



2022

Type TU 4-, 5-Stage Centrifugal Pumps

REPAIR INSTRUCTIONS



REPAIR INSTRUCTIONS

TYPE TUT 4-, 5-STAGE CENTRIFUGAL PUMPS

Grease or Oil Lubricated Ball Bearings

Read this entire book

Before attempting to install, operate or repair this pump. Properly installed, your Peerless pump will give you satisfactory, dependable service. We urge that you carefully read these step-by-step instructions to simplify any problems of installation, operation or repair.

Failure to read and comply with installation and operating instructions will void the responsibility

This book is intended to be a permanent part of your installation and should be preserved in a convenient location for ready reference. If these instructions should become soiled, obtain a new copy from Peerless Pump Company. Include pump model and/or serial number with your request.

WARRANTY

New Equipment manufactured by Seller or Service supplied by Seller is warranted to be free from defects in material and workmanship under normal use and service for a period of one year from date of shipment. In the case of spare or replacement parts manufactured by Seller, the warranty period shall be for a period of twelve months from shipment. Seller's obligation under this warranty is limited to repairing or replacing, at its option, any part found to its satisfaction to be so defective, provided that such part is, upon request, returned to Seller's factory from which it was shipped, transportation prepaid. Parts replaced under warranty shall be warranted only from date of repair. This warranty does not cover parts damaged by decomposition from chemical action or wear caused by abrasive materials, nor does it cover damage resulting from misuse, accident, neglect or from improper operation, maintenance, installation, modification or adjustment. This warranty does not cover parts repaired outside Seller's factory without prior written approval. Seller makes no warranty as to starting equipment, electrical apparatus or other material not of its manufacture. If Purchaser or others repair, replace, or adjust Equipment or parts without Seller's prior written approval, Seller is relieved of any further obligation to Purchaser under this section with respect to such Equipment or parts, unless such repair, replacement, or adjustment was made after Seller failed to satisfy within a reasonable time Seller's obligations under this Paragraph. of the manufacturer and may also result in bodily injury as well as property damage.

Seller's liability for breach of these warranties (or for breach of any other warranties found by a court of competent jurisdiction to have been given by Seller) shall be limited to:

- (a) accepting return of such Equipment FCA Plant of Manufacture (CPT under Incoterms 2000), and
- (b) refunding any amount paid thereon by Purchaser (less depreciation at the rate of 15% per year if Purchaser has used Equipment for more than thirty [30] days), and canceling any balance still owing on the Equipment.
- (c) in the case of Service, at Seller's option, redoing the Service, or refunding the purchase order amount of the Service or portion thereof upon which such liability is based.

These warranties are expressly in lieu of any other warranties, express or implied, and Seller specifically disclaims any implied warranty of merchantability or fitness for a particular purpose, and in lieu of any other obligation or liability on the part of the Seller whether a claim is based upon negligence, breach of warranty, or any other theory or cause of action. In no event shall Seller be liable for any consequential, incidental, indirect, special or punitive damages of any kind.

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WARNING

Do not operate this pump at any pressure, flow rate or liquid temperature other than those for which the pump was originally purchased. Do not pump any other liquid than the one for which the pump was originally purchased

without the consent of Peerless Pump Company or its authorized representatives. Disregard of this warning can result in pump failure and serious personal injury or death.

SECTION 1 DISASSEMBLY

WARNING

Shut down pumps. Temporarily disable the pump driver before starting any repairs. Refer to Bulletin No. 2880549 for the procedure to follow.

1-1. Disengage the coupling halves. If pin and rubber bushing type, remove the pins; if other type, refer to the coupling manufacturer's instructions. Disconnect plumbing from water-cooled bearings.

1-2. **PUMP.** (See figure 1 or 2.) Disassemble pump (to the extent required) as follows:

NOTE

Disassembly and reassembly instructions for both type pumps are included in this bulletin. Disregard the instructions which do not apply to the specific pump being repaired.

- a. Remove the nuts from the gland bolts (17B), withdraw gland flanges (17D) and remove glands (17) from the shaft (6). The gland halves are separable.
- b. Remove all nuts or cap screws from the upper casing (1B) and from the bearing caps (41).
- c. Screw down the jackscrews alternately and evenly to separate the upper and lower casings. Turn the jackscrews back after the case halves have separated to avoid interference at reassembly.
- d. Match mark and remove both bearing caps (41).
- e. Attach a hoist to the eye bolts (customer furnished) or to a sling through external cross-over to lift upper casing (1B). Do not use eye bolts to lift pump!
- f. Place slings around the shaft near the bearing housings and lift rotating element from lower casing (1A). Tap lightly on the underside of the bearing housings (31 and 33) to separate the housings from the brackets.
- g. Place rotating element in a convenient work place.

1-3. **ROTATING ELEMENT.** Remove the plugs and drain oil from the oil lubricated bearings. Remove constant-level oilers (125) and pipe nipples. (Not required for grease lubricated bearings.) Proceed as follows:

- a. Loosen set screw and remove the coupling half. Tap from the back of the hub or use a puller. Remove coupling key (46).
- b. Loosen set screws on the water deflector (40A).
- c. Remove cap screws or stud nuts from bearing covers (35) and separate covers from housings (31) and (33). (Use care not to damage the oil seal (107) used with oil lubricated bearings.) See figure 3.
- d. Lightly tap around housings (31,33) to remove. Do not cock or force housings off, as to do so may damage the

bearings (16, 18), or the oil seal (107).

e. Loosen and remove bearing locknut (22 and lock washer (69A).

f. Remove bearings as described in Figure No. 4.

g. Carefully remove shaft collars (68) (if present) and bearing covers (35). Use care not to damage cover gasket (73B) or oil seal (107).

