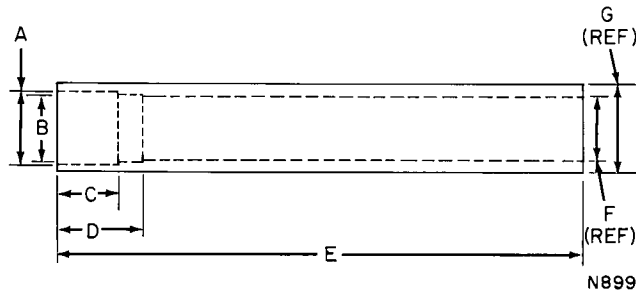


Dimensions in Inches					
A (Ref)	B	C	D	E (Ref)	F (Ref)
6.625	6.263	5.125	55	5.047	5.563

NOTES:

1. Fabricate piece No. 1 from 6-inch Schedule 40 steel pipe. Machine ID to dimension B specified above.
2. Fabricate piece No. 2 from 5-inch Schedule 40 steel pipe.
3. Weld piece No. 1 and 2 concentrically on centerline. Approximate weight of finished tool is 80 lbs.
4. Dimension B tolerance: $-0.000 +0.010$ inch.
5. Dimension C tolerance: ± 0.010 inch.

Figure 5-6. Shaft Sleeve Tool, Model L and M Pumps

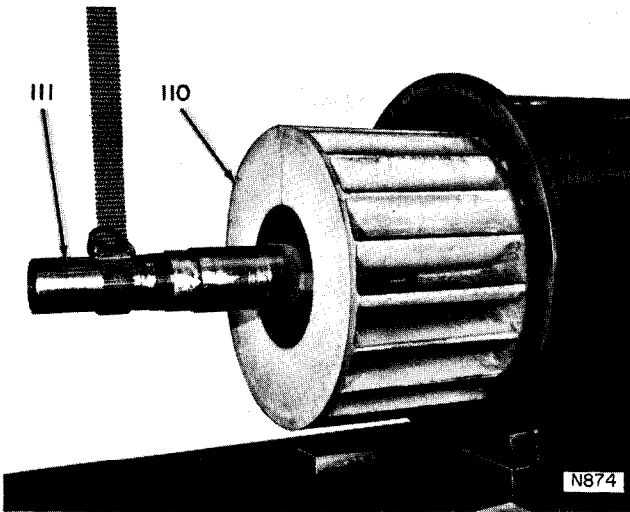


Pump Model	Dimensions in Inches							Notes
	A	B	C	D	E	F (Ref)	G (Ref)	
P, R	8.063	7.313	6.25	8.50	66	7.25	8.75	1,3,4
S, T	8.313	8.000	5.875	8.00	72	7.75	9.25	2,3,4

NOTES:

1. For Model P and R pumps, make from 8-3/4-inch OD steel mechanical tubing with 3/4-inch wall thickness. Approximate weight of finished tool 335 lbs.
2. For Model S and T pumps, make from 9-1/4-inch OD steel mechanical tubing with 3/4-inch wall thickness. Approximate weight of finished tool 390 lbs.
3. Dimension A and B tolerances: $-0.000 +0.010$ inch.
4. Dimension C and D tolerances: ± 0.010 inch.

Figure 5-6A. Shaft Sleeve Tool, Model P, R, S and T Pumps



110. Rotor 111. Shaft

Figure 5-7. Removing Rotor and Shaft Assembly

5-5 Removing Rotor and Shaft Assembly

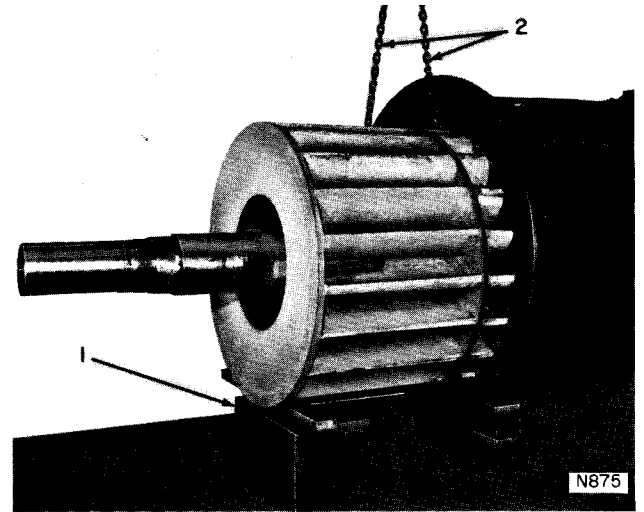
Remove the rotor and shaft assembly from the body and the floating bearing end head as follows:

- a. Remove two gland nuts (102-1, Figure 5-21, 5-22, or 5-23) and gland assembly (112) from floating bearing end head (102). Remove and discard packing rings (1).
- b. Fabricate shaft sleeve tool as specified in Figure 5-6 or 5-6A. For Model U pumps, cut a piece of 10-inch Schedule 40 steel pipe 60 inches long for use as shaft sleeve tool.

Note

Shaft sleeve tool is required to guide shaft through cone and head and to protect shaft bearing journal and locknut threads from damage.

- c. Carefully slide machined end of shaft sleeve tool over floating bearing end of shaft (111, Figure 5-21, 5-22, or 5-23) until sleeve tool seats against bearing journal shoulder.
- d. Using chain hoist and strap at the fixed bearing end of shaft, as shown in Figure 5-7, and second chain hoist and strap or floor jack on shaft sleeve tool at floating bearing end of shaft, keep shaft level and move rotor and shaft assembly toward fixed bearing end until center shroud of rotor nears end of body (101).
one Assembly
- e. Using wood blocks, support fixed bearing end of rotor and remove strap from shaft. Install two chains, one on either side of rotor center shroud, with hooks engaging bottom edges of rotor blades as shown in Figures 5-8.
- f. Remove wood blocks, keep shaft level and continue to slide rotor and shaft assembly out of body. Remove sling or floor jack and shaft sleeve tool when floating bearing end of rotor comes into view.
- g. Inspect rotor and shaft assembly as specified in Paragraphs 5-11 and 5-12.



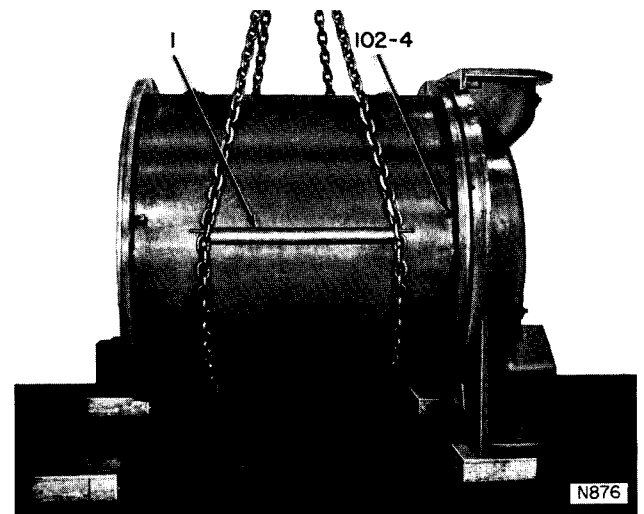
1. Wood Blocks 2. Chains

Figure 5-8. Supporting Rotor to Move Chain Hoist

5-6 Removing Body and Final Disassembly

Remove the body from the floating bearing end head and cone assembly and complete the disassembly as follows.

- a. Using chain hoist, chains and spreader bars, support but do not lift body (101, Figure 5-21, 5-22, or 5-23). (See Figure 5-9.) Remove wood blocks from under body.
- b. On Model L, M, P, R, S and T pumps, proceed as follows.
 1. Remove 12 floating bearing end head screws (102-4, Figure 5-21).
 2. Install two head screws (102-4) in tapped holes in flange of body to serve as jackscrews. (See Figure 5-9.)
- c. On Model U pumps, proceed as follows:
 1. Remove three floating bearing end head screws (102-4, Figure 5-22).
 2. Remove 10 floating bearing end head screws (102-5).



1. Spreader Bar
102-4. Floating Bearing End Head Screw (Jackscrew)

Figure 5-9. Removing Body

3. Install two head screws (102-5) in tapped holes in flange of floating bearing end head (103) to serve as jackscrews.
- d. Tighten two jackscrews evenly until body is free of head.
- e. Remove two gland nuts (102-1, Figure 5-21, 5-22, or 5-23) and gland assembly (112) from floating bearing end head (102). Remove packing rings (1) from stuffing box of floating bearing end head and discard packing rings.
- f. Install two 7/8-9 (Model L, M, P and R pumps) or 1-8 (Model S, T and U pumps) eyebolts in two opposite tapped holes in inlet flange of head and, using chain hoist, lower head to floor with cone up.
- g. Inspect floating bearing end cone (104) as specified in Paragraph 5-10.

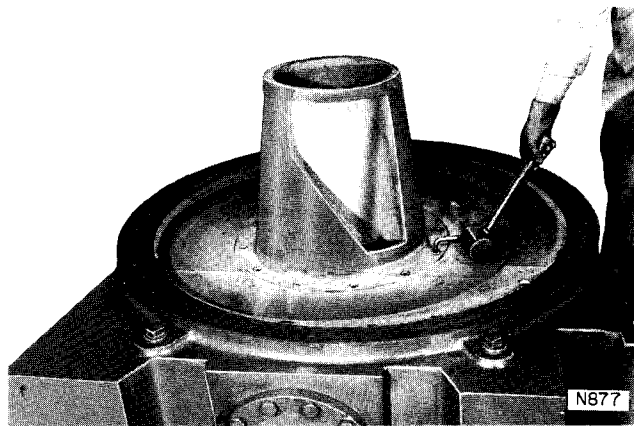


Figure 5-10. Loosening Cone Screws

5-7 Disassembling Rotor and Shaft

If inspection of the rotor (Paragraph 5-11) or shaft (Paragraph 5-12) indicates that either part requires replacement or repair which requires disassembly, proceed as follows.

