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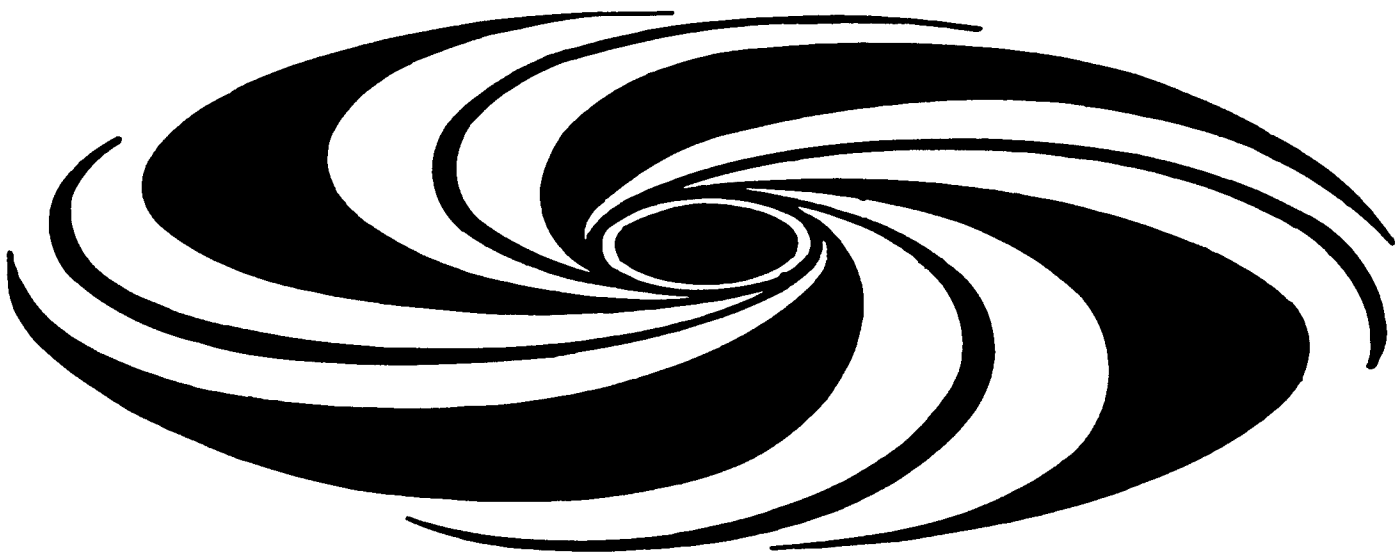
INSTRUCTION } I-501

INSTALLATION, OPERATION, & MAINTENANCE INSTRUCTIONS



NON-CLOGGING
CENTRIFUGAL
CHEMICAL PROCESS
PUMPS

KWP

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1. DESCRIPTION.

KWP pumps are horizontal, single-stage, single-entry, non-clogging centrifugal process pumps with an overhung impeller. KWP pumps can be applied for corrosive and non-corrosive services. These pumps can be used to pump contaminated fluids and sludges, fluids containing solid admixtures, and thick stocks of all kinds.

The pump mainly consists of a pump casing, impeller, stuffing box, and a bearing frame. Positive alignment of the pump is assured by a full-circle registered fit on all mating parts. All fits are away from liquid being pumped to prevent crevice corrosion.

The back pull-out casing has a fitted wear ring at impeller inlet, integrally casted feet fastened to the base with four bolts for the most effective transmittal of pipe load, an axial (end) suction nozzle, and a radial discharge nozzle. The pump casing is self-venting. The casing is open to the discharge side, enabling the complete pump rotor to be dismantled toward the motor side without having to disconnect the piping.

The enclosed impeller is a non-clogging, two-port wide passage design for smooth flow pattern and good efficiency. The back vanes ensure axial thrust balancing and low stuffing box pressure. The impeller is keyed to the shaft for positive fastening and is locked in position by an allen head self-locking screw.

The stuffing box can be altered for particular application requirements, whether soft packings or mechanical seals are used. The shaft sleeves provide maximum adaptability for various seal designs along with protecting the shaft in the area of the stuffing box.

The bearing frame houses the pump bearings and is flanged onto the pump casing by the frame adapter. The bearing frame is supported on the baseplate by means of a bolted-on frame foot.

2. INSTALLATION.

The pump should be installed, leveled, and aligned by skilled personnel. Faulty erection will result in operating troubles and premature wear of pump parts.

