Carver®

Creating Value.

Instruction I-200a

Installation, Operation, and Maintenance Instructions for Models WKL High-Pressure Multi-Stage Centrifugal Pumps

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I. GENERAL INFORMATION.

A. Preface.

Carver Pump Company (CPC) products are carefully engineered and manufactured and, if properly installed, maintained, and operated, should provide maintenance free operation and a long service life.

Follow instructions in this manual carefully. Factory warranty applies only when pump operates under conditions as specified on order acknowledgment, and if pump is properly installed and maintained as recommended herein. A copy of these instructions should be available to operating personnel. Additional copies of this handbook are available on request from your local CPC office, or from the factory. CPC service personnel will assist you with any questions you may have.

B. Pump Identification.

The type of pump, pump size, operating data, and serial number are all stamped on the nameplate attached to the pump. Pump specifications should be recorded upon receipt of the pumping unit. A table for this purpose has been provided at the end of this manual.

To facilitate correctness when ordering spare parts, **the serial number and model number of the pump must be included in all correspondence regarding this unit.**

C. Safety Precautions.

The following are general safety precautions that are not related to any specific procedure and therefore do not appear elsewhere in this publication. These are recommended precautions that personnel must understand and apply during many phases of operation and maintenance of the pump and the electrical motor used to drive the pump.

1. Installation, use, and operation of pumping equipment is affected by various federal, state, and local laws. Compliance with such laws relating to proper installation and safe operation of pumping equipment is the responsibility of equipment owner.
2. Prior to working on pump or motor, ensure that all switches and circuit breakers have been locked in the open (off) position and tagged: "Out of Service."
3. All circuits not known to be dead must be considered live at all times.
4. Do not wear loose clothing when working with rotating machines.
5. When working near electricity, do not use metal rules, flashlights, metallic pencils, or any other objects having exposed conducting material.
6. Be certain you are not grounded whenever you are adjusting electrical equipment or using measuring equipment.
7. In general, use only one hand when servicing live electrical equipment.
8. Be sure to de-energize all electrical equipment before connecting or disconnecting meters or test leads.
9. When connecting a meter to terminals for measurement, use a range higher than the expected voltage.
10. Before operating pumping unit or performing any tests or measurements, make certain that the frame of the motor and starter panel are securely grounded.
11. If a test meter must be held or adjusted while voltage is applied, ground case of meter before starting measurement and do not touch live equipment while you are holding meter. Some moving vane type meters should neither be grounded nor should they be held during measurements.
12. Do not use test equipment known to be in poor condition.

D. Equipment Description.

WKL high pressure pumps are multi-stage centrifugal pumps with vertically split casings. The casing consists of suction and discharge casings, plus a number of intermediate (stage) casings, all secured with tie-bolts. Diffusers are inserted in individual stage casings. Individual stage casings are sealed by o-rings. Suction and stage casings are provided with wear rings (on pump models 50 through 150) which can be replaced if, after prolonged operation, wear has become excessive. Bearing housings are attached to the suction and discharge casings by capscrews.

The pump shaft is protected against corrosion and wear by interstage sleeves, spacer sleeves, and shaft sleeves. Impellers are secured on pump shaft by keys; all impellers face the same direction on the shaft.

WKL high pressure pumps incorporate special design refinements which help to absorb the appreciable axial thrust generated by their high head operation. Residual axial thrust is absorbed by the bearings.

High Temperature Design. If pumped fluid is at operating temperatures between 220 degrees F and 285 degrees F, pumps of high temperature construction are used (1 1/4" to 3" sizes only). These are provided with cooled stuffing boxes. Stuffing box cooling housings separate casings and bearing housings. Cooling water flows through cavities of these cooling housings and keeps temperature at stuffing boxes within acceptable limits. The cooling housings surround shaft sleeves, considerably reducing temperature of hot fluid pumped before it enters stuffing boxes. However, cooling is effective only if stuffing boxes are in good condition and are sealing satisfactorily. Maintenance of high temperature stuffing boxes is the same as those for normal (low temperature) stuffing boxes.

NOTE

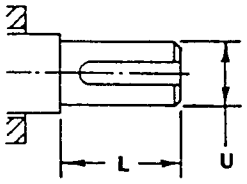
CPC recommends that flush lines to the stuffing boxes incorporate heat exchangers to cool flushing fluid. Clean, fresh water should be used as coolant; sediment and lime deposits seriously affect rate of heat transfer and will impair effective cooling. Even when using clean, fresh water, a periodic thorough cleaning of cooling water cavities is recommended.

Cooling water should flow freely and visibly so that its temperature and flow rate can be checked periodically. Temperature differential between cooling water inlet and outlet should not exceed 18 degrees F. The cooling water supply lines should be provided with valves to enable flow adjustment as required and shut off when cooling water cavities are to be cleaned or when the pump is shutdown.

E. Technical Data.

Specifications and operating limits should be recorded in the back of this manual upon receipt of pumping unit. For further information, refer to tables 1 and 2.

Table 1. Stub Shaft Dimensions

PUMP SIZE SUCTION X DISCHARGE	PUMP MODEL NO.	BEARING SIZE		STUB SHAFT		
						
		INBOARD	OUTBOARD	DIA. U	KEYWAY	L
2-1/2 X 1-1/4	WKL-32	3305	5305	0.875	3/16 X 2.250	3.000
3 X 1-1/2	WKL-40	3306	5306	1.125	1/4 x 2.375	2.500
3 x 2	WKL-50	3307	7307YBG	1.250	1/4 x 2.250	3.750
4 x 2-1/2	WKL-65	3307	7307YBG	1.250	1/4 x 2.250	3.750
6 x 3	WKL-80	3308	7308YBG	1.500	3/8 x 2.375	3.000
6 x 4	WKL-100	3309	7309YBG	1.625	3/8 x 2.500	4.000
6 x 6	WKL - 125	3310	7310YBG	1.875	1/2 x 3.000	4.500
8 x 6	WKL-150	3312	7312YBG	2.250	1/2 x 3.250	5.750

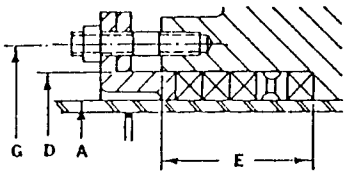
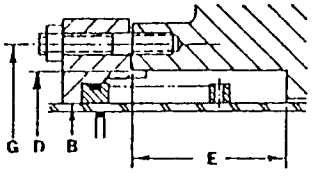
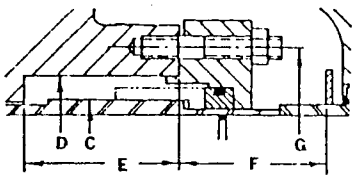
F. Method of Operation.

Pumped fluid enters suction casing and passes into first stage impeller, which propels fluid into first stage diffuser. The fluid then flows into the next impeller. This process is repeated from one stage to the next, and at each stage fluid pressure increases by the same increment (this is termed "stage head"). After leaving final stage diffuser, fluid enters discharge casing and passes into discharge piping.

G. Handling.

Complete pump set must be handled with care. Do not pass lifting slings through eye bolt on motor. Pump is shipped with flange covers to protect flange faces and to prevent foreign matter from entering pump. Flange covers should remain intact until suction and discharge piping are connected to pump flanges.

Table 2. Stuffing Box Dimensions

PUMP MODEL NO.	STUFFING BOX							
	Packed, Discharge & Suction End 			Mechanical Seal, Suction End 		Mechanical Seal, Discharge End 		
	SLEEVE A	SLEEVE B	SLEEVE C	BORE D	DEPTH E	1ST OBSTR.-F	GLAND BOLTING - G	PKG. SIZE
WKL-32	1.375	1.250	1.500	2.250	2.500	2.250	3.125 D.B.C.	7/16□
WKL-40	1.750	1.750	1.875	2.625	3.000	1.750	3.375 D.B.C.	7/16□
WKL-50	1.750	1.750	1.875	2.625	3.000	1.750	3.375 D.B.C.	7/16□
WKL-65	1.750	1.750	1.875	2.625	3.000	1.750	3.375 D.B.C.	7/16□
WKL-80	2.125	2.125	2.375	3.125	3.000	2.000	4.125 D.B.C.	1/2 □
WKL-100	2.375	2.375	2.375	3.375	3.500	2.000	4.875 D.B.C.	1/2 □
WKL-125	2.750	2.625	2.750	3.750	3.500	3.000	5.000 D.B.C.	1/2 □
WKL-150	3.000	2.875	3.000	4.500	5.000	3.000	6.000 D.B.C.	3/4 □

H. Unpacking.

Inspect pumping unit when it is received for missing hardware, flange covers or possible damage. In general, make certain the shipment complies with purchase order. Inspect any parts containers that may be shipped with unit (coupling, seals, etc.). Report any damage or shortage immediately to carrier's agent or factory. Claims made at a later time cannot be accepted.

I. Packing.

If pump is sent back to CPC factory for repair, it must be drained and all flanges and connections covered or plugged. Ship pumps in assembled condition to prevent damage to sealing faces of individual components.

II. INSTALLATION.

A. Foundation and Mounting.

The foundation must be rigid enough to absorb vibration without yielding. Ensure that concrete foundation has set before mounting pumping unit. Surface of foundation must be horizontal and perfectly even.

If anchor bolts have not been preset in foundation, mark hole locations of bolt holes in baseplate on foundation and drill appropriate holes. Suspend anchor bolts from baseplate. Level baseplate on foundation by using shims or metal wedges. Shims must be fitted in close proximity to left and right of foundation bolts. If spacing between adjoining holes exceeds 30 inches, shims should be fitted halfway between holes. All shims must lie perfectly flush.

B. Coupling Alignment.

A pump or any rotating equipment will not be aligned after transport and installation, regardless of pre-alignment at factory. Pumping unit must be realigned before and after grouting of baseplate, and connection of suction and discharge piping. Before attempting any work on pumping unit, refer to safety precautions set forth in section I, paragraph C. Align pump and driver as follows:

1. Remove coupling guard.
2. Remove nuts and lockwashers from motor hold down bolts. Reinstall nuts only and finger tighten.
3. Disconnect coupling halves by removing flexible component from coupling.
4. Connect wiring to driver.
5. "Jog" motor to establish direction of rotation. Direction of rotation should be clockwise as viewed from driver end toward pump.
6. Disconnect, lock off, and tag electrical power supply to motor while aligning pumping unit.
7. Axial alignment of coupling is checked with a straight edge across both coupling halves (refer to figure 1). Measure distance A or B between straight edge and both shafts. Repeat measuring at two locations, 120 degrees apart, on periphery of coupling. The difference between three measurements for A or B must not exceed 0.005 inch at any of the three positions.
8. Angular alignment of coupling is checked with a feeler gauge (refer to figure 1). Measure distance between faces of both coupling halves, near their outside, at four locations spaced 90 degrees apart. The four measurements must be within $\pm$ 0.005 inch tolerance. The same tolerance applies if a dial indicator is used to check angular alignment. Fix dial indicator to one coupling half and take readings while other coupling half is rotated 360 degrees.
9. If coupling halves are misaligned, make necessary adjustments by tapping motor housing with mallet and shimming.
10. Repeat steps 7 through 9 until proper alignment is achieved.

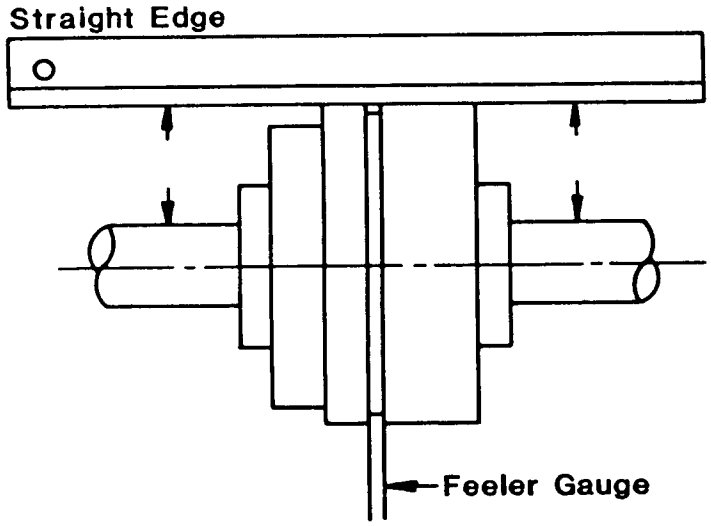


Figure 1. Coupling Alignment

11. Remove nuts from motor hold down bolts. Reinstall lockwashers and finger tighten nuts.
12. Reconnect coupling by reinstalling the flexible component on coupling. Reinstall coupling guard.

C. Grouting.

Saturate the top of rough concrete foundation with water before grouting. Build a wooden form around the outside of the baseplate. Add grout until the entire space under the baseplate is filled to the top of the underside. A stiff wire should be used through the grout holes in the baseplate to work the grout and release any air pockets.

Cover exposed surfaces of the grout with wet burlap to prevent cracking from drying too rapidly. When the grout is sufficiently set so that the forms can be removed, the exposed surfaces of the grout and foundations are finished smooth. When the grout is hard (after 72 hours or more), tighten foundation bolts firmly and evenly. Align pump and driver shafts as outlined in paragraph B of this section.

D. Piping Installation.

All piping must be supported so that no undue stress from piping weight is placed upon pump. **Do not force piping.** Never use pump as an anchorage point for the piping.

CAUTION

Extreme care should be taken when connecting new piping to see that no foreign matter such as dirt, slag, chips, tools, etc., are in piping as this debris will be drawn into pump and cause excessive damage. During initial installation and testing, a strainer should be installed in suction piping to keep debris from entering pump.

Suction lift lines should be laid with a rising slope toward pump and positive suction head lines should be laid with a downward slope toward pump to avoid air pocket formation. Suction piping must be at least the same size as pump suction nozzle. Compensation for heat elongation must be provided where required.

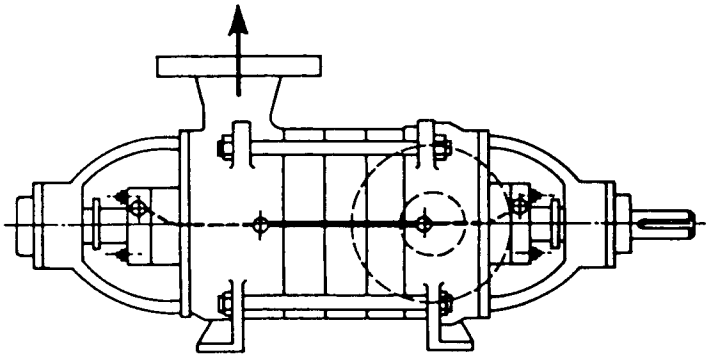
The coupling alignment must be rechecked as outlined in paragraph B of this section after installation of piping. Realign coupling if required by adjusting driver end.

E. Auxiliary Connections.

Connect auxiliary connections. On high temperature pumps, plates are installed on pump locating connections for cooling of the stuffing boxes. Refer to figures 2a and 2b for fluid line schematics.

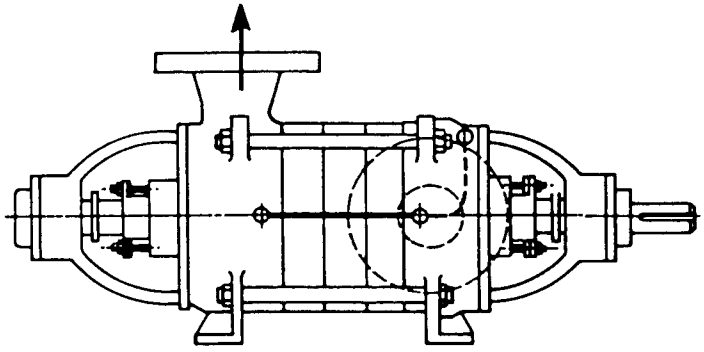
FLUID LINE SCHEMATIC
COLD SERVICE

MECHANICAL SEAL
ALL MODELS



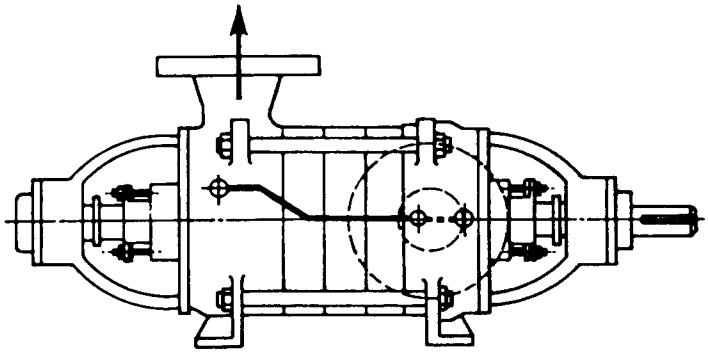
Balancing line from discharge casing to suction casing with high pressure (discharge) and low pressure (suction) flush.

PACKED STUFFING BOX
WKL-32,40,50,65



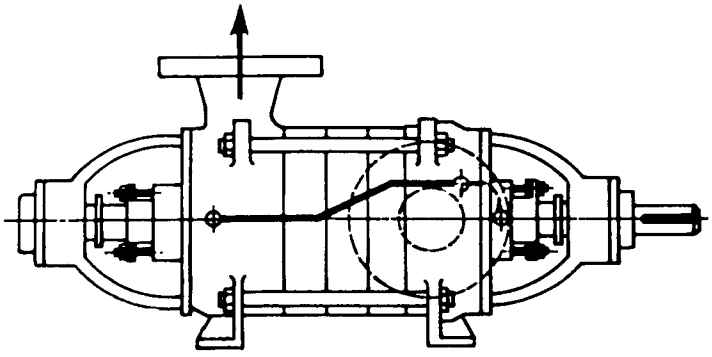
Balancing line from discharge casing to suction casing with low pressure (suction) flush. Flush at top of suction casing.

PACKED STUFFING BOX
WKL-80 & 100



Balancing line from discharge casing to suction casing with low pressure (suction) flush. Flush at side of suction casing.