- a. Lift rotor and shaft assembly by placing sling around center shroud of rotor or with chains as shown in Figure 5-8.

CAUTION

FOR MODEL U PUMPS, PIPE SECTION USED IN STEP b MUST BE 16-INCH STEEL PIPE, SCHEDULE 30 MINIMUM, SCHEDULE 100 MAXIMUM.

- b. Slide bushing or pipe section sized to fit over fixed bearing end of shaft with face of bushing contacting rotor hub face only.
- c. Position rotor and shaft assembly in press large enough to handle rotor diameter with floating bearing end of shaft against press ram and end of bushing installed in step c, against press backup plate.
- d. Make provision to support fixed bearing end of shaft as it is pushed from rotor. Support rotor with blocks or sling passed through rotor blades and around each shroud.
- e. Make certain that shaft is level and apply ram force to remove shaft from rotor.
- f. If rotor taper bore is to be machined oversize, **call your local Nash Representative** for guidance on dimensions to be used.
- g. Install floating and fixed bearing locknuts (119-1 and 120-1, Figure 5-21, 5-22, or 5-23) to protect shaft threads.

5-8 Disassembling Head and Cone Assembly

If inspection of the cone (Paragraph 5-10) indicates that the cone must be replaced or reworked, proceed as follows.

- a. Insert Allen wrench in socket of each cone screw (104-1 or 105-1, Figure 5-21, 5-22, or 5-23) in turn; tap Allen wrench with mallet as shown in Figure 5-10 to loosen and remove 8 (Model L and M pumps), 12 (Model P, R, S and T pumps) or 15 (Model U pumps) cone screws.
- b. Tap side of floating or fixed cone (104 or 105) with soft-headed mallet to free cone from head (102 or 103).
- c. Using hoist and grab hooks (hooks inward) inserted into cone ports, pull cone from head.
- d. Remove gaskets (104-3 or 105-3). Record number of gaskets removed and discard gaskets.

5-9 INSPECTION OF DISASSEMBLED PARTS

With the pump disassembled, inspect the parts as described in the following paragraphs.

Note

If there is any question about the reusability or repair of worn major pump parts, **contact your local Nash Representative.**

5-10 Cones

Normally worn tapered surfaces of the cones will be smooth, requiring only cleaning and light filing around the ports and tips. If foreign material has entered the pump suction inlet during operation, circular score marks may be noticed around the outside of the cone tapers. Inspect the cones for damage and wear as follows:

Check for uneven wear and scoring between the ports and at the edges of the ports with a straightedge as shown in Figure 5-11. Localized wear or scoring not more than 0.030-inch deep is acceptable unless the pump is required to operate at or near maximum capacity. If the localized

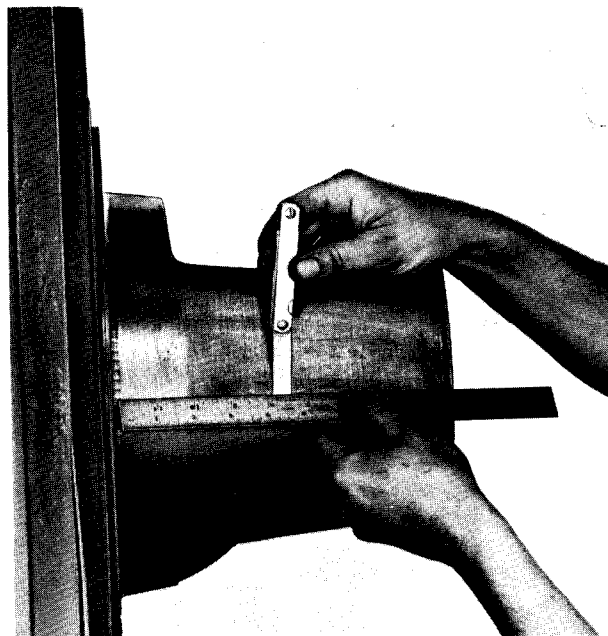


Figure 5-11. Checking Cone for Wear

wear or scoring exceeds 0.030 inch in depth, **contact your Nash Representative** for assistance in determining the reusability of the rotor. Minor pitting is acceptable.

5-11 Rotor

Inspect the taper cone bores of the rotor on the same basis as the tapered surface of the cones as follows:

Check for uneven wear, undercutting or scalloping on the cone bore tapered surface with a straightedge in a manner similar to that shown in Figure 5-11. Localized wear, undercutting or scalloping not more than 0.030-inch deep is acceptable. If localized wear, undercutting or scalloping exceeds 0.0300 inch in depth, **contact your Nash Representative** for assistance in determining the reusability of the rotor. Minor pitting is acceptable.

5-12 Shaft

Check the shaft diameters on which the packing seats for excessive wear. If the shaft is scored or worn through the metalized surface, **contact your Nash Representative** for assistance in determining the reusability of the shaft.

Check shaft journals for signs of pick-up and check all surfaces for wear and/or damage.

5-13 Heads

Check to make sure that all ports and passages in fixed and floating bearing end heads are clean and free of obstructions. Remove all pipe plugs to properly inspect internal passages. Remove any foreign material and replace pipe plugs.

Remove cover plate (12-1, Figure 5-21, 5-22, or 5-23) and see that check ball (18) is free. On Model L, M, P, R, S and T pumps, see that three rollpins (12-4, Figure 5-21) are in place. Reinstall cover plate with new gasket (12-3, Figure 5-21, 5-22, or 5-23) if necessary.

5-14 REASSEMBLING PUMP

CAUTION

THOROUGHLY CLEAN ALL PARTS BEFORE REASSEMBLY. BE SURE TO REMOVE ALL OLD GASKET MATERIAL FROM MOUNTING FLANGES. REMOVE BURRS FROM MATING SURFACES AND MOUNTING FACES.

5-15 Reassembling Rotor and Shaft

To reassemble the rotor on the shaft, proceed as follows:

CAUTION

THIS PROCEDURE APPLIES TO ASSEMBLY OF IRON ROTOR ON STEEL SHAFT ONLY. ROTOR AND SHAFT MUST BE AT SAME TEMPERATURE DURING ASSEMBLY.

- File tape bores of rotor (110, Figure 5-21, 5-22, or 5-23) to remove burrs and high spots.
- Check shaft for dents or rough spots on rotor seat and bearing journals.
- Stone or polish shaft smooth.
- Coat rotor hub bore and rotor seat of shaft with Molykote G-n paste, or equivalent, to prevent damage from friction or pick-up when shaft is pressed into rotor.

Note

Make sure that bearing locknuts (119-1 and 120-1) have been removed from shaft.

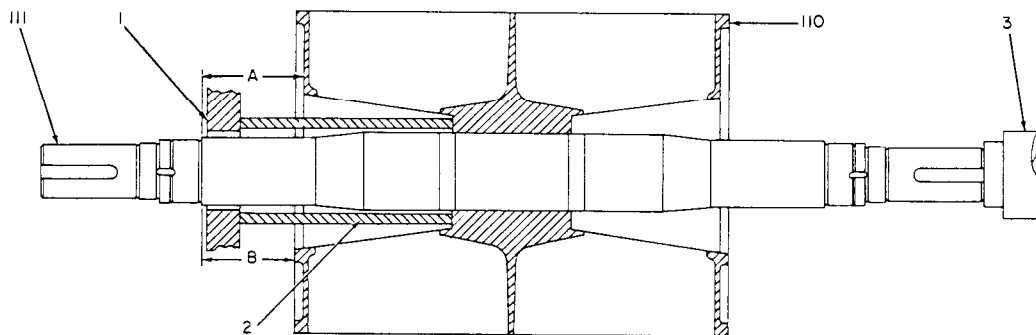
CAUTION

CHECK HEAD (102 or 103) AND NOTE NUMBER SHOWN ON ASSEMBLY POSITION PLATE. REFER TO FIGURE 5-1 OR 5-1a AND DETERMINE LOCATION OF FIXED AND FLOATING BEARING ENDS FOR THIS ASSEMBLY POSITION NUMBER.

- Position rotor on shaft with blades curving in the proper direction for assembly position number. (See Figure 5-1 or 5-1a.)
- Slide same bushing or pipe section used in disassembly, on floating bearing end of shaft. (See Figure 5-12.)
- Sling rotor and shaft by a sling placed around outside diameter at point of balance and place rotor and shaft in press with fixed bearing end of shaft in line with ram end of press and face of bushing or pipe section contacting rotor hub face only, with bushing or pipe section supported by press backup plate. Level shaft in press.
- Press shaft into rotor until dimension A, Figure 5-12, from recess of outer shroud surface to floating bearing journal shoulder is as follows:

Model "A" Dimension

L, M	13.563 +/- 0.010
P, R	13.438 +/- 0.010
S, T	16.062 +/- 0.010
U	16.500 +/- 0.010



- | | |
|----------------------------|---|
| 1. Press Backup Plate | 110. Rotor |
| 2. Bushing or Pipe Section | 111. Shaft (Level Before Pressing into Rotor) |
| 3. Press Ram | |

N900A

Figure 5-12. Pressing Rotor onto Shaft

Record force applied. Minimum allowable force is as follows:

Pump Model	Minimum Allowable Force - tons
L	19
M	20
P	30
R	50
S	55
T	60
U	69

CAUTION

IF ASSEMBLY FORCE RECORDED IS LESS THAN MINIMUM SPECIFIED ABOVE, DO NOT INSTALL ASSEMBLED ROTOR AND SHAFT IN VACUUM PUMP. CONTACT YOUR LOCAL NASH REPRESENTATIVE TO DETERMINE WHETHER ROTOR AND/OR SHAFT MUST BE REPLACED.