When a pump is supplied complete with coupling, motor, and baseplate, the complete set is assembled at our factory. After ascertaining the unit has suffered no damage in transfer, the pump can be installed.

The baseplate should be leveled with the aid of a spirit level. In the case of installation without a foundation, leveling is accomplished with leveling screws. If there is a foundation, level the baseplate by inserting shims to the right and left of the foundation bolts and grout them in with a good grouting material.

Coupling Alignment. The pump and motor are connected by a flexible coupling. The drive and pump shafts must be accurately aligned as any misalignment will cause damage to the coupling, motor, and pump. When the shafts are in correct alignment, the coupling hubs will be on a common axis, concentric with each other, and at the correct distance apart.

To check gap and angular alignment, use a spacer bar equal in thickness to the gap specified by the coupling manufacturer. Insert the bar to the same depth at 90 degree intervals and measure clearance between bar and coupling hub face with feelers. The gap should be the same at all points. For more accurate alignment, mount a dial indicator on coupling hub and rotate other hub. Record total indicator readings at 90 degree intervals. The four measurements must be within ± .005 inches tolerance.

To check offset alignment, place a straight edge on coupling hubs. The straight edge should be parallel to the pump and motor shafts at all points around the periphery. For more accurate alignment, mount a dial indicator on the driving shaft and a dial indicator on the pump shaft. Slowly rotate both shafts. Record total indicator readings at 90 degree intervals. The final readings should be within .005 inches of each other.

If the coupling hubs are misaligned, it is general practice to adjust the driver to the pump. Insert full shims under the feet or supports of the motor and tighten fastening bolts until correct alignment is achieved.

Piping Connections. Before connecting suction, discharge, and auxiliary piping, check to see that the piping is absolutely clean internally. Any debris in the piping will be drawn into the pump passageways and cause extreme damage. All pipelines must be connected so that no stresses are transmitted to the pump, nor should the pump carry the weight of the piping. Also, the internal diameters of the suction and discharge lines must be equal to the internal diameters of the pump suction and discharge nozzles.

Suction Head or Suction Lift Line. The suction line must be absolutely leakproof and not exhibit any features likely to promote the formation of air pockets. In order to keep pipe friction losses as low as possible, it is essential to avoid any sharp bends and abrupt changes of direction or cross section.

Positive suction head lines should be laid with a downward slope toward the pump. Positive suction head lines should incorporate an isolating valve to allow the fluid supply to be cut off in the event of internal pump inspection. The isolating valve should remain fully open while the pump is operating and must not be used to

regulate the rate of flow.

Suction lift lines should be laid with a rising incline toward the pump. The mouth of the suction lift line should lie as deep as possible below the liquid level surface, but with an adequate clearance above the floor of the suction vessel to prevent any interference with flow conditions. Isolating valves in suction lift lines must always remain fully open while the pump is operating and must not be used to regulate the rate of flow.

Discharge Line. The discharge line should be laid with a gradual rising slope away from the pump. Sharp bends and branches at sharp angles should be avoided. A control valve should be incorporated in the discharge line, as close to the pump as possible, to enable the required rate of flow and discharge head to be adjusted. A pressure gauge connection is provided in the discharge nozzle.

If the total head exceeds 33 feet or if the discharge line is of considerable length, a check valve should be incorporated between the pump and isolating valve on the discharge line. The check valve protects the pump against water hammer and reverse flow of fluid upon shutdown.

Auxiliary Piping. If necessary, auxiliary lines for sealing, flushing, and cooling fluid should be made up and laid. They should be joined to their respective connections on the pump casing, stuffing box cover, and frame adaptor. All auxiliary piping should be flushed clean before connection to the pump.

Vent Line. Pumps operating on positive suction head are subject to the risk of air penetrating the pump casing when the suction vessel is pumped dry or when the fluid pumped releases gas out of solution. In this case, a vent line should be connected to the discharge flange and lead back into the suction vessel at a point above the highest level the liquid is likely to reach.

3. OPERATION.

Preliminary Checks.

1. The bearing frame should be filled with oil before operation. Hinge down the bottle of the constant level oiler and pour oil into the opening of the bottle stem. Replace the bottle and allow oil to flow into the bearing reservoir. It may require the filling of the bottle several times before the oil level in the reservoir is equal for which the oiler is adjusted. The bottle must not be allowed to become empty during operation.