NOTE

Clearance between collar and shaft is approximately 0.002 inch. Use care when removing not to cock or force, as this will score the shaft.

h. Withdraw casing rings (7, 7A) from lowest stage impellers. On most pumps, these may be withdrawn before removing the coupling half.

i. Remove water deflector (40), gland flanges (17D), packing (13), lantern rings (29) (not used on 5-stage pump) and stuffing box bushings (63). Make note of the number of packing rungs on each side of the lantern rings.

j. Loosen the shaft sleeve (14) set screws near impeller hub. With a spanner wrench, turn the inboard sleeve in the same direction as shaft rotation to remove (shaft has right- and left-hand threads on opposite sides of impeller).

NOTE

A seal between the shaft and sleeve is made with a rubber O-ring in a groove in the sleeve. Use care not to damage the O-ring.

k. Support the back side of first stage impeller (2) with a split ring on the base of a suitable arbor press. Shift the inter stage bushing (113A) toward third stage impeller so that support ring bears on impeller close to shaft (6). Carefully press shaft through impeller (2).

l. Take off inter stage bushing (113A) and remove casing ring (7) and impeller key (32).

m. Similarly support second stage impeller (2A) with split ring, press shaft through impeller and remove key (32). Remove casing ring (7A) and inter stage bushing (113A).

n. Support third (2) and fourth stage impellers (2A) in same manner, press shaft through inter stage sleeve (58, 58A) and impeller, then remove keys (32).

o. Remove fifth stage impeller in the same manner.

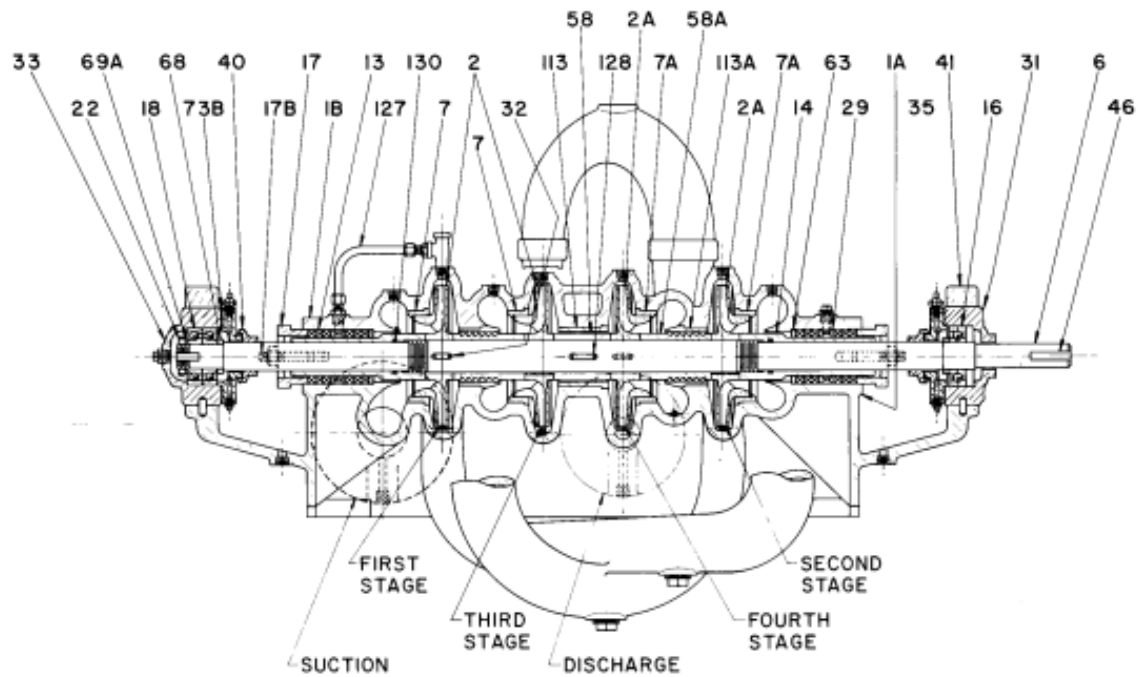
p. Press shaft through inter stage sleeve (58) and remove key (128), or balancing disc (56) last.

1-4. **CLEANING.** Clean all metal parts (except bearings) with a solvent. Use a bristle brush (NOT metal or wire) to remove tightly adhering deposits. A fiber scraper may be used to remove the gasket and shellac from casing flanges.

a. Blow dry with clean, dry, compressed air.

b. Clean bearings as described in 1-5.