WARNING

BEFORE REMOVING ROTOR AND SHAFT ASSEMBLY FROM PRESS, MOVE SLING TO NEW POINT OF BALANCE TO AVOID INJURY OR DAMAGE.

5-16 Installing Cone in Head

- If one or both the head and cone assemblies have been disassembled, reassemble them as follows:
- Place head in horizontal position with cone side up.
 - If new cone is being installed, check it carefully against old cone for correct number and orientation of ports, and remove rust preventative from surfaces with solvent such as kerosene.
 - File taper surfaces on the cone smooth, paying special attention to edges of cone ports.
 - Apply light coat of grease to both sides of replacement cone gasket (104-3 or 105-3, Figure 5-21, 5-22, or 5-23) and position gasket on head (102 or 103).

CAUTION

ON MODEL P, R, S, AND T PUMPS, CONE MOUNTING HOLE PATTERN IS SYMMETRICAL ABOUT BOTH CENTERLINES. TO AVOID INSTALLING CONE IN WRONG POSITION, MAKE CERTAIN TO ALIGN PORTS IN CONE WITH PORTS IN HEAD. (SEE FIGURE 5-13.)

- Place grab hooks in ports at small end of cone, lift cone with chain hoist, lower it into place on associated head and remove grab hooks. Thread in the following:

Model	Qty	Index #	Screw
L,M	8	104-1	5/8 - 11
P,R,S,T	12	104-1	5/8 - 11
U	15	105-1	3/4 - 10

- Using leaf (feeler) gauge inserted between cone mounting flange and head rabbet at four places, 90 degrees apart, around circumference, tap cone with rawhide hammer until cone is centered and then pull it into place with socket head cone screws. (See Figure 5-14.) After tightening screws by hand, tap Allen wrench with mallet to finish tightening each screw.

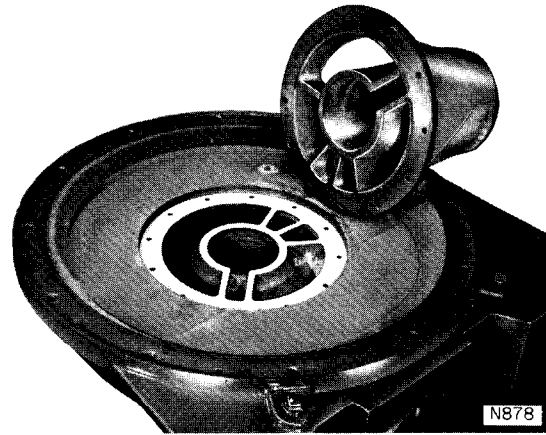


Figure 5-13. Aligning Cone Ports with Ports in Head, Model P, R, S and T Pumps

5-17 Installing Body on Floating Bearing End Head and Cone Assembly

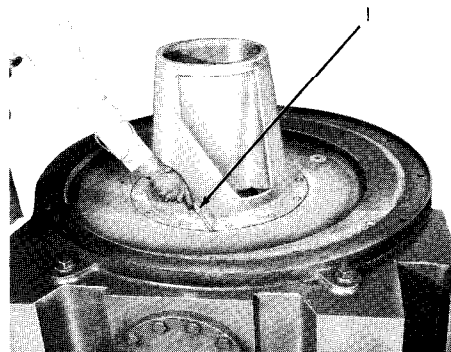
Install the body (101, Figure 5-21, 5-22, or 5-23) on the floating bearing end head and cone assembly as follows:

- Install two 7/8-9 (Model L, M, P and R pumps) or 1-8 (Model S, T and U pumps) eyebolts in opposite tapped holes in inlet flange of floating bearing end head (102).
- Using chain hoist, raise floating bearing end head and cone assembly to vertical position, lower to level pads used at disassembly of pump and secure feet to work surface with mounting bolts.
- Lightly grease body mounting flange on floating bearing end head.
- Install two of the following studs or threaded rods in two horizontally opposite tapped holes in floating bearing end head flange to align gaskets and body.

Model	Stud/Rod
L, M	3/4-10 x 4.0
P, R, S, T, U	1.0-8 x 4.0

CAUTION

ON MODEL L, M, P, R, S AND T PUMPS, WHEN INSTALLING BODY GASKETS (101-3), MAKE CERTAIN TO ALIGN 9/16-INCH DIAMETER HOLE IN EACH GASKET WITH CORRESPONDING HOLE IN HEAD FLANGE.



1. Leaf (Feeler) Gauge

Figure 5-14. Checking Cone Concentricity

- e. Apply light coat of grease to four (Model L and M pumps), five (Model P, R, S and T pumps) or seven (Model U pumps) body gaskets (101-3) and install each separately over studs installed in step d and against floating bearing end head flange.

CAUTION

ON MODEL L, M, P, R, S AND T PUMPS, MAKE SURE THAT BOTH BODY PINS (101-2, Figure 5-21) PROTRUDE 5/8 INCH MINIMUM FROM BODY FLANGE.

- f. Lift body (101) with chains and spreader bar as shown in Figure 5-9. Position body with body rotation arrow in same direction as rotation arrow on floating bearing end head.
- g. Guide body into floating bearing end head rabbet until it seats. On Model L, M, P, R, S and T pumps, make certain that body pin (101-2, Figure 5-21) enters 9/16-inch diameter hole in head as body flange mounting holes engage studs installed in step d.
- h. Secure body to floating bearing end head with the following head screws or body nuts, finger tight.

<u>Model</u>	<u>Qty</u>	<u>Screw/Nut</u>	<u>Index #</u>	<u>Ref. Fig</u>
L,M	10	3/4 - 10	102-4	5-21
P,R,S,T	10	1.0 - 8	102-4	5-21

Remove studs and replace with following remaining head screws:

<u>Model</u>	<u>Qty</u>	<u>Screw/Nut</u>	<u>Index #</u>
L,M	2	3/4 - 10	102-4
P,R,S,T	2	1.0 - 8	102-4

- i. On Model U pumps, secure body to floating bearing end head with eight 1-8 x 3 inch head screws (102-5, Figure 5-22) and three 1-8 x 4 inch head screws (102-4) finger-tight. Remove two studs; replace and tighten remaining two head screws (102-5).
- j. Support fixed bearing end of body with wood blocks and remove chains.

5-18 Installing Rotor and Shaft Assembly

Install the rotor and shaft assembly in the body and the floating bearing end head and cone assembly as follows:

Note

Make sure that floating bearing locknut (119-1) has been removed from shaft (111).

- a. Slide machined end of shaft sleeve tool, fabricated in Paragraph 5-5, step b, through floating bearing end head (102) and shaft bore of cone (104).
- b. Using chain hoist and sling around rotor center shroud or chains as shown in Figure 5-8, lift rotor and shaft assembly and insert floating bearing end of shaft into body until shaft engages shaft sleeve tool.
- c. Hold shaft sleeve tool level and continue moving rotor and shaft assembly into body until bearing journal shoulder on shaft seats against end of shaft sleeve tool.
- d. Continue to move rotor and shaft assembly with shaft guided through cone and head by shaft sleeve tool until strap or chains reach body flange. Using wood blocks,

- support fixed bearing end of rotor as shown in Fig. 5-8.
- e. Remove sling or chains from rotor. Install strap around fixed bearing end of shaft and second sling and chain hoist or floor jack on shaft sleeve tool at floating bearing end.
- f. Level rotor and shaft assembly, remove wood blocks, and continue to move rotor and shaft assembly into body, with rotor centered in body shroud ID, until rotor taper bore rides up on floating bearing end cone.
- g. Remove straps, hoists, floor jack and shaft sleeve tool.

5-19 Installing Fixed Bearing End Head and Cone Assembly

Install the fixed bearing end head and cone assembly as follows:

- a. Install two eyebolts in inlet flange of fixed bearing end head (103, Figure 5-21, 5-22, or 5-23) in same manner as specified in Paragraph 5-17, step a. Using chain hoist, raise fixed bearing end head and cone assembly to vertical position.
- b. Perform steps c and d, Paragraph 5-17, on fixed bearing end head.

CAUTION

ON MODEL L, M, P, R, S AND T PUMPS, WHEN INSTALLING BODY GASKETS (101-3), MAKE CERTAIN TO ALIGN 9/16-INCH DIAMETER HOLE IN EACH GASKET WITH CORRESPONDING HOLE IN HEAD FLANGE.

- c. Apply light coat of grease to six (Model L and M pumps), seven (Model P, R, S and T pumps), or 10 (Model U pumps) body gaskets (101-3) and install each separately over studs installed in step b and against fixed bearing end head.
- d. Remove fixed bearing locknut (120-1) from shaft (111).
- e. Position fixed bearing end head and cone assembly with shaft bore of con (105)e aligned with fixed bearing end of shaft (111).
- f. Slide machined end of shaft sleeve tool, fabricated in Paragraph 5-5, step b, through fixed bearing end head and shaft bore of cone until shaft sleeve tool engages shaft.
- g. Supporting end of shaft sleeve tool by hand, move fixed bearing end head and cone assembly and shaft sleeve tool towards body (101) until shaft sleeve tool is seated against bearing journal shoulder on shaft and head and cone assembly begins to move over shaft.
- h. Continue to carefully move fixed bearing end head and cone assembly toward body until head rabbet seats on body flange. On Model L, M, P, R, S and T pumps, make certain that body pin (101-2, Figure 5-21) enters 9/16-inch diameter hole in had as studs, installed in step b, engage body flange mounting holes.

Note

It may be necessary to lift end of shaft sleeve tool with strap and chain hoist or floor jack to enable rotor end shroud to engage shroud recess in head.