If the vent plug on top of the bearing frame is accessible, the reservoir may also be filled through this aperture. Remove the vent plug, hinge the bottle of the constant level oiler down, and pour oil into the vent plug opening until it reaches the level of the connection elbow of the oiler. Fill the oiler bottle and snap it back into position. Reinstall the vent plug.

The bearing frame reservoir oil fill capacities are listed below.

Pump Size	Bearing Frame Size	Oil Fill Capacity (Fl. Oz.)
65-200 80-250	45	13.5
100-250 80-400	55	17

2. Check the shaft seal to see that it is in good order. On soft-packed stuffing boxes, the gland should be tightened very lightly by hand. A mechanical seal should be leakproof.

3. Check final alignment of pump and driver. Both shafts must turn freely by hand.

4. Check rotation of pump by energizing the driver momentarily.

Priming the Pump. Before start-up, the suction lift line or the positive suction head line and the pump must be completely primed with the fluid pumped. For positive suction head operation, open the isolating valve in the suction line and vent the pump's discharge system. For suction lift line, open isolating valve in the suction lift line and evacuate the air from the pump and suction lift line. Before starting the pump, check to see that it is completely filled with fluid.

Operation. Turn the pump on with the following procedure:

1. Open the suction valve fully.
2. Turn on any auxiliary fluid supply lines.
3. Start the pump.
4. When pump has reached operating speed, slowly open discharge valve. Use the discharge valve to

adjust the rate of flow, not to exceed the capacity stamped on the nameplate.

5. Check the stuffing box for leakage. For a soft-packed pump, there should be a slight leakage at all times. Adjust the leakage rate by very slowly tightening or loosening the gland. For a pump with a mechanical seal, there should be no leakage.

Turn the pump off with the following procedure:

1. Close the discharge valve.
2. Shut off motor and check that the pump runs down smoothly and gradually.
3. Close suction valve and any auxiliary fluid supply lines.
4. If the pump will be shut down for a prolonged period, drain the pump completely.

4. GENERAL SUPERVISION DURING OPERATION.

The following should be observed during operation:

1. The pump should run smoothly and quietly at all times.
2. Avoid any dry running of the pump and any prolonged running against a closed discharge valve.
3. Never overload the motor.
4. Check the bearing temperature and the oil level in the constant level oiler at regular intervals.
5. Check leakage at stuffing box.
6. Any valves in the auxiliary lines should be open while the pump is running.

Lubrication. The first oil change should be carried out after 300 hours of operation. Subsequent oil changes should be effected at intervals of 3000 hours of operation.

To change oil, unscrew pipe plug in bearing bracket and drain oil. Flush bearing bracket with petrol or benzol. Slowly rotate the shaft by hand during flushing. Replace the plug and fill the bracket with SAE #20 oil free of acid and resin. The constant level oiler should be topped up as required during operation.

5. TROUBLE SHOOTING.

SYMPTOM	PROBABLE CAUSE	REMEDY
Failure to deliver liquid.	1. Suction line or pump casing not completely vented.	1. Prime pump and vent the system.
	2. Suction valve closed.	2. Open suction valve.
	3. Suction line contains air pockets, because line is incorrectly laid.	3. Relay suction head line with a continuously falling slope, or suction lift line with a continuously rising slope toward the pump.
	4. Leaky suction line.	4. Repair connections.
	5. Wrong rotation.	5. Check power connection to motor.
	6. Impeller or suction pipe clogged.	6. Clean impeller or suction pipe.
Reduced capacity.	1. Air in liquid or air leaks in suction line.	1. Tighten all pipe connections.
	2. Suction valve not fully open.	2. Open valve fully.
	3. Liquid level occasionally sinks too low.	3. Throttle discharge valve.
	4. Impeller or suction pipe clogged.	4. Clean impeller or suction pipe.
	5. Damaged impeller.	5. Replace impeller.
	6. Wear ring clearance too great.	6. Replace wear ring.
	7. Pump not up to speed.	7. Check voltage and power consumption for motor overload. Refer to "Overload on motor."
	8. Excess leakage in stuffing box.	8. Check packing or mechanical seal.
Overload on motor.	1. The actual total head is lower than that specified.	1. Throttle discharge valve or fit a different size impeller.