PACKED STUFFING BOX
WKL-125 & 150



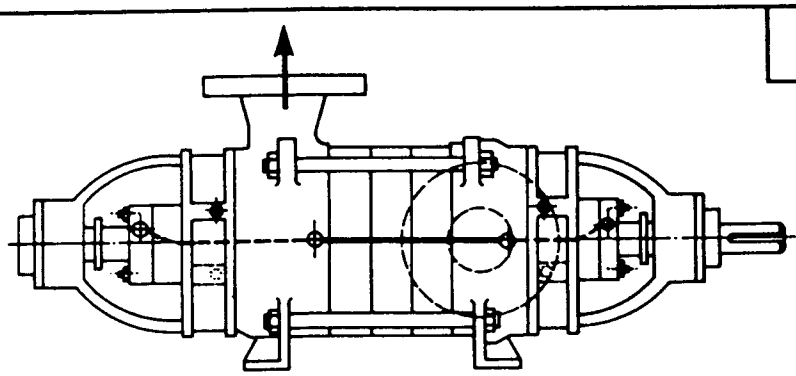
Balancing line from discharge casing to suction casing with low pressure (suction) flush. Flush at side of stuffing box.

Figure 2a. Auxiliary Connections — Cold Service

FLUSH LINE ----------
BALANCE LINE ——————

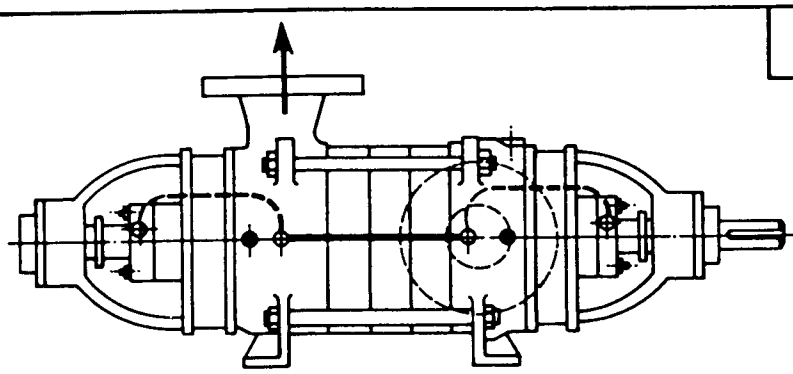
FLUID LINE SCHEMATIC
HOT SERVICE

MECHANICAL SEAL
WKL-32



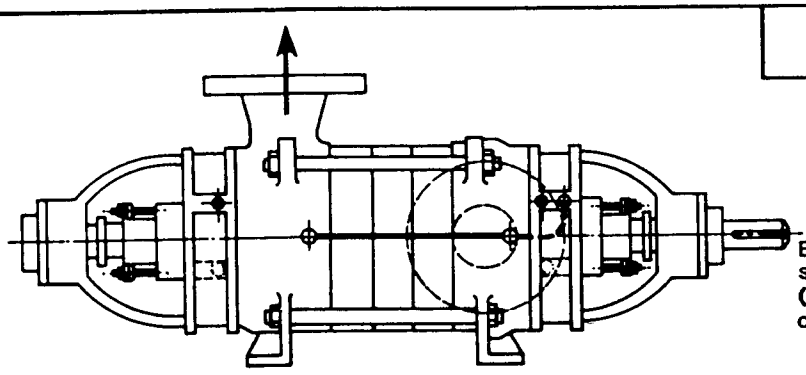
Balancing line from discharge casing to suction casing with high pressure (discharge) and low pressure (suction) flush. Cooling in & out connections located in cooling housing.

MECHANICAL SEAL
WKL-40,50,65,80



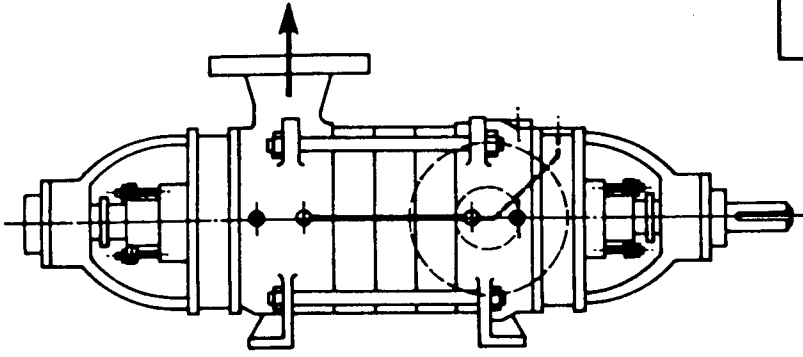
Balancing line from discharge casing to suction casing with high pressure (discharge) and low pressure (suction) flush. Cooling in & out connections located in suction and discharge casings.

PACKED STUFFING BOX
WKL-32



Balancing line from discharge casing to suction casing with low pressure (suction) flush. Flush and cooling connections located in cooling housing.

PACKED STUFFING BOX
WKL-40,50,65,80



Balancing line from discharge casing to suction casing with low pressure (suction) flush. Flush located at top of cooling housing. Cooling in & out located in suction and discharge casings.

Figure 2b. Auxiliary Connections — Hot Service

FLUSH LINE ——————
BALANCE LINE ——————
COOLING PORT ✦

III. OPERATION.

A. Preparations.

Before starting pumping unit, make the following checks:

Lubricants. Grease lubricated pumps are shipped with factory lube packed bearings. This lubrication is adequate for a minimum of 5,000 operating hours or six months of continuous operation under normal conditions. After extended storage or exposure to unusually humid or hot environmental conditions, the bearings and their lubricant should be checked before operating pumping unit. For further details on lubricating bearings, refer to section IV, paragraph B.

Stuffing Boxes. If pump has packed stuffing boxes, check that nuts securing packing gland are finger tightened only.

Rotation Check. Check direction of driver rotation by connecting electrical power supply to motor and "jogging" motor. Direction of rotation should be clockwise when viewed from driver end toward pump.

Final Check. Check pump and motor shafts for free rotation by manually turning coupling. If necessary, loosen stuffing box packing (packed pumps only) or recheck coupling alignment. Unit is now ready for initial startup.

B. Startup.

Before starting pumping unit, refer to safety precautions in section I, paragraph C. Use the following procedure to start the pump:

WARNING

Do not operate pumping unit against a closed discharge system. If pump has any chance of operation against a closed system, a bypass system allowing a minimum of 10% of design flow should be installed. See table 3 for minimum flow rates.

Table 3. Minimum Flow Rates

Model	Speed	Minimum Flow
WKL-32	1750 RPM	5 GPM
WKL-32	3500 RPM	10 GPM
WKL-40	1750 RPM	7.5 GPM
WKL-40	3500 RPM	15 GPM
WKL-50	1750 RPM	10 GPM
WKL-50	3500 RPM	20 GPM
WKL-65	1750 RPM	20 GPM
WKL-65	3500 RPM	35 GPM
WKL-80	1750 RPM	35 GPM
WKL-80	3500 RPM	65 GPM
WKL-100	1750 RPM	65 GPM
WKL-125	1750 RPM	150 GPM
WKL-150	1750 RPM	200 GPM

NOTE

For temperatures in excess of 212 degrees F. (100 degrees C.), increase flow rates by 25%.

1. Open suction valve and fill pump completely with fluid.
2. Open discharge valve to allow a minimum of 10% design flow according to table 1 above.
3. Open valves to auxiliary connections, if applicable.
4. If a high temperature design is used, turn on cooling water and check to make sure it is flowing freely. Refer to table 4 for high temperature cooling water flow requirements.

Table 4. High Temperature
Cooling Water Flow Rates
(For operating temperatures over 220 degrees F.,
based on water temperatures of 70 degrees F.)

Model	Flow Rate
WKL-32	1 GPM
WKL-40	1.5 GPM
WKL-50	2 GPM
WKL-65	3 GPM
WKL-80	4 GPM

5. Start pumping unit.
6. Open discharge valve as required to establish system flow and pressure.
7. Operate pump for approximately one hour to expel excess grease from inboard (radial) bearing cap. During this one hour operation, it is recommended that the following checks be made and recorded:
   a. Vibration on motor bearings should not exceed I mil displacement at 3500 RPM and 2 mills displacement at 1750 RPM.
   b. Vibration on pump bearings should not exceed 1 mil displacement at 3500 RPM and 2 mills displacement at 1750 RPM.
   c. Check motor horsepower (amps and kilowatts). Check all 3 leads on motor. If amperes vary more than 2%, electrical supply should be checked to prevent damage to motor.
   d. Make sure pump discharge pressure at prescribed operating speed never drops below 90% of design point pressure.
   e. Check pressure/vacuum at suction.
   f. Check stuffing boxes for leakage. Packed stuffing boxes should have slight leakage at all times. For instructions on adjusting leakage rate, refer to section IV, paragraph C. If pump has mechanical seals, there should be no leakage.
8. The following is recommended after initial run-in and checks:
   a. Stop unit.
   b. Drain system.
   c. Remove strainer from suction piping and any debris found.
   d. Check all hold down bolts and piping connections.
   e. Check coupling alignment as outlined in section II, paragraph B.
9. The unit should now be ready for continuous service.

C. Shutdown.

The procedure for shutting down pumping unit is as follows:

1. Close valve in discharge line.
2. Switch off driver, and observe the unit running to a stand still.
3. If applicable, shut off cooling water.
4. Refer to section IV, paragraph F for protective measures to follow for extended shutdown.

IV. MAINTENANCE.

A. General Operating Checks.

The pump should always run quietly and smoothly, without vibration. To ensure such operation, the following maintenance should be carried out at regular intervals during operation of the pump:

Daily:

1. Visually inspect unit.
2. Check stuffing boxes. If pump has packed boxes, there should be slight leakage during operation. If leakage is excessive, consult paragraph C for further instruction.
3. If pump has a mechanical seal, there will be either minimal leakage or invisible leakage (flashing). The seal is maintenance free. If seal does not function properly, CPC recommends replacement of the seal rather than repair.

Weekly:

1. Check horsepower (amps and kilowatts) readings. Check all 3 leads on motor. If amperes vary more than 2%, electrical supply should be checked to prevent damage to motor.
2. Check vibration. Vibration on motor bearings should not exceed 1 mil displacement at 3500 RPM and 2 mills displacement at 1750 RPM. Vibration on pump bearings should not exceed above limits.
3. Check bearing temperatures. Bearing temperatures should not exceed 185 degrees F at 100 degrees ambient. After greasing, bearing temperatures may exceed 200 degrees F until excess grease is expelled. If operating conditions are severe or there is a possibility of grease contamination, bearing grease level and condition should be checked more frequently.

Monthly:

1. Grease coupling (if applicable). **Do not overgrease.**
2. Check coupling alignment according to section II, paragraph B.
3. Check foundation bolts.

Semiannually:

1. Grease radial bearing. **Do not overgrease.**

If stand-by pumping sets are installed, it is advisable to operate pumps on a rotation system, giving each pump a certain amount of operational duty. This ensures that stand-by pumps will always be in condition for instant start-up.

Coupling misalignment may occur due to settling of foundation. Coupling alignment should be checked occasionally for pumps erected on new foundations.

B. Maintenance of Bearings.

The bearings are mounted in bearing housings, which are fitted onto suction and discharge casings of the pump. The drive end bearing is an ABEC 1, Class 3 single row bearing (i.e., a ball bearing mounted either on a clamping sleeve or held by housing and bearing cap as on WKL-40). The front end bearing is an ABEC 1, Class 3 bearing, and is either a double row angular contact bearings (WKL-32 and 40) or a matched back to back angular contact ball bearing set (WKL-50 through 150). (Revised 03-1999)

NOTE

It is recommended that bearings be replaced if pump is to be overhauled.

Bearings are grease lubricated, and packed at the factory for six months or 5,000 hours continuous operation under normal conditions without relubrication. CPC lubricates bearings with Amoco Rykon Premium Grease No. 2EP, a non soap, polyurea thickened grease with a drop point of 450 degrees F. This grease was selected due to its suitability to extreme pressures and its high temperature stability. **Never mix greases with differing properties.** Polyurea base greases are not compatible with lithium or soda soap base greases; therefore, type of grease added should not vary. However, if it is necessary to change grease type, bearings, bearing housings, and bearing covers should be removed according to the procedure described in section VI, paragraph B. Thoroughly clean bearings and flush with suitable solvent as described below:

1. Place bearings, bearing housings, and bearing covers in a wire or mesh basket and suspend basket in a light mineral solvent and allow to soak, preferably overnight.
2. After soaking and cleaning, bearings, bearing housings, and bearing covers should be rinsed in a clean, light mineral solvent and agitated vigorously to remove all loosened hard grease and dirt.
3. Dip bearings in clean, light oil and spin by hand, ensuring all foreign matter has been removed. Failure to remove all foreign matter could cause poor bearing performance later.
4. After cleaning, repack bearings on both sides with a good quality ball bearing grease. One to two pumps with a hand operated grease gun every 500 hours is adequate. **DO NOT OVERGREASE.**

If bearing temperatures increase by 10 to 15 degrees F during a period of one week, and there is not a variance in ambient or liquid temperature, add grease to bearings through grease fittings on top of bearing housings with a hand operated grease gun. **Overgreasing will cause bearings to overheat.**

Pump should run a minimum of one hour to permit expulsion of excess grease through overflow opening in bearing cap. After greasing, bearing temperatures may exceed 200 degrees F at 100 degrees ambient due to excess grease in bearing housing. After the run in period, bearing temperatures should stabilize and not exceed 185 degrees F at 100 degrees ambient. If bearing temperatures remain high, the pump should be shutdown and the cause determined. Some common causes of high bearing temperatures are:

a. Overgreasing bearings.
b. Dirty or inadequate lubrication.
c. Misalignment of shaft or bearing housing. Check coupling alignment according to section II, paragraph B.
d. Piping causes pump to "warp". Ensure that piping transmits no stress to pump. If necessary, alter piping layout. Realign pump and motor shafts.

Before the pump is started after prolonged shutdown, grease level must be checked. Add grease as required. Check temperature of bearings and listen for quiet running at regular intervals.

C. Maintenance of Packed Stuffing Boxes.

Pumps are delivered with stuffing boxes packed. Packed stuffing boxes will give trouble free service provided that they are carefully and correctly serviced and maintained. A newly packed stuffing box will leak considerably after initial packing, or repacking. If there is not a substantial reduction in leakage after the first two hours of operation, the gland nuts should be tightened until leakage rate drops to a small steady stream. Gland nuts should only be tightened lightly.

NOTE

If further reduction in leakage is necessary, packing gland nuts should be tightened in slow increments until stuffing box temperature begins to rise. At this point, packing gland nuts should be loosened until stuffing box temperature stabilizes.

Every freshly packed stuffing box needs a certain running in period before it stabilizes; therefore, close observation at frequent intervals during running-in is important. Later, it need only be checked occasionally.

After prolonged service, or when packing has been compressed by approximately the width of one packing ring, packing should be renewed and condition of shaft sleeve checked. Refer to section VI, paragraph E, for packing installation instructions. If shaft sleeve shows signs of scoring, grooving, or surface roughness, it should be replaced. Worn, unsuitable or badly fitted packing can cause stuffing boxes to leak, as can a damaged shaft.

Insufficient cooling water or fouling of cooling water jackets can also cause stuffing boxes to leak. In this instance, remove cooling water jackets according to disassembly procedure described in section VI and clean thoroughly. Ensure adequate cooling water supply to cooling water jackets.

D. Parts Cleaning and Inspection.

Whenever pump is disassembled, individual parts should be cleaned and inspected as follows:

1. Discard all old gaskets and o-rings. Thoroughly wash and clean all parts with a suitable solvent.
2. Check shaft for runout, scratches, grooves, or any possible damage. Touch up scratches and grooves with a polishing cloth and inspect for remaining grooves or deep scratches. Bent or excessively damaged shaft should be replaced.
3. DO NOT remove mechanical seal rotating assemblies from shaft protecting sleeves if mechanical seals are relatively clean and in good working condition. This will simplify reassembly. If mechanical seals are extremely dirty or damaged, they should be replaced.

NOTE

If mechanical seals are **NOT** to be replaced, mark location of locking collars (type 1 and type 21 seals on suction end) or spring retainers (type 9BT seals on discharge end) on shaft protecting sleeves.

4. Check all shaft protecting sleeves and spacer sleeves visually for score marks, scratches, pits, or grooves. Touch up sleeves with polishing cloth and inspect for remaining grooves or deep scratches. Shaft protecting sleeves and spacer sleeves should be replaced if any marks, pits or grooves are still visible after touching up.
5. Inspect impellers for pitting, erosion, or clogged vanes. If impellers are damaged in any way, they should be replaced. If new impellers are installed, they must be axially aligned with respect to diffusers. Refer to section VI, paragraph G, for axial alignment procedures.
6. Inspect wear ring clearance for each stage (on pump sizes 50 through 150, only) as follows:
   a. Measure outside diameters of impeller hubs in three places.
   b. Measure inside diameters of corresponding wear rings in three places.
   c. Corresponding differences between high readings of inside diameters of wear rings and low readings of outsid diameters of impellers must not exceed clearances specified in table 5.
   d. If replacement is required, convey applicable casings and impellers to a work area with access to machine shop equipment. Replace the wear rings as described in paragraph E.

E. Wear Ring Replacement.

If pump is not already disassembled, perform disassembly procedures outlined in section VI. Take applicable casings anc impellers to a machine shop. Procedure for replacing wear rings is as follows:

1. Remove old wear ring from suction casing and/or stage casing(s), as applicable. This can best be accomplished oı a lathe.
2. Press new wear ring in suction casing and/or stage casing(s), as applicable.
3. Place impeller on an arbor and mount between centers in a lathe. Indicate back of impeller hub to within 0.002 T.I.R. maximum to be sure that arbor and impeller are running square.

4. Turn wearing surface of impeller until a 63 RMS or better finish is obtained.
5. Measure outside diameter of impeller hub and record.
6. Mount suction casing and/or stage casing, with wear ring inserted, in a lathe. Indicate male rabbet to within 0.002 T.I.R. maximum.
7. Bore wear ring to within the specified tolerance listed in table 6 over the recorded size of outside diameter of impeller hub.
8. Return impeller and suction casing and/or stage casing(s) to pump assembly.

Table 5. Maximum Wear Ring Clearance

Model	Stage	Maximum Diametrical Clearance
WKL-50	All	0.038 inches
WKL-65	All	0.034 inches
WKL-80	First	0.036 inches
WKL-80	Second	0.042 inches
WKL-100	All	0.032 inches
WKL-125	All	0.042 inches
WKL-150	All	0.044 inches

Table 6. New Wear Ring Clearance Limits

Model	Stage	Diametrical Clearance
WKL-50	All	0.015 to 0.019 inches
WKL-65	All	0.013 to 0.017 inches
WKL-80	First	0.012 to 0.018 inches
WKL-80	Second	0.017 to 0.021 inches
WKL-100	All	0.011 to 0.016 inches
WKL-125	All	0.016 to 0.021 inches
WKL-150	All	0.018 to 0.022 inches

F. Pump Protection During Prolonged Shutdown.

If pump is to be shutdown for an extended period of time (such as a unit used for seasonal operation), the following steps are recommended:

1. Disconnect coupling.
2. Disconnect or lock off power supply.
3. Block off suction piping.
4. Fill unit with oil or suitable non corrosive liquid.