- i. Remove shaft sleeve tool.
- j. Secure fixed bearing end head to body with the following:

<u>Model</u>	<u>Qty</u>	<u>Screw/Nut</u>	<u>Index #</u>	<u>Ref. Fig</u>
L,M	10	3/4 - 10	103-4	5-21
P,R,S,T	10	1.0 - 8	103-4	5-21

- k. On Model U pumps, secure fixed bearing end head to body with eight 1-8 x 3.00 inch head screws (103-5, Figure 5-22) and three 1-8 x 4.00 inch head screws (103-4) finger-tight.
- l. Lift fixed bearing end head end of pump and remove wood blocks supporting body.
- m. Lower pump so that all four mounting feet are on level pads.
- n. Remove studs and replace with remaining two 3/4-10 (Model L and M pumps) or 1-8 (Model P, R, S and T pumps) head screws (103-4, Figure 5-21) or two 1-8 (Model U pumps) head screws (103-5, Figure 5-22).
- o. Loosen floating bearing end head screws (102-4, Figure 5-21 or 5-22) and on Model U pumps, floating bearing head screws (102-5, Figure 5-22).
- p. Make sure that pump mounting feet are level on mounting pads. Securely tighten the following fixed and floating bearing end head screws or nuts.

Model	Qty	Screw/Nut	Index #	Ref. Fig
L,M	24	3/4 - 10	103-4	5-21
			102-4	
P,R,S,T	24	1.0 - 8	103-4	5-21
			102-4	
U	20	1.0 - 8	103-5	5-22
			102-5	
	6	1.0 - 8	103-4	5-22
			102-4	

5-20 Installing Fixed Bearing Bracket

Install fixed bearing bracket (109, Figure 5-21, 5-22, or 5-23) and associated parts on fixed bearing end head (103) as follows:

- a. If gland studs (103-2) were removed, install replacement gland studs in head.
- b. Install gland assembly on fixed bearing end gland studs (103-2). Install two 1/2-13 (Model L and M pumps) or 5/8-11 (Model P, R, S, T and U pumps) gland nuts (103-1). Do not tighten gland nuts.
- c. Install slinger (3) and slinger spring (3-1) on fixed bearing end of shaft (111).
- d. Apply light coat of grease to ID and OD of new lip seal (5). Install lip seal in fixed bearing inner cap (118) with sealing edge (and spring) facing head side of inner cap.
- e. Install fixed bearing inner cap on fixed bearing end of shaft using care not to damage sealing edge of lip seal.
- f. Lightly grease fixed bearing inner cap gasket (118-3) and position on fixed bearing inner cap lip.
- g. Install chains with spreader bar around top two ribs of fixed bearing bracket (109) as shown in Figure 5-2 lift fixed bearing bracket into position on fixed bearing end head (103) and tap bracket flange into head rabbet with a rawhide mallet. Secure bearing bracket to head with four 7/8-9 (Model L and M pumps), 1-8 (Model P and

R pumps) or 1-1/4-7 (Model S, T and U pumps) bearing bracket screws. **MAKE CERTAIN THAT BEARING BRACKET IS FULLY SEATED AGAINST HEAD.**

5-21 Installing Fixed Bearing

Install the fixed bearing (120, Figure 5-21, 5-22, or 5-23) on the shaft as follows:

Note

It is recommended that new bearings be installed.

- a. Move shaft toward fixed bearing end of pump so that rotor taper bore rides up on fixed bearing end cone (105) to ensure that shaft is centered in bearing housing. This can be accomplished by using a soft-faced hammer or ram to impact floating bearing end of shaft.
- b. Push fixed bearing inner cap (118) back against gland studs (103-2).

Note

Make certain that fixed bearing locknut (120-1) has been removed from shaft (111).

CAUTION

MAKE CERTAIN THAT BEARING CUP AND SPACER SUPPLIED WITH TAPERED CONE BEARINGS ARE NOT MISPLACED WHEN TAPERED CONE BEARINGS ARE BEING HEATED. (SEE FIGURE 5-15.) CUP, SPACER AND TAPERED CONE BEARINGS ARE SUPPLIED AS MATCHED SET; CUP AND/OR SPACER FROM ONE SET SHALL NOT BE USED WITH TAPERED CONE BEARINGS FROM ANOTHER SET. SERIOUS CLEARANCE ERRORS CAN RESULT IF THIS CAUTION IS NOT OBSERVED.

- c. Heat two tapered cone bearings of fixed bearing set, using hot air oven and 250°F (121°C) temp stick, to 240° to 250°F (116° to 121°C).

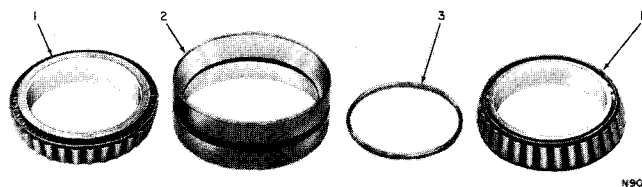
CAUTION

DO NOT HEAT BEARING CUP OR SPACER.

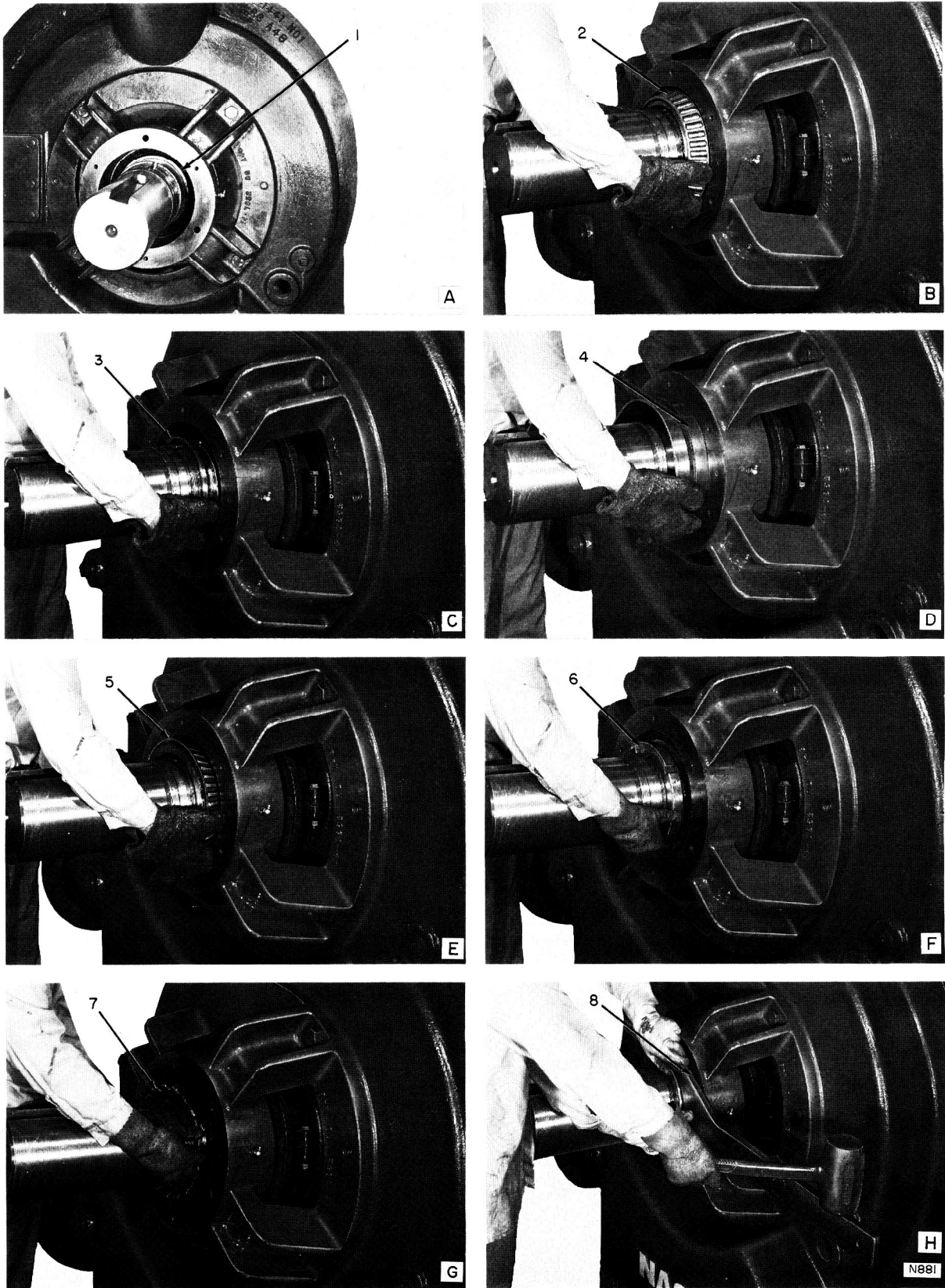
WARNING

USE ASBESTOS GLOVES WHEN HANDLING HEATED TAPERED CONE BEARING TO AVOID SERIOUS BURNS.

- d. Remove one tapered cone bearing from heater or oven. Position large end of taper toward shaft and line up ID of bearing with shaft OD.



1. Tapered Cone Bearing 2. Bearing Cup 3. Bearing Spacer
Figure 5-15. Tapered Roller Bearing Assembly,



1. Bearing Journal
2. Inner Tapered Cone Bearing

4. Bearing Cup
5. Outer Tapered Cone Bearing

6. Fixed Bearing Locknut
7. Fixed Bearing Lockwasher
8. Spanner Wrench

Figure 5-16. Installing Fixed Bearing

Note

Following step must be performed as rapidly as possible. As soon as heated tapered bearing contacts shaft, it will cool rapidly and contract. Contraction may be sufficient to cause bearing to seize at wrong location on shaft, requiring that bearing be pulled, reheated and reinstalled.