SYMPTOM	PROBABLE CAUSE	REMEDY
Overload on motor (continued).	2. Misalignment.	2. Disconnect suction and discharge flanges, realign pump and motor, and connect piping without imposing any stresses or strains on the pump.
	3. Mechanical defects of pump or motor such as bent shaft, binding or rubbing rotating element.	3. Replace defective parts or replace pump or motor.
Pump delivers too much liquid.	1. The actual total head is lower than that specified. 2. Motor speed too high.	1. Throttle discharge valve or fit a different size impeller. 2. Arrange for motor to run at prescribed speed.
Excessive bearing temperature.	1. Misalignment. 2. Strain due to piping or improper piping supports. 3. Incorrect coupling clearance gap. 4. Oil in bearing bracket is low, or of an unsuitable quality.	1. Realign pumping unit. 2. Check piping alignment and remove piping strain from pump with proper supports. 3. Reinstate correct coupling clearance gap. 4. Top up oil fill or replace it with suitable quality.

6. DISASSEMBLY AND REASSEMBLY INSTRUCTIONS.

The back pull-out design of the KWP pump enables the pump to be disassembled without disconnecting the piping or removing the pump casing from the baseplate. If a spacer coupling is fitted, the driver can also remain bolted on the baseplate.

After completion of dismantling, all parts should be thoroughly cleaned or replaced by new ones if necessary. All gaskets and sealing faces should be perfectly clean. When cutting new gaskets, make sure they are exactly the same thickness as the old ones.

After reassembly, it must be possible to rotate the pump rotor easily by hand without causing any scraping noises. If motor remained bolted on baseplate, it is not always necessary to realign the unit, but a coupling check as outlined in section 2 is recommended. If the motor was removed from the baseplate, the pumping unit must be realigned.

After reassembly, the pump should be hydrostatically tested at 1.5 times the operating pressure.

During any of the disassembly or reassembly procedures, refer to the exploded isometric view or the sectional assembly diagram for location of parts followed by an item number.

Disassembly. For a soft-packed pump, use the following procedures:

1. Disconnect electrical power supply to motor.
2. Close all system valves.
3. Drain unit by removing pipe plug (44).
4. Remove coupling guard.
5. Disconnect coupling between pump and motor. If a non-spacer coupling is fitted, the driver will have to be removed from the baseplate.
6. Disconnect auxiliary piping.
7. Remove hex nuts (37) from studs (34). Remove hex head screws (43) holding the frame foot (17) to the baseplate.
8. Loop a rope tightly around the top stay of the frame adaptor (4) or lifting eye (56) to sustain the weight of the subassembly that is to be lifted out. Force off the frame adaptor (4), including the bolted-on bearing frame (5) and pump rotor, by means of forcing screws (41) in the frame adaptor (4).
9. Carefully pull the complete rotor out of the casing (1) and remove it to a work area.
10. Remove drain plug (48) and drain the oil from the bearing frame (5).
11. Remove allen head screw (39). Remove impeller washer (23). Pull off impeller (2) with the aid of a

puller device. Remove impeller key (24).

12. Remove hex nuts (38) from studs (35). Remove gland (18). Remove lantern ring (21), two packing rings (31), lantern ring (21), and two remaining packing rings (31).

13. Remove stuffing box cover (3) with attached stuffing box bushing (20) from the frame adaptor (4).

14. Remove nuts (36) from studs (33). Remove frame adaptor (4).

15. Remove shaft sleeve (22) and slinger (8).

16. Remove coupling hub on pump end with the aid of a puller device. Remove coupling key (51).

17. Remove hex head screws (40) on both ends of bearing frame (5). Remove outboard and inboard bearing covers (6 and 7).

18. Carefully drive out the shaft (11), together with bearings (12 and 13), toward the motor end.

19. If the bearings (12 and 13) need to be replaced, they should be warmed with a welding torch or a blowlamp before pulling them off the shaft (11), and the shaft (11) itself should be kept as cool as possible. Before pulling the outboard bearing (12) off, uncrimp bearing lockwasher (14A) and remove bearing locknut (14). Remove bearing lockwasher (14A).

