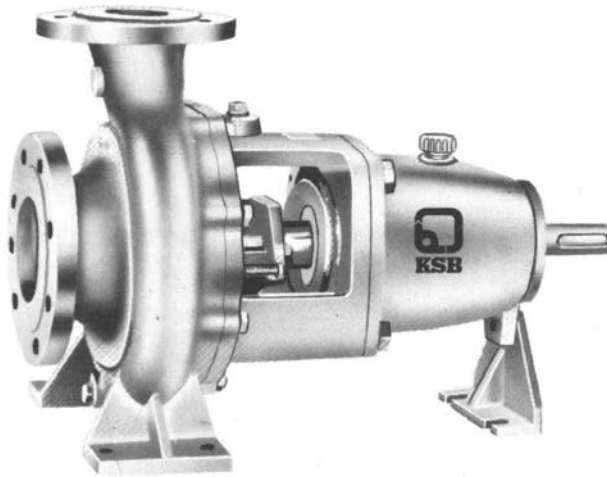


Process pumps for chemical and industrial application



STANDARDS: ISO 2858 / DIN EN 22858

1. Application

Designed to operate at chemical and petrochemical industries pumping organic and inorganic products.

It is also applied to the food and beverage industries, steel works and sugar mills, paper and cellulose pulp industries, rubber and plastic industries, in the circulation of heat transfer oil and condensates.

2. Design

Horizontal, single stage, end suction and top centerline discharge. "Back-pull-out" design in compliance with standards DIN EN 22858 / ISO 2858.

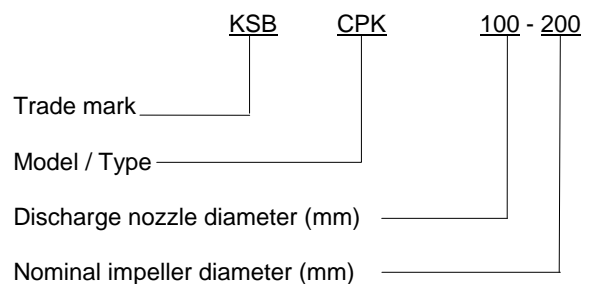
Exceeds the requirements of standard ANSI B.73.1

Due to its modular construction, it allows interchangeability of a large number of parts, particularly bearings brackets, reducing the maintenance cost.

The "back-pull-out" system allows repair and maintenance without dismantling piping and supports.

This model KSB CPK offers a wide variety of sizes to enable optimized values of efficiency and required NPSH.

3. Designation



4. Operating data

Sizes	-DN 32 to 300 (3" to 12")
Flow	- to 8,365 gpm (1,900 m ³ /h)
Head	- to 720 ft (220 m)
Temperature	- to 660° F (350°C)
Speed	- to 3,500 rpm
Operation pressure	-to 370 psi (25 bar)

5. Introduction

KSB has supplied you with equipment that has been designed and manufactured with the most advanced technology. Due to its simple and tough construction it will not need much maintenance. With the aim of providing our clients with a satisfactory, trouble free operation, we recommend to install and care our equipment according to the instructions contained in this service manual.

This manual has been prepared to inform the end user about the construction and operation of our pumps, describing the adequate procedures for handling and maintenance. We recommend that this manual should be handled by the maintenance supervision.

This equipment should be used in the operational conditions for which it was selected as to: flow rate, total head, speed, voltage, frequency, and temperature of pumped liquid.

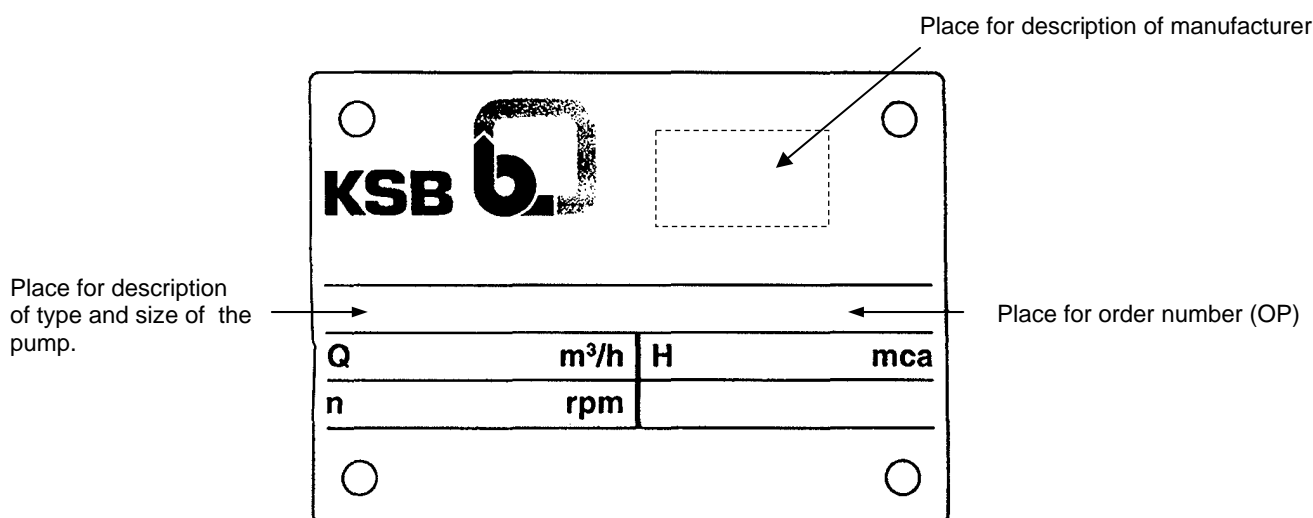


Fig.01 – Nameplate

For requests about the product, or when ordering spare parts, please indicate the type of pump and the production order n° (serial n°). This information can be obtained from the nameplate on the actual pump. If the nameplate is not available, the OP n° is engraved in low relief on the suction flange, in the impeller diameter you may find in discharge flange.

Attention: This manual contains very important instructions and recommendations. **Its careful reading is an obligation** before installation, electrical connections, first starting and maintenance.