CAUTION

It is better to have pump full of water than partially full of water. The latter will cause accelerated corrosion of wear rings and diffusers, resulting in a 10% drop in capacity during initial operation after restart. However, **if there is a possibility of liquid freezing, completely drain casings by removing casing plugs and drain all piping.**

5. Relubricate bearings.
6. Provide pump and motor with a protective cover.

If the pump is sent back to Carver Pump Company for repair, it should first be drained and all flanges and connections covered or plugged. Ship pumps in assembled condition to prevent damage to sealing faces of individual components.

V. TROUBLESHOOTING.

If the installation and starting procedures outlined in this manual are followed, the pump should provide reliable service and long life. However, if operating problems do occur, significant time and expense can be saved if the following check list is used to eliminate the most common causes of those problems.

Table 7. Troubleshooting

Pump does not deliver rated capacity

	Possible Cause	Corrective Action
1.	Excessive pressure in discharge line.	Check GPM and head against design conditions; pump may be too small. Consult local CPC office.
2.	Incomplete priming or venting of pump or piping.	Prime pump and piping again and carefully vent.
3.	Suction line or impeller is clogged.	Clean out suction strainer; dismantle pump and clean impeller if necessary.
4.	Positive suction head is too low (on pumps with positive suction head).	Check liquid level. Valves in suction line should be fully open. If necessary, lock valves open to prevent accidental closure. Check design and lay of suction line for features which might cause excessive pressure drop. Clean out line strainers.
5.	Excessive suction lift (on pumps operating on suction lift).	Check liquid level and make sure foot valve is fully open. Clean out line strainers.
6.	Entrapment of air through stuffing boxes.	Check external sealing line for clogging.
7.	Reverse rotation.	Change direction of rotation. If pump is electrically driven, reverse polarity of motor. Retighten shaft nut if necessary.
8.	Pump speed is too low.	On pumps driven by internal combustion engines, adjust governor. Adjust governor on pumps driven by steam turbines.
9.	Excessive wear of internal parts.	Dismantle pump and replace worn components.

Table 7. Troubleshooting Continued

Stuffing boxes leak

	Possible Cause	Corrective Action
1.	Worn, unsuitable, or badly fitted packing.	Repack stuffing boxes, carefully observing instructions in section IV, paragraph C.
2.	Scoring, grooving of shaft protecting sleeve due to improper tightening of gland or due to wear.	Shaft protecting sleeves should be replaced. After repacking stuffing boxes, tighten gland carefully and evenly.
3.	Insufficient cooling water, or fouling of cooling water jackets.	Remove and clean cooling water jackets. Ensure adequate cooling water supply.
4.	Pump runs "rough"; shaft chatters.	Check pump bearings and replace if necessary. If this fails, check shaft for true running, rebalancing entire rotating assembly. Carefully reassemble according to section VI.

Leakage at casings or cooling water jackets

	Possible Cause	Corrective Action
1.	Tie bolts not sufficiently tightened.	Shut down pump, release pressure, and tighten tie bolts evenly after pump has cooled completely.
2.	O-rings are damaged.	Replace o-rings.

Bearings run hot

	Possible Cause	Corrective Action
1.	Pump and motor shafts are misaligned.	Check coupling alignment, section II, paragraph B.
2.	Piping causes pump to "warp."	Ensure piping transmits no stress to pump. Alter piping layout if necessary. Realign pump and motor shafts.
3.	Insufficient or unsuitable grease.	Top off grease nipples. If necessary, change grease.
4.	Overgreased bearings.	Remove excess grease.

Pump discharge pressure excessive

	Possible Cause	Corrective Action
1.	Excessive speed.	Check speed precisely and: a. Decrease speed, if possible. b. Remove one or more impellers and their diffusers. c. Trim outlet tips of impeller vanes. Consult factory, specifying exact operating conditions.

Table 7. Troubleshooting Continued

2. Specific gravity of fluid pumped is too high (temperature of fluid is lower than specified).	If pump must operate for prolonged periods at low temperatures or high specific gravity, follow corrective actions given under "Excessive speed."
Driver is overloaded	
Possible Cause	**Corrective Action**
1. Pump discharge pressure is lower than design point (check pump nameplate).	Partially close discharge valve until pressure at discharge flange is as specified. Decrease speed or trim impellers if driver remains overloaded (consult CPC factory before taking this step).
2. Pump is pumping fluid with specific gravity in excess of that specified (if temperature of fluid is lower than specified, specific gravity will be higher).	If prescribed fluid temperature or specific gravity cannot be attained, one or more of the following measures can be taken: a. Partially close discharge valve, reducing pump capacity to a point where driver is not overloaded. b. Remove one or more impellers and their diffusers. c. Trim one or more impellers. d. Install more powerful pump driver. Consult factory, specifying exact operating conditions.

VI. DISASSEMBLY AND REASSEMBLY.

A. General.

Before dismantling, make sure pump is disconnected from power supply and cannot be accidentally switched on. Close suction and/or discharge valves. The pump casing should be cooled down to ambient temperature. Casing must be empty and not under pressure.

After prolonged operation, it may be difficult to pull components from shaft. In such cases rust solvent may be used and suitable extracting tools applied where possible. **Never use force under any circumstances.** The following tools are recommended for disassembly and reassembly:

1. Bearing puller.
2. Spanner wrench.
3. Rawhide or wood mallet.
4. Wooden wedge (support stage casings).
5. Allen wrench set.
6. Punch.
7. Socket, open, and/or box wrench set.
8. Scribe (for new seal installation).

B. Disassembly for Pumps with Packing

(Refer to appropriate sectional drawing, figures 7 through 14, for location of parts followed by an item number.) Before attempting any work on pumping unit, refer to safety precautions set forth in section I, paragraph C.

WARNING

Make sure the driver can not be accidentally switched on while unit is being worked on. Serious injury to personnel could result.

1. Disconnect, lock off, and tag power supply to driver.
2. Close all system valves.
3. Drain pump by removing drain plugs (424) from bottom of casings (203), (197), and (1). Vent pump by removing plugs (423) from suction and discharge casings. If pump is high temperature design, remove drain plugs (422) from bottom of cooling water jackets (215).
4. Disconnect suction, discharge, and gage lines.
5. Disconnect male connector retaining nuts from male connector bodies (410 or 411). Remove tubing (400 and 408). Retaining nuts will remain with tubing.
6. Remove coupling guard.
7. Uncouple pump from driver.
8. Pull coupling half off pump shaft. Remove coupling key (46).
9. Remove capscrews holding pump to base. Remove pump from base and take to a suitable work area.
10. Clamp down discharge casing foot to steady pump during disassembly.
11. Number and match mark stage casing(s) (1) so that suction casing (203), stage casing(s), and discharge casing (197) will be reassembled in correct sequence and position.
12. Support stage casing(s) (1) before dismantling to prevent them from dropping when suction casing (203) is removed.

NOTE

Pump should be dismantled from suction end. Mark or number each component as it is dismantled according to sequence. **IMPORTANT: Watch for shims between impellers and spacer sleeves, and mark the sequence accordingly.** The individual components should be unscrewed, pulled off, or removed in the following sequence:

13. From inboard side, remove capscrews (601). Remove bearing cover (35).
14. On inboard side, uncrimp locking tab of bearing lockwasher (69). Remove bearing locknut (22) and bearing lockwasher. Note: Model WKL-40 does not have bearing locknut or bearing lockwasher.
15. From inboard side, remove capscrews (600). Remove bearing housing (99) with radial bearing (16) intact. Inspect the bearing for wear, corrosion and contamination. Refer to section IV, paragraph B for bearing maintenance. If replacement is necessary, remove radial bearing and grease seal (169) from bearing housing. NOTE: WKL-40 pumps do not have a grease seal (169). On pump model WKL-100, remove bearing spacer (14G).
16. On WKL-40, remove snap ring (176).
17. Remove deflector (40) and spacer sleeves (14C).
18. From inboard side, remove nuts (615) from studs (630). Remove gland (17).
19. Remove shaft sleeve (14A).
20. If pumps are equipped with cooled stuffing boxes for high temperature design, remove cooling water jacket (215) from suction casing (203). Remove o-ring (89C) from cooling water jacket. Remove gasket (73C) between cooling water jacket and suction casing.
21. Remove hex nuts (616). Remove tie bolts (173) connecting suction (203) and discharge (197) casings.
22. Remove suction casing (203) along with packing. Remove casing o-ring (89D) from suction casing.

23. Remove packing rings (13) and lantern ring (29) from stuffing box in suction casing (203) or cooling water jacket (215), as applicable.
24. On WKL-32, 50, and 65, remove o-ring (89B) from groove in shaft (6).
25. Remove sleeve key (32B). NOTE: Sleeve key is (32C) on WKL-40.
26. Remove spacer sleeve (14G) on WKL-50 hot service. Remove spacer sleeve (14D) on WKL-50 hot service and WKL-100. Remove suction spacer sleeve (14C) on WKL-65 hot service. Remove suction spacer (14E) on all models excluding WKL-50.
27. Remove first stage impeller (2A).
28. Remove diffuser (5A).
29. Pry off stage casing (1) with interstage sleeve (58) and casing o-ring (89D) intact. Remove interstage sleeve (58) and o-ring (89D) from stage casing.
30. Remove first stage impeller key (32A).
31. Remove stage impeller (part number 2B for WKL-32 through 80 and part number 2A for WKL-100 through 150).
32. Repeat steps 28 through 31 for each remaining stage.
33. Remove last stage diffuser (5B).
34. From outboard side, remove nuts (615) from studs (630). Remove split packing gland (17).
35. From outboard side, remove capscrews (601) and bearing cover (37). NOTE: Capscrews are (600) on WKL-100.
36. On outboard side, uncrimp locking tab of bearing lockwasher (69). Remove bearing locknut (22) and bearing lockwasher.
37. From outboard side, remove capscrews (601). Remove bearing housing and shaft assembly from discharge casing (197).

NOTE

Bearing housing and shaft assembly consists of shaft, discharge spacer sleeve, shaft sleeve, sleeve key, o-ring, spacer sleeve, deflector, bearing spacer(s), snap ring, thrust bearing, cooling water jacket (if high temperature design), and bearing housing. Dismantle bearing housing and shaft assembly in following sequence:

38. Remove bearing housing (99) with thrust bearing (18) intact. Inspect the bearing for wear, corrosion and contamination. Refer to section IV, paragraph B for bearing maintenance. If replacement is necessary, remove thrust bearing and grease seal (169) from bearing housing. NOTE: WKL-40 pumps do not have a grease seal (169).
39. On WKL-32, 40, 80, and 100, remove bearing spacer (78). On models WKL-50, 65, 125, and 150, remove bearing spacer with deflector (40). On all models, remove snap ring (176).
40. On WKL-40, remove second bearing spacer (78).
41. Remove deflector (40) with outboard spacer sleeve (14C or 14D) on WKL-32, 40, 80, and 100.
42. Remove shaft sleeve (14A) on all models excluding WKL-50 cold service. NOTE: Shaft sleeve on WKL-50 cold service is (14B). On WKL-40, 80, 100, 125, and 150, o-ring (89B) will be removed with shaft sleeve.
43. If pumps are equipped with cooled stuffing boxes for high temperature design, remove cooling water jacket (215). Remove o-ring (89C) from cooling water jacket. Remove gasket (73C) from cooling water jacket or discharge casing (197).
44. Remove packing rings (13) from stuffing box in discharge casing (197) or cooling water jacket (215), as applicable.
45. On WKL-32, 50, and 65, remove o-ring (89B) from groove in shaft (6).
46. On all models, excluding WKL-50 cold service and model WKL-80, remove sleeve key (32B). Note: Sleeve key on WKL-40 is (32C). Remove spacer sleeve (14C) on WKL-65 hot service. Remove spacer sleeve (14G) on WKL-50 hot service.
47. Remove discharge spacer sleeve (14E or 14F) on all models, excluding WKL-50 cold service and WKL-80.
48. Remove remaining impeller key (32A). NOTE: On WKL-50, last stage impeller key is (32C); on WKL-40, (32B).

49. Remove o-ring (89A) from discharge casing (197).

C. Disassembly for Pumps with Mechanical Seals

(Refer to appropriate sectional drawing, figures 7 through 14, for location of parts followed by an item number.) Before attempting any work on pumping unit, refer to safety precautions set forth in section I, paragraph C.

WARNING

Make sure the driver can not be accidentally switched on while unit is being worked on. Serious injury to personnel could result.

1. Disconnect, lock off, and tag power supply to driver.
2. Close all system valves.
3. Drain pump by removing drain plugs (424) from bottom of casings (203), (197), and (1). Vent pump by removing plugs (423) from suction and discharge casings. If pump is high temperature design, remove drain plugs (422) from bottom of cooling water jackets (215).
4. Disconnect suction, discharge, and gage lines.
5. Disconnect male connector retaining nuts from male connector bodies (410 or 411). Remove tubing (400 and 408). Retaining nuts will remain with tubing.
6. Remove coupling guard.
7. Uncouple pump from driver.
8. Pull coupling half off pump shaft. Remove coupling key (46).
9. Remove capscrews holding pump to base. Remove pump from base and take to a suitable work area.
10. Clamp down discharge casing foot to steady pump during disassembly.
11. Number and match mark stage casing(s) (1) so that suction casing (203), stage casing(s), and discharge casing (197) will be reassembled in correct sequence and position.
12. Support stage casing(s) (1) before dismantling to prevent them from dropping when suction casing (203) is removed.

NOTE

Pump should be dismantled from suction end. Mark or number each component as it is dismantled according to sequence. **IMPORTANT: Watch for shims between impellers and spacer sleeves, and mark the sequence accordingly.** The individual components should be unscrewed, pulled off, or removed in the following sequence:

3. From inboard side, remove capscrews (601). Remove bearing cover (35).
4. On inboard side, uncrimp locking tab of bearing lockwasher (69). Remove bearing locknut (22) and bearing lockwasher. Note: Model WKL-40 does not have bearing locknut or bearing lockwasher.
5. From inboard side, remove capscrews (600). Remove bearing housing (99) with radial bearing (16) intact. Inspect bearings for wear, corrosion or contamination. Refer to section IV, paragraph B for bearing maintenance. If replacement is necessary, remove radial bearing and grease seal (169) from bearing housing. NOTE: WKL-40 pumps do not have a grease seal (169). On WKL-100, remove bearing spacer (14G).
6. On WKL-40, remove snap ring (176).
7. Remove deflector (40) and spacer sleeve (14C).
8. From inboard side, remove nuts (615) from studs (630). Remove seal gland (17A). Mechanical seal stationary element (90) will be mounted in seal gland. Remove gasket (73F) from seal gland.

19. Remove shaft sleeve (14A) with mounted mechanical seal rotating element (90). On WKL-40, 80, 100, 125, and 150, o-ring (89B) will be removed with shaft sleeve.

NOTE

Do not remove mechanical seal rotating element from shaft sleeve at this point, especially if mechanical seal is relatively clean and in good working condition. This will simplify reassembly.

20. If pumps are equipped with cooled stuffing boxes for high temperature design, remove cooling water jacket (215) from suction casing (203). Remove o-ring (89C) from cooling water jacket. Remove gasket (73C) between cooling water jacket and suction casing (203).
21. Remove hex nuts (616). Remove tie bolts (173) connecting suction and discharge casings.
22. Remove suction casing (203) along with mechanical seal (90). Remove casing o-ring (89D) from suction casing.
23. On WKL-32, 50, and 65, remove o-ring (89B) from groove in shaft (6).
24. Remove sleeve key (32B). NOTE: Sleeve key is (32C) on WKL-40.
25. Remove spacer sleeve (14G) on WKL-50 hot service. Remove spacer sleeve (14D) on WKL-50 hot service and WKL-100. Remove suction spacer sleeve (14C) on WKL-65 hot service. Remove suction spacer (14E) on all models excluding WKL-50.
26. Remove first stage impeller (2A).
27. Remove diffuser (5A).
28. Pry off stage casing (1) with interstage sleeve (58) and casing o-ring (89D) intact. Remove interstage sleeve and o-ring from stage casing (1).
29. Remove first stage impeller key (32A).
30. Remove stage impeller (part number 2B for WKL-32 through 80 and part number 2A for WKL-100 through 150).
31. Repeat steps 27 through 30 for each remaining stage.
32. Remove last stage diffuser (5B).
33. From outboard side, remove nuts from studs (630). Pull seal gland (17A or 17B), with mechanical seal stationary element (91) away from stuffing box.
34. From outboard side, remove capscrews (601) and bearing cover (37). NOTE: Capscrews are (600) on WKL-100.
35. On outboard side, uncrimp locking tab of bearing lockwasher (69). Remove bearing locknut (22) and bearing lockwasher.
36. From outboard side, remove capscrews (600). Remove bearing housing and shaft assembly from discharge casing (197).

NOTE

Bearing housing and shaft assembly consists of shaft, discharge spacer sleeve, shaft sleeve, mechanical seal rotating element, sleeve key, seal gland, mechanical seal stationary element, o-ring, spacer sleeve, deflector, bearing spacer(s), snap ring, thrust bearing, cooling water jacket (if high temperature design), and bearing housing. Dismantle bearing housing and shaft assembly in the following sequence:

37. Remove bearing housing (99) with thrust bearing (18) intact. Inspect bearing for wear, corrosion or contamination. Refer to section IV, paragraph B for bearing maintenance. If replacement is necessary, remove thrust bearing and grease seal (169) from bearing housing. NOTE: WKL-40 pumps do not have a grease seal (169).
38. On WKL-32, 40, 80, and 100, remove bearing spacer (78). On WKL-50, 65, 125, and 150, remove bearing spacer with deflector (40). On all models, remove snap ring (176).
39. On WKL-40, remove second bearing spacer (78).

40. On WKL-32, 40, 80 and 100, remove deflector (40) with outboard spacer sleeve (14C or 14D).
41. Remove seal gland (17A or B) with mechanical seal stationary element (91). Remove gasket (73F) from seal gland.
42. Remove shaft sleeve (14B). Mechanical seal rotating element (91) will come off with shaft sleeve. On models WKL-40, 80, 100, 125, and 150, o-ring (89B) will be removed with shaft sleeve (14B).