For pumps with a mechanical seal, use the following disassembly procedures:

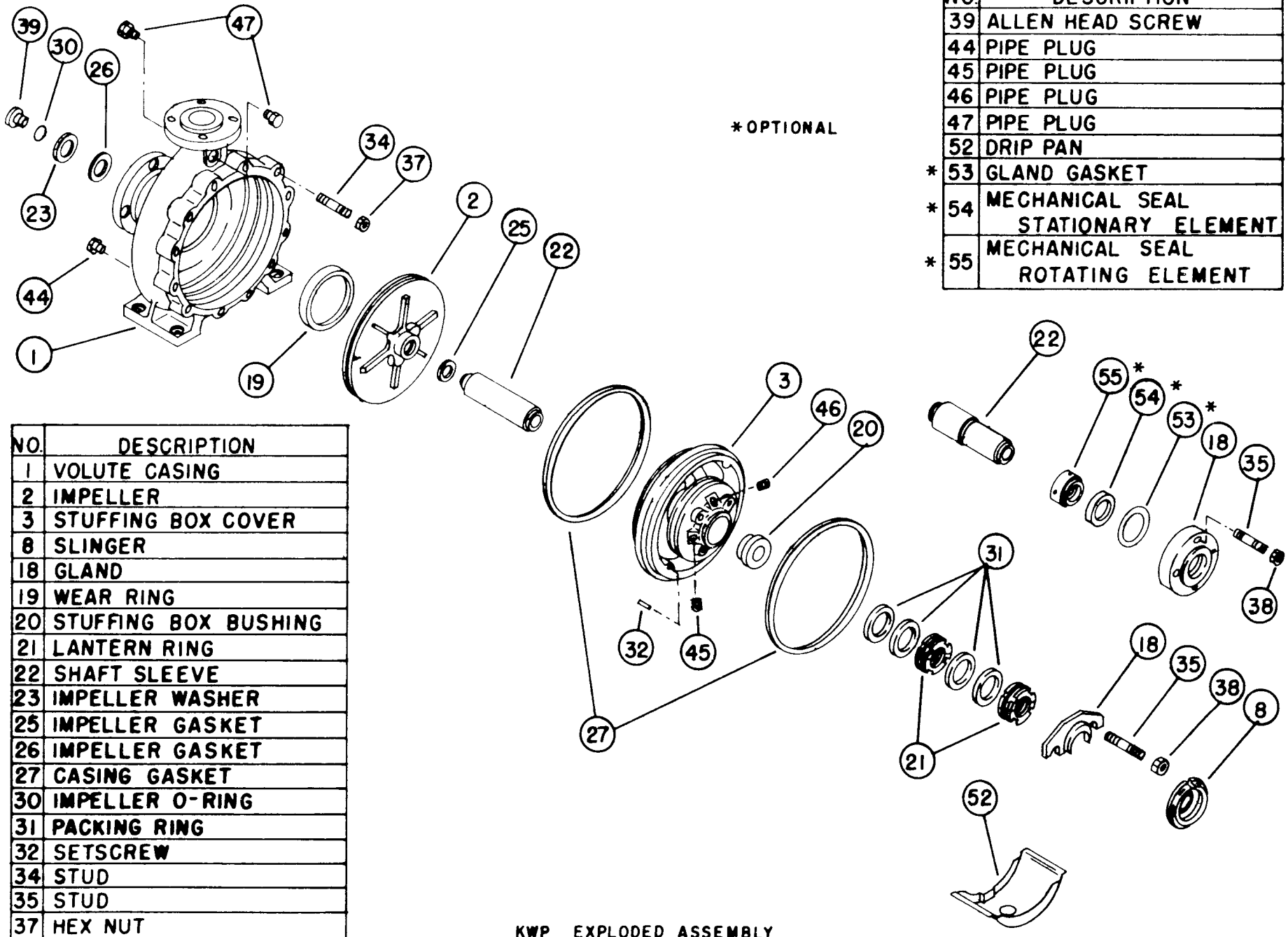
1. Disassemble pump according to steps 1 - 11 as outlined above.
2. Remove hex nuts (38) from studs (35). Remove stuffing box cover (3).
3. Remove shaft sleeve (22). Remove mechanical seal rotating element (55) from shaft sleeve (22).
4. Remove gland (18). Remove mechanical seal stationary element (54) from gland (18).
5. Remove slinger (8).
6. Remove nuts (36) from studs (33). Remove frame adaptor (4).
7. Disassemble pump further according to steps 16 - 19 as outlined above.