**FIGURE 1 - 4 STAGE
GREASE LUBRICATED BEARINGS**

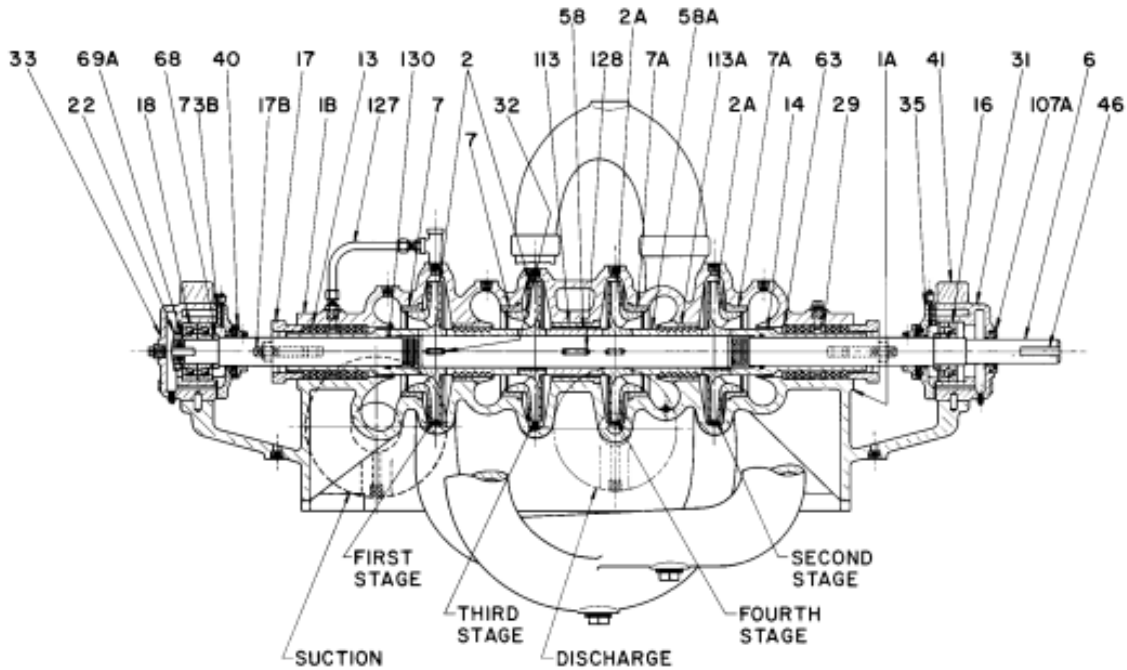


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Parts List

Item No.	Description	Item No.	Description
1A	Lower Casing	33	Outboard Bearing Housing
1B	Upper Casing	35	Bearing Cover
2	Right Hand Impeller	40	Water Deflector
2A	Left Hand Impeller	41	Bearing Cap
6	Shaft	46	Coupling Key
7	Right Hand Casing Ring	58	Inter stage Sleeve
7A	Left Hand Casing Ring	58A	Inter stage Sleeve A
13	Packing	63	Stuffing Box Bushing
14	Shaft Sleeve	68	Shaft Collar
16	Outboard Bearing	69A	Bearing Lock washer
17	Packing Gland	73A	Casing Gasket (Not Shown)
17B	Gland Bolt	73B	Bearing Cover Gasket
18	Outboard Bearing	113	Inter stage Bushing
22	Bearing Locknut	113A	Inter stage Bushing - A
29	Lantern Ring	127	Seal Piping
31	Inboard Bearing Housing	128	Inter stage Sleeve Key
32	Impeller Key	130	Shaft Sleeve "O"-Ring

**FIGURE 1A - TUT 4 STAGE
OIL LUBRICATED BEARINGS**



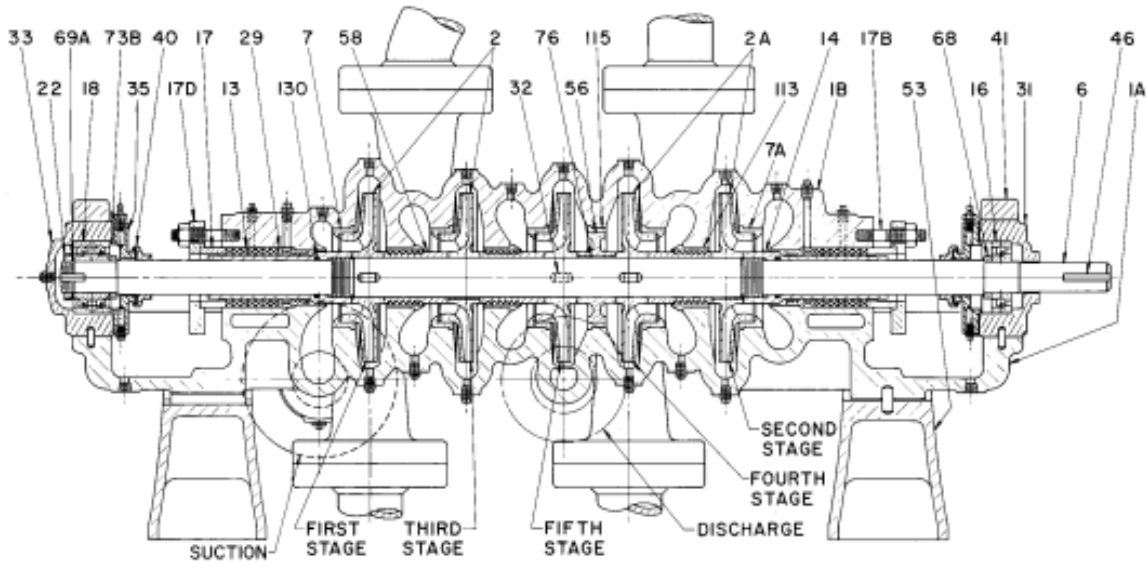
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Parts List

Item No.	Description	Item No.	Description
1A	Lower Casing	35	Bearing Cover
1B	Upper Casing	40	Water Deflector
2	Right Hand Impeller	41	Bearing Cap
2A	Left Hand Impeller	46	Coupling Key
6	Shaft	58	Inter stage Sleeve
7	Right Hand Casing Ring	58A	Inter stage Sleeve A
7A	Left Hand Casing Ring	63	Stuffing Box Bushing
13	Packing	68	Shaft Collar
14	Shaft Sleeve	69A	Bearing Lock washer
16	Outboard Bearing	73A	Casing Gasket (Not Shown)
17	Packing Gland	73B	Bearing Cover Gasket
17B	Gland Bolt	107A	Oil Retaining Shield
18	Outboard Bearing	113	Inter stage Bushing
22	Bearing Locknut	113A	Inter stage Bushing - A
29	Lantern Ring	125	Constant Level Oiler (Not Shown)
31	Inboard Bearing Housing	127	Seal Piping
32	Impeller Key	128	Inter stage Sleeve Key
33	Outboard Bearing Housing	130	Shaft Sleeve "O"-Ring