Contents	Item	Contents	Item
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6. Technical data

Pump sizes		Unid	32-125	32-160	32-200	40-160	40-200	50-160	50-200	32-250	40-250	40-315	50-250	50-315	65-160	65-200	65-250	80-160	80-200	80-250	100-200	65-315	80-315	80-400	100-250	100-315	100-400	125-250	125-315	125-400	150-250	150-315	150-400	150-500	200-250	200-315	200-400	200-500	250-315	250-400	250-500	300-400																											
Technical data																																																																					
Bearing bracket			--	P 25/62 s								P 35/80 s								P 45/120 s								P 55/140 s								P 65/160 s		P 80/200 s																															
Width of impeller passage			mm	8	7	7	9	7	15	12	6	7	8	10	8	20	16	13	27	22	17	29	10	14	11	23	19,3	15	32	26	20	46	38	29	22,9	62	50	40	32	72,9	63,5	43,2	59																										
GD ² rotating element with water			Kg.m ²	0,020	0,035	0,075	0,035	0,075	0,040	0,090	0,185	0,185	0,410	0,200	0,410	0,050	0,090	0,200	0,060	0,100	0,220	0,120	0,420	0,500	1,190	0,280	0,560	1,280	0,350	0,690	1,600	0,400	0,900	1,850	3,900	0,600	1,100	2,150	4,600	1,250	2,400	5,100	5,200																										
Max. suction pressure			bar	Up to the max. discharge pressure																																																																	
Max. discharge pressure			bar	See fig. 02 and 03																																																																	
Temperature / cooling	Min./max. without cooling	°C	See fig. 02 and 03/120																																																																		
	Max. with cooling		See fig. 02 and 03																																																																		
	Coolant flow	l/min	3 up to 5				4 up to 6								6 up to 8								8 up to 10								10 up to 12																																						
	Max. cooling liq. pressure	Bar	10																																																																		
	Cooling liq. temp. inlet	°C	10 up to 20																																																																		
	Max. cooling liq. temp. outlet		50																																																																		
Min./ Max. flow			--	0,1 Qopt / 1,1 Qopt																																																																	
Direction of rotation			--	Clockwise, seen from the driver end																																																																	
Flanges	Cast iron	-	ANSI B 16.1 250# RF														● ● ●		ANSI B16.1 125# FF or ANSI B 16.1 250# RF																																																		
	Steel		ANSI B 16.5 150# RF or ANSI B 16.5 300# RF																																																																		
Hydrostatic test pressure			bar	According to ANSI B 73.1																																																																	
Bearings	Pump side		NU 305 C3				NU 307 C3								NU 311 C3								NU 313 C3								NU 413 C3		NU 416 C3																																				
	Motor side		2x 7206 BG				2x 7307 BG								2x 7311 BG								2x 7313 BG								2x 7315 BG		2x 7319 BG																																				
Lubrication			--	Oil, though the automatic resupply glass																																																																	
Lubricant capacity			l	0,2				0,5								0,5								1,5								1,8		4,5																																			
Max. permissible p/n			CV/rpm	0,012				0,028								0,068								0,15								0,30		0,56																																			
Original clearances in Ø between impeller x wear ring	Máx.	mm	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)																												
	Min.		(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)																												
Allowance for corrosion			mm	3,3																																																																	
Stuffing box chamber	Ø Sleeve	mm	35				45								55								70								80		100																																				
	Ø Chamber		51				65								75								95								105		132																																				
	□ Gasket		8				10								10								12,5								12,5		16																																				
Weight	Cast iron or nodular cast iron	KG	33	33	39	35	48	40	38	75	75	86	75	114	100	72	64	81	66	90	80	71	85	71	100	97	100	88	121	117	130	122	162	151	120	112	140	131	175	162	138	132	160	149	193	177	180	170	240	240	275	290	344	365	447	475	515	485	640	570	696	620							
	Stainless steel or carbon steel		39	39	48	41	35	41	48	48	38	45	38	44	84	75	84	75	106	86	85	75	114	100	72	64	81	66	90	80	71	85	71	100	97	100	88	121	117	130	122	162	151	120	112	140	131	175	162	138	132	160	149	193	177	180	170	240	240	275	290	344	365	447	475	515	485	640	570

Table 01

Note:

(1) Consult KSB

● ANSI B 16.1 125# FF or ANSI B 16.1 250# RF
●● ANSI B 16.1 250# RF

PN 16

7. Transportation

The transport of motor-pump set or only pump should be made with ability and sound sense, according to safety standards. By the motor eyebolt should only lift it, never the motor-pump set.

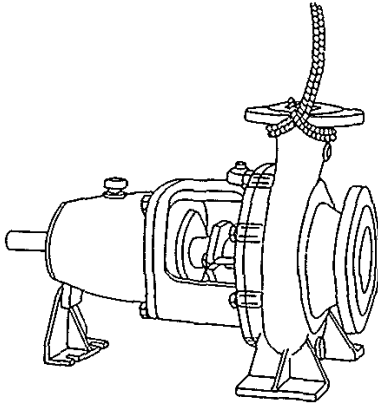


Fig. 04 - Transportation of the pump through the discharge flange

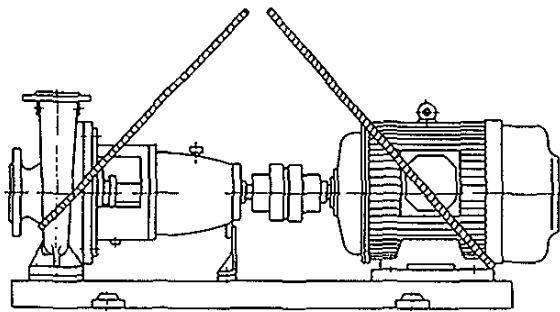


Fig. 05 - Transportation of the motor pump assembly

Note: Be sure that the coupling guard and the anchoring bolts are not lost or damaged during transportation.

8. Preservation and storage

KSB standard storage and preservation procedures maintain the pump protected for a maximum period of 6 months in an indoor installation. It is client responsibility to keep these procedures after receiving the pump. The unit / pump should be stored in a dry room where the atmospheric humidity is as constant as possible.

After sale, if performance test is not executed, the areas that have contact with the pumped liquid and are not painted, for example, stuffing box, wear rings, flanges sealing area, etc., receive an application of RUSTILO DW 301, by brush.

When the pump contain packing and performance test is executed, after test, the pump is drained without disassemble. Afterwards the pump is fulfilled with RUSTILO DW 301, moving the rotor to optimize the application. Thereafter the RUSTILO is drained. The shaft exposed areas (end and region between gland cover and bearing bracket) receive an application of TECTYL 506, by brush.

Bearings in the bearing brackets lubricated with oil receive one charge of spray MOBILARMA 524.

The pump must be protected against physical damage, humidity, dust and aggressive ambient, indoor.