- e. Using one smooth, swift motion, center bearing on shaft and push bearing onto bearing journal until it contacts bearing journal shoulder. (See Figure 5-16, Parts A and B.) **MAKE CERTAIN THAT TAPERED CONE BEARING IS SEATED AGAINST BEARING JOURNAL SHOULDER.**
- f. Slide bearing spacer over shaft and into bearing bracket until it contacts tapered cone bearing. (See Figure 5-16, Part C.)
- g. Install bearing cup over tapered cone bearing installed in step e being careful not to jam bearing cup in bearing bracket and making certain that cup is seated properly on tapered cone bearing. (See Figure 5-16, Part D.)
- h. Using asbestos gloves, remove second tapered cone bearing from heater or oven. Position small end of taper towards shaft and line up ID of bearing with OD of shaft.
- i. Observing precaution in Note preceding step e and using smooth, swift motion, center bearing on shaft and push bearing onto bearing journal until spacer installed in step f is wedged between two tapered cone bearings. (See Figure 5-16, Part D.)
- j. Quickly install fixed bearing locknut (120-1) on shaft, carefully engage threads and tighten with spanner wrench of punch and hammer. (See Figure 5-16, Parts F and H.)
- k. On Model L, M, P, R, S and T pumps, when fixed bearing has cooled, proceed as follows:
 1. Remove fixed bearing locknut from shaft. Install fixed bearing lockwasher (120-2, Figure 5-21) as shown in Figure 5-16, Part G, with inner tab in slot in shaft.
 2. Reinstall fixed bearing locknut, tighten with spanner wrench and mallet, or punch and hammer, until slot in locknut aligns with tab on lockwasher.
 3. Bend lockwasher tab into locknut slot.
- l. On Model U pumps, when fixed bearing has cooled, proceed as follows:
 1. Retighten fixed bearing locknut with spanner wrench and mallet, or punch and hammer, until locknut lockplate (102-2, Figure 5-22) can be mounted on locknut with tab in keyway in shaft (111).
 2. Secure locknut lockplate to locknut with two screws (120-4). Lockwire screws.

5-22 Preliminary End Travel Check

Perform the following end travel check to determine the correct number of body gaskets (101-3, Figure 5-21, 5-22, or 5-23) required.

Note

Make certain that rotor taper bore is still mating with fixed bearing end cone (105) and shaft cannot be rotated.

- a. Mount dial indicator on floating bearing end of shaft using strap or magnetic mount with dial indicator spindle against machined bearing bracket mounting face on floating bearing head (102). Set dial indicator to zero.
- b. Install fixed bearing outer cap (117) on fixed bearing

bracket (109) and secure to fixed bearing inner cap (118) with fasteners as follows:

Model	Qty	Index No.	Screw
L,M,P,R	3	117-2	1/2 - 13
S,T	3	117-2	5/8 - 11
U	3	117-2	3/4 - 10

- c. Install the following screws through fixed bearing outer cap and thread into bearing bracket to serve as takeup screws. (See Figure 5-17.)

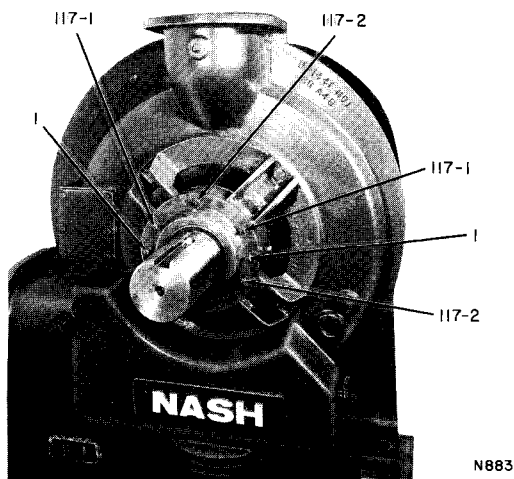
Model	Qty.	Index No.	Screw
L,M,P,R	3	117-1	1/2 - 13
S,T	3	117-1	5/8 - 11
U	3	117-1	3/4 - 10

- d. Alternately tighten three takeup screws (117-1) until rotor and shaft assembly cannot be moved any farther and shaft cannot be rotated. **DO NOT ATTEMPT TO TIGHTEN SCREWS BEYOND THIS POINT.** Rotor taper bore is now mating against floating bearing end cone (104). Record dial indicator reading and remove dial indicator.
- e. If value recorded in step d is less than recommended end travel specified in Table 5-3, subtract recorded value from recommended end travel. If difference is 0.010 inch or more, proceed to step f; if difference is less than 0.010 inch, proceed to Paragraph 5-23. If value recorded in step d is more than recommended end travel specified in Table 5-3, proceed to Paragraph 5-23.
- f. Select thickness of body gaskets (101-3) equal to difference calculated in step e and install at floating bearing end as follows:

Note

Procedure in steps f.1 through f.18 below is for adding body gaskets when end travel is less than recommended end travel. Each body gasket is 0.010-inch thick.

- 1. Install eyebolts in inlet flange of floating bearing end head (102) as specified in Paragraph 5-6, step f.



1. Jackscrew 117-2. Fixed Bearing Outer Cap Screw
117-1. Takeup Screw

Figure 5-17. End Travel Check Setup at Fixed Bearing End

Table 5-3. Recommended End Travel

Pump Model	End Travel-Inches (Iron)	End Travel-Inches (St. St)
L	0.160	0.290
M	0.170	0.305
P	0.190	0.345
R	0.195	0.350
S	0.220	0.395
T	0.230	0.410
U	0.250	0.445

2. Remove mounting bolts from feet of floating bearing and head.
3. Using chain hoist connected to eyebolts installed in step f.1, lift pump enough to raise mounting feet of floating bearing end head off level pads.
4. Using wood blocks, support floating bearing end of body (101). Lower pump so that it is supported by wood blocks but maintain tension on chain hoist.
5. Remove 12 (Model L, M, P, R, S and T pumps) or three (Model U pumps) floating bearing end head screws (102-4) and 10 (Model U pumps) floating bearing end head screws (102-5, Figure 5-22). Install two 3/4-10 (Model L and M pumps) or 1-8 (Model P, R, S, T and U pumps) by 4-inch long studs or threaded rods as specified in paragraph 5-17, step d.
6. Install two 3/4-10 (Model L and M pumps) or 1-8 (Model P, R, S, T and U pumps) screws in tapped holes in flange of body to serve as jackscrews.
7. Tighten two jackscrews evenly until floating bearing end head rabbet is free of body flange and remove floating bearing end head and cone assembly.

CAUTION

ON MODEL L, M, P, R, S AND T PUMPS, WHEN INSTALLING BODY GASKETS, MAKE CERTAIN TO ALIGN 9/16-INCH DIAMETER HOLE IN EACH GASKET WITH CORRESPONDING HOLE IN HEAD FLANGE.

8. Apply light coat of grease to each additional body gasket and install each separately over studs installed in step f.5 and against body gaskets previously installed.
9. Position floating bearing end head and cone assembly with shaft bore of cone (104) aligned with floating bearing end of shaft (111).
10. Slide machined end of shaft sleeve tool, fabricated in Paragraph 5-5, step b, through floating bearing end head and shaft bore of cone until shaft sleeve tool engages shaft.
11. Supporting end of shaft sleeve tool by hand, move floating bearing end head and cone assembly and shaft sleeve tool towards body (101) until shaft sleeve is seated against bearing journal shoulder on shaft and head and cone assembly begins to move over shaft.
12. Continue to carefully move floating bearing end head and cone assembly toward body until head rabbet seats on body flange. On Model L, M, P, R, S and T pumps, make certain that body pin (101-2, Figure 5-21) enters 9/16-inch diameter hole in head as studs, installed in step f.5, engage body flange mounting holes.

Note

It may be necessary to lift end of shaft sleeve tool with strap and chain hoist or floor jack to enable rotor end shroud to engage shroud recess in head.

13. Remove shaft sleeve tool.
14. Secure floating bearing end head with the following screws or nuts (on studs). Install all head screws/nuts, finger tight.

Model	Qty.	Index No.	Screw	Nut	Figure
L, M	10	102-4	3/4-10	-	5-21
P,R,S,T	10	102-4	1.0- 8	-	5-21
U	3	102-4	1.0-8x4.0	-	5-22
	8	102-5	1.0-8x3.0	-	

15. Slightly raise pump and remove wood blocks supporting body.
16. Lower pump so that mounting feet are on level pads. Remove chain hoist and eyebolts.
17. Remove studs and replace with the remaining screws.

Model	Qty.	Index No.	Screw	Nut	Figure
L, M	2	102-4	3/4-10	-	5-21
P,R,S,T	2	102-4	1.0- 8	-	5-21
U	2	102-5	1.0-8x4.0	-	5-22

18. Make sure that all pump parts are level and tighten:

Model	Qty.	Index No.	Screw	Nut	Figure
L, M	12	102-4	3/4-10	-	5-21
P,R,S,T	12	102-4	1.0- 8	-	5-21
U	3	102-4	1.0-8x4.0	-	5-22
	10	102-5	1.0 8x3.0	-	

5-23 Installing Floating Bearing Bracket and Floating Bearing

Install the floating bearing bracket (108, Figure 5-21 or 5-22), the floating bearing (119) and associated parts on the floating bearing end head (102) as follows:

- a. Install floating bearing bracket (108) and corresponding floating bearing end parts in the same manner as specified in Paragraph 5-20, steps a through g.