NOTE

Do not remove mechanical seal rotating element from shaft sleeve at this point, especially if the mechanical seal is relatively clean and is in good working condition. This will simplify reassembly.

43. If pumps are equipped with cooled stuffing boxes for high temperature design, remove cooling water jacket (215). Remove o-ring (89C) from cooling water jacket. Remove gasket (73C) from cooling water jacket or discharge casing (197).
44. On WKL-32, 50, and 65, remove o-ring (89B) from groove in shaft.
45. On all models, excluding WKL-50 cold service and model WKL-80, remove sleeve key (32B) and discharge spacer sleeve (14E, F, or G). NOTE: Sleeve key is (32C) on WKL-40.
46. Remove remaining impeller key (32A). NOTE: On WKL-50, last stage impeller key is item number (32C); on WKL-40, (32B).
47. Remove o-ring (89A) from discharge casing (197).

D. Reassembly for Pumps with Packing

(Refer to appropriate sectional drawing, figures 7 through 14, for location of parts followed by an item number.) Reassemble the pump in accordance with accepted rules of engineering practice. Coat individual components with a suitable lubricant before assembly. Reassembly of unit should be performed on a flat surface.

When the pumping unit is being reassembled, CPC recommends that the following parts be replaced with new:
1. All o-rings.
2. All gaskets.
3. Radial and thrust bearings.
4. Grease seals.
5. Packing.

If new impellers or new shaft protecting sleeves are fitted, impellers must be axially aligned with respect to diffusers. Refer to paragraph G for axial alignment procedures.

Ensure components are fitted in correct sequence. **IMPORTANT: Reinsert shims in correct sequence.** Reassembly begins at the discharge end of the pump. Individual components are assembled as follows:
1. Install packing (13) in stuffing box of discharge casing (197) or cooling water jacket (215), as applicable. Refer to section VI, paragraph E, for procedures on packing stuffing box.
2. Install new lubricated o-ring (89A) on male rabbet inside discharge casing (197). Install last stage diffuser (5B) into discharge casing. Clamp down discharge casing to work area.
3. On WKL-32, 50, and 65, install new lubricated o-ring (89B) into groove in shaft (6).
4. Insert impeller key (32A) into keyway in shaft (6). NOTE: On WKL-50, item number of impeller key is (32C). Impeller key for WKL-40 is (32B).
5. On all models excluding WKL-50 cold service pumps and WKL-80, slide discharge spacer sleeve (14E, F or G) onto shaft (6), lining up keyway of sleeve with end of impeller key (32A, B or C).
6. On all models excluding WKL-50 cold service pumps and WKL-80, insert sleeve key (32B) into keyway on shaft (6). NOTE: On WKL-40, sleeve key is (32C).

7. On WKL-50 cold service pumps and WKL-80, slide shaft sleeve (14A) onto shaft (6), lining up keyway of shaft sleeve with end of impeller key (32A or 32C).
8. On all models excluding WKL-50 cold service pumps and WKL-80, slide shaft sleeve (14A) onto shaft (6), lining up keyway of shaft sleeve with end of sleeve key (32B). NOTE: Sleeve key on WKL-40 hot service is (32C).
9. On WKL-40, 80, 100, 125, and 150 slide new lubricated o-ring (89B) onto shaft (6) and seat behind shaft sleeve (14A). O-ring seats between shaft sleeve and outboard spacer sleeve (14D). NOTE: Outboard spacer sleeve on WKL-40 cold service pumps and WKL-100 is (14C).
10. Insert partially assembled shaft (6) through discharge casing (197) and last stage diffuser (5B).
11. If pumps are equipped with cooled seal boxes for high temperature design, install new lubricated gasket (73C) and new lubricated o-ring (89C) on cooling water jacket (215). Reinstall cooling water jacket on discharge casing (197).
12. Slide split packing gland (17) onto shaft over studs (630) and secure gland loosely in place with hex nuts (615) on studs (630). Do not tighten hex nuts down at this point.
13. Slide the outboard spacer sleeve (14C or D) onto outboard end of shaft.
14. On WKL-32, 40, 80, and 100 install deflector (40) onto outboard spacer sleeve (14C or D).
15. On pump WKL-40, slide one bearing spacer (78) onto shaft next to outboard spacer sleeve (14D).
16. Install snap ring (176).
17. On WKL-50, 65, 125, and 150, install deflector (40) onto bearing spacer (78).
18. On all models excluding WKL-40, install new grease seal (169) in bearing housing (99). Slide bearing spacer (78) beneath grease seal into bearing housing. Bearing spacer provides a pilot hole for the bearing housing during installation, and also prevents damage to the grease seal.
19. On model WKL-40, slide bearing spacer (78) onto shaft and position on outboard side of snap ring (176).
20. Install bearing housing (99). Bolt bearing housing and cooling water jacket (215), if equipped, to discharge casing (197) with capscrews (600). Position housing so that grease fitting is on top.
21. Hand pack new thrust bearing (18) with approved grease (refer to section IV, paragraph B). Install new thrust bearing. Pump models WKL-50 through WKL-150 are supplied with matched bearing sets. Install matched bearing sets back to back. (Revised 03-1999)
22. Install bearing lockwasher (69) so that tab of lockwasher fits into keyway on shaft (6).
23. Install bearing locknut (22) and tighten against lockwasher (69) and bearing (18). Crimp lockwasher tab into slot provided on outside of bearing locknut.
24. Install outboard bearing cover (37) and bolt to bearing housing (99) with capscrews (601). Position cover so that the grease overflow hole is on lower half of cover.
25. Slide last stage impeller (part number 2B for WKL-32 through 80 or part number 2A for WKL-100 through 150) onto shaft (6) from inboard end, fitting keyway of impeller to impeller key (32A, B or C) on shaft.
26. If new impellers or new shaft sleeves are being installed, check last stage impeller (2A or 2B) and last stage diffuser (5B) for axial alignment. Refer to section VI, paragraph G.
27. If equipped with wear ring, make sure wear ring (7A or B) is in stage casing (1).
28. Install new lubricated o-ring (89D) in groove provided in stage casing (1). Lightly tap diffuser (5A) into stage casing. Align diffuser vanes on either side of boss located in stage casing. Slip interstage sleeve (58) onto shaft (6) and insert impeller key (32A). Install stage casing assembly over shaft and fit into discharge casing (197). Slide next impeller (2A or 2B) onto shaft and align keyway of impeller with key (32A) in shaft (6). NOTE: On pump model WKL-40 hot service, interstage key is (32B). First stage impeller key is (32A) on WKL-40.
29. Repeat steps 27 and 28 for each remaining stage.
30. Slide suction spacer sleeve (14E) onto shaft next to first stage impeller (2A). On WKL-100, slide spacer sleeve (14D) onto shaft next to suction spacer sleeve (14E). On WKL-50 hot service, slide spacer sleeve (14G) onto shaft next to suction spacer sleeve. On all models excluding WKL-40, insert sleeve key (32B) in keyway on shaft (6). NOTE: Sleeve key on WKL-40 is (32C).
31. On models WKL-32, 50, and 65, slide new lubricated o-ring (89B) into groove in shaft (6).
32. Slide shaft sleeve (14A) on shaft (6) next to suction spacer sleeve (14D, E or G), aligning keyway with sleeve key (32B or C). NOTE: On model WKL-65 hot service, slide spacer sleeve (14C) on shaft next to suction spacer sleeve (14E) before adding shaft sleeve (14A).

33. If equipped with wear ring, make sure wear ring (7A or 7B) has remained in suction casing (203).
34. Install new lubricated o-ring (89D) on suction casing (203). Install packing rings (13) and lantern ring (29) in stuffing box of suction casing or cooling water jacket (215), as applicable. Refer to section VI, paragraph E, for location of lantern ring and procedures on packing stuffing box.
35. Slide suction casing (203) onto shaft (6) and tap into place against stage casing (1). Insert tie bolts (173) and secure with hex nuts (616). Tighten hex nuts (616) firmly and evenly. Refer to table 8 for lubricated torque requirements.

Table 8. Lubricated Torque Requirements

Model	Foot Pounds
WKL-32 and 40	60
WKL-50	100
WKL-65 and 80	160
WKL-100	245
WKL-125	500
WKL-150	800

36. On models WKL-40, 80, 100, 125, and 150, slide new lubricated o-ring (89B) onto shaft and seat behind shaft protecting sleeve (14A). o-ring seats between shaft protecting sleeve (14A) and inboard spacer sleeve (14C).
37. If pumps are equipped with cooled stuffing boxes for high temperature design, install new lubricated gasket (73C) and new lubricated o-ring (89C) on cooling water jacket (215). Reinstall cooling water jacket on suction casing (203).
38. Slide split packing gland (17) over shaft (6) and position over studs (630). Secure gland loosely in place with hex nuts on studs. Do not tighten hex nuts down at this point.
39. Install deflector (40) on inboard spacer sleeve (14C).
40. On WKL-100, slide inboard spacer sleeve (14C) with mounted deflector (40) onto shaft next to shaft sleeve (14A).
41. On WKL-40, slide inboard spacer sleeve (14C) with mounted deflector (40) onto shaft next to shaft sleeve (14A). Install snap ring (176).
42. On all models except WKL-40, install new grease seal (169) in inboard bearing housing (99).
43. On WKL-100, fit inboard bearing spacer sleeve (14G) beneath grease seal (169) in bearing housing (99). Bearing spacer sleeve provides a pilot hole for the bearing housing during installation, and also prevents damage to the grease seal.
44. On all models exlcuding WKL-40 and 100, fit inboard spacer sleeve (14C) with mounted deflector (40) beneath grease seal (169) in bearing housing (99). Inboard spacer sleeve provides a pilot hole for the bearing housing during installation, and also prevents damage to the grease seal.
45. Install bearing housing (99). Bolt bearing housing and cooling water jacket (215), if equipped, to suction casing (203) with capscrews (600). Position housing so that grease fitting is located on top of housing.
46. Hand pack new radial bearing (16) with approved grease (refer to section IV, paragraph B). Install new radial bearing in bearing housing (99).
47. On all models excluding WKL-40, install bearing lockwasher (69) so that tab of lockwasher fits into keyway on shaft (6). Install bearing locknut (22) and tighten against lockwasher and bearing (16). Ensure bearing is pushed back completely. Crimp lockwasher tab into slot provided on outside of bearing locknut.
48. Install inboard bearing cover (35) and bolt to bearing housing (99) with capscrews (601). Position cover with the grease overflow hole located on lower half.

49. Finger tighten hex nuts (615) on studs (630) securing packing gland (17) to stuffing box on both ends of pump.
50. Return pump to installation site. Reinstall pump on base and secure with capscrews.
51. Reinstall coupling key (46) in keyway in shaft (6). Reinstall coupling half on pump shaft.
52. Align coupling as outlined in section II, paragraph B. Reconnect coupling between pump and driver.
53. Reinstall coupling guard.
54. Reinstall tubing (400 and 408) (refer to figures 2a and 2b). Secure tubing by tightening retaining nuts on male connectors (410 and 411).
55. Reconnect suction, discharge, and gage lines. After connecting all piping, inspect shaft for concentricity.
56. Reinstall plugs (424) in bottom of casings (203, 197, and 1). Reinstall plugs (423) in suction and discharge casings. If high temperature design, reinstall plugs (422) in bottom of cooling water jackets (215).
57. Open system valves.
58. Unlock and reconnect the electrical power supply to the motor. Remove all tags. Start the pumping unit as described in section III.

E. Packing Installation.

Before repacking the stuffing boxes, thoroughly clean the stuffing boxes and shaft protecting sleeves. A lantern ring is fitted inside the stuffing box between the packing rings in the suction casing, see figure 3. Lantern rings are required only in the low pressure (suction) stuffing box. Five packing rings are required in the high pressure (discharge) stuffing box of model WKL-32, 40, 50, 65 and 80 pumps. Six packing rings are required in the high pressure (discharge) stuffing box of model WKL-100, 125 and 150 pumps.

To Repack: The first packing ring is inserted and pushed to bottom of the stuffing box. The following rings are then inserted individually, with the butt joint of each packing ring offset approximately 90 degrees from the preceding ring. The packing gland may be used to push each ring into position. The packing rings should be pressed lightly against each other by the gland. Make sure that the butts of any two adjoining rings do not lie in line (see figure 4). Insert packing rings, leaving a 1/4" gap at end so that the gland will have positive guidance and cannot be tightened askew.

After inserting the packing rings, tighten the gland nuts lightly by hand. A newly packed stuffing box will leak appreciably at first. If this leakage does not stop after the pump has been running a few hours, the gland nuts should be tightened slowly and evenly on either side while the pump is running until the gland only leaks slightly, indicating that it is functioning correctly. If the stuffing box does not leak, or if it starts to smoke, loosen the gland nuts slightly.

Every freshly packed stuffing box needs a certain running-in period before it stabilizes; therefore, close observation at frequent intervals during running-in is important. Later, it need only be checked occasionally. As the packing wears from operation, gradually tighten the gland nuts alternately, one quarter turn at a time. **NEVER** tighten the gland nuts excessively. An additional packing ring may be added to the stuffing box after the gland nuts have been taken up full travel. Repack the stuffing box when the gland nuts have **AGAIN** been taken up full travel. Keep spare sets of proper packing on hand. Refer to section IV, paragraph C, for maintenance instructions for packed stuffing boxes.

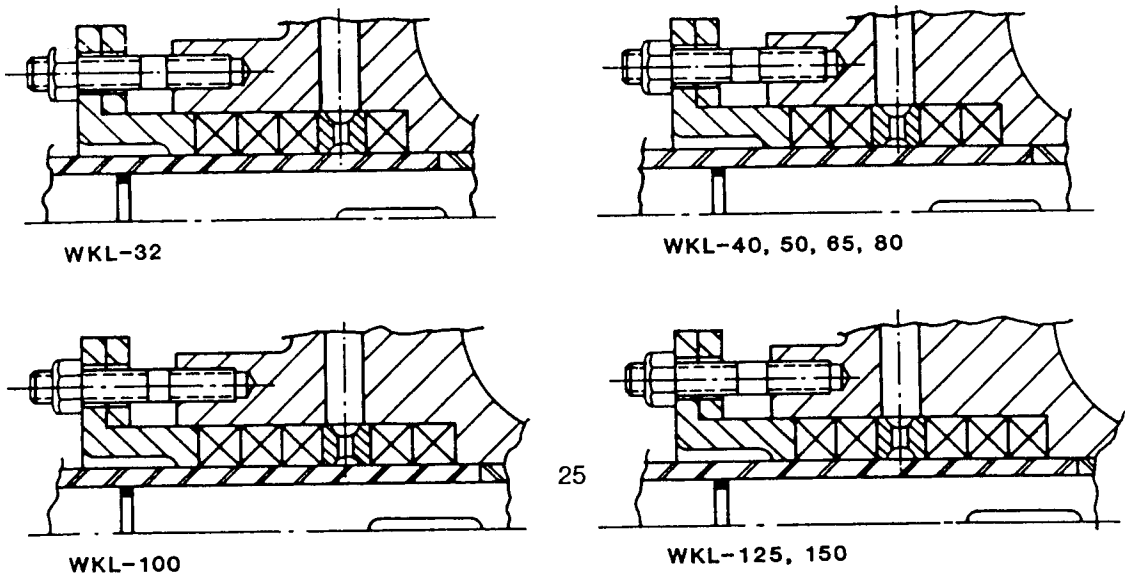


Figure 3. Lantern Ring Location

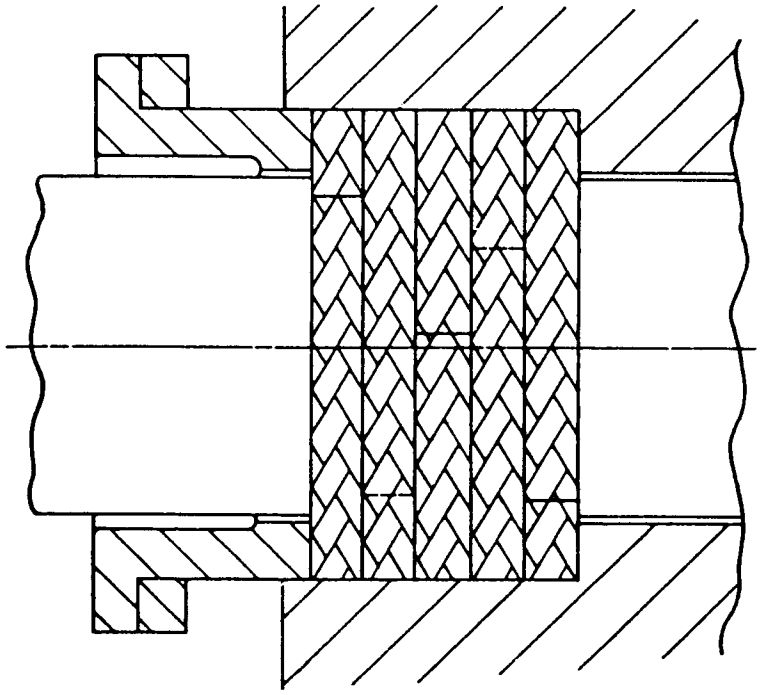


Figure 4. Stuffing Box Packing Arrangement

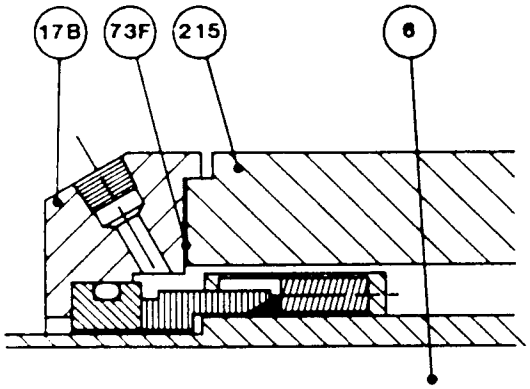
F. Reassembly for Pumps with Mechanical Seals

(Refer to appropriate sectional drawing, figures 7 through 14, for location of parts followed by an item number.) Reassemble the pump in accordance with accepted rules of engineering practice. Coat individual components with a suitable lubricant before assembling. Reassembly of unit should be performed on a flat surface.