8.1 Additional procedures of preservation / storage of idle pumps

- Pumps stored for periods over 1 year must have the preservative process done each 12 month. The pumps must be disassembled, cleaned and the storage process must be done again.
- For pumps assembled with PACKING, they must be removed from the equipment before storage.
- MECHANICAL SEALS must be cleaned with dry air. Do not apply liquids or other preservative materials in order to not damage the secondary sealings (o'rings and flat gaskets).
- All the existent connections, like: plugs for liquids of external source, vent, drainage, etc., should be properly closed.
- The pump suction and discharge nozzles are properly closed with tape, in order to avoid strange bodies inside the pump.
- Assembled pumps waiting for start up or installation should have their rotor manually rotated each 15 days. In case of difficulty, use a box spanner, protecting the motor shaft surface at the point of application.
- Before conservation liquids application, areas should be washed with gasoline or kerosene until they are completely cleaned.

Characteristics of the protecting liquids used for pump preservation purposes:

Protecting liquid	Thickness of the applied layer (µm)	Drying time	Removal	Manufacturer
TECTIL 506	From 80 up to 100	½ up to 1 hour	Gasoline/Benzene/ Diesel Oil	BRASCOLA
RUSTILO DW-301	From 6 up to 10	1 up to 2 hours	Gasoline/Benzene	CASTROL
Mobilarma 524	≤ 6	Liquid	Not necessary	MOBIL OIL

Table 02 - Protecting liquids

9. Installation

Pumps should be installed, leveled and aligned by qualified people. When this service is inappropriate executed, it can have as consequence, operational troubles, premature wear and irreparable damage.

10. Base grouting

Place the anchor bolts in the holes of foundation block according to the drawing dimensions. Between the base and foundation block must be placed besides the anchor bolts, metallic chocks of same height for base support. The chock blocks must be set with grout. The anchor bolts are set with concrete of appropriate feature, using for positioning a mould with holes according to Foundation plan. For perfect adherency, the anchor bolts and metallic chocks must be free of any residue of grease or oil.

The base should be placed over the foundation block after grout and concrete cure. Please see fig. 06.

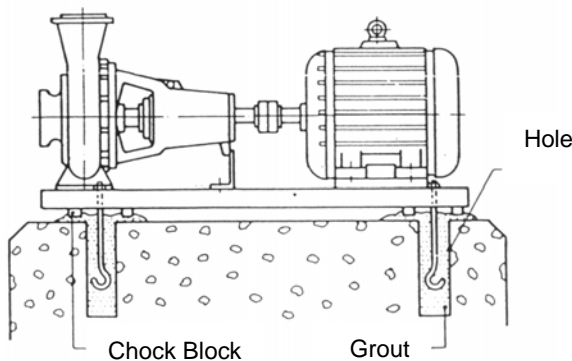


Fig. 06 - Base grouting

11. Base leveling

Check if baseplate is equally resting in all chock blocks. If positive, place and tighten uniformly the nuts in the anchor bolts. With the auxiliary of a spirit level, check the base leveling in the transversal and longitudinal direction. In case of unevenness, loose the nuts from anchor bolts and introduce shims to correct the leveling between the metallic chock block and the baseplate. Please see fig.07.

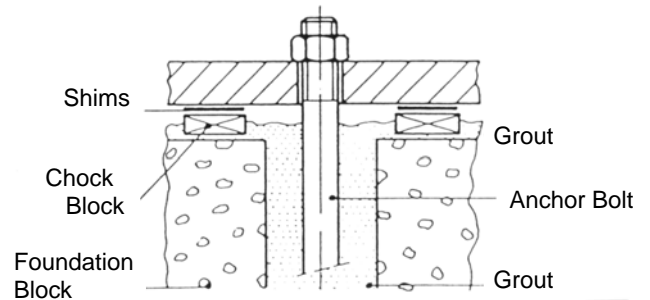


Fig.07 – Base leveling

Note: After leveling the base and before concrete fulfill, the motor-pump set must be pre-aligned according to the instructions of item 13.

12. Grouting

For a solid settle and operation free of vibrations, the base interior must be fulfilled with appropriate concrete. The concrete preparation must be done with specific products available in the civil construction market, which avoid shrinkage during the cure process, as well as provide appropriate fluidity for the complete fulfill of base interior preventing gaps. Please see fig. 08.

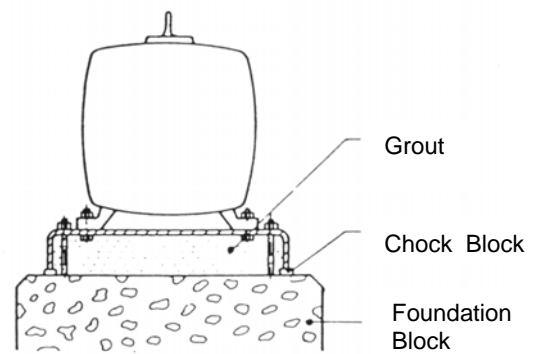


Fig. 08 - Filling the base with grout

13. Coupling alignment

The perfect alignment between the pump and the drive will affect the rotor useful life and equipment functioning free of abnormal vibrations.

The alignment performed at the factory must be rechecked, since during transport and handling the set is subjected to distortions that affect the initial alignment. After concrete cure, perform the alignment with suction and discharge piping already connected.

The alignment must be executed with dial indicator for radial and axial dislocating control.

Settle the instrument base in the peripheral part of one of the coupling halves, and adjust the dial indicator positioning the feeler perpendicular to the peripheric of other coupling half.

Zero the clock and move by hand the coupling side where the instrument base is set with the dial indicator and completing 360° turn (fig. 09). The same procedure must be adopted for the axial control (fig. 10).

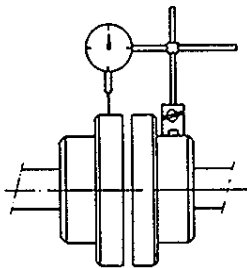


Fig. 09 – Radial control

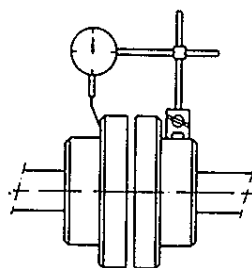


Fig. 10 – Axial control

For the alignment correction, loosen the bolts from the drive replacing them laterally, or insert shims to correct the height as required.

The axial and radial alignment must remain in the allowance of 0,1 mm with pump and drive bolts definitely tightened.

If it is not possible to use a dial indicator, use the straight edge leaned in the longitudinal direction in both parts of coupling sleeve. The control must be executed for horizontal and vertical plans. For control in the axial direction, use gauge. The clearance between the coupling sleeve hubs, specified by the manufacturer must be applied.