Coolant flow per bearing is 1 US GPM @ 50 Psig maximum, coolant temperature 90° F. . maximum. Normal coolant medium is water

**FIGURE 2 - 5 STAGE
GREASE LUBRICATED BEARINGS**

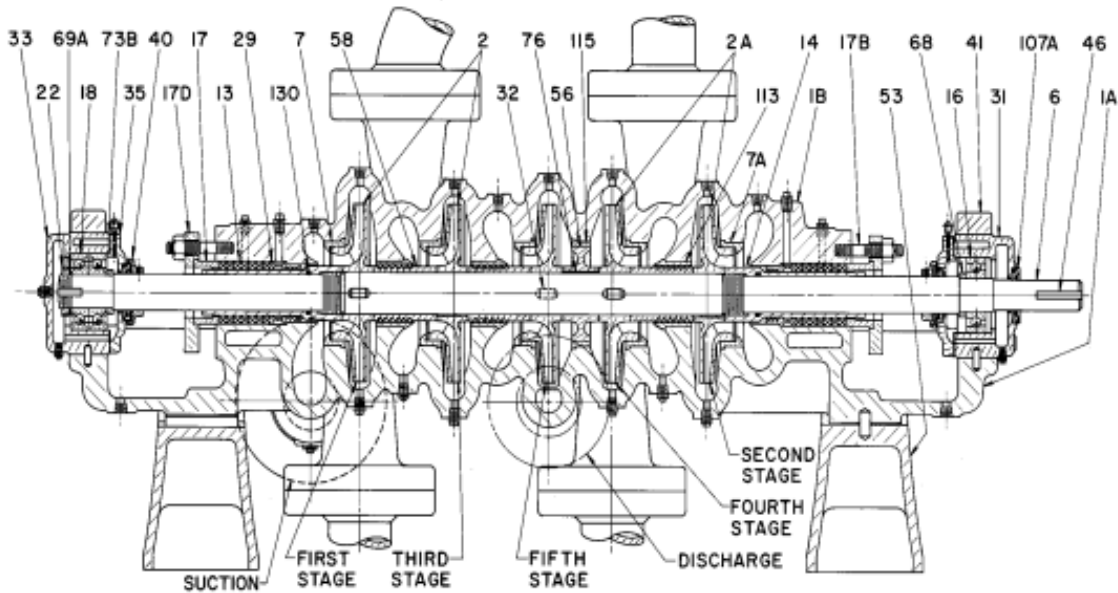


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Rev. 1-85**

Parts List

Item No.	Description	Item No.	Description
1A	Lower Casing	33	Outboard Bearing Housing
1B	Upper Casing	35	Bearing Cover
2	Right Hand Impeller	40	Water Deflector
2A	Left Hand Impeller	41	Bearing Cap
6	Shaft	46	Coupling Key
7	Right Hand Casing Ring	53	Base
7A	Left Hand Casing Ring	56	Balancing Disc
13	Packing	58	Inter stage Sleeve
14	Shaft Sleeve	63	Stuffing Box Bushing
16	Outboard Bearing	68	Shaft Collar
17	Packing Gland	69A	Bearing Lock washer
17B	Gland Bolt	73A	Casing Gasket (Not Shown)
17D	Gland Flange	73B	Bearing Cover Gasket
18	Outboard Bearing	76	Balance Disc Key
22	Bearing Locknut	113	Inter stage Bushing
29	Lantern Ring	115	Balance Disc Ring
31	Inboard Bearing Housing	127	Seal Piping
32	Impeller Key	130	Shaft Sleeve "O"-Ring

**FIGURE 2A – TUT 5 STAGE
OIL LUBRICATED BEARINGS**



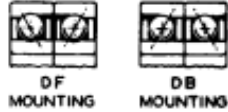
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Parts List

Item No.	Description	Item No.	Description
1A	Lower Casing	33	Outboard Bearing Housing
1B	Upper Casing	35	Bearing Cover
2	Right Hand Impeller	40	Water Deflector
2A	Left Hand Impeller	41	Bearing Cap
6	Shaft	46	Coupling Key
7	Right Hand Casing Ring	53	Base
7A	Left Hand Casing Ring	56	Balancing Disc
13	Packing	58	Inter stage Sleeve
14	Shaft Sleeve	63	Stuffing Box Bushing
16	Outboard Bearing	68	Shaft Collar
17	Packing Gland	69A	Bearing Lock washer
17B	Gland Bolt	73A	Casing Gasket (Not Shown)
17D	Gland Flange	73B	Bearing Cover Gasket
18	Outboard Bearing	76	Balance Disc Key
22	Bearing Locknut	113	Inter stage Bushing
29	Lantern Ring	115	Balance Disc Ring
31	Inboard Bearing Housing	125	Constant Level Oiler (Not Shown)
32	Impeller Key	130	Shaft Sleeve "O"-Ring

Coolant flow per bearing is 1 US GPM @ 50 Psig maximum, coolant temperature 90° F. . maximum. Normal coolant medium is water



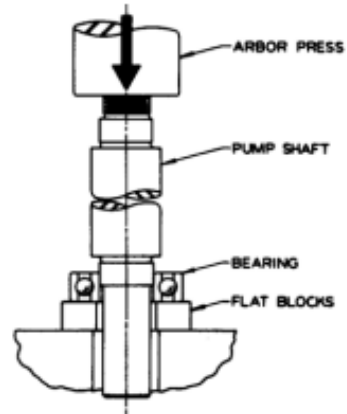
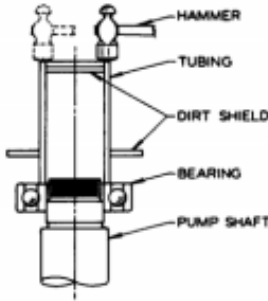


USING AN ARBOR PRESS

1. PLACE THE BEARING ON TWO FLAT BLOCKS SO THAT THEY CONTACT THE INNER RING OR BOTH RINGS OF THE BEARING.
2. HOLD SHAFT STRAIGHT – FORCE THE SHAFT BY A STEADY PRESSURE, UNTIL THE BEARING IS SEATED AGAINST THE SHAFT SHOULDER.