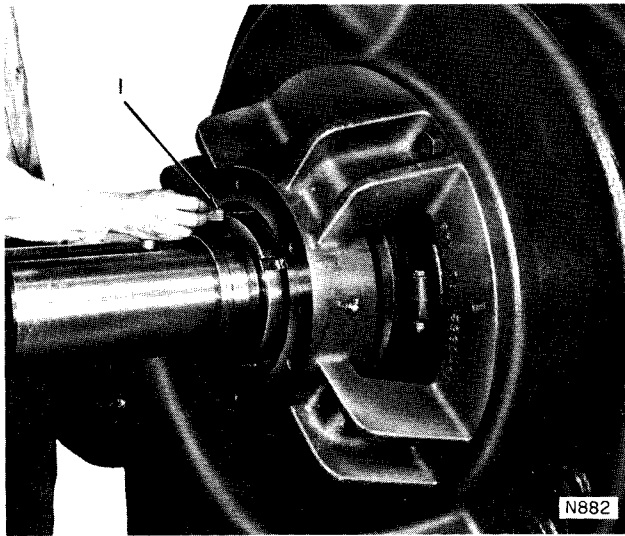
Note

Make sure that rotor and shaft assembly is engaging floating bearing end cone (104).

- b. Install floating bearing in same manner as specified in Paragraph 5-21, steps b through j.
- c. Install the following screws in tapped holes in the fixed bearing outer cap (117) to act as jackscrews. (See Figure 5-17).

Model	Qty.	Screw
L, M, P, R	2	1/2 - 13
S, T	2	5/8 - 11
U	2	3/4 - 10

- d. Loosen three takeup screws (117-1) on fixed bearing outer cap. Tighten two jackscrews installed in step c and pull rotor and shaft assembly off floating bearing end cone (102) until shaft can be rotated.



1. Leaf (Feeler) Gauge

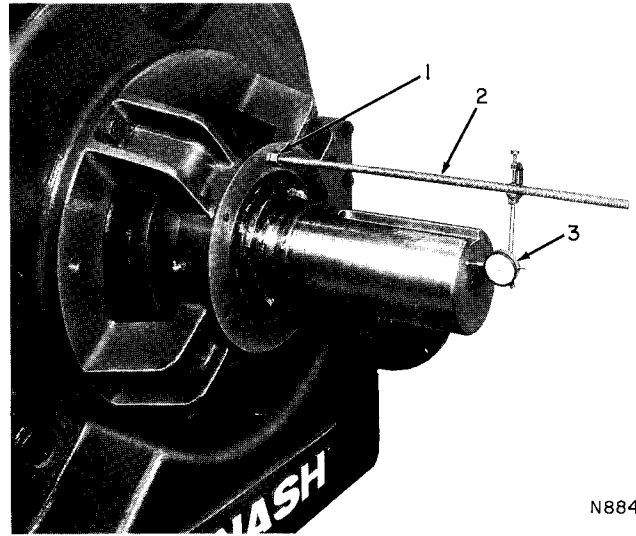
Figure 5-18. Measuring Bearing Roller-Cup Clearance. Models L, M, P, R, S & T

- e. Using spanner wrench, rotate shaft through three revolutions minimum.
- f. Insert leaf (feeler) gauge between a high point of any tapered cone bearing roller and inner race of bearing cup as shown in Figure 5-18 to measure bearing roller-cup clearance. Maximum allowable clearance at any point is 0.002 inch. If clearance exceeds 0.002 inch, bearing installation may be incorrect or all bearing parts may not be from matched set; disassemble pump as necessary to pull bearing; check bearing parts; reassemble pump and reinstall bearing.
- g. Remove fixed bearing outer cap (117) and repeat step f for fixed bearing (120). Reinstall fixed bearing outer cap.
- h. On Model L, M, P, R, S and T pumps, proceed as follows:
 1. Remove floating bearing locknut (119-1, Figure 5-21) from shaft (111). Install floating bearing lockwasher (119-2) as shown in Figure 5-16, Part G, with inner tab in slot in shaft.
 2. Reinstall floating bearing locknut, tighten with spanner wrench and mallet, or punch and hammer, until slot in locknut aligns with tab on lockwasher.
 3. Bend lockwasher tab into locknut slot.
- i. On Model U pumps, proceed as follows:
 1. Retighten floating bearing locknut with spanner wrench and mallet, or punch and hammer, until locknut lockplate (119-2, Figure 5-22) can be mounted on locknut with tab in keyway in shaft (111).
 2. Secure locknut lockplate to locknut with two screws (119-4). Lockwire the screws.

5-24 Setting End Travel

Set end travel as follows:

- a. Make certain that three fixed bearing outer cap screws (117-2) are tightened and make certain that three takeup screws (117-1) are loosened at least 1/4 inch (Model L, M, P, R, S and T pumps) or 3/8 inch (Model U pumps). (See Figure 5-17.)



1. Nut
2. Threaded Rod

3. Dial Indicator

Figure 5-19. Measuring End Travel at Floating

- b. Install the following threaded rod in the top floating bearing outer cap mounting hole in floating bearing bracket (108) and secure with one nut on each side of bearing housing (see figure 5-19).

Model	Thread	Length Inches
L,M,P,R	1/2 - 13	30
S,T	5/8 - 11	30
U	3/4 - 10	30

- c. Mount dial indicator on threaded rod with dial indicator spindle against end of shaft as shown in Figure 5-19.
- d. Evenly tighten two jackscrews in fixed bearing outer cap

(117, Figure 5-21 or 5-22) until rotor and shaft assembly cannot be moved any farther and shaft cannot be rotated. (See Figure 5-17.) **DO NOT ATTEMPT TO TIGHTEN SCREWS BEYOND THIS POINT.** Rotor taper bore is now mating against fixed bearing end cone (105). Set dial indicator to zero.

- e. Remove jackscrews from fixed bearing outer cap.
- f. Alternately tighten takeup screws (117-1) until rotor and shaft assembly cannot be moved any farther and shaft cannot be rotated. (See Figure 5-17.) **DO NOT ATTEMPT TO TIGHTEN SCREWS BEYOND THIS POINT.** Rotor taper bore is now mating against floating bearing end cone (104). Record dial indicator reading.
- g. compare value recorded in step f with recommended end travel specified in Table 5-3. If recorded end travel value is greater than value specified in Table 5-3, proceed to step h; if value recorded is less than value specified in Table 5-3, proceed to step j.
- h. Subtract value specified in Table 5-3 from value recorded in step f. If difference is 0.010 inch or more, remove body gaskets (101-3) as specified in step i; if difference is less than 0.010 inch, end travel is within limits, proceed to step l.
- i. Remove body gaskets (101-3) from fixed bearing end as follows:
 1. Install eyebolts in inlet flange of fixed bearing end head (103) as specified in Paragraph 5-4, step a.
 2. Using chain hoist connected to eyebolts, lift pump

enough to raise mounting feet of fixed bearing end head off level pads.

3. Using wood blocks, support fixed bearing end of body (101). Lower pump so that it is supported by wood blocks but maintain tension on chain hoist.
4. Remove three fixed bearing outer cap screws (117-2) to free fixed bearing inner cap (118).
5. Remove 12 (Model L, M, P, R, S and T pumps) or three (Model U pumps) fixed bearing end head screws (103-4) and 10 (Model U pumps) fixed bearing end head screws (103-5, Figure 5-22). Install two 3/4-10 (Model L and M pumps) or 1-8 (Model P, R, S, T and U pumps) by 4-inch long studs or threaded rods as specified in paragraph 5-17, step d.
6. Install the following screws in the tapped holes of the listed flanges to serve as jackscrews.

<u>Model</u>	<u>Qty.</u>	<u>Screw</u>	<u>Flange</u>
L,M,P,R	2	3/4 - 10	Body
S,T	2	1.0 - 8	Body
U	2	1.0 - 8	Head

7. Tighten two jackscrews evenly until fixed bearing end head rabbet is free of body flange.

CAUTION

MAKE CERTAIN THAT COMPLETE GASKET IS REMOVED WHEN PERFORMING STEP i.8.

8. Move fixed bearing end head back just enough to insert jaws of needle-nosed pliers in space. Tear off thickness of body gaskets equal to value calculated in step h. Each gasket is 0.010-inch thick.

Note

If number of gaskets to be removed is more than quantity installed or will result in only one gasket remaining, gaskets may have to be removed from floating bearing end or additional cone gaskets (104-3 and 105-3) may be to be added. **Contact your Nash Representative** for assistance in establishing acceptable end travel.

9. Reassemble fixed bearing end head and cone assembly to body in same manner as specified in paragraph 5-22, steps f.12 and f.14 through f.18.
 10. Repeat steps d through g.
- j. If value recorded in step f is less than value specified in Table 5-3, subtract recorded end travel value from value specified in Table 5-3. if difference is greater than 0.010 inch, add body gaskets as specified in step k; if difference is less than 0.010 inch, end travel is within limits, proceed to step l.
 - k. Select thickness of body gaskets (101-3) equal to difference calculated in step j, disassemble pump and install additional body gaskets at floating bearing end as follows:
 1. Remove dial indicator and threaded rod from floating bearing end.
 2. Remove floating bearing bracket (108), floating

bearing (119) and associated parts as specified in Paragraph 5-3.

3. remove floating bearing end head and cone assembly in same manner as specified in Paragraph 5-4.

CAUTION

ON MODELS L, M, P, R, S AND T PUMPS, WHEN INSTALLING BODY GASKETS, MAKE CERTAIN TO ALIGN 9/16-INCH DIAMETER HOLE IN EACH GASKET WITH HOLE IN HEAD FLANGE.