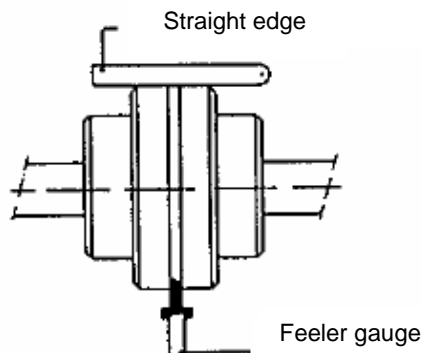


Fig.11 – Alignment with straight edge and feeler gauge

14. Suction pipeline recommendations

To install the suction piping follow these instructions:

- a) Connect the suction piping to the pump only after the complete hardening of the grout in the base plate;
- b) The suction piping should be as straight and short as possible – reducing pressure losses - and totally air tight, preventing any air leaks;
- c) In order to be free of air pockets, the horizontal section of the suction piping, when negative, should be installed with gradual rise slope. When positive, the horizontal section of the pipeline should be installed with a gradual rise slope to the suction tank;
- d) The nominal diameter of the pump suction flange does not determine the suction pipe nominal diameter. To calculate the ideal diameter as a reference, the liquid velocity can be defined between 3.2 ft/s and 6.5 ft/s (1,0 and 2,0 m/s);
- e) If it were necessary to use a reduction, it should be eccentric, mounted with its taper facing downwards, so that the reduction upper generatrix stays in a horizontal position coincident with the pump generatrix, so as to prevent air pockets;
- f) Curves and accessories, when needed should be designed and installed reducing pressure losses to a minimum, i.e. always prefer long or medium radius curves;
- g) The suction line flange should fit to the pump suction flange without any stress or tension and without applying any kind of force to the casing. The pump should never be an anchor point for the suction pipeline. If this condition is not observed a misalignment may happen, originating cracks on pump parts and/or other severe damages;
- h) On installations equipped with foot valve, observe that the free passage area should be 1.5 times the cross sectional area of the suction pipeline. Normally coupled to the foot valve there should be a suction strainer with a free passage area 3 to 4 times larger than the cross sectional area of the suction pipeline;
- i) When the liquid being pumped has large temperature variations, expansion joints should be installed preventing the effects of contractions and expansions of the suction pipeline on the pump;
- j) With positive suction, it is advisable to install an inlet valve to close the flow to the pump when necessary. During the pump operation it should stay totally open. The suction with a common header for several pumps should have an inlet valve for each pump and the connection between the header and each suction line should be made with line angle changes less than 45 degrees. In all these applications of gate valves, the valve stems should be directed either horizontally or vertically downwards;

- k) To prevent turbulence, leakage of air, sand or mud at the pump suction, all recommendations of the HYDRAULIC INSTITUTE referred to these types of installation should be strictly observed;
- l) Even if the coupling alignment has been checked before tightening, it has to be repeated after the final tightening of the suction pipeline;
- m) To facilitate the mounting of the suction pipeline and the fitting of the parts, install as necessary, flexible joints of the following types: Dresser, common or special with tie bolts.

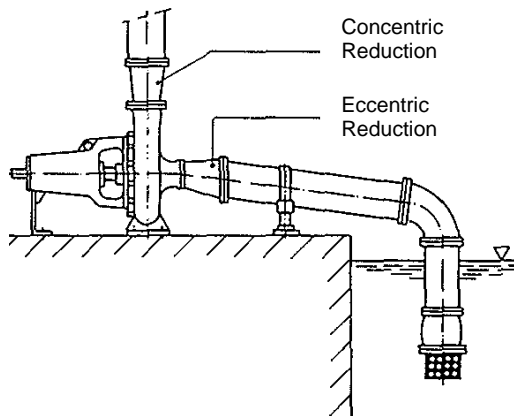


Fig. 12 - Negative suction

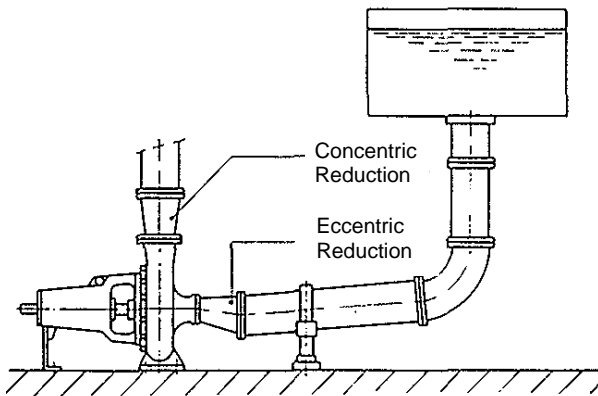


Fig. 13 - Positive suction

15. Discharge pipeline recommendations

To install the discharge pipeline follow these instructions should be checked:

- a) If the overpressures caused by the returning of the liquid in long pipe lines, exceed the limits specified for the line and the pump, water hammer control devices should be installed on the discharge pipe line;
- b) When the diameters of the pump and pipeline flanges are different, the connections should be done through a concentric reduction.

- c) On the points where it is necessary to bleed the air in the pipeline, vent valves should be installed.
- d) Install a discharge valve, if possible immediately after the discharge nozzle of the pump in order to properly control the flow rate and pressure or to prevent driver overloads.
- e) When a non-return valve is installed, it should be mounted between the pump and the discharge valve, prevailing this condition over item D.
- f) Tie mounting joints should be installed to absorb the system reaction forces, originated on the applied loads;
- g) Safety valves, pressure relief devices and other operational valves not included up to now, should be installed as necessary for adequate operation of the pipeline.
- h) The recommendations for the suction pipeline described on items A, B, F, G, I, L and M are also valid for the discharge pipeline.

16. Coupling guard

For increased safety in operation, coupling guards should be installed. They are made of steel or brass and fixed to the base.

Check that the coupling guard is not in touch with moving parts.

17. Instruments

It is recommended to use pressure gage and vacuum meter on discharge and suction pipes respectively for a better operation control.

Their ranges must correspond to 150% of highest pumping pressure.

Instruments must be equipped with valves.

When pumping chemicals and aggressive liquids, the instruments and their valves should be made of proper materials. When pumping liquid with solids must be using separators or eardrum instruments.

In order to obtain a longer useful life the valves should be open only to read the instruments and then closed again.