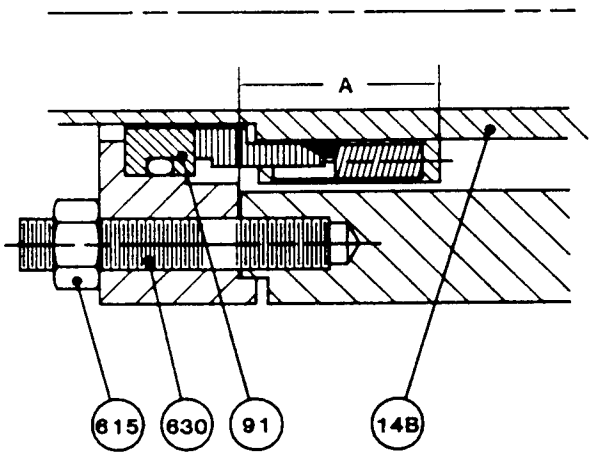
When the pumping unit is being reassembled, CPC recommends that the following parts be replaced with new:

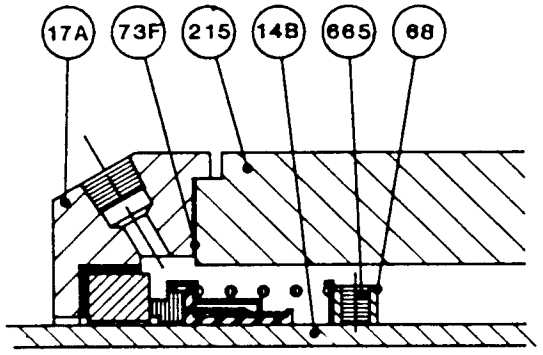
1. All o-rings.
2. All gaskets.
3. Radial and thrust bearings.
4. Grease seals.
5. Mechanical seals.

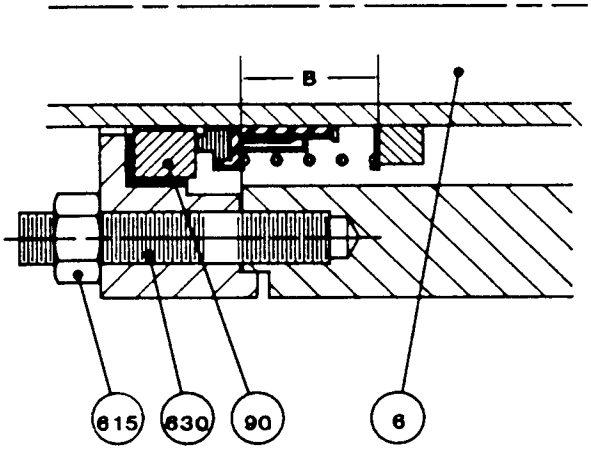
If new impellers or new shaft protecting sleeves are fitted, impellers must be axially aligned with respect to diffusers. Refer to paragraph G, for axial alignment procedures.

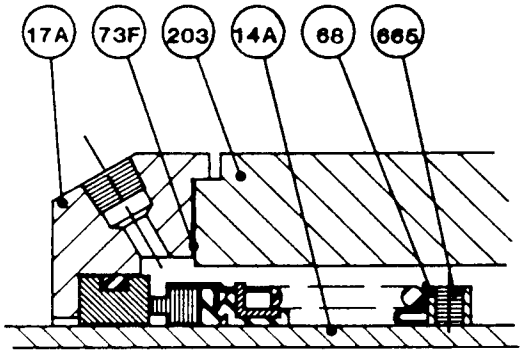


← *Figure 5a. Mechanical Seal, Type 98T, Discharge End, All Models*

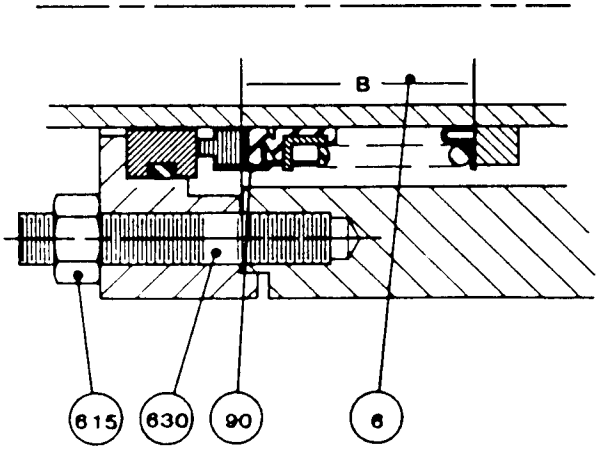








↑ *Figure 5c. Mechanical Seal, Type 21, Suction End, Models WKL-32 through WKL-65*



← *Figure 5b. Mechanical Seal, Type 1, Suction End, Models WKL-80 through WKL-150*

Ensure components are fitted in correct sequence. **IMPORTANT: Reinsert shims in correct sequence.**
Reassembly begins at the discharge end of the pump. Individual components are assembled as follows:

1. Install new lubricated o-rings (89A) on male rabbet inside discharge casing (197). Install last stage diffuser (5B) into discharge casing. Clamp down discharge casing to work area.
2. Hand pack new thrust bearing (18) with approved grease (refer to section IV paragraph B). Pump models WKL-50 through 150 are equipped with matched bearing sets. Install matched bearing sets back to back. (Revised 03-1999)
3. Install snap ring (176) on shaft (6).
4. Install bearing spacer (78).
5. Install thrust bearings (18) on shaft (6).
6. Install bearing lockwasher (69) so that tab of lockwasher fits into keyway on shaft (6).
7. Install bearing locknut (22) and tighten against lockwasher (69) and bearing (18). Crimp lockwasher tab into slot provided on outside of bearing locknut.
8. Position outboard bearing cover (37) so that grease overflow hole is on lower half of cover. Bolt cover to bearing housing (99) with capscrews (601). NOTE: Capscrews are (600) on WKL-100.
9. Carefully slide grease seal (169) over bearing spacer (78) into bearing housing (99). Bearing spacer provides a pilot hole for the bearing housing during installation, and also prevents damage to the grease seal.
10. On WKL-40, install second bearing spacer (78).
11. Install outboard spacer sleeve (14C or D).
12. Install shaft sleeve (14B).
13. Install cooling water jacket (215), if equipped. Bolt bearing housing (99) to discharge casing (197) or cooling water jacket.
14. Scribe a mark on shaft sleeve (14B) corresponding to bolting face of stuffing box in discharge casing (197) or cooling water jacket (215), as applicable.
15. Remove cooling water jacket (215) and bearing housing (99) from discharge casing (197).
16. Scribe a second mark on shaft sleeve (14B) at the distance specified in table 9. Refer to figure 5a.
17. Lubricate interior diameter of mechanical seal rotating assembly (91). Slide mechanical seal on shaft sleeve (14B), locating back edge of seal at second scribe mark (refer to figure 9), and tighten setscrew.
18. Install deflector (40) on bearing spacer (78).
19. Install mechanical seal stationary element (91) in seal gland (17A or B). Install new lubricated gasket (73F) onto seal gland.
20. Install seal gland (17A or B) assembly on shaft (6).
21. On WKL-32, 50 and 65, install lubricated o-rings (89B) in groove in shaft (6).
22. On all models except WKL-50 cold service and WKL-80, insert sleeve key (32B) into keyway in shaft (6). NOTE: Sleeve key on WKL-40 is (32C).
23. Insert impeller key (32A, B or C) into keyway in shaft (6).
24. Slide shaft sleeve (14B) with mechanical seal (91) in place on shaft (6) next to seal gland (17A or B). Line up keyway of sleeve with end of sleeve key (32B or C).
25. On all models excluding WKL-50 cold service and WKL-80, slide discharge spacer sleeve (14E, F or G) onto shaft (6), lining up keyway of sleeve with end of impeller key (32A, B or C). On WKL-65 hot service, install spacer sleeve (14C).
26. Install cooling water jacket (215), if applicable. Bolt bearing housing (99) to discharge casing (197).
27. Slide last stage impeller (part number 2B for WKL-32 through 80 or part number 2A for WKL-100 through 150) onto shaft (6) from inboard end, fitting keyway of impeller to impeller key (32A) on shaft.
28. If new impellers or new shaft sleeves are being installed, check last stage impeller (2A or 2B) and last stage diffuser (5B) for axial alignment. Refer to section VI, paragraph G.
29. If equipped with wear ring, make sure wear ring (7A or B) is in stage casing (1).

Table 9. Mechanical Seal Settings

Model	Discharge End (Type 8B1T) "A" dimension in figure 5a	Suction End (Type 21, WKL-32 through 65: Type 1, WKL-80 through 150) "B" dimension in figures 5b and 5c
WKL-32	1.033	0.656
WKL-40	1.375	1.000
WKL-50	1.400	1.000
WKL-65	1.400	1.000
WKL-80	1.75	2.062
WKL-100	1.993	1.906
WKL-125	1.656	2.906
WKL-150	1.625	2.875

(Revised October, 2000)

30. Install new lubricated o-ring (89D) in groove provided in stage casing (1). Lightly tap diffuser (5A) into stage casing. Align diffuser vanes on either side of boss located in stage casing. Slip interstage sleeve (58) onto shaft (6) and insert impeller key (32A). Install stage casing assembly over shaft and fit into discharge casin (197). Slide next impeller (2A or 2B) onto shaft and align keyway of impeller with key (32A) in shaft. NOTE: On WKL-40 hot service, interstage key is (32B). First stage impeller key is (32A) on WKL-40.
31. Repeat steps 29 and 30 for each remaining stage. (Revised 04-1995)
32. Slide suction spacer sleeve (14E) onto shaft next to first stage impeller (2A). On WKL-100 slide spacer sleeve (14D) onto shaft next to suction spacer sleeve (14E). On WKL-50 hot service, slide spacer sleeve (14G) onto shaft next to suction spacer sleeve. On all models excluding WKL-40, insert sleeve key (32B) in keyway on shaft (6). NOTE: Sleeve key on WKL-40 is (32C).
33. On WKL-32, 50, and 65, slide new lubricated o-ring (89B) into groove in shaft (6).
34. If equipped with wear ring, make sure wear ring (7A or B) has remained in suction casing (203).
35. Install new lubricated o-ring (89D) on suction casing (203).
36. Slide suction casing (203) onto shaft (6) and tap into place against stage casing (1). Insert tie bolts (173) and secure with hex nuts (616). Tighten hex nuts firmly and evenly. Refer to table 8 for lubricated torque requirements.
37. If mechanical seal (90) does not need to be replaced, proceed to step 38. If a new seal needs to be installed, proceed as follows:
    a. Slide inboard shaft protecting sleeve (14A) onto shaft (6). Align keyway of shaft sleeve with key (32B) in shaft. Note: Shaft key on WKL-40 is (32C).
    b. Slide inboard spacer sleeve (14C) onto shaft next to shaft sleeve (14A).
    c. If pumps are equipped with cooled seal boxes for high temperature design, reinstall and temporarily bolt cooling water jacket (215) to suction casing (203).
    d. Push impeller components toward outboard end, flush against outboard snap ring (176) with spacer sleeve (14C).
    e. Scribe a mark on shaft sleeve (14A) corresponding to outer edge of stuffing box (refer to figure 5b or 5c).
    f. If pumps are equipped with cooled seal boxes for high temperature design, remove cooling water jacket (215) from suction casing (203). Remove suction casing.
    g. Remove inboard spacer sleeve (14C) and shaft sleeve (14A).
    h. Scribe a second mark on shaft sleeve (14A) at distance specified in table 9 from first scribe mark, toward outboard end (refer to figure 5b or 5c).

i. Slide locking collar (68) onto shaft sleeve (14A). Locate inboard edge of collar at second scribe mark (refer to figure 5b or 5c). Secure locking collar with setscrews (665).
j. Lubricate shaft sleeve (14A). Slide mechanical seal rotating assembly onto inboard end of shaft sleeve, flush against locking collar (68).
k. Carefully install lubricated mechanical seal stationary element into seal gland (17A).

38. Slide shaft sleeve (14A) complete with rotating component of mechanical seal onto shaft (6), aligning keyway of shaft sleeve with sleeve key (32B). NOTE: Sleeve key on WKL-40 is (32C).
39. On WKL-40, 80, 100, 125, and 150, slide new lubricated o-ring (89B) onto shaft and seat behind shaft sleeve (14A). O-ring (89B) seats between shaft sleeve and inboard spacer sleeve (14C).
40. If pumps are equipped with cooled stuffing boxes for high temperature design, install new lubricated gasket (73C) and new lubricated o-ring (89C) on cooling water jacket (215). Reinstall cooling water jacket on suction casing (203).
41. Install new lubricated gasket (73F) onto gland (17A).
42. Slide seal gland (17A) complete with mechanical seal stationary element onto shaft (6) and over studs (630). Ensure tap for flush lines in gland is positioned so that the flush lines can be connected. Secure gland loosely in place with hex nuts (615) on studs. Do not tighten hex nuts down at this point.
43. Install deflector (40) on inboard spacer sleeve (14C).
44. On WKL-100, slide inboard spacer sleeve (14C) with mounted deflector (40) onto shaft next to shaft sleeve (14A).
45. On WKL-40, slide inboard spacer sleeve (14C) with mounted deflector (40) onto shaft (6) next to shaft sleeve (14A). Install snap ring (176).
46. On all models except WKL-40, install new grease seal (169) in inboard bearing housing (99).
47. On WKL-100, fit inboard bearing spacer sleeve (14G) beneath grease seal (169) in bearing housing (99). Bearing spacer sleeve provides a pilot hole for the bearing housing during installation, and also prevents damage to the grease seal.
48. On WKL-32, 50, 65, 80, 125, and 150, fit inboard spacer sleeve (14C) with mounted deflector (40) beneath grease seal (169) in bearing housing (99). Inboard spacer sleeve provides a pilot hole for the bearing housing during installation, and also prevents damage to the grease seal.
49. Install bearing housing (99). Bolt bearing housing and cooling water jacket (215), if equipped, to suction casing (203) with capscrews (600). Position housing so that grease fitting is located on top of housing.
50. Hand pack new radial bearing (16) with approved grease (refer to section IV, paragraph B). Install new radial bearing in bearing housing (99).
51. On all models excluding WKL-40, install bearing lockwasher (69) so that tab of lockwasher fits into keyway on shaft (6). Install bearing locknut (22) and tighten against lockwasher and bearing (16). Ensure bearing is pushed back completely. Crimp lockwasher tab into slot provided on outside of bearing locknut.
52. Install inboard bearing cover (35) and bolt to bearing housing (99) with capscrews (601). Position cover with the grease overflow hole located on lower half of cover.
53. Tighten hex nuts on studs (630) firmly and evenly securing seal gland (17A and 17B) to seal box on both ends of pump.
54. Return pump to installation site. Reinstall pump on base and secure with capscrews.
55. Reinstall coupling key (46) in keyway in shaft (6). Reinstall coupling half on pump shaft.
56. Align coupling as outlined in section II, paragraph B, of this manual. Reconnect coupling between pump and driver.
57. Reinstall coupling guard.
58. Reinstall tubing (400 and 408) (refer to figures 2a and 2b). Secure tubing by tightening retaining nuts on male connectors (410 and 411).
59. Reconnect suction, discharge, and gage lines. After connecting piping, inspect shaft for concentricity.
60. Reinstall plugs (424) in bottom of casings (203, 197, and 1). Reinstall plugs (423) in suction and discharge casings. If high temperature design, reinstall plugs (422) in bottom of cooling water jackets (215).
61. Open system valves.
62. Unlock and reconnect the electrical power supply to the motor. Remove all tags. Start the pumping unit according to section III, paragraph B.

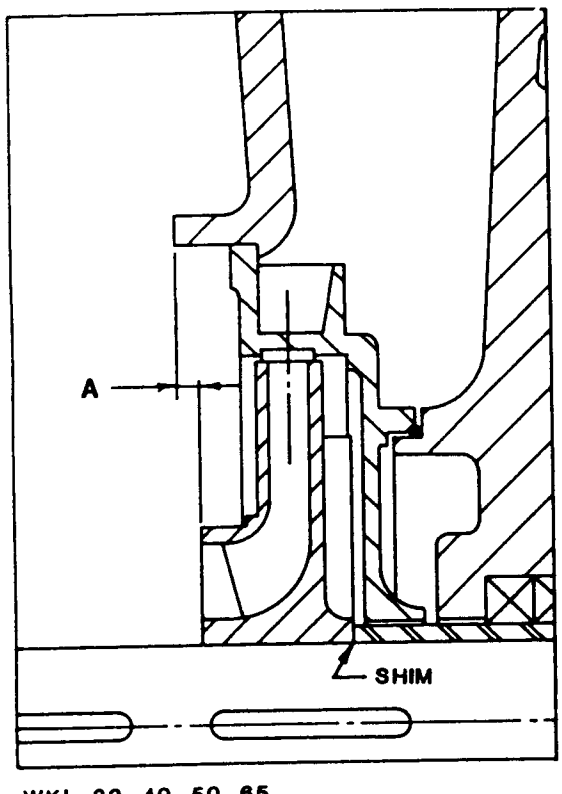
G. Axial Alignment of Impeller.

If new parts are fitted during reassembly, such as impellers and/or sleeves, the last stage impeller must be axially aligned with respect to the diffuser.

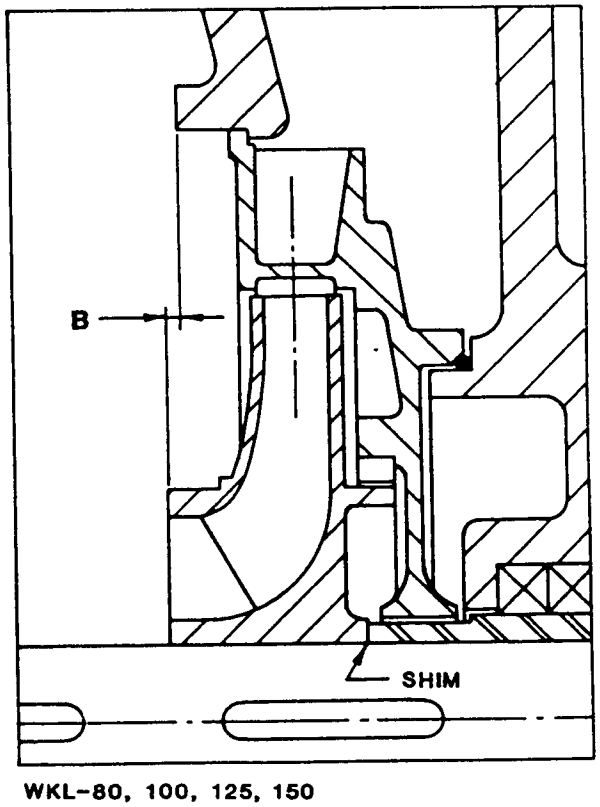
Refer to figure 6. Measure distance "A" or "B" from the inboard face of the discharge casing to the inboard face of the impeller hub. Compare the measured distance to the dimensions given in table 10. CPC recommends that this dimension be within 0.015 inches. If shimming is required, install shim between the impeller and the shaft sleeve as shown in figure 6. Repeat measuring and shimming until the correct control dimension is achieved.