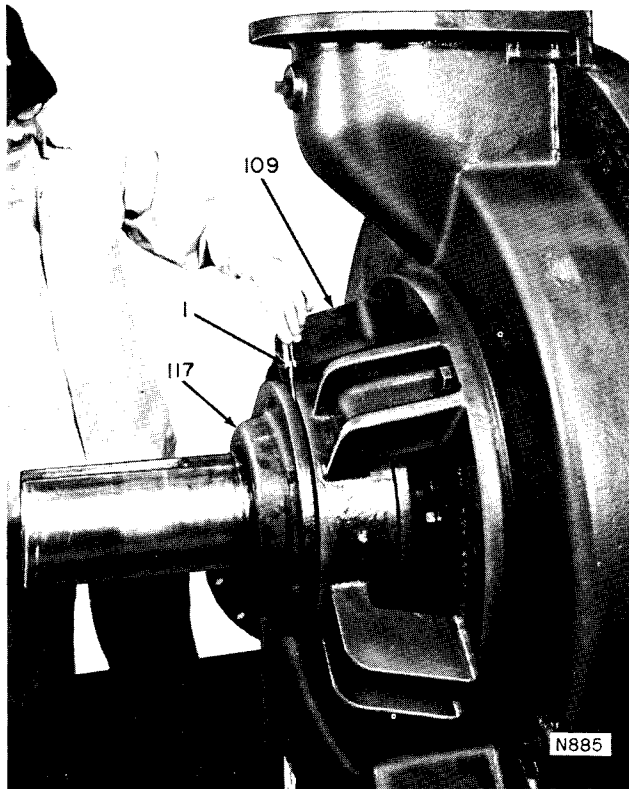
4. Apply light coat of grease to each additional body gasket and install each separately over studs in head and against body gaskets previously installed.
 5. reinstall floating bearing end head and cone assembly in same manner specified in paragraph 5-22, steps f.10 through f.18.
 6. Reinstall floating bearing bracket, floating bearing and associated parts as specified in Paragraph 5-23.
 7. Repeat steps a through g to make certain that end travel is as specified in Table 5-3.
- l. When end travel is acceptable, remove three takeup screws and reinstall two jackscrews in fixed bearing outer cap (117). Evenly tighten two jackscrews until dial indicator reading is equal to one half of final end travel value recorded, to center rotor. Make certain that shaft turns freely. Record dial indicator reading.
 - m. Using leaf (feeler) gauge, measure gap between fixed bearing outer cap and fixed bearing bracket (109) at four places 90 degrees apart. Add four measurements and divide sum by four to compute average gap.
 - n. Select combination of new shims (4) and new shim gaskets (4-1) equal to average gap computed in step m.

Note

Select combination of metal shims and paper shim gaskets to provide for shim gasket against fixed bearing bracket, at least one shim gasket between each pair of shims and shim gasket against fixed bearing outer cap.

- o. Remove two jackscrews, three screws (117-2) and lock and position on outer cap lip.
- p. On pumps with double extended shaft, apply light coat of grease to ID and OD of new lip seal (95-1). Install lip seal in fixed bearing outer cap so that sealing edge (and spring) will face end of shaft.
- q. Lightly grease fixed bearing outer cap gasket (117-3) and position on outer cap lip.
- r. Position shims and shim gaskets selected in step n on fixed bearing outer cap.
- s. Install fixed bearing outer cap on bearing bracket (109) and secure with:

<u>Model</u>	<u>Qty</u>	<u>Index #</u>	<u>Screw</u>
L,M,P,R	3	117-1	1/2 - 13
S,T	3	117-1	5/8 - 11
U	3	117-1	3/4 - 10



1. Leaf (Feeler) Gauge 117. Fixed Bearing Outer Cap
109. Fixed Bearing Bracket

Figure 5-20. Measuring Shim Cap

- t. Make certain that fixed bearing inner cap (118) with gasket (117-3) is seated against bearing in bearing bracket and secure with:

<u>Model</u>	<u>Qty</u>	<u>Index #</u>	<u>Screw</u>	<u>Lockwasher</u>
L,M,P,R	3	117-2	1/2 - 13	117-4
S,T	3	117-2	5/8 - 11	117-4
U	3	117-2	3/4 - 10	117-4

- u. Make certain that dial indicator reading is same as value recorded in step 1. Then remove dial indicator and threaded rod from floating bearing bracket (108).
v. Install new lip seal (5-1) in floating bearing outer cap in same manner as specified in step p.
w. Lightly grease floating bearing outer cap gasket (115-3) and position in floating bearing outer cap.
x. Install floating bearing outer cap on bearing bracket and secure with three 1/2-13 (Model L, M, P and R pumps), 5/8-11 (Model S and T pumps) or 3/4-10 (Model U pumps) screws (115-1).

- y. Slide floating bearing inner cap (116) with gasket (116-3) properly positioned onto bearing bracket and secure with the following fasteners:

<u>Model</u>	<u>Qty</u>	<u>Screw</u> <u>Index #</u>	<u>Lockwasher</u> <u>Index #</u>	<u>Nut</u> <u>Index#</u>
L,M,P,R	3	1/2 - 13 115 - 2	1/2 115 - 4	-
S,T	3	5/8 - 11 115 - 2	5/8 115 - 4	-
U	3	3/4 - 10	3/4	-

5-25 Final Assembly and Lubricating Bearings

Complete assembly of pump and lubricate floating and fixed bearings as follows:

- If removed, install reducing bushing (23-1, Figure 5-21 or 5-22) and grease fitting (23) in floating and fixed bearing brackets (108 and 109). Make certain that plugs (22-4) are installed.
- Using fresh new grease as specified in Table 4-1 and an automatic grease gun, pump grease into grease fittings on both ends of pump until grease extrudes from end of rollers. Continue pumping grease while slowly rotating shaft 360°. Pump grease into outer bearing caps until they are about 1/3 full. Assemble caps.
- Install new packing (1) in floating and fixed end heads (102 and 103) as specified in Paragraph 4-5.
- Install slingers and springs on both the fixed and floating ends of shaft.

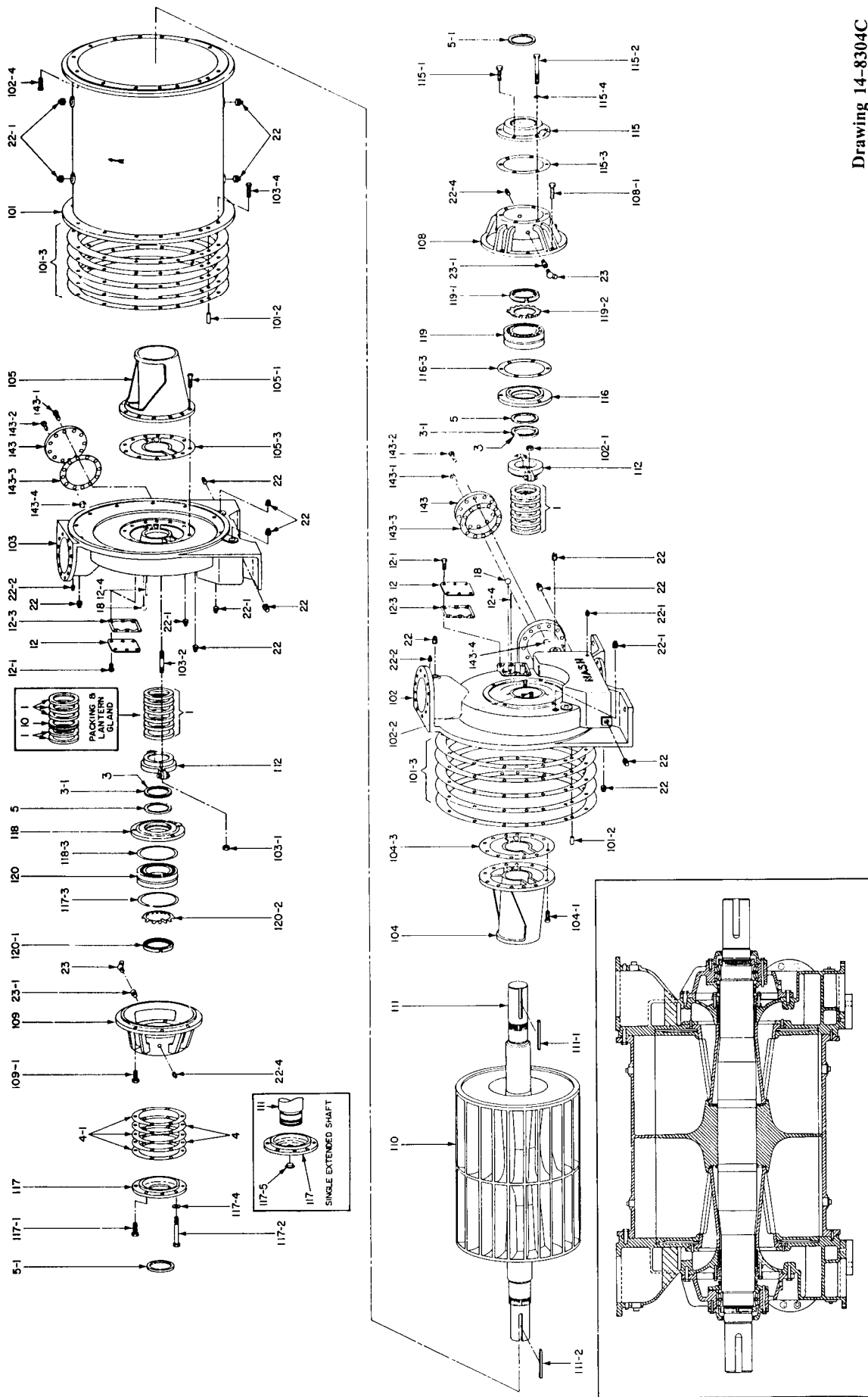
Note

Leave 1.0 inch seal water line open.

- Install one 2.5 inch Teflon vent passage gasket in each head.
- Install on each head one vent passage gasket and cover, using four 1/2 - 13 screws.

Note

Before placing pump back in service, align coupling or V-belt drive as specified in Bulletin No. 642, Installation Instructions, Nash Vacuum Pumps and Compressors.