18. Operation

18.1 First start up procedure

The following items must be provided for pump first startup:

- a) Pump and its driver must be securely fastened to the base plate;
- b) Fix firmly the suction and discharge pipelines;
- c) Connect and run auxiliary pipelines and connections (if any);

- d) Wiring should be done upon assuring that all motor thermal overload protections are securely and adequately connected and set;
- e) Check bearings for cleanliness and dampness. Fill bearing bracket with oil in quantity and quality as specified in item 21;
- f) Check the rotation direction of driver without coupling the pump to avoid dry operation;
- g) Manually check for the free running of the moving parts;
- h) Check that the proper coupling alignment according to item 13 has been performed. When pumping liquids at temperatures above 221°F (105°C), the alignment must be done after 30 minutes operating;
- i) Mount coupling guard;
- j) Prime pump by filling it and suction pipeline with water or with the liquid to be pumped, bleeding internal air simultaneously;
- k) Check that the gland cover nuts are just fitted, without tightening them (pumps with packing);
- l) Fully open suction valve (if any) and close discharge valve.

18.2 Immediate steps after first start up

Once the pump has started and is already in operation follow these instructions:

- a) Adjust pump to its operation point (pressure and flow) by opening slowly the discharge valve shortly after pump drive has reached its nominal speed;
- b) Motor current consumption (amperage) must be controlled as well as power supply voltage value;
- c) Assure that suction pressure value corresponds to the designed one;
- d) Assure that pump runs vibration-free and without unusual noises. Vibration criteria in accordance to Hydraulic Institute;
- e) Check bearing temperature that may reach 122°F (50°C) over ambient temperature. However the sum of bearing temperature and ambient temperature should not exceed 197°F (90°C);
- f) Adjust the packing by tightening gland cover nuts about 1/6 turn. Like any new packing, it is required a certain period to set. The new packing should be checked during the first 5 to 8 hours of operation and in the event of leakage in excess, the gland cover nuts should be tightened about 1/6 turn again. During normal operation, packing should drip. When packing reach the set stage, a weekly inspection should be enough. The procedure mentioned above should be practiced every 15 minutes over the first 2 hours of operation. If all tests pass, new checking should be

carried out every hour, until the first 5 to 8 running hours (pumps with packing).

Remarks: The pumps that will operate with liquids above 221°F (105°C) must be rechecked for misalignment after 30 minutes operating.

If during this period any abnormalities were found consult item 24 – Operational abnormalities and troubleshooting.

19. Supervision during operation

Depending on the availability of personnel and the importance of the pump, we recommend the following supervision. In case of any abnormality, the maintenance supervisor must be called immediately.

19.1 Weekly supervision

Check:

- a) Operation point of the pump;
- b) Electric motor current consumption and power supply voltage;
- c) Suction pressure;
- d) Vibrations and abnormal noises;
- e) Oil level;
- f) Packing leakage.

19.2 Monthly supervision

Check:

- a) Oil change interval. Consult item 21.1.1;
- b) Bearings temperature.

19.3 Semestral supervision.

Check:

- a) Fixing bolts on the pump, driver and base;
- b) Alignment of the motor-pump assembly;
- c) Coupling lubrication (if any);
- d) Replace packing if necessary.

19.4 Annual supervision

Disassemble the pump for maintenance. After cleaning, inspect (very carefully) the condition of bearings, radial shaft seal rings, gaskets, o-rings, impellers, internal areas of the volute casing (check also thickness), wear areas and coupling.

20. Shutdown procedure

Follow in sequence these instructions:

- Shut off pump discharge valve;
- Turn off the driver and observe the gradual and smooth stop of the rotating assembly;
- Close the suction valve (if any);
- Close the auxiliary pipelines (if there is no restriction).

21. Maintenance

21.1 Bearings maintenance

The purpose of this maintenance is to exceed as much as possible the useful life of the bearings system. While the pump is in operation, maintenance consists in controlling the bearings temperature and the bearing bracket oil level. The pumps are delivered from our factory without any oil the bearing bracket. After checking that the bearing bracket is free from dirt or moisture, the constant-level-oiler should be filled up as follows:

- Remove the venting device and pour oil into the bearing bracket through the fitting orifice for the venting device until the oil level reaches half of the height of the fitting orifice for the Constant-Level-Oiler on the bearing bracket (the oil will appear at the bottom of the fitting connection on the bracket);
- Lower completely the transparent reservoir of the oiler and fill it through the immersion tube;
- Return the transparent reservoir to its original position.

Wait approximately 10 minutes until part of the oil go down automatically from the reservoir to the bracket, completing the necessary level, which is stated at the central line of the bearing lowest ball, as shown on fig.14.

During pump operation, IF the level is checked to be at 1/3 of the height of the transparent reservoir, the Oiler should be refilled as indicated on item "b".

We advice that na insufficient lubrication can be so dangerous as na excessive one, both producing damages to the equipment.

Note: Quantity of oil to be used on the KSB CPK pumps bearing brackets, see table 01.

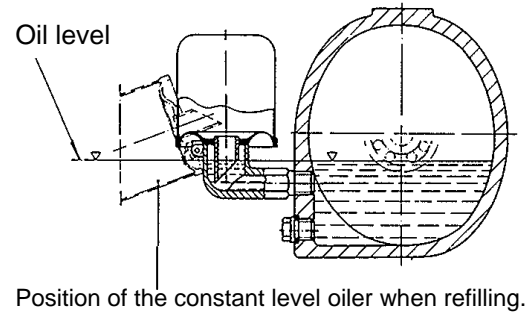


Fig. 14 – Constant level oiler

Note: The constant level oiler volume is: 140 ml

21.1.1 Lubrication intervals and oil specification.

The lubricating properties of oil are lost due to aging and mechanical work. Besides, all lubricants are contaminated during their working period, reason why should be completed and changed on regular intervals. The first change should be done after the first 200 or 300 hours of work. The next one, after 1,500 to 2,000 hours. These changes prevent the particles which have not been eliminated by the cleaning and are mixed with the oil for damaging the bearings. From then on, change every 8,000 hours of effective work or at least once a year (the one that comes first).

The bearings must be washed, as a minimum every two years.

Fanufacturer	Up to 3,000 rpm	Exceeding 3,000 rpm
ATLANTIC	EUREKA-68	EUREKA-46
CASTROL	HYS PIN AWS 68	HYS PIN AWS 46
ESSO	Turbine oil-68	Turbine oil-46
MOBIL OIL	DTE - 26	DTE -24
IPIRANGA	IPITURAW-68	IPITUR AW-46
PETROBRÁS	MARBRAX TR-68	MARBRAX TR-46
SHELL	TELLUS - 68	TELLUS - 46
TEXACO	REGAL R & O-68	REGAL R & O-46

Table 03 – Lubricant oil specification

21.2 Shaft seal maintenance

21.2.1 Mechanical seal maintenance

If the pump is equipped with mechanical seal, complementary instructions from the seal manufacturer will be sent attached.