USING TUBING

1. PLACE THE BEARING ON SHAFT.
2. PLACE TUBING OVER SHAFT IN CONTACT WITH THE INNER RING OF THE BEARING.
3. APPLY HAMMER ALTERNATELY AT OPPOSITE POINTS – AVOID COCKING.



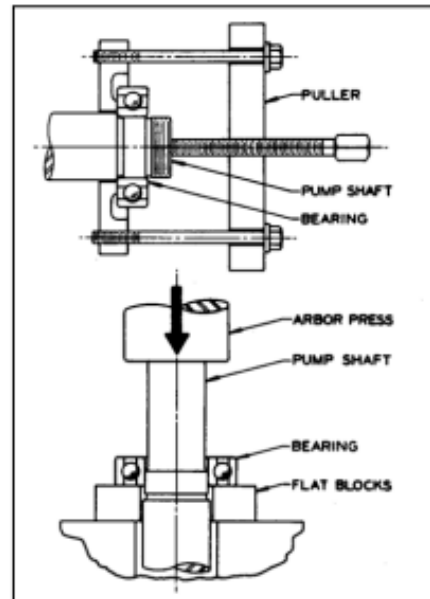
BEARING MOUNTING

USING A BEARING PULLER

1. PLACE BEARING PULLER BEHIND BEARING INNER RING. SET PULLER JAWS SO THAT THEY WILL NOT SLIP OVER THE INNER RING AND DAMAGE SPARATOR OR SHIELD WHEN PRESSURE IS APPLIED.
2. FORCE BEARING OFF SHAFT BY A STRAIGHT PULL. DO NOT COCK BEARINGS.

USING AN ARBOR PRESS

1. REST THE BEARING INNER RING OR BOTH RINGS (NEVER THE OUTER RING ONLY) AGAINST A PAIR OF FLAT BLOCKS.
2. FORCE THE SHAFT OUT BY A STEADY PRESSURE – KEEP SHAFT STRAIGHT – DO NOT ALLOW SHAFT TO COCK OR DROP.



BEARING REMOVAL

-COURTESY OF NEW DEPARTURE-

FIGURE 2, BEARING REMOVAL AND MOUNTING

1-5. CLEANING BEARINGS

- a. Remove bearings from the housings, referring to disassembly instructions.
- b. Place bearings in a wire basket, so there is space for the cleaning solvent to reach all parts.
- c. Immerse the basket in Stoddard solvent or equivalent, agitating the basket until grease is thoroughly loosened and can be flushed out.

- d. Place bearing on a screened surface.
- e. Using a spray gun with air filter and clean Stoddard solvent, flush each bearing until all grease and sludge is removed.
- f. Blow solvent out of bearings with dry filtered air.
- g. Lubricate bearings immediately after cleaning with light spindle oil and place them in a covered container.
- h. Do not spin bearings any time during cleaning.

**SECTION II
INSPECTION AND REPAIR**

2-1. INSPECTION. Visually inspect parts for damage affecting serviceability or sealing. Emphasize inspection of mating parts having relative motion – wear rings, for example. Perform detail inspection as follows:

- a. Check O-rings and bearing cover gaskets for cracks, nicks or tears; packing rings for excessive compression, fraying or shredding, embedded particles (dirt or metal). Replace if defective in any way.
- b. Mount the shaft between lathe centers. Check the eccentricity trough out entire length with a dial indicator to be not more than .003 inch total indicator reading. Check that threads are clean and sharp. Surfaces on which bearings mount must be smooth, have a finish not less than 32 micro-inches, and have shoulders square and free from nicks.
- c. Measure the OD of the integral impeller wear surfaces and the ID of the casing rings (7 and 7A). Compute the diametrical clearance (ID minus OD) and compare with the limit given in Figure No. 5. ID surface of casing ring must be smooth and concentric. For pumps equipped with impeller rings, clearances should not exceed two times the maximum amount shown for pump type in Figure No. 5.
- d. Measure OD of inter stage sleeves (58, 58A) (balancing disc (56) and ID of inter stage bushings (113, 113A). Compute diametrical clearance and compare with limits given in Figure No. 6. ID surface of inter stage bushing must be smooth and concentric. Sleeve lands must be free from burrs and flat spots.
- e. Examine impeller passages for cracks, dents, gouges or embedded material.
- f. Check upper and lower casing machined surfaces to be free of burrs or nicks.
- g. Inspect shaft sleeves (14) for excessive wear.
- h. Inspect bearings according to Table I.

FIGURE 5

IMPELLER/CASE WEAR RING DIAMETRICAL CLEARANCE (Inches)		
0.010	0.012	0.023
0.014	0.016	0.027
1-1/2TUT74 1-1/2TUT7G4 2TUT8-4 2TUT8A4 3TUT9-4 3TUT9A4	4TUT10-4 4TUT10A4 4TUT10G4	2TUT9-5 2TUT9A5

2-2. REPAIR. Make needed repairs in the following manner:

- a. If ID of casing ring (7, 7A) is grooved, scored or eccentric, bore to produce a smooth, concentric surface, replacement of casing ring and impeller ring is recommended. Measure and record the new ID.
- b. If impeller rings are defective, or mating casing rings require boring, remove old rings by turning in a lathe – be sure machining is concentric with impeller ID. Use care NOT to reduce hub OD.