Reassembly. For soft-packed pumps, reassemble as follows:

1. If new bearings are fitted, they should be heated to 80 degrees C (175 degrees F) in an oil bath before slipping them onto the cleaned shaft (11) until they abut the shaft shoulders. On outboard side, install bearing lockwasher (14A) and bearing locknut (14). Recrimp bearing lockwasher (14A).
2. Carefully insert shaft (11) and bearings (12 and 13) into the bearing frame (5).
3. Make sure the oil seals (15 and 16) are not damaged. Install outboard and inboard bearing covers (6 and 7) and secure with hex head screws (40).
4. Install coupling key (51). Install coupling hub.
5. Install slinger (8) and shaft sleeves (22).
6. Install frame adaptor (4) and secure with nuts (36) on studs (33).
7. Install stuffing box cover (3) with attached stuffing box bushing (20).
8. Install two packing rings (31), lantern ring (21), two remaining packing rings (31) and lantern ring (21). Install gland (18) and secure finger-tight with hex nuts (38) on studs (35).
9. Install impeller key (24). Install impeller (2), impeller washer (23), and allen head screw (39).
10. Install drain plug (48) and fill bearing frame (5) with oil as described in section 3.
11. Carefully install complete rotor in casing (1).
12. Secure frame foot (17) to baseplate with hex head screws (43). Secure frame adaptor (4) to casing with nuts (37) on studs (34).
13. Connect auxiliary piping.
14. Connect, align, and relubricate coupling.
15. Install coupling guard.
16. Install pipe plug (44).
17. Connect electrical power supply to motor. Open system valves. Start pump.

For pumps with a mechanical seal, reassemble as follows:

1. Reassemble pump according to steps 1 - 4 as outlined above.
2. Install frame adaptor (4) and secure with nuts (36) on studs (33).
3. Install slinger (8).
4. Install mechanical seal stationary element (54) in gland (18). Install gland (18) on shaft (11).
5. Install mechanical seal rotating element (55) on shaft sleeve (22). Install shaft sleeve (22).
6. Install stuffing box cover (3). Secure gland (18) to stuffing box cover (3) with nuts (38) on studs (35).
7. Reassemble the pump further according to steps 9 - 17 as outlined above.