21.3 Gland packing maintenance

If the gland packing has already been pressed equivalent to one packing ring thickness and even thus the leaking is still excessive, it will need maintenance according to the following instructions:

- Shutdown the pump;

- Loosen the gland cover and remove it. The removal of gland cover is easy due to its split design. To remove it, just push it in the direction of the bearing cover, and then pull half of the gland cover to the right and the other half to the left;
- Remove with a flexible rod all the packing rings and the lantern ring;
- Clean the stuffing box chamber;
- Check the conditions of the shaft protecting sleeve surface. If it is rough or has grooves that could damage the packing rings, the sleeve may be re-machined on its diameter up to maximum of 0,039" (1 mm) or replaced by a new one;
- Cut the new packing rings, if possible with slanted ends (see fig.15). To facilitate this cutting operation a very simple device may be constructed as shown in fig.16;



Fig. 15 - Slanted cut of the packing rings

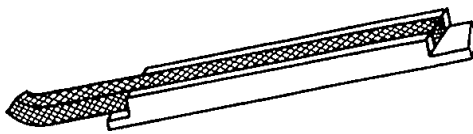


Fig. 16 - Packing rings cutting device

- Lubricate the inner diameter of each packing ring with grease;
- Lubricate the outer diameters of the lantern ring, neck bush and neck ring (if any) with Molykote G paste;
- Proceed to the assembly in the inverse sequence of the disassembly, introducing each part into the stuffing box chamber with the help of the gland cover. The packing rings should be mounted with their ends positioned 90° from each other. (See fig. 17).

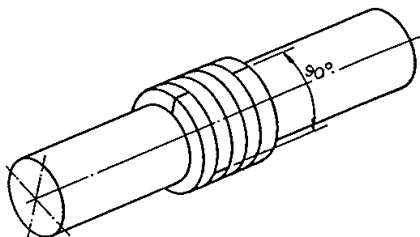


Fig. 17 - Rings position with ends positioned 90° from each other

After all the parts have been mounted in the stuffing box chamber, 0.12" (3 mm) should remain free as a guide for the gland cover.

21.4 Wear areas maintenance

When the pump shows wear between the casing wear ring and the external diameter of the suction side of the impeller hub and/or between the discharge cover and the impeller wear ring on its discharge side and both, casing and impeller are in good conditions, the wear rings must be replaced.

KSB and its Dealer Network supply wear rings for repair or as spare parts for the KSB CPK pumps.

These wear rings are supplied with their external finished diameter within the proper tolerance and their internal diameter with 2 mm of over-metal.

21.5 When to replace

The wear rings replacement should take place when the clearance between the wear ring and the impeller or between the wear ring and the discharge cover has reached three times the maximum clearance indicated on table 01 or when the pump shows an appreciable loss in efficiency.

21.6 Replacement of the casing wear ring

Centralize the impeller through the internal hole of the shaft passage (use mandrel), machine the worn out area of the impeller (suction side of the hub) until you obtain a uniform surface (maximum machining allowance: 2 mm on diameter).

Check the diameter measurement after machining.

Then, machine the internal diameter of the wear ring according to that measurement on the impeller and observe the clearances established on table 01. Remove the damaged ring from the casing and fit the spare wear ring under pressure with a piece of lead or wood.

Notes:

- 1) The tolerance for the radial and axial warping for this item is specified at a maximum of 0.05mm.
- 2) If the client judges it necessary, auxiliary locking ways may be used such as: chemical (Loctite) or even threaded pin.

22. Disassembly instructions

The numbers indicated between parentheses just after the name of each part refers to the part list and to the exploded view drawing (Item 25).

Due to its modern project KSB CPK pump offers several maintenance advantages. The whole set can be dismantled to the back; bearing bracket, pressure cover and impeller. The spiral casing (102) and the suction and discharge piping remain in their place. In case of installation with spacer coupling, the driver remains also in its place, during the pump maintenance.

22.1 Sequence for the pump disassembly when equipped with gland packing

- 1) Close the suction valve (if any) and the discharge valve;
- 2) Drain the pump, taking the threaded plug (903.1);
- 3) Close the valves and disconnect the auxiliary piping (if any);
- 4) Remove the coupling guard;
- 5) Remove the venting (672);
- 6) Remove the threaded plug (903.5) and drain the oil from the bearing bracket;
- 7) Remove the constant-level-oiler (638) from the bearing bracket;
- 8) If the coupling has a spacer, remove it; if it doesn't have one, disconnect the sleeve removing the driver;
- 9) Remove the coupling from the pump shaft, loosening before the coupling fixing allen bolt;
- 10) Loosen the bolts that fix the support foot (183) to the base plate;
- 11) Loosen the nuts (920.1);
- 12) Remove all the set by fastening uniformly the extracting bolts (901.1);
- 13) Return the extracting bolts (901.1) to the original position for the next assembly;
- 14) Support the overhang side of the set with a piece of wooden. Lock the shaft using a device in the region of coupling sleeve key (940.2);
- 15) Loosen and extract the impeller bolt (922.3) and gasket (400.3) except for sizes 40-315, 50-315 and 150-500 (these pumps use o'rings). For sizes 40-315 and 50-315 remove the gasket (411.31) and the spacer disc (551.31) instead of the flat gasket (400.3). For size 150-500 remove the counter nut (922.2), the impeller nut (922.1), the lock washer (931.2), the sleeve (520) and the o'rings (412.2) and (412.3) ;
- 16) Extract the impeller (230), the key (940.1) and the other gasket (400.3), except for sizes 40-315 and 50-315 (for these pumps remove the o'rings). For these sizes remove the gasket (411.32) and remove the space disc (551.32);
- 17) Loosen the nuts (920.2) and extract the gland cover (452) the stuffing box ring (454), the gland packing (461) and the lantern ring (458);
- 18) Extract the discharge cover (163) and the flat gasket (400.1);
- 19) Extract the shaft protecting sleeve (524);

20) Extract the thrower (507) and the key (940.2);

- 21) Loosen the bolt (901.3) and release the support foot (183);
- 22) Loosen the nuts (920.3) of studs (902.3) from the bearing bracket lantern (344) of bearing bracket (330). Remove the bearing bracket lantern (344).
- 23) Loosen the bolts (901.2), extract the bearing covers (360.1 and 360.2) and the flat gaskets (400.2). Take care not to damage the radial shaft seal rings (421.1 and 421.2) which come outside with the bearing cover;
- 24) With a piece of lead, strike against the shaft (210) suction side, in order to make the external surfaces of the radial ball bearings (322) run inside of the bearing bracket (330) until the complete extracting. After these instructions are completed, the parts will be available for analysis and maintenance.