NOTE

For bronze impellers and rings, the ring is shrunk on the hub according to standard fit FN-4 or ANSI B4.1 standards. For pumps of 10-inch discharge and larger, the rings are also tack welded to the hub at 3 places 120 degrees apart. Hardened impeller rings are installed according to ANSI B4-1 standard fit FN-1.

- c. Install new rings on the impeller (shrink or press depending on material and tack weld if old rings were tacked. This ID is factory – machined for proper fit.
- d. Turn the OD of the new rings to provide the proper diametrical clearance and to be smooth and concentric with hub bore. Use clearance limit from Figure No. 5 and ID of casing ring from paragraph 2-2a. to compute OD of impeller rings.
- e. Replace worn shaft sleeves.
- f. Straighten or replace shaft having excessive run-out (eccentricity).

INTERSTAGE SLEEVE/BUSHING DIAMETRICAL CLEARANCE (Inches)	
0.008	0.012
0.012	0.015
1-1/2TUT74, 1-1/2TUT7G4, 2TUT8-4, 2TUT8A4, 3TUT9-4, 3TUT9A4	2TUT9-5 2TUT9A5

FIGURE 6

NOTE

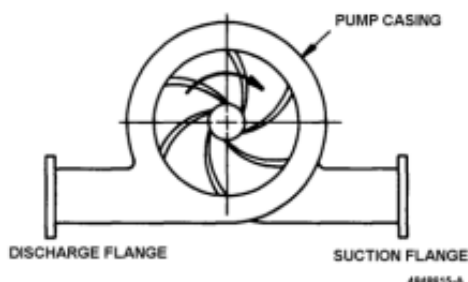
Clearances are for standard or cast iron fitted pumps. For materials with a tendency to gall, such as stainless steel, increase clearance approximately .010 inch.



SECTION III REASSEMBLY

3-1. **ROTATING ELEMENT.** (See Figure 7 or 8). Re-assemble as follows:

- a. Coat shaft (6) with oil. Re-oil as necessary while pressing on impellers and sleeves.
- b. With grooves, square shoulder side, facing toward the highest number stage, press inter stage sleeve (58) or balancing disc (56) on shaft. Insert key (128) and locate sleeve in the center of impeller section over square key (128); disc to engage Woodruff key (32) between fourth and fifth stages.
- c. Insert key (32), align fifth (or fourth) stage impeller (2 or 2A) and press on outboard (inboard) end of shaft to contact disc (56) (sleeve 58).
- d. Install casing ring A (7A), or inter stage bushing (113), insert key (32) and press on fourth (or third) stage impeller (2 or 2A).
- e. Locate casing rings (7, 7A) on impellers.
- f. Position inter stage sleeves A (58A) so that grooves will be closer to lower number stages and press on shaft to contact impeller hubs.



- g. Install inter stage bushings A (113A) over sleeves (58A) with beveled ends toward higher stages.
- h. In turn, insert remaining keys (32), align impellers in descending order of stages and press on shaft. Install inter stage sleeves and bushings, and casing rings between impeller stages. Carefully bump parts to remove all clearance so that first and second stage impeller hubs extend equally beyond central portion of shaft (slightly into threaded portions).

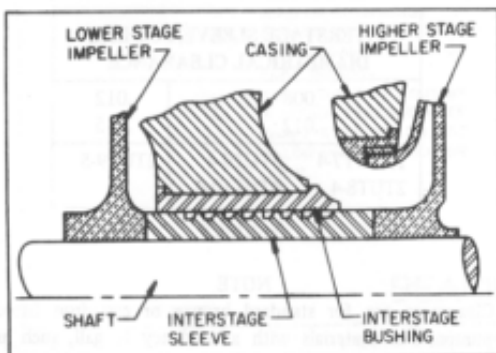


FIGURE 8. TYPICAL ASSEMBLY RELATIONSHIP
OF INTERSTAGE SLEEVES

- i. Install O-rings shaft sleeves (14), coat ring and shaft with oil and screw sleeves on shaft against impeller hubs.
- j. Install the stuffing box bushing (63) and lantern ring (29) (not used on 5-stage pumps) on the shaft.
- k. Locate casing rings (7) on lowest stage impellers; install gland flanges (17D).
- l. Place water detectors (40) on shaft.
- m. Slide bearing covers (35) (with oil seals (107) installed for oil lubricated bearings) on the shaft.
- n. Place shaft collars (68) on the shaft.
- o. Mount the bearings (16) and (18) as described in Figure No. 4. The outboard bearings are two single row angular contact bearings mounted in the duplex DB mounting.
- p. Install bearing lock washer (69A) and locknut (22) (oil thrower) and tighten against the outboard bearing.
- q. Install gaskets (73B) on bearing covers. Cut replacement gaskets from 1/16 inch No. 444 Vellumoid.
- r. Slide the housings (31, 33) over the bearings. Tap lightly and evenly around the end as necessary. Do not force.
- s. Attach the bearing covers (35). In the assembled position, the grease fittings or breather tubes must be located on top.
- t. Locate water deflector (40) and tighten the setscrews. Install oil seal (107) in the inboard bearing housing (31) (for oil lubricated bearings).
- u. Install coupling key; assemble coupling half on the shaft and tighten the setscrew.