Table 10. Axial Alignment Control Dimensions
(Revised 04-1995)

Model	Distance "A" in figure 6 ± 0.015	Distance "B" in figure 6 ± 0.015
WKL-32	0.068	
WKL-40	0.138	
WKL-50	0.138	
WKL-65	0.138	
WKL-80		0.138
WKL-100		0.098
WKL-125		0.177
WKL-150		0.413



WKL-32, 40, 50, 65



WKL-80, 100, 125, 150

Figure 6. Axial Alignment of Impeller

VII . SPARE PARTS.

Table 11 lists recommended WKL pump spare parts. When ordering spare parts, include the part name, item number, serial number, model number of the pump, and quantity of parts needed.

Carver may ship an improved interchangeable part that is not identical in appearance or symbol to the original part. Examine the parts carefully on receipt before calling the factory or representative. Never return parts to the factory without authorization from Carver Pump Company.

If an impeller is ordered, specify the diameter across the blade tips.

If a driver or driver parts are ordered, specify the name of the driver manufacturer and all data on the driver nameplate.

Table 11. Recommended Spare Parts

ITEM NUMBER	PART NAME	QUANTITY REQUIRED
02A/02B	Impeller	1 per stage
07A/07B	Casing Wear Ring	as required
013	Packing Rings*	as required
014A	Shaft Sleeve* (inboard packing)	2
014A	Shaft Sleeve** (inboard mechanical seal)	1
014B	Shaft Sleeve** (inboard mechanical seal)	1
014C	Spacer Sleeve (inboard)	2
014D	Spacer Sleeve (outboard)	2
014E	Suction Spacer Sleeve	1
014F	Discharge Spacer Sleeve	1
016	Bearing (radial)	1
018	Bearing (thrust)	1
029	Lantern Ring*	2
058	Interstage Sleeve	1 per stage
068	Locking Collar (inboard mechanical seal)	1
073C	Gasket*** (cooling water jacket)	2
073F	Gasket** (seal gland)	2
089A	O-ring (discharge casing)	1
089B	O-ring (shaft or shaft protecting sleeve)	2
089C	O-ring*** (cooling water jacket)	2
089D	O-ring (suction and stage casings)	as required
090	Mechanical Seal** (inboard)	1
091	Mechanical Seal** (outboard)	1
169	Grease Seal (all models excluding WKL-40)	2
176	Snap Ring (inboard and outboard on WKL-40)	2
176	Snap Ring (outboard on all models except WKL-40)	1

*Packing pumps only **Mechanical seal pumps only ***Hot service pumps only

VIII. PARTS LISTS AND DRAWINGS.

Tables 12 through 18 contain parts listings for all WKL models. For the location of parts listed in tables 13 through 19, refer to figures 8 through 14.

Table 12. Parts List for Model WKL-32

ITEM NO.	PART NAME	QTY. REQUIRED	
001	Stage Casing	As reqd.	
002A	Impeller	1	First stage
002B	Impeller	As reqd.	Stage
005A	Diffuser	As reqd.	Stage
005B	Diffuser	1	Last stage
006	Shaft	1	
013	Packing Rings*	9	Inboard and Outboard
014A	Shaft Sleeve* (inboard packing)	2	
014A	Shaft Sleeve** (inboard mechanical seal)	1	
014B	Shaft Sleeve**	1	Outboard mech. seal
014C	Spacer Sleeve	2	
014E	Suction Spacer Sleeve	1	Inboard
014F	Discharge Spacer Sleeve	1	Outboard
016	Bearing	1	Radial
017	Packing Gland*	2	Inboard and outboard
017A	Seal Gland**	2	Inboard and outboard
018	Bearing	1	Thrust
022	Bearing Locknut	2	Inboard and outboard
029	Lantern Ring*	1	Inboard
032A	Impeller Key	As reqd.	
032B	Sleeve Key	2	Shaft protecting sleeve
035	Bearing Cover	1	Inboard
037	Bearing Cover	1	Outboard
040	Deflector	2	Inboard and outboard
046	Coupling Key	1	
058	Interstage Sleeve	As reqd.	
068	Locking Collar**	1	Inboard mechanical seal
069	Bearing Lockwasher	2	Inboard and outboard
073C	Gasket***	2	Cooling water jacket and casings
073F	Gasket**	2	Seal gland and casings or cooling water jackets
077	Grease Fitting	2	Inboard and outboard
078	Bearing Spacer	1	Outboard
089A	O-Ring	1	Discharge casing
089B	O-Ring	2	Shaft
089C	O-Ring***	2	Cooling water jacket

Table 12. Parts List for Model WKL-32 Continued

ITEM NO.	PART NAME	QTY.	REQUIRED
089D	O-Ring	As reqd.	Suction casing and stage casing
090	Mechanical Seal**	1	Inboard
091	Mechanical Seal**	1	Outboard
099	Bearing Housing	2	Inboard and outboard
169	Grease Seal	2	Inboard and outboard
173	Tie Bolt	4	Suction casing and discharge casing
176	Snap Ring	1	Outboard
197	Discharge Casing	1	
203	Suction Casing	1	
215	Cooling Water Jacket***	2	Inboard and outboard
400	Tubing	As reqd.	Flush line
408	Tubing	As reqd.	Balance line
410	Male Connector	As reqd.	Flush line
422	Plug	As reqd.	Suction and discharge casings
422	Plug***	As reqd.	Cooling water jacket
423	Plug	2	Suction and discharge casings
424	Plug	As reqd.	Stage Casing
445	Pipe Tee	As reqd.	
455	Pipe Elbow	As reqd.	
486	Pipe Nipple	As reqd.	
600	Capscrew	8	Inboard and outboard bearing housing, suction and discharge casings, and cooling water jacket
601	Capscrew	8	Inboard and outboard bearing cover and bearing housing
615	Hex Nut*	4	
615	Hex Nut**	8	
616	Nut	8	Tie bolt
630	Stud, Hex Nut*	4	Inboard and outboard packing gland
630	Stud, Hex Nut**	8	Inboard and outboard seal gland
665	Setscrew**	2	Locking collar

*Packing pumps only **Mechanical seal pumps only ***Hot service pumps only

Table 13. Parts List for Model WKL-40

ITEM NO.	PART NAME	QTY.	REMARKS
001	Stage Casing	As reqd.	
002A	Impeller	1	First stage
002B	Impeller	As reqd.	Stage
005A	Diffuser	As reqd.	Stage
005B	Diffuser	1	Last stage
006	Shaft	1	
013	Packing Ring*	10	Inboard and outboard
014A	Shaft Sleeve*	2	Inboard and outboard
014A	Shaft Sleeve**	1	Inboard mech. seal
014B	Shaft Sleeve**	1	Outboard mech. seal
014C	Spacer Sleeve	1	Inboard
014D	Spacer Sleeve	1	Outboard
014E	Suction Spacer Sleeve	1	
014F	Discharge Spacer Sleeve	1	
016	Bearing	1	Radial
017	Packing Gland*	2	Inboard and outboard
017A	Seal Gland**	1	Inboard
017B	Seal Gland**	1	Outboard
018	Bearing	1	Thrust
022	Bearing Locknut	1	Outboard
029	Lantern Ring*	1	Inboard
032A	Impeller Key	1	First stage impeller and suction spacer sleeve
032B	Impeller Key	As reqd.	Stage impeller, last stage impeller and discharge spacer sleeve
032C	Sleeve Key	3	Shaft protecting sleeve
035	Bearing Cover	1	Inboard
037	Bearing Cover	1	Outboard
040	Deflector	2	Inboard and outboard
046	Coupling Key	1	
058	Interstage Sleeve	As reqd.	
068	Locking Collar**	1	Inboard mechanical seal
069	Bearing Lockwasher	1	Outboard
073C	Gasket***	2	Cooling water jacket and casings
073F	Gasket**	2	Seal gland and casings or cooling water jackets
077	Grease Fitting	2	Inboard and outboard
078	Bearing Spacer	2	One on each side of outboard snap ring
089A	O-Ring	1	Discharge casing
089B	O-Ring	2	Shaft protecting sleeve and spacer sleeve
089C	O-Ring***	2	Cooling water jacket

Table 13. Parts List for Model WKL-40 Continued

ITEM NO.	PART NAME	QTY.	REMARKS
89D	O-Ring	As reqd.	Suction casing and stage casing
090	Mechanical Seal**	1	Inboard
091	Mechanical Seal**	1	Outboard
099	Bearing Housing	2	Inboard and outboard
173	Tie Bolt	4	Suction casing and discharge casing
176	Snap Ring	1	Inboard and outboard
197	Discharge Casing	1	
203	Suction Casing	1	
215	Cooling Water Jacket***	2	Inboard and outboard
400	Tubing	As reqd.	Flush line
408	Tubing	As reqd.	Balance line
410	Male Connector	As reqd.	Flush line
411	Male Connector	As reqd.	Balance line
422	Plug	As reqd.	Suction and discharge casings
422	Plug***	As reqd.	Cooling water jacket
423	Plug	2	Suction and discharge casings
424	Plug	As reqd.	Stage Casing
445	Pipe Tee	As reqd.	
455	Pipe Elbow	As reqd.	
486	Pipe Nipple	As reqd.	
600	Capscrew	8	Inboard and outboard bearing housing, suction and discharge casings, and cooling water jacket
601	Capscrew	8	Inboard and outboard bearing cover and bearing housing
615	Hex Nut*	4	
615	Hex Nut**	8	
616	Nut	8	Tie bolt
630	Stud, Hex Nut*	4	Inboard and outboard packing gland
630	Stud, Hex Nut**	8	Inboard and outboard seal gland
665	Setscrew**	2	Locking collar

*Packing pumps only **Mechanical seal pumps only ***Hot service pumps only

Table 14. Parts List for Model WKL-50 Hot and Cold Service and Model WKL-65 Hot Service

ITEM NO.	PART NAME	QTY.	REMARKS
001	Stage Casing	As reqd.	
002A	Impeller	1	First stage
002B	Impeller	As reqd.	Stage
005A	Diffuser	As reqd.	Stage
005B	Diffuser	1	Last stage
006	Shaft	1	
007A	Wear Ring	1	Suction casing
007B	Wear Ring	As reqd.	Stage casing
013	Packing Ring*	10	Inboard and outboard
014A	Shaft Sleeve*	1	Inboard and outboard
014A	Shaft Sleeve**	1	Inboard mechanical seal
014B	Shaft Sleeve**	1	Outboard mechanical seal
014C	Spacer Sleeve**	1	Inboard
014C	Suction/Discharge Sleeve	2	WKL-65 requires Spacer and Suction/ Discharge Sleeves
014D	Spacer Sleeve	2	Outboard and Suction
014E	Suction Spacer Sleeve	1	Model WKL-65 Hot Service Only
014F	Discharge Spacer Sleeve***	1	Model WKL-65 Hot Service Only
016	Bearing	1	Radial
017	Packing Gland*	2	Inboard and outboard
017A	Seal Gland**	1	Inboard
017B	Seal Gland**	1	Outboard
018	Bearing	1	Thrust
022	Bearing Locknut	2	Inboard and outboard
029	Lantern Ring*	1	Inboard
032A	Impeller Key	As reqd.	
032B	Sleeve Key	As reqd.	Inboard shaft protecting sleeve for cold service pumps; inboard and outboard shaft protecting sleeve for hot service pumps
032C	Impeller Key	1	Last stage impeller and shaft protecting sleeve for cold service pumps and discharge spacer sleeve for hot service pumps
035	Bearing Cover	1	Inboard
037	Bearing Cover	1	Outboard
040	Deflector	2	Inboard and outboard

Table 14. Parts List for Model WKL-50 Hot and Cold Service and Model WKL-65 Hot Service Continued

ITEM NO.	PART NAME	QTY.	REMARKS
046	Coupling Key	1	
058	Interstage Sleeve	As reqd.	
068	Locking Collar**	1	Inboard mechanical seal
069	Bearing Lockwasher	2	Inboard and outboard
073C	Gasket***	2	Cooling water jacket and casings
073F	Gasket**	2	Seal gland and casings or cooling water jackets
077	Grease Fitting	2	Inboard and outboard
078	Bearing Spacer	1	Outboard
089A	O-Ring	1	Discharge casing
089B	O-Ring	2	Shaft
089C	O-Ring***	2	Cooling water jacket
089D	O-Ring	As reqd.	Suction casing and stage casing
090	Mechanical Seal**	1	Inboard
091	Mechanical Seal**	1	Outboard
099	Bearing Housing	2	Inboard and outboard
169	Grease Seal	2	Inboard and outboard
173	Tie Bolt	4	Suction casing and discharge casing
176	Snap Ring	1	Outboard
197	Discharge Casing	1	
203	Suction Casing	1	
215	Cooling Water Jacket***	2	Inboard and outboard
400	Tubing	As reqd.	Flush line
408	Tubing	As reqd.	Balance line
410	Male Connector	As reqd.	Flush line
411	Male Connector	As reqd.	Balance line
422	Plug	As reqd.	Suction and discharge casings
422	Plug***	As reqd.	Cooling water jacket
423	Plug	2	Suction and discharge casings
424	Plug	As reqd.	Stage Casing
445	Pipe Tee	As reqd.	
486	Pipe Nipple	As reqd.	
600	Capscrew	8	Inboard and outboard bearing housing, suction and discharge casings, and cooling water jacket
601	Capscrew	8	Inboard and outboard bearing cover and bearing housing

Table 14. Parts List for Model WKL-50 Hot and Cold Service and Model WKL-65 Hot Service Continued

ITEM NO.	PART NAME	QTY.	REMARKS
615	Nut*	4	
615	Nut**	8	
616	Nut	8	Tie bolt
630	Stud, Hex Nut*	4	Inboard and outboard packing gland
630	Stud, Hex Nut**	8	Inboard and outboard seal gland
665	Setscrew**	2	Locking collar

*Packing pumps only **Mechanical seal pumps only ***Hot service pumps only

Table 15. Parts List for Model WKL-65 Cold Service

ITEM NO.	PART NAME	QTY.	REMARKS
001	Stage Casing	As reqd.	
002A	Impeller	1	First stage
002B	Impeller	As reqd.	Stage
005A	Diffuser	As reqd.	Stage
005B	Diffuser	1	Last stage
006	Shaft	1	
007A	Wear Ring	1	Suction casing
007B	Wear Ring	As reqd.	Stage casing
013	Packing Ring*	10	Inboard and outboard
014A	Shaft Sleeve*	1	Inboard packing
014A	Shaft Sleeve*	1	Outboard packing
014A	Shaft Sleeve**	1	Inboard mechanical seal
014B	Shaft Sleeve**	1	Outboard mechanical seal
014C	Spacer Sleeve	1	Inboard
014D	Spacer Sleeve	1	Outboard
014E	Suction Spacer Sleeve	1	
014F	Discharge Spacer Sleeve	1	
016	Bearing	1	Radial
017	Packing Gland*	2	Inboard and outboard
017A	Seal Gland**	1	Inboard
017B	Seal Gland**	1	Outboard
018	Bearing	1	Thrust
022	Bearing Locknut	2	Inboard and outboard
029	Lantern Ring*	1	Inboard
032A	Impeller Key	As reqd.	
032B	Sleeve Key	2	Shaft protecting sleeve
035	Bearing Cover	1	Inboard
037	Bearing Cover	1	Outboard

Table 15. Parts List for Model WKL-65 Cold Service Continued

040	Deflector	2	Inboard and outboard
046	Coupling Key	1	
058	Interstage Sleeve	As reqd.	
068	Locking Collar**	1	Inboard mechanical seal
069	Bearing Lockwasher	2	Inboard and outboard
073F	Gasket**	2	Seal gland and casings
077	Grease Fitting	2	Inboard and outboard
078	Bearing Spacer	1	Outboard
089A	O-Ring	1	Discharge casing
089B	O-Ring	2	Shaft
089D	O-Ring	As reqd.	Suction casing and stage casing
090	Mechanical Seal**	1	Inboard
091	Mechanical Seal**	1	Outboard
099	Bearing Housing	2	Inboard and outboard
169	Grease Seal	2	Inboard and outboard
173	Tie Bolt	4	Suction casing and discharge casing
176	Snap Ring	1	Outboard
197	Discharge Casing	1	
203	Suction Casing	1	
400	Tubing	As reqd.	Flush line
408	Tubing	As reqd.	Balance line
410	Male Connector	As reqd.	Flush line
411	Male Connector	As reqd.	Balance line
422	Plug	As reqd.	Suction and discharge casings
423	Plug	2	Suction and discharge casings
424	Plug	As reqd.	Stage Casing
445	Pipe Tee	As reqd.	
486	Pipe Nipple	As reqd.	
600	Capscrew	8	Inboard and outboard bearing housing and suction and discharge casings
601	Capscrew	8	Inboard and outboard bearing cover and bearing housing
615	Nut*	4	
615	Nut**	8	
616	Nut	8	Tie bolt
630	Stud, Hex Nut*	4	Inboard and outboard packing gland
630	Stud, Hex Nut**	8	Inboard and outboard seal gland
665	Setscrew**	2	Locking collar