22.2 Sequence for pump disassembly when equipped with mechanical seal

Loosen the auxiliary pipelines (if any) and the seal cover. Follow the instructions contained in the mechanical seal manufacturer O&M manual that is supplied with the pump.

23. Assembly instructions

All parts should be cleaned and deburred before assembly.

23.1 Unauthorized modification and manufacture of spare parts

Modifications or alterations of the equipment supplied are only permitted after consultation with the manufacturer and to the extent permitted by the manufacturer. Original spare parts and accessories authorized by the manufacturer ensure safety. The use of other parts can invalidate any liability of the manufacturer for consequential damage.

23.2 Sequence for the pump assembly when equipped with gland packing

- 1) Before the assembly at the shaft, the bearings should be heated at a furnace or with an oil bath up to a maximum temperature from 176°F (80°C) to 194°F (90°C) over the shaft temperature during 30 minutes, observing the maximum limit of 257°F (125°C);
- 2) Assemble the bearings (322 and 320) at the shaft. With a piece of lead, assemble the shaft at the bearing bracket, from the suction side;
- 3) Assemble the radial shaft seal rings (421.1 and 421.2) at the bearing covers (360.1 and 360.2);
- 4) Assemble the covers carefully not to damage the radial shaft seal rings with the flat gaskets (400.2). Fasten the bolts (901.2);

- 5) Fit the support foot (183) and fasten the bolt (901.3);
- 6) Support the overhang side of the bearing bracket (330) with a piece of wooden. Introduce the centrifugal ring (507) at the shaft, without touching the bearing cover;
- 7) Assemble the studs (902.2) at the pressure cover (163).
So, assemble the packing (461) at the sealing chamber see the packing code showing in the cross sectional drawing. Assemble the gland (452) tightening the nuts (920.2)
- 8) Assemble the shaft protecting sleeve (524) at the shaft, having first greased its internal diameter with Molykote G;
- 9) Assemble the bearing bracket lantern (344) at the bearing bracket (330);
- 10) Assemble the o'ring (412.1) at the bearing bracket lantern (344);
- 11) Guide the flat gasket (400.1) at the pressure cover; fit the discharge cover (163) at the bearing bracket lantern (344);
- 12) Assemble the flat gasket (400.3), the key (940.1), the impeller (230) (grease its internal diameter with Molykote G), the other flat gasket (400.3), and the impeller bolt (922.3), except for sizes 40-315, 50-315 and 150-500.
For sizes 40-315 and 50-315 assemble the gasket (411.32) and the space disc (551.32) at the shaft protecting sleeve and assemble the gasket (411.31) and the space disc (551.31) at the impeller nut side (922.3), instead of the flat gasket. For size 150-500 assemble the o'rings (412.2 and 412.3) at the sleeve (520) and after the sleeve, the lock washer (931.2), the impeller nut (922.1) and the counter nut (922.2);
- 13) Assemble the key (940.2) at the shaft drive side, lock the shaft with a device and tight firmly the impeller bolt (922.1);
- 14) Introduce the whole set at the volute casing (102) guiding the set through the diameter of the pressure cover;
- 15) Assemble the stud (902.1) with the nuts (920.1) tightening them, crossly and uniformly;
- 16) Assemble the constant-level-oiler (638), on the bearing bracket, using PTFE tape on the oiler thread. Check manually if the rotor round free.

23.3 Sequence for pump assembly when equipped with mechanical seal

See O&M manual from the seal manufacturer supplied together with the pump.

24. Operational abnormalities and troubleshooting

Abnormalities	Probable Causes
Insufficient flow rate	1, 2, 3, 4, 5, 6, 8, 9, 10, 11
Driver overload	12, 13, 14, 15, 28
The pump final pressure is too high	15
Bearings overheating	22, 23, 24, 25, 26, 31, 34
Pump leaking	16
Excessive leaking at the shaft seal	17, 18, 22, 33
Irregular operation of the pump, abnormal noises	3, 6, 11, 15, 21, 22, 23, 25, 30, 31, 32
Excessive heating of the pump casing	3, 6, 21, 32

Table 04 - Abnormalities and causes

Probable causes – suggestion

- | | |
|---|---|
| <p>1- The pump is discharging at an excessive pressure.</p> <ul style="list-style-type: none"> Adjust the operational point of the pump. <p>2- Total head (counter-pressure) higher than the pump nominal head.</p> <ul style="list-style-type: none"> Install an impeller with larger diameter. Increase driver speed (if turbine or internal combustion engine). <p>3- Pump and / or suction pipe are not totally full of liquid or are not airtight.</p> <ul style="list-style-type: none"> Fill the pump and suction pipe with liquid to be pumped and / or seal both. <p>4- Suction pipe and / or impeller clogged.</p> <ul style="list-style-type: none"> Remove obstructions from suction pipe and / or impeller. <p>5- Air pockets in the pipeline.</p> <ul style="list-style-type: none"> Modify piping lay-out. If necessary, install a venting valve. <p>6- NPSH available too low (negative suction installation).</p> <ul style="list-style-type: none"> Check if it is necessary to correct the level of the liquid -being pumped. Install the pump at a lower level referred to the suction tank. Open the suction pipeline valve totally. In case the suction pipeline has excessive pressure losses, modify the pipeline to reduce them. <p>7- Air getting into the stuffing box chamber.</p> <ul style="list-style-type: none"> Clear out the line that supplies liquid for lubrication / sealing of the stuffing box chamber. Clear out the line that supplies liquid for lubrication / sealing of the stuffing box chamber. Increase the pressure of lubrication / sealing liquid of the stuffing box chamber. Service the packing or the mechanical seal. | <p>8- Wrong rotation direction.</p> <ul style="list-style-type: none"> Change one of the electric motor phase cables. <p>9- Slow speed.</p> <ul style="list-style-type: none"> Increase speed. <p>10- Wear of the inner parts of the pump.</p> <ul style="list-style-type: none"> Replace worn parts. <p>11- Total head (counter-pressure) lower than specified when the pump was purchased.</p> <ul style="list-style-type: none"> Adjust operational point of the pump. If the overload continues, trim the impeller. <p>12- The specific weight or viscosity of the liquid being pumped is higher than the one specified when the pump was purchased.</p> <p>13- Wrong tightening of the gland cover.</p> <ul style="list-style-type: none"> Correct tightening. <p>14- High speed.</p> <ul style="list-style-type: none"> Reduce speed. <p>15- Defective gasket between the volute casing and the discharge cover.</p> <ul style="list-style-type: none"> Replace it. <p>16- Inefficient (worn out) shaft sealing.</p> <ul style="list-style-type: none"> Replace it. Check if the sealing / lubrication liquid pressure is not too high. <p>17- Scratches, grooves and excessive roughness on the shaft protecting sleeve. Defective gasket between impeller and sleeve.</p> <ul style="list-style-type: none"> Replace protecting sleeve or gasket. <p>18- Pump operation excessively noisy.</p> <ul style="list-style-type: none"> Correct the suction conditions. Increase pressure at the pump suction. |
|---|---|