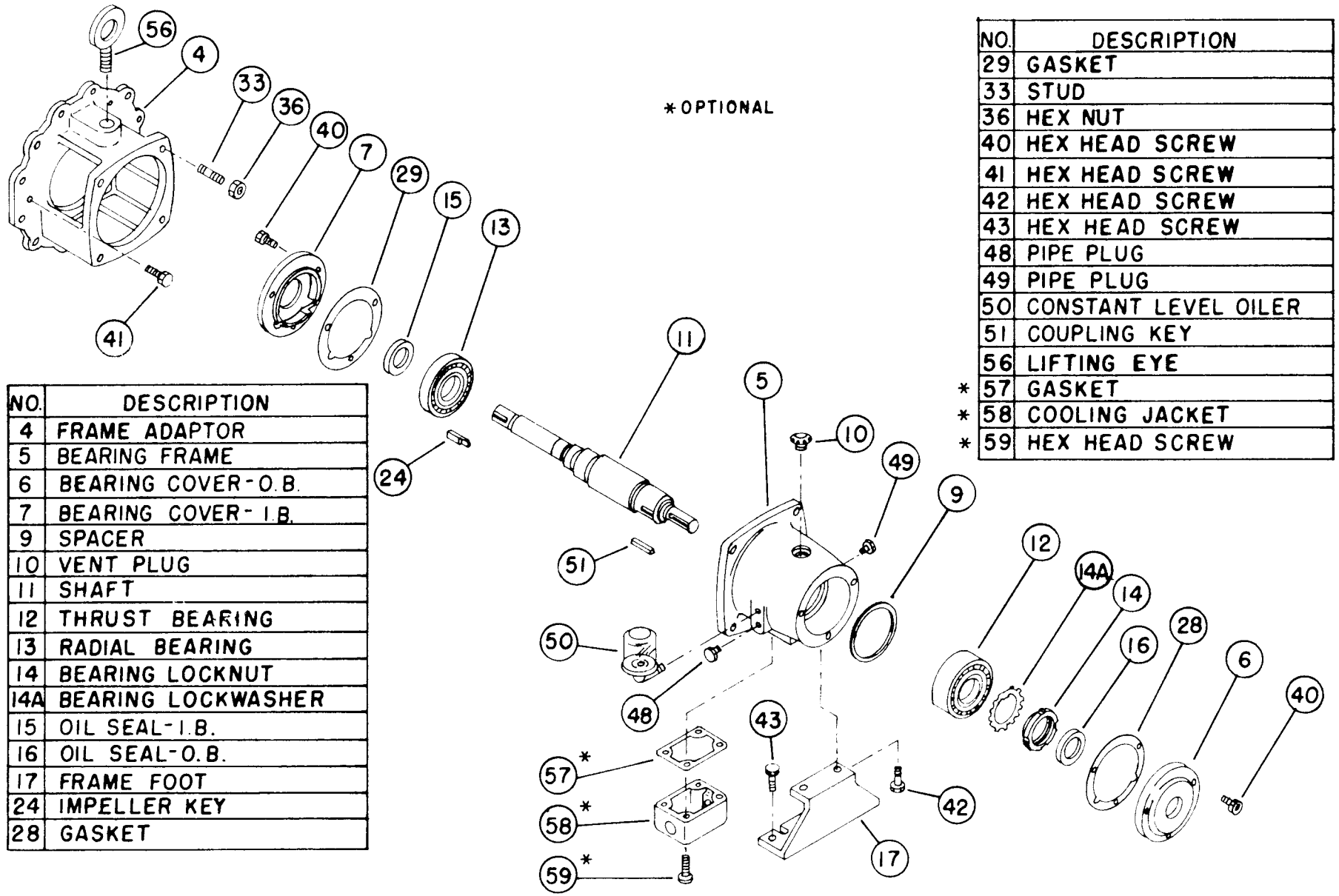


*OPTIONAL

NO.	DESCRIPTION
39	ALLEN HEAD SCREW
44	PIPE PLUG
45	PIPE PLUG
46	PIPE PLUG
47	PIPE PLUG
52	DRIP PAN
* 53	GLAND GASKET
* 54	MECHANICAL SEAL STATIONARY ELEMENT
* 55	MECHANICAL SEAL ROTATING ELEMENT

NO.	DESCRIPTION
1	VOLUTE CASING
2	IMPELLER
3	STUFFING BOX COVER
8	SLINGER
18	GLAND
19	WEAR RING
20	STUFFING BOX BUSHING
21	LANTERN RING
22	SHAFT SLEEVE
23	IMPELLER WASHER
25	IMPELLER GASKET
26	IMPELLER GASKET
27	CASING GASKET
30	IMPELLER O-RING
31	PACKING RING
32	SETSCREW
34	STUD
35	STUD
37	HEX NUT
38	HEX NUT