3-2. **PUMP.** Complete the assembly of pump as follows:

- a. Use the upper casing (1B) as a template to cut a gasket (73A) from 1/64 inch Vellumoid. Machined surfaces of both casings must be perfectly clean and free from burrs and nicks.
- b. Affix the new gasket to lower casing (1A) with shellac.
- c. Use slings around the shaft near bearings to set rotating element into lower casing. Position the casing rings (7, 7A), inter stage bushing (113) and both bearing housings so that all dowel pins engage. If necessary, loosen setscrews of water deflector to shift bearing housings slightly. Retighten screws.
- d. Assemble both bearing caps (41) and tighten the cap screws.
- e. If impellers are not (approximately) centered in volute or impellers are not allowing case rings to seat in casing, adjust sleeves by loosening one and tightening the other in direction required. Tighten setscrews in sleeve after final adjustment is made.
- f. Cover the top side of the casing gasket with a mixture of graphite and oil. Install the gland bolts. Carefully locate the upper casing on the lower (17B), making certain the dowel pins engage. Attach case nuts and alternately tighten at diagonally opposite positions. Rotate shaft by hand to check that it runs free. See Torque Chart, Table II.
- g. Withdraw the lantern rings (29) (not used on 5-stage).

TABLE 1
BEARING DEFECTS
(Failures – Replace if found)

DEFECT (Failure)	APPEARANCE	PROBABLE CAUSE
Flaking and cracking	In the early stages, the surface of the inner and outer races develop small cracks, which flake. The cracks and flaking ultimately spread over the entire race surface.	<ol style="list-style-type: none"> 1. Normal fatigue failure. 2. Bearing loads in excess of bearing capacity caused by misalignment.
Indentations	Indentations or cavities in the inner and outer races.	<ol style="list-style-type: none"> 1. Dirt in the bearings. 2. Excessive impact loading of the bearings such as improper mounting or removal.
Broken separator (cage)	Cracked separator or separator in pieces.	<ol style="list-style-type: none"> 1. Poor Lubrication. 2. Misalignment of shaft. 3. Excessive shaft deflection.
Wear	Bore and OD of outer ring of bearing galled or braided.	<ol style="list-style-type: none"> 1. Fit on shaft or in housing too loose. 2. Bearing locked by dirt and turning on shaft or in housing.
Fractured ring	Hairline cracks or complete ring fracture.	<ol style="list-style-type: none"> 1. Forcing a cocked bearing on or off a shaft. 2. Too heavy a press fit.
Discoloration	Rolling elements and races darker than normal appearance of bearing metal. (Moderate discoloration of rolling elements and races not a reason for discard.)	<ol style="list-style-type: none"> 1. Inadequate lubrication.
Corrosion	Rolling elements and raceways rusted.	<ol style="list-style-type: none"> 1. Water entering the housing. 2. Condensation inside the housing. 3. Lubricant breaks down into acid. (Wrong lubricant.)

pump) and push the bushings (63) to the rear of the stuffing boxes. Insert the same number of packing rings as were found during disassembly, on each side of the lantern ring. Insert each ring separately and stagger the joints of successive rings 90 degrees. Insert the glands (17) and set the nuts finger tight – DO NOT USE A WRENCH.

h. Rotate shaft by hand to check that it runs free.

i. Replace all drain plugs removed during disassembly.

3-3. Reinstall plumbing (if used) for water-cooled bearings.

a. Re-lubricated the bearings. Refer to Bulletin No. 2880549 for grease type recommendation.

It is most important to provide proper lubrication and keep bearings clean. Frequency of lubrication must be determined by experience as it depends upon bearing size, speed, operating conditions and location (environment). Table II should be used as a guide for grease re-lubrication. Oil bottles should have a visible supply at all times.

b. Oil. (Pumps are shipped without oil in the bearing housings.) Be sure to fill and adjust constant level oilers before initial start of pump. See Figure 9.

(1) Adjust dust cap to lowest possible position on base fittings.

(2) The pipe nipple and base fitting must be level – check with spirit level. If the pipe nipple is bent, replace it. A constant level oiler that is not level will not provide proper lubrication to the bearings.

(3) Fill bottle, screw it into the dust cap as far as it will go do not force. Allow the oil to flow into the bearing housing. Repeat this procedure until there remains a supply of oil in the bottle. Never fill bearing housing through base fitting.

(4) Check the breather tube for cleanliness. The breather tube must be used with the oil lubrication system.

3-4. Follow instructions in Bulletin No. 2880549 to check out the pump after repair and place the pump in service.

LUBRICATION INSTRUCTIONS

1. The pump is shipped without oil in the bearing housings.
2. Change the first oil after operating 1000 hrs. or 60 days, whichever occurs sooner.
3. Frequency of oil change thereafter is dictated by service conditions, it is suggested, however, that oil changes occur at least every 3,000 hrs. of operation.
4. In order to keep the bearing housings vented, the breather tubes and filters must be kept clean.

Lubrication Oils

A high quality turbine oil of 330 SSU viscosity at 100 degrees F. with rust and oxidation inhibitors should be used.

RECOMMENDED OIL MANUFACTURERS

Atlantic Richfield	DURO S-315, DURO AW S-315
Chevron	CHEVRON OC TURBINE OIL 68
Exxon	TERESSTIC 68
Gulf	GULF HARMONY 68
Mobil	DTE 26 300SSU
Sunoco	SUNVIS 968

FIGURE 9

3-5. TROUBLES. To reliably establish the malfunctioning of either the pump or driver, instruments such as tachometers, pressure gauges and electric meters must be in proper working condition and preferably of recent calibration. In many cases, much time and expense have been expended with faulty instruments. Table V lists a number of troubles commonly occurring. If unable to determine the cause and remedy the problem from this list, refer the problem to the Peerless Pump Company representative.