*Packing pumps only **Mechanical seal pumps only ***Hot service pumps only

Table 16. Parts List for Model WKL-80

ITEM NO.	PART NAME	QTY.	REMARKS
001	Stage Casing	As reqd.	
002A	Impeller	1	First stage
002B	Impeller	As reqd.	Stage
005A	Diffuser	As reqd.	Stage
005B	Diffuser	1	Last stage
006	Shaft	1	
007A	Wear Ring	1	Suction casing
007B	Wear Ring	As reqd.	Stage casing
013	Packing Ring*	9	Inboard and outboard
014A	Shaft Sleeve*	1	Inboard packing
014A	Shaft Sleeve*	1	Outboard packing
014A	Shaft Sleeve**	1	Inboard mech. seal
014B	Shaft Sleeve**	1	Outboard mech. seal
014C	Spacer Sleeve	1	Inboard
014D	Spacer Sleeve	1	Outboard
014E	Suction Spacer Sleeve	1	
016	Bearing	1	Radial
017	Packing Gland*	2	Inboard and outboard
017A	Seal Gland**	2	Inboard and outboard
018	Bearing	1	Thrust
022	Bearing Locknut	2	Inboard and outboard
029	Lantern Ring*	1	Inboard
032A	Impeller Key	As reqd.	
032B	Sleeve Key	1	Inboard shaft protecting sleeve
035	Bearing Cover	1	Inboard
037	Bearing Cover	1	Outboard
040	Deflector	2	Inboard and outboard
046	Coupling Key	1	
058	Interstage Sleeve	As reqd.	
068	Locking Collar**	1	Inboard mechanical seal
069	Bearing Lockwasher	2	Inboard and outboard
073C	Gasket***	2	Cooling water jacket and casings
073F	Gasket**	2	Seal gland and casings or cooling water jacket
077	Grease Fitting	2	Inboard and outboard
078	Bearing Spacer	1	Outboard
089A	O-Ring	1	Discharge casing
089B	O-Ring	2	Shaft protecting sleeve and spacer sleeve
089C	O-Ring***	2	Cooling water jacket
089D	O-Ring	As reqd.	Suction casing and stage casing
090	Mechanical Seal**	1	Inboard
091	Mechanical Seal**	1	Outboard

Table 16. Parts List for Model WKL-80 Continued

ITEM NO.	PART NAME	QTY.	REMARKS
099	Bearing Housing	2	Inboard and outboard
169	Grease Seal	2	Inboard and outboard
173	Tie Bolt	4	Suction casing and discharge casing
176	Snap Ring	1	Outboard
197	Discharge Casing	1	
203	Suction Casing	1	
215	Cooling Water Jacket***	2	Inboard and outboard
400	Tubing	As reqd.	Flush line
408	Tubing	As reqd.	Balance line
410	Male Connector	As reqd.	Flush line
422	Plug	As reqd.	Suction and discharge casings
422	Plug***	As reqd.	Cooling water jacket
423	Plug	2	Suction and discharge casings
424	Plug	As reqd.	Stage Casing
445	Pipe Tee	As reqd.	
486	Pipe Nipple	As reqd.	
600	Capscrew	8	Inboard and outboard bearing housing, suction and discharge casings, and cooling water jacket
601	Capscrew	8	Inboard and outboard bearing cover and bearing housing
615	Nut*	4	
615	Nut**	8	
616	Nut	8	Tie bolt
630	Stud, Hex Nut*	4	Inboard and outboard packing gland
630	Stud, Hex Nut**	8	Inboard and outboard seal gland
645	Washer*	4	Packing gland
665	Setscrew**	2	Locking collar
666	Setscrew**	2	

*Packing pumps only **Mechanical seal pumps only ***Hot service pumps only

Table 17. Parts List for Model WKL-100

ITEM NO.	PART NAME	QTY.	REMARKS
001	Stage Casing	As reqd.	
002A	Impeller	As reqd.	
005A	Diffuser	As reqd.	Stage
005B	Diffuser	1	Last stage
006	Shaft	1	
007A	Wear Ring	As reqd.	Suction casing and stage casing
013	Packing Ring*	11	Inboard and outboard
014A	Shaft Sleeve*	1	Inboard packing
014A	Shaft Sleeve*	1	Outboard packing
014A	Shaft Sleeve**	1	Inboard mech. seal
014B	Shaft Sleeve**	1	Outboard mech. seal
014C	Spacer Sleeve	2	Inboard and Outboard
014D	Suction Spacer Sleeve	1	Suction
014E	Spacer Sleeve	2	Suction and Discharge
014G	Bearing Spacer	1	Inboard
016	Bearing	1	Radial
017	Packing Gland*	2	Inboard and outboard
017A	Seal Gland**	1	Inboard
017B	Seal Gland**	1	Outboard
018	Bearing	1	Thrust
022	Bearing Locknut	2	Inboard and outboard
029	Lantern Ring*	1	Inboard
032A	Impeller Key	As reqd.	
032B	Sleeve Key	2	Shaft protecting sleeve
035	Bearing Cover	1	Inboard
037	Bearing Cover	1	Outboard
040	Deflector	2	Inboard and outboard
046	Coupling Key	1	
058	Interstage Sleeve	As reqd.	
068	Locking Collar**	1	Inboard mechanical seal
069	Bearing Lockwasher	2	Inboard and outboard
073F	Gasket**	2	Seal gland and casings
077	Grease Fitting	2	Inboard and outboard
078	Bearing Spacer	1	Outboard
089A	O-Ring	1	Discharge casing
089B	O-Ring	2	Shaft protecting sleeve and spacer sleeve
089D	O-Ring	As reqd.	Suction casing and stage casing
090	Mechanical Seal**	1	Inboard
091	Mechanical Seal**	1	Outboard
099	Bearing Housing	2	Inboard and outboard
169	Grease Seal	2	Inboard and outboard
173	Tie Bolt	8	Suction casing and discharge casing

Table 17. Parts List for Model WKL-100 Continued

ITEM NO.	PART NAME	QTY.	REMARKS
176	Snap Ring	1	Outboard
197	Discharge Casing	1	
203	Suction Casing	1	
400	Tubing	As reqd.	Flush line
408	Tubing	As reqd.	Balance line
409	Tubing	As reqd.	
410	Male Connector	As reqd.	Flush line
411	Male Connector	As reqd.	Balance line
423	Plug	As reqd.	Suction and discharge casings
424	Plug	As reqd.	Stage Casing
445	Union Tee	As reqd.	
600	Capscrew	16	Inboard and outboard bearing housing and suction and discharge casings
615	Nut*	4	
615	Nut**	8	
616	Nut	8	Tie bolt
630	Stud, Hex Nut*	4	Inboard and outboard packing gland
630	Stud, Hex Nut**	8	Inboard and outboard seal gland
645	Washer*	4	Packing gland
645	Washer**	8	seal gland
665	Setscrew**	2	Locking collar

*Packing pumps only **Mechanical seal pumps only ***Hot service pumps only

Table 18. Parts List for Model WKL-125 and Model WKL-150

ITEM NO.	PART NAME	QTY.	REMARKS
001	Stage Casing	As reqd.	
002A	Impeller	As reqd.	
005A	Diffuser	As reqd.	Stage
005B	Diffuser	1	Last stage
006	Shaft	1	
007A	Wear Ring	As reqd.	Suction casing and stage casing
013	Packing Ring*	11	Inboard and outboard
014A	Shaft Sleeve*	1	Inboard packing
014A	Shaft Sleeve*	1	Outboard packing
014A	Shaft Sleeve**	1	Inboard mechanical seal

Table 18. Parts List for Model WKL-125 and Model WKL-150 Continued

ITEM NO.	PART NAME	QTY.	REMARKS
014B	Shaft Sleeve**	1	Outboard mechanical seal
014C	Spacer Sleeve	1	Inboard
014D	Spacer Sleeve	1	Outboard
014E	Suction Spacer Sleeve	1	
014F	Discharge Spacer Sleeve	1	
016	Bearing	1	Radial
017	Packing Gland*	2	Inboard and outboard
017A	Seal Gland**	2	Inboard and outboard
018	Bearing	1	Thrust
022	Bearing Locknut	2	Inboard and outboard
029	Lantern Ring*	1	Inboard
032A	Impeller Key	As reqd.	
032B	Sleeve Key	2	Shaft protecting sleeve
035	Bearing Cover	1	Inboard
037	Bearing Cover	1	Outboard
040	Deflector	2	Inboard and outboard
046	Coupling Key	1	
058	Interstage Sleeve	As reqd.	
068	Locking Collar**	1	Inboard mechanical seal
069	Bearing Lockwasher	2	Inboard and outboard
073F	Gasket**	2	Seal gland and casings
077	Grease Fitting	2	Inboard and outboard
078	Bearing Spacer	1	Outboard
089A	O-Ring	1	Discharge casing
089B	O-Ring	2	Shaft protecting sleeve and spacer sleeve
089D	O-Ring	As reqd.	Suction casing and stage casing
090	Mechanical Seal**	1	Inboard
091	Mechanical Seal**	1	Outboard
099	Bearing Housing	2	Inboard and outboard
169	Grease Seal	2	Inboard and outboard
173	Tie Bolt	8	Suction casing and discharge casing
176	Snap Ring	1	Outboard
197	Discharge Casing	1	
203	Suction Casing	1	
400	Tubing	As reqd.	Flush line
408	Tubing	As reqd.	Balance line
410	Male Connector	As reqd.	Flush line
411	Male Connector	As reqd.	Balance line
423	Plug	4	Suction and discharge casings
424	Plug	As reqd.	Stage Casing
445	Pipe Tee	As reqd.	
480	Pipe Coupling	As reqd.	

Table 18. Parts List for Model WKL-125 and Model WKL-150 Continued

ITEM NO.	PART NAME	QTY.	REMARKS
486	Pipe Nipple	As reqd.	Discharge Casing
487	Pipe Nipple	As reqd.	Suction Casing
600	Capscrew	16	Inboard and outboard bearing housing and suction and discharge casings
601	Capscrew	8	Inboard and outboard bearing cover and bearing housing
615	Nut*	4	
615	Nut**	8	
616	Nut	8	Tie bolt
630	Stud, Hex Nut*	4	Inboard and outboard packing gland
630	Stud, Hex Nut**	8	Inboard and outboard seal gland
365	Setscrew**	2	Locking collar