KWP EXPLODED ASSEMBLY
WET END PARTS



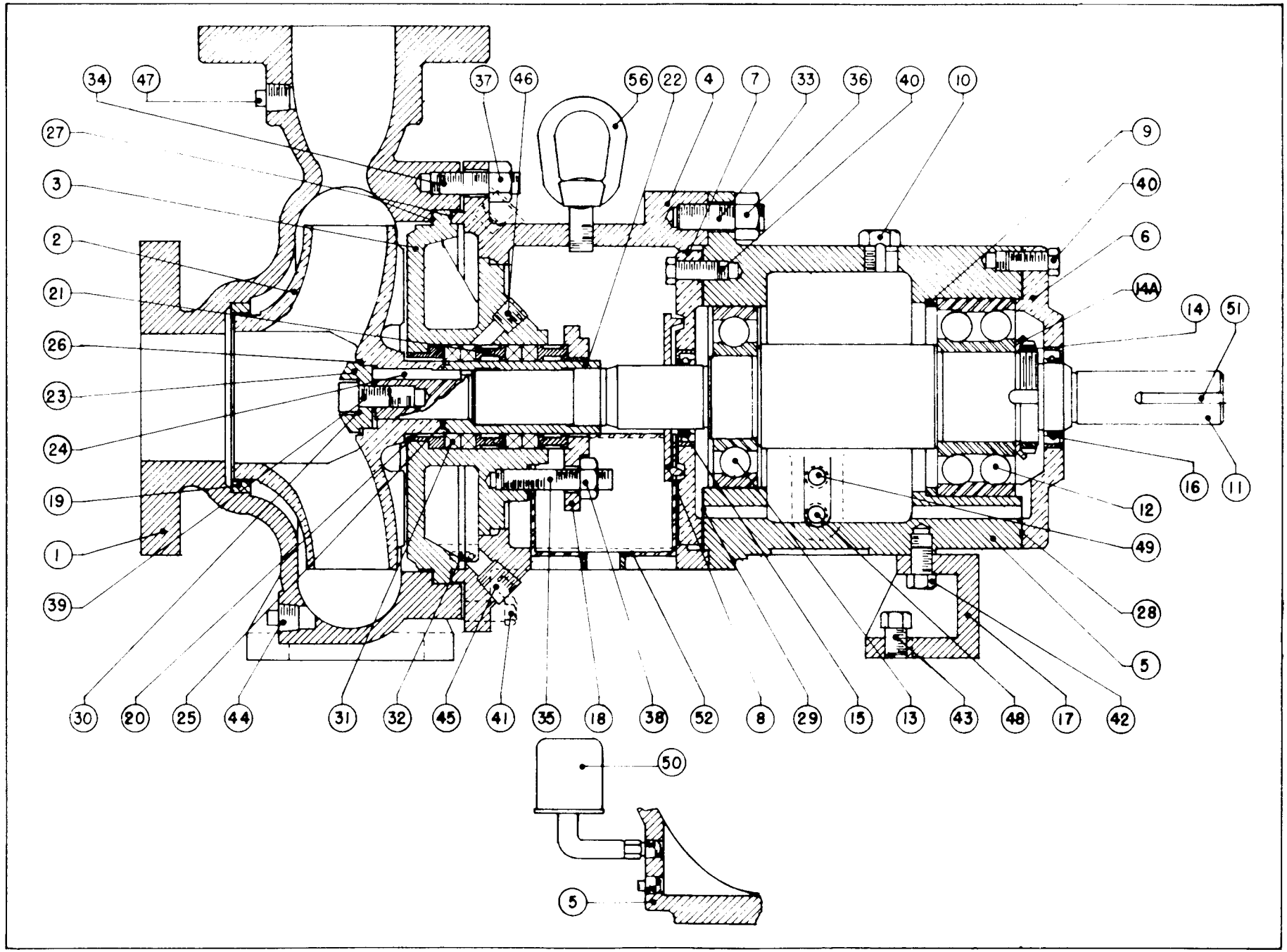
* OPTIONAL

NO.	DESCRIPTION
4	FRAME ADAPTOR
5	BEARING FRAME
6	BEARING COVER - O.B.
7	BEARING COVER - I.B.
9	SPACER
10	VENT PLUG
11	SHAFT
12	THRUST BEARING
13	RADIAL BEARING
14	BEARING LOCKNUT
14A	BEARING LOCKWASHER
15	OIL SEAL - I.B.
16	OIL SEAL - O.B.
17	FRAME FOOT
24	IMPELLER KEY
28	GASKET

NO.	DESCRIPTION
29	GASKET
33	STUD
36	HEX NUT
40	HEX HEAD SCREW
41	HEX HEAD SCREW
42	HEX HEAD SCREW
43	HEX HEAD SCREW
48	PIPE PLUG
49	PIPE PLUG
50	CONSTANT LEVEL OILER
51	COUPLING KEY
56	LIFTING EYE
* 57	GASKET
* 58	COOLING JACKET
* 59	HEX HEAD SCREW

KWP EXPLODED ASSEMBLY

POWER END PARTS



Sectional Assembly Diagram

ITEM NO.	PART NAME
1	VOLUTE CASING
2	IMPELLER
3	STUFFING BOX COVER
4	FRAME ADAPTOR
5	BEARING FRAME
6	BEARING COVER - O.B.
7	BEARING COVER - I.B.
8	SLINGER
9	SPACER
10	VENT PLUG
11	SHAFT
12	THRUST BEARING
13	RADIAL BEARING
14	BEARING LOCKNUT
14A	LOCKWASHER
15	OIL SEAL - I.B.
16	OIL SEAL - O.B.
17	FRAME FOOT

ITEM NO.	PART NAME
18	GLAND
19	WEAR RING
20	STUFFING BOX BUSHING
21	LANTERN RING
22	SHAFT SLEEVE
23	IMPELLER WASHER
24	IMPELLER KEY
25	IMPELLER GASKET
26	IMPELLER GASKET
27	CASING GASKET
28	GASKET - O.B.
29	GASKET - I.B.
30	IMPELLER O-RING
31	PACKING RING
32	SETSCREW
33	STUD - ADAPTOR
34	STUD - CASING
35	STUD - GLAND

ITEM NO.	PART NAME
36	HEX NUT - ADAPTOR
37	HEX NUT - CASING
38	HEX NUT - GLAND
39	ALLEN HEAD SCREW
40	HEX HEAD SCREW
41	HEX HEAD SCREW
42	HEX HEAD SCREW
43	HEX HEAD SCREW
44	PIPE PLUG
45	PIPE PLUG
46	PIPE PLUG
47	PIPE PLUG
48	PIPE PLUG
49	PIPE PLUG
50	CONSTANT LEVEL OILER
51	COUPLING KEY
52	DRIP PAN
56	LIFTING EYE

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November 1999