Table II
TORQUE VALUE CHART

TORQUE VALUT (FT.-LB)	
SIZE INCH	MEDIUM CARBON STEEL. SAE 5 105-120,000 PSI
3/4	210-225
7/8	305-325
1	450-475
1-1/8	605-635
1-1/4	850-890
1-1/2	1465-1525

TORQUE VALUES SHOWN ARE FOR CLEAN & LUBRICATED THREADS: GASKETED JOINTS. STUDS MUST BE DRIVEN TIGHT IN LOWER WHEN USED. INSTALL UPPER CASE, TIGHTEN CENTER NUT (OR CAP SCREWS), THEN WORK OUT FROM CENTER TO EACH SIDE. TIGHTENING WITH TORQUE WRENCH AS SHOWN ON CHART.

TABLE III
GREASING FREQUENCY
(See Table IV for amounts)

SERVICE	GREASE EACH
Normal, 8-hour day operation, Room free of dust and damaging atmosphere.	6 Months
Severe, 24-hour day operation. Room with moderate dust And/or damaging atmosphere, or outdoor service.	1 Month
Light, approximately 10-hour week. Room relatively free of dust and damaging atmosphere.	1 Year

TABEL IV
AMOUNT OF GREASE FOR BALL BEARINGS

OUNCES	GRAMS	MODEL
1.3	36.4	1 1/2TUT7, 1 1/2TUT7G4,
1.4	39.2	2TUT8, 2TUT8A4, 2TUT9,
3.0	84.0	2TUT9A5,3TUT9, 3TUT9A4,
4.5	126.0	4TUT10, 4TUT10A4, 4TUT10G4

TABLE V
TROUBLES

TROUBLE	PROBABLE CAUSE	REMEDY
Failure to deliver liquid or sufficient pressure.	Pump not primed. Pump not up to speed. Discharge head too high. Insufficient available NPSH. Incorrect direction of rotation. Air leaks in suction line or through stuffing boxes. Impeller passages restricted Worn wearing rings. Damaged impeller. Foot valve too small or restricted by dirt.	Re-prime. Check for low motor voltage or motor overload. Other drives, increase driver speed when possible. Check to see that all discharge valves are opened and the discharge line is free from obstructions. In some cases, the installation has to be altered or a pump of suitable rating must be provided. Check NPSH requirements of pump and increase system NPSH accordingly. Check the impeller assembly for correct rotation either by removing upper case or through priming connection. Check rotation of driver. Tighten packing. Check for air leaks between sleeve and shaft and replace O-ring if there is an air leak. Check all suction line joints for bad gaskets and loose joints. Disassemble the pump and clean impeller. Replace worn parts. Replace or repair impeller. Replace with adequate size foot valve or clean foot valve.
Pump loses prime after starting	Air leaks in suction line. Insufficient available NPSH	Tighten packing. Check for air leaks between sleeve and shaft and replace O-ring if there is an air leak. Check all suction line joints for bad gaskets and loose joints. Check NPSH requirements of the pump and increase the system available NPSH accordingly.

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**TABLE V (continued)
TROUBLES**

TROUBLE	PROBABLE CAUSE	REMEDY
Overload on driver	<p>Pump speed high.</p> <p>Total head lower than rating.</p> <p>Tight packing.</p> <p>Liquid is of higher specific gravity or Viscosity than rating.</p> <p>Mechanical trouble of pump or driver.</p>	<p>Motor voltage higher than name plate rating will cause the motor to run faster. Either reduce motor voltage or trim impeller diameter. On other drives, reduce speed if possible. If speed reduction not realized, trim impeller diameter.**</p> <p>Check suction and discharge pressures and determine the total dynamic head. If TDH lower than ratings, throttle discharge to rated TDH or, if this is not possible, reduce impeller diameter.**</p> <p>Stop pump – following proper repacking procedure. Check for scored sleeve; and for sleeve run-out if packing wears rapidly. Replace sleeve and packing as required.</p> <p>Check with Peerless Pump Company distributor to determine if a larger motor is required.</p> <p>See if pump and motor turn freely. Check impeller fit, shaft straightness and ball bearings.</p>
Pump vibrates or is noisy	<p>Driver unbalanced.</p> <p>Misalignment</p> <p>Cracked foundation.</p> <p>Worn ball bearings.</p>	<p>Disconnect driver and operate it alone. Check pump for large pieces of debris, such as wood, rags, etc.</p> <p>Realign pumping unit.</p> <p>Replace foundation.</p> <p>Replace bearings. Check lubricants for proper Grade. Check pump alignment. Check for Condensation on water cooled bearings.</p>

**Always obtain new trim diameter from Peerless Pump Company representative.

3-6. SPARE PARTS. To keep delays to a minimum when pump repairs are required, we suggest that the following spare parts be stocked. The number of each part required depends upon the application. For a minimum, we

recommend:

- (A) One set of inboard bearings.
- (B) One set of outboard bearings.
- (C) One set of shaft sleeves.
- (D) One set of case wear rings
- (E) One set impeller wear rings.
- (F) In some instances, and entire rotating element should be stocked.

3-7. To obtain quick and accurate service when ordering spare parts, provide the following information:

- (A) Pump size and type as noted on nameplate.
- (B) Pump serial number as noted on nameplate.
- (C) The name and number of the parts as shown on the sectional drawings.
- (D) Quantity required of each item.

Aid may be obtained from the Peerless representative, or an authorized distributor, for planning an adequate supply of spare parts.

NOTICE: Materials of construction, specifications, dimensions, design features, and application information, where shown in this bulletin, are subject and/or modification without notice by Peerless Pump Company at their option.

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