*Packing pumps only **Mechanical seal pumps only ***Hot service pumps only

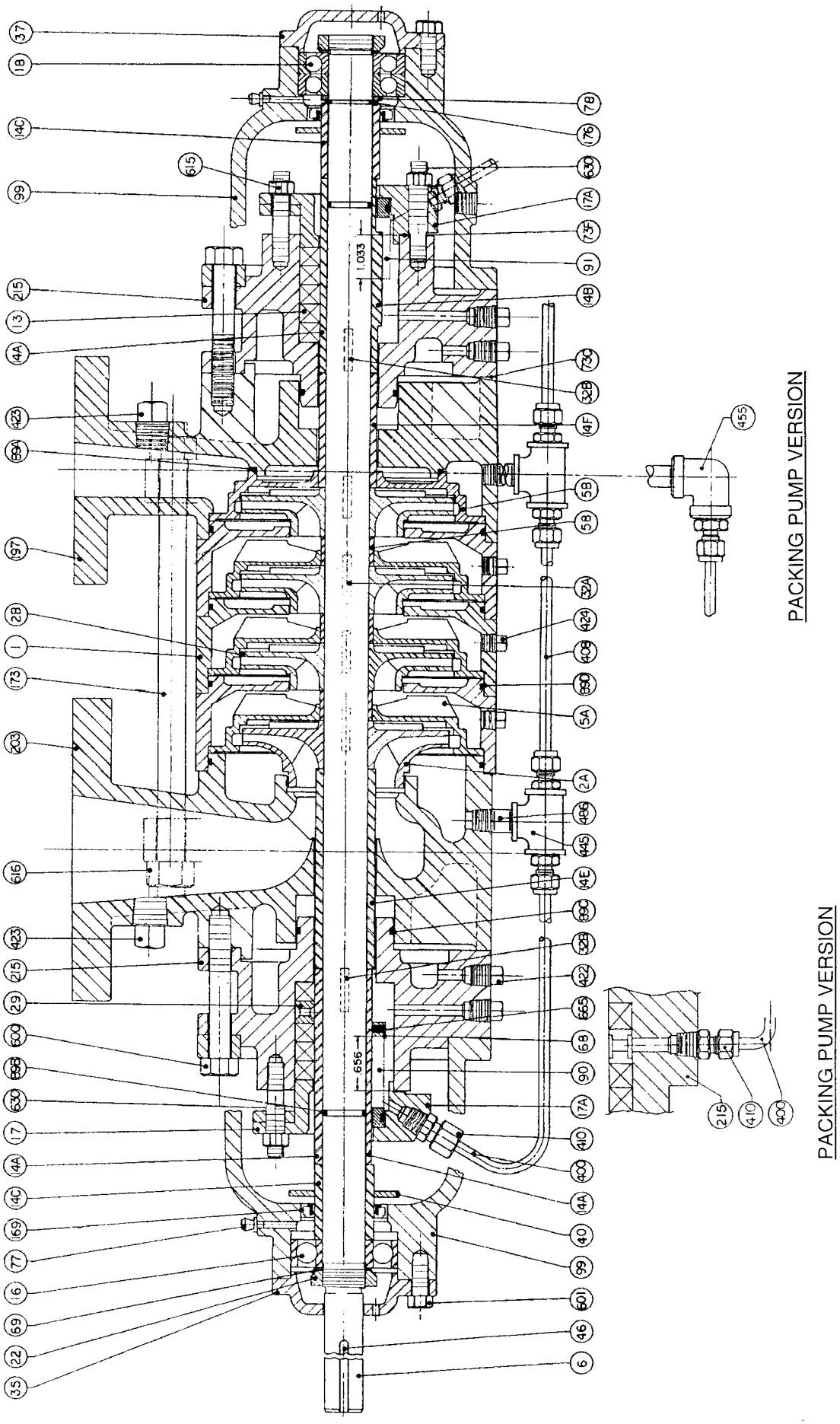


Figure 7. Model WKL-32 Sectional Drawing

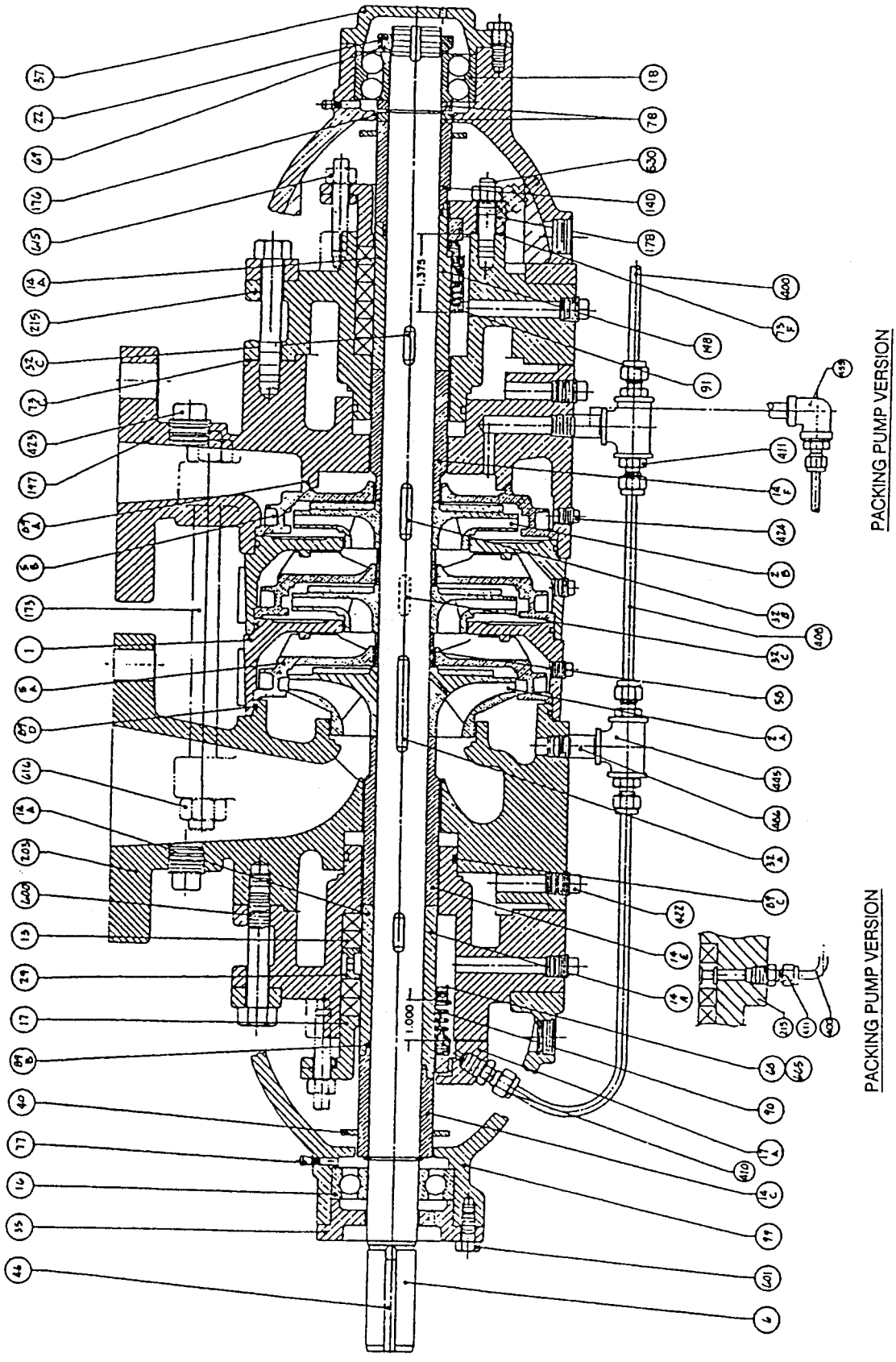


Figure 8. Model WKL-40 Sectional Drawing

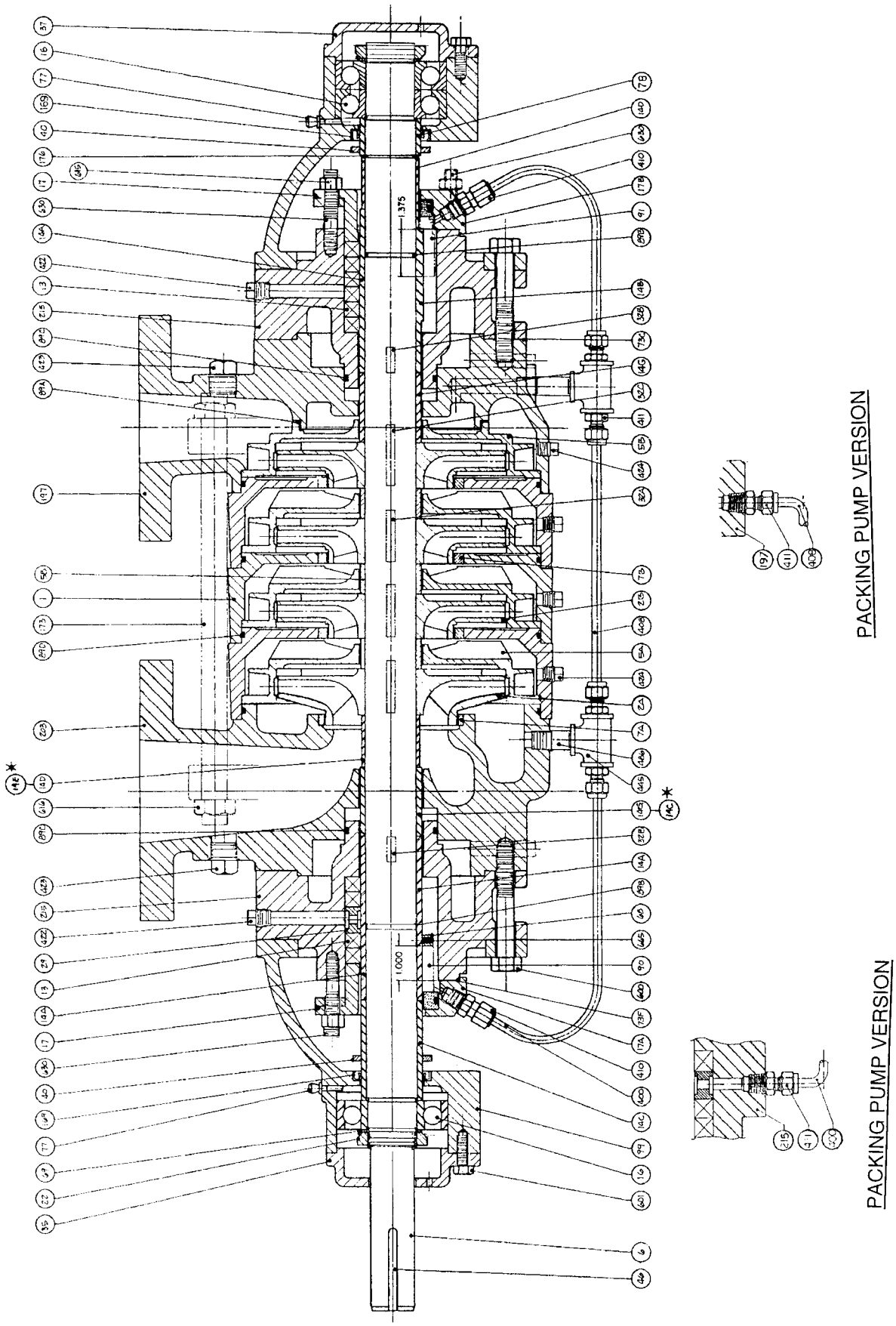


Figure 9. Model WKL-50 and Model WKL-65 Hot Service Sectional Drawing

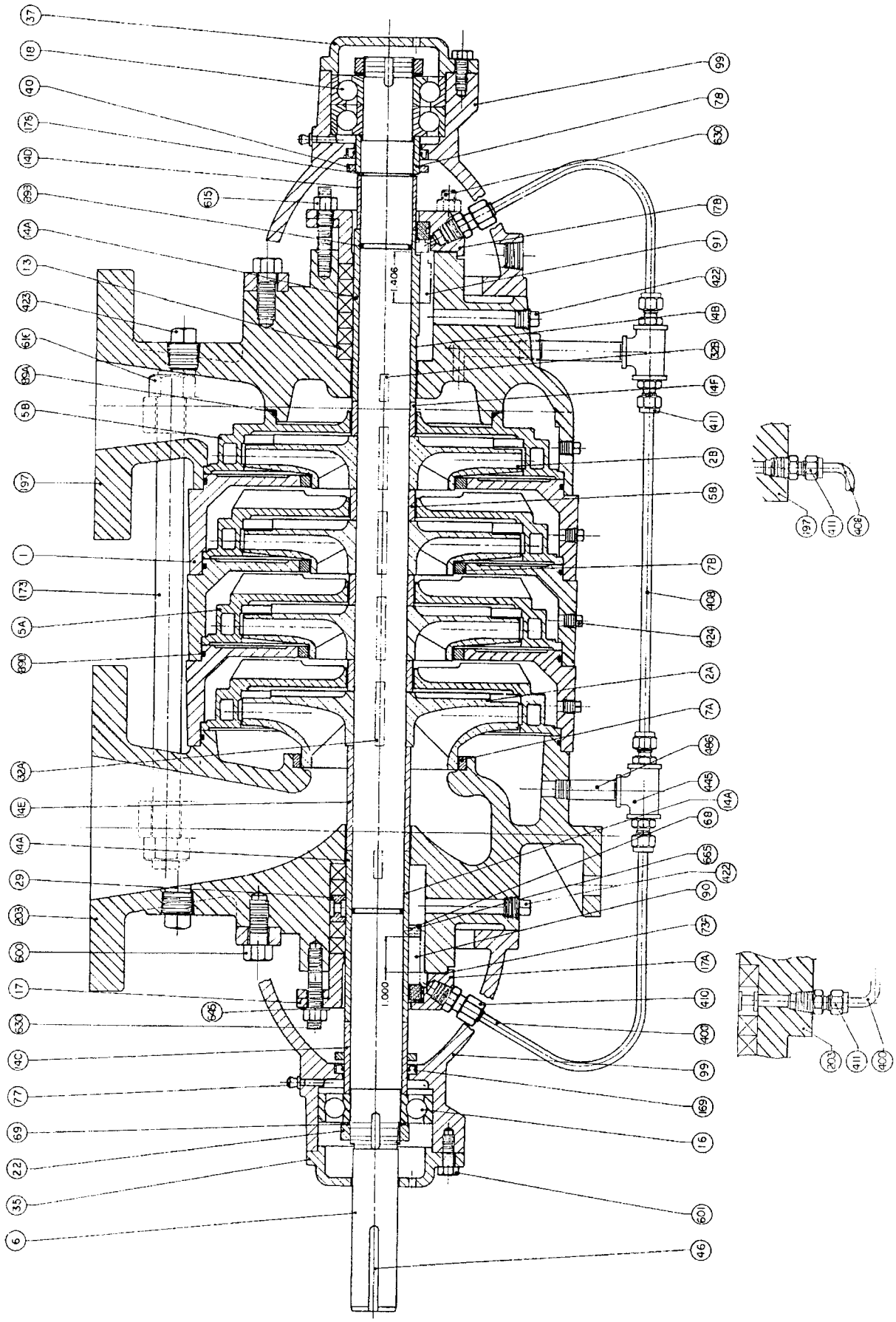


Figure 10. Model WKL-65 Cold Service Sectional Drawing

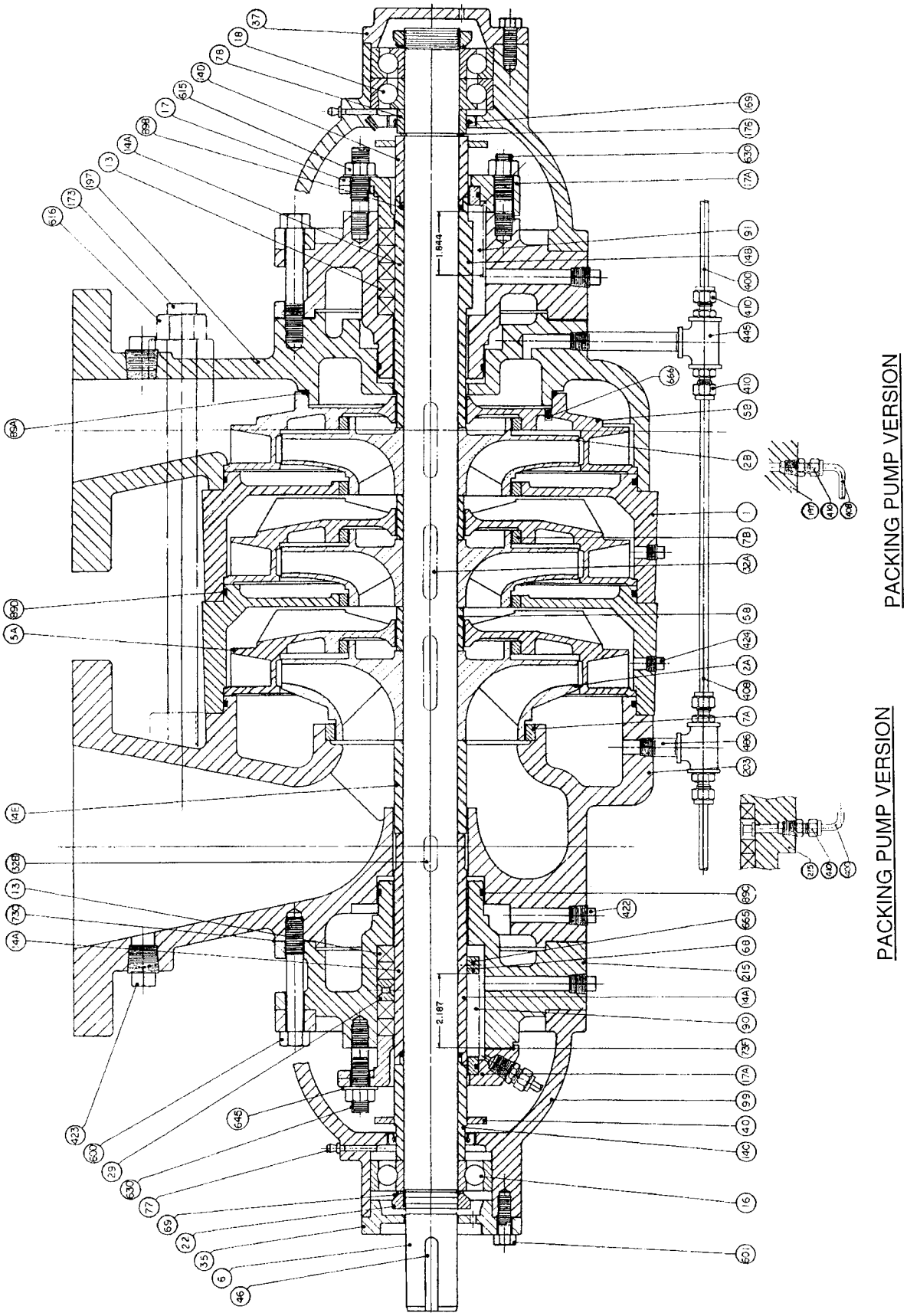


Figure 11. Model WKL-80 Sectional Drawing

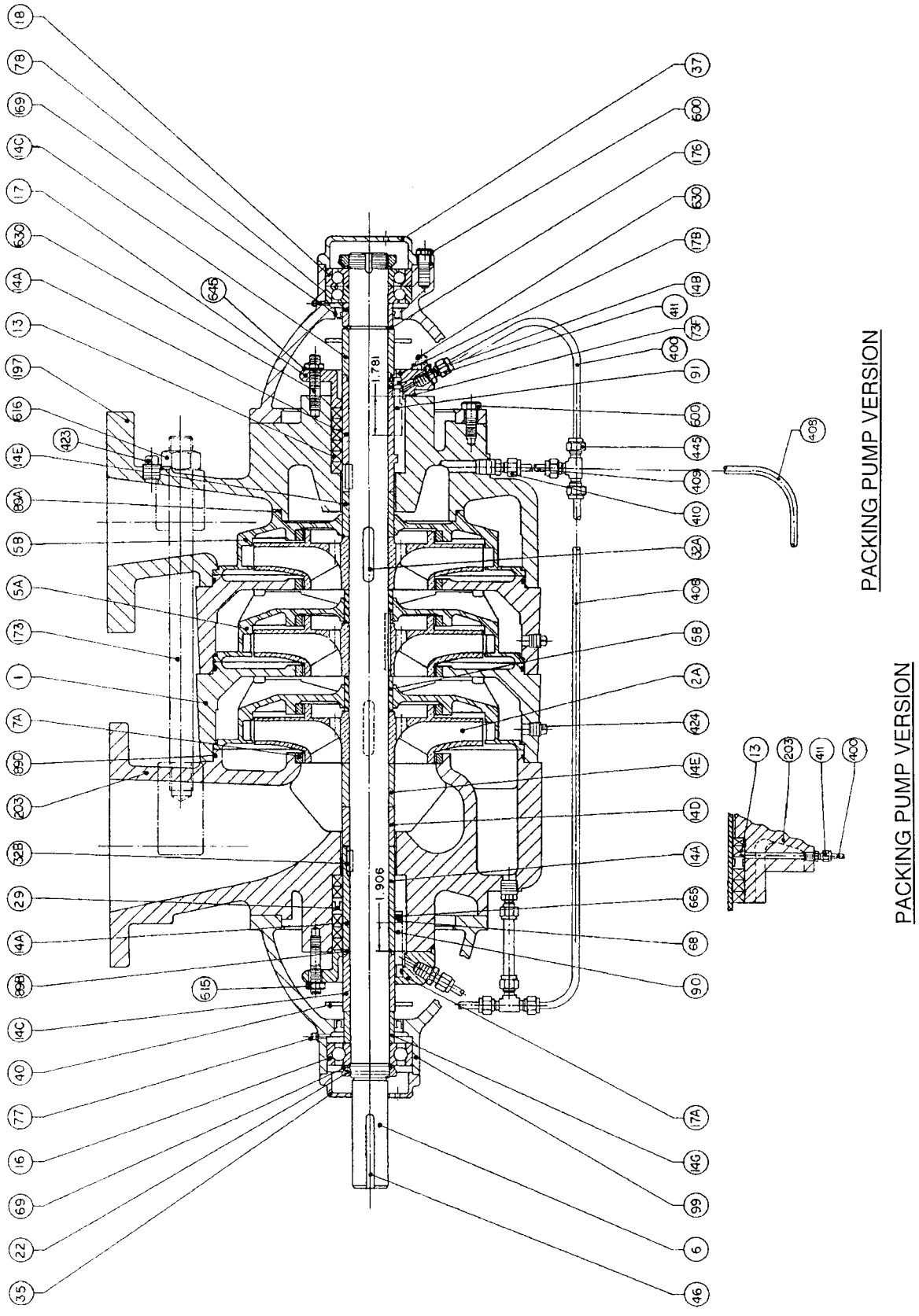


Figure 12. Model WKL-100 Sectional Drawing

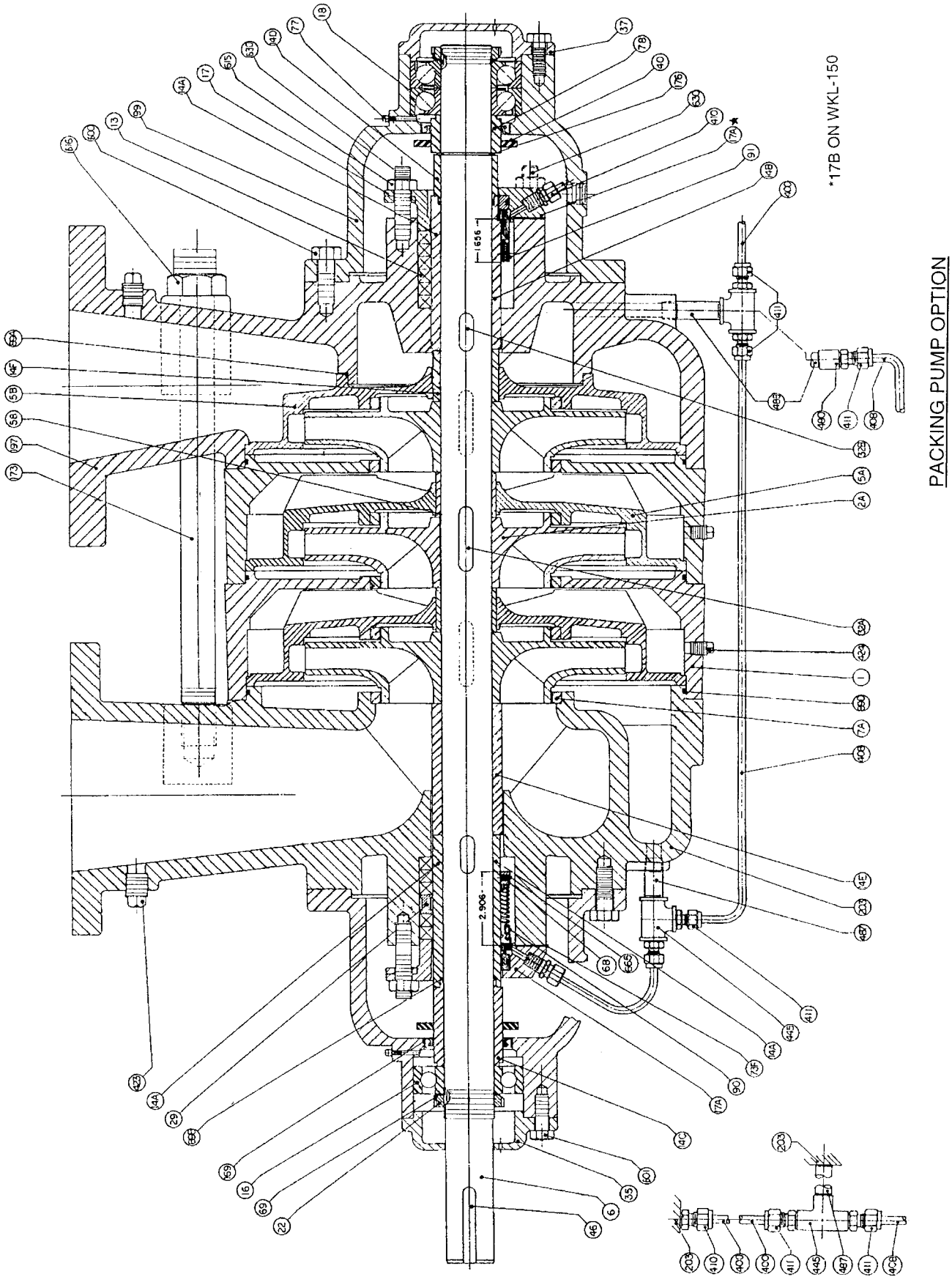


Figure 13. Model WKL-125 and Model WKL-150 Sectional Drawing

PUMP SERVICE RECORD

Serial Number _____ Customer Order Number _____

Size and Type _____ Make _____

Date Installed _____ Pump Location _____

Application _____

PUMP RATING

Capacity (GPM) _____ Total Head (feet) _____

Suction Head (+ /- feet) _____ Speed (RPM) _____

Liquid _____ Liquid Temperature _____

Specific Gravity _____ Viscosity Impeller _____ Diameter _____

MOTOR DATA

Serial Number _____ Type _____

Make _____ Frame Size _____

Horsepower _____ Speed (RPM) _____

AC or DC _____ Volts _____

Phase _____ Cycles _____

NOTES ON INSPECTION AND REPAIRS

INSPECT DATE	REPAIR TIME	REPAIRS	COST	REMARKS

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