Drawing 14-8304C

Figure 5-21. NASH® 904® Vacuum Pumps, Models L, M, P, R, S, T, Exploded View

LEGEND FOR FIGURE 5-21

Index No.	Qty	Part Name	Index No.	Qty	Part Name	Index No.	Qty	Part Name
*1	12 rings	Packing	102-1	2	Gland Nut	115-1	3	Outer Cap Screw
*3	2	Slinger	102-2	2	Gland Stud	115-2	3	Outer Cap Screw
*3-1	2	Slinger Spring	102-4	12	Floating Bearing End Head Screw	*115-3	1	Outer Cap Gasket
*4	AR	Shim	103	1	Fixed Bearing End Head	115-4	3	Outer Cap Lockwasher
*4-1	AR	Shim Gasket	103-1	2	Gland Nut	116	1	Floating Bearing Inner Cap
*5	2	Lip Seal	103-2	2	Gland Stud	*116-3	1	Inner Cap Gasket
*5-1	2(1†)	Lip Seal	103-4	12	Fixed Bearing End Head Screw	117	1	Fixed Bearing Outer Cap
**10	2	Lantern Gland	104	1	Floating Bearing End Cone	117-1	3	Outer Cap Screw
12	2	Cover Plate	104-1	12(8‡)	Cone Screw	117-2	3	Outer Cap Screw
12-1	12(8‡)	Cover Plate Screw	*104-3	1	Cone Gasket	*117-3	1	Outer Cap Gasket
*12-3	2	Cover Plate Gasket	105	1	Fixed Bearing End Cone	117-4	3	Outer Cap Lockwasher
12-4	6	Rollpin	105-1	12(8‡)	Cone Screw	117-5	1	Access Plug
18	2	Check Ball	*105-3	1	Cone Gasket	118	1	Fixed Bearing Inner Cap
22	14	Pipe Plug	108	1	Floating Bearing Bracket	*118-3	1	Inner Cap Gasket
22-1	8	Pipe Plug	108-1	4	Bearing Bracket Screw	*119	1	Floating Bearing
22-2	2	Pipe Plug	109	1	Fixed Bearing Bracket	*119-1	1	Floating Bearing Locknut
22-4	2	Pipe Plug	109-1	4	Bearing Bracket Screw	*119-2	1	Floating Bearing Lockwasher
23	2	Grease Fitting	110	1	Rotor	*120	1	Fixed Bearing
23-1	2	Reducing Bushing	111	1	Shaft	*120-1	1	Fixed Bearing Locknut
101	1	Body	111-1	1	Floating Bearing End Shaft Key	*120-2	2	Fixed Bearing Lockwasher
101-2	2	Body Pin	111-2	1	Fixed Bearing End Shaft Key	#143	2	Blank Flange
*101-3	12(10‡)	Body Gasket	112	2	Gland Assembly	#143-1	24	Flange Screw
102	1	Floating Bearing End Head	115	1	Floating Bearing Outer Cap	**143-3	2	Flange Gasket

AR — As required.

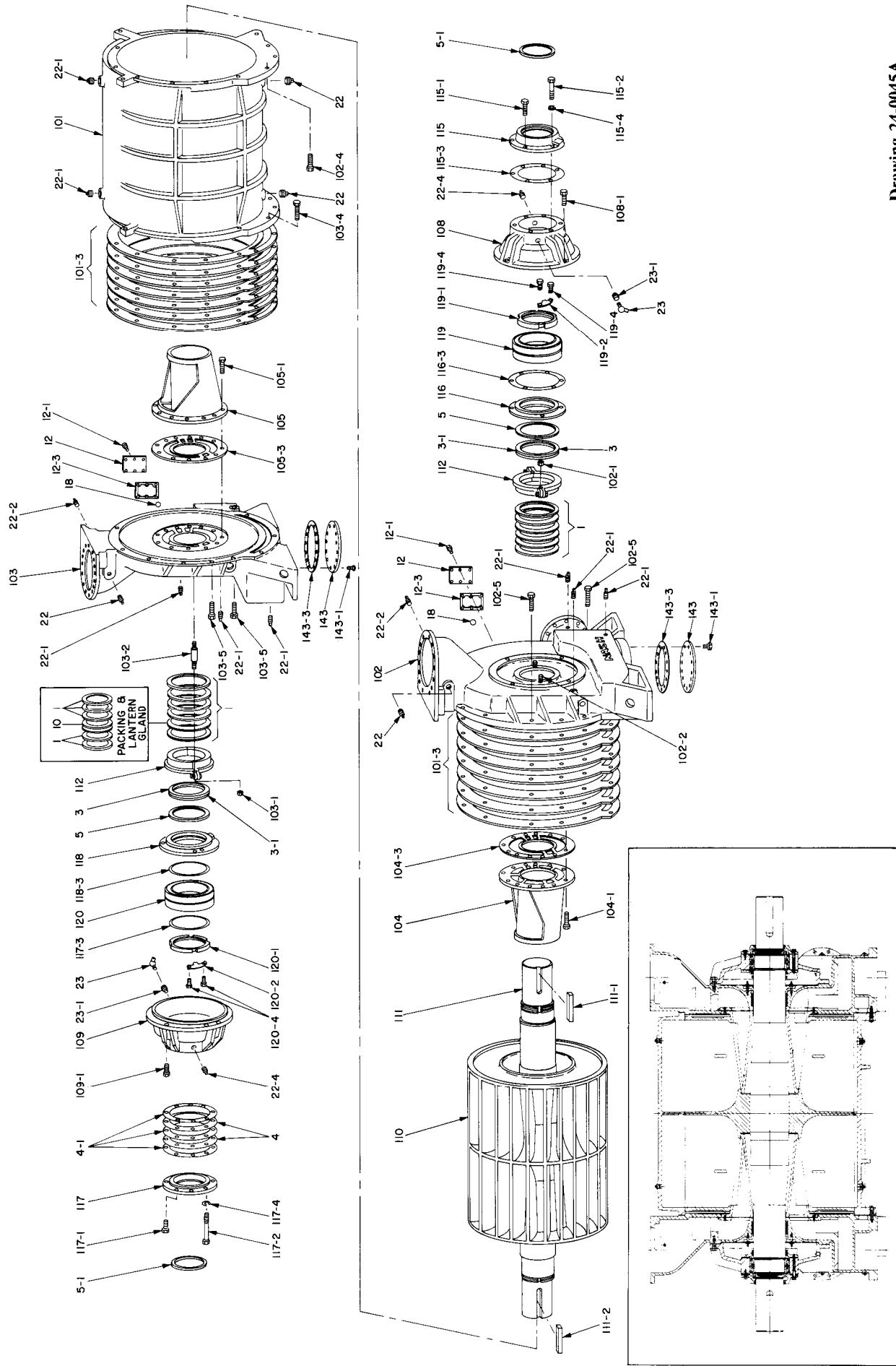
*Minimum recommended spares.

**When used.

†Single extended shaft only.

‡Model L and M pumps only.

#Model P, R, S and T pumps only.



Drawing 24-0045A

Figure 5-22. NASH® 904® Vacuum Pumps, Model U, Exploded View

LEGEND FOR FIGURE 5-22

Index No.	Qty	Part Name	Index No.	Qty	Part Name	Index No.	Qty	Part Name
*1	12 rings	Packing	102-5	10	Floating Bearing End Head Screw	*115-3	1	Outer Cap Gasket
*3	2	Slinger	103	1	Fixed Bearing End Head	115-4	3	Outer Cap Lockwasher
*3-1	2	Slinger Spring	103-1	2	Gland Nut	116	1	Floating Bearing Inner Cap
*4	AR	Shim	103-2	2	Gland Stud	*116-3	1	Inner Cap Gasket
*4-1	AR	Shim Gasket	103-4	3	Fixed Bearing End Head Screw	117	1	Fixed Bearing Outer Cap
*5	2	Lip Seal	103-5	10	Fixed Bearing End Head Screw	117-1	3	Outer Cap Screw
*5-1	2	Lip Seal	104	1	Floating Bearing End Cone	117-2	3	Outer Cap Screw
**10	2	Lantern Gland	104-1	15	Cone Screw	*117-3	1	Outer Cap Gasket
12	2	Cover Plate	*104-3	1	Cone Gasket	117-4	3	Outer Cap Lockwasher
12-1	12	Cover Plate Screw	105	1	Fixed Bearing End Cone	117-5	1	Access Plug
*12-3	2	Cover Plate Gasket	105-1	15	Cone Screw	118	1	Fixed Bearing Inner Cap
18	2	Check Ball	*105-3	1	Cone Gasket	*118-3	1	Inner Cap Gasket
22	4	Pipe Plug	108	1	Floating Bearing Bracket	*119	1	Floating Bearing
22-1	10	Pipe Plug	108-1	4	Bearing Bracket Screw	*119-1	1	Floating Bearing Locknut
22-2	2	Pipe Plug	109	1	Fixed Bearing Bracket	*119-2	1	Floating Bearing Locknut Lockplate
22-4	2	Pipe Plug	109-1	4	Bearing Bracket Screw	119-4	2	Lockplate Screw
23	2	Grease Fitting	110	1	Rotor	*120	1	Fixed Bearing
23-1	2	Reducing Bushing	111	1	Shaft	*120-1	1	Fixed Bearing Locknut
101	1	Body	111-1	1	Floating Bearing End Shaft Key	*120-2	1	Fixed Bearing Locknut Lockplate
*101-3	17	Body Gasket	111-2	1	Fixed Bearing End Shaft Key	120-4	2	Lockplate Screw
102	1	Floating Bearing End Head	112	2	Gland Assembly	143	2	Blank Flange
102-1	2	Gland Nut	115	1	Floating Bearing Outer Cap	143-1	24	Flange Screw
102-2	2	Gland Stud	115-1	3	Outer Cap Screw	*143-3	2	Flange Gasket
102-4	3	Floating Bearing End Head Screw	115-2	3	Outer Cap Screw			

AR – As required.
 *Minimum recommended spares.
 **When used.