- 19- The motor-pump assembly is misaligned.
 - Align the motor-pump.
- 20- The parts of the pump have their radial and axial warp out of specification. Suction and discharge pipelines exerting mechanical strengths.
 - Adjust the axial and radial warping of those parts or replace them.
 - Eliminate stresses, fixing properly the suction and discharge pipelines or installing flexible joints, if necessary.
- 21- Excessive axial thrust.
 - Clear out the balance holes on the impeller.
 - Replace the wear rings (impeller x casing and impeller x discharge cover).
- 22- Bearing oil excess, lacking or inadequate.
 - Reduce, refill or use the adequate oil, according specifications.
- 23- Incorrect clearance at the coupling sleeve.
 - Adjust to the correct clearance.
- 24- The electric motor is working with two phases.
 - Replace the defective fuse.
 - Check electrical connections.
- 25- Unbalanced impeller.
 - Clean, deburr and balance the impeller.
- 26- Defective bearings.
 - Replace them.
- 27- Insufficient flow rate.
 - Increase minimum flow.
- 28- Defective supply of stuffing box chamber sealing liquid.
 - Decrease sealing liquid pressure.
- 29- Friction of the stationary and turning parts.
 - Check, adjust or replace the parts.

25. Sectional drawing and parts

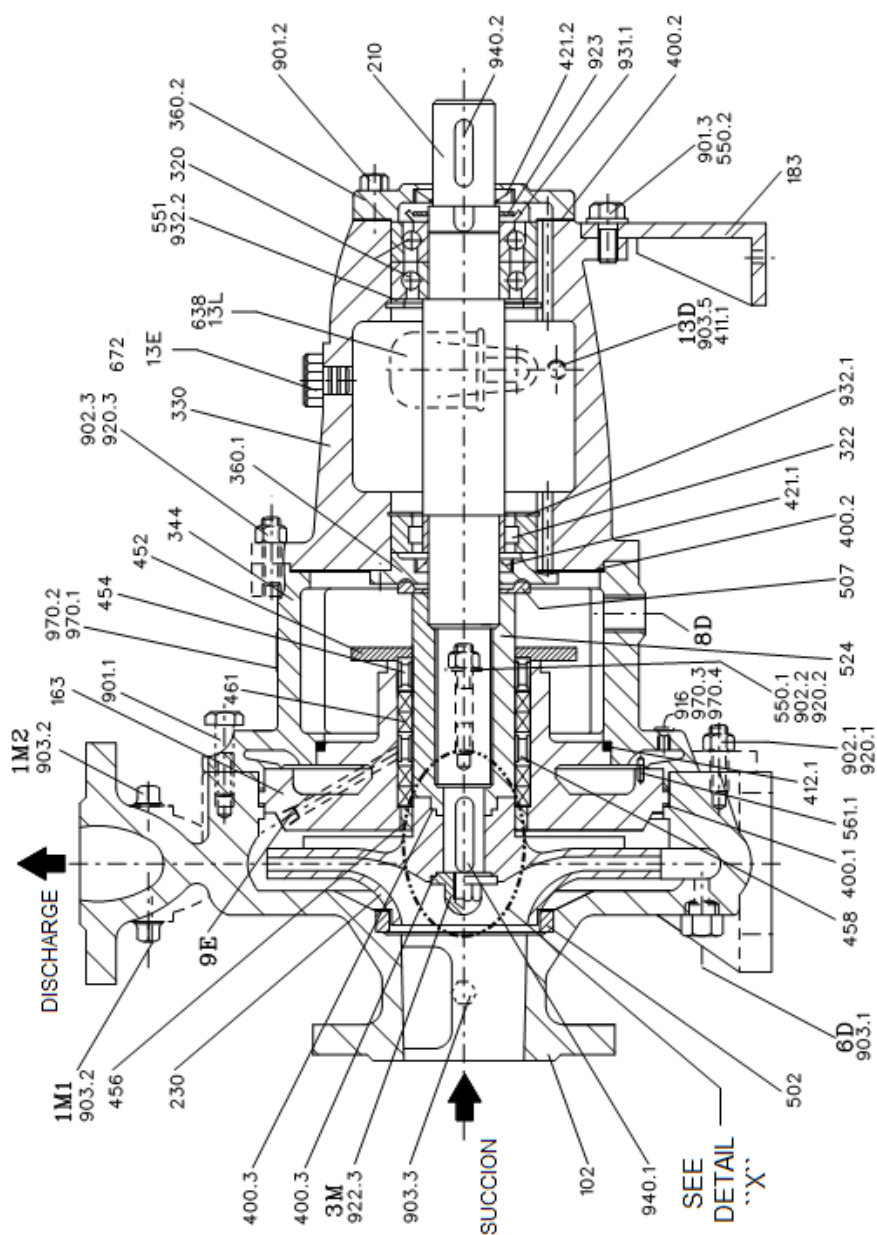
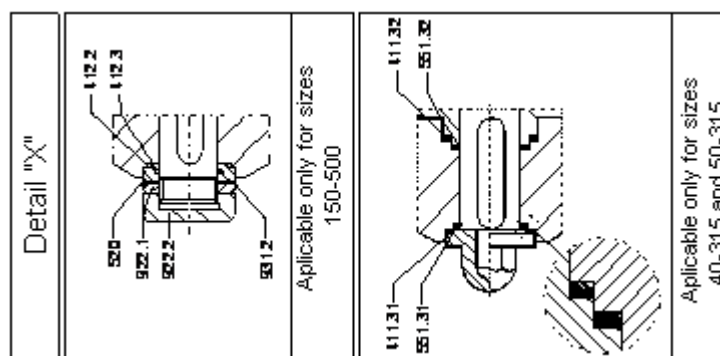


Fig. 18 – Sectional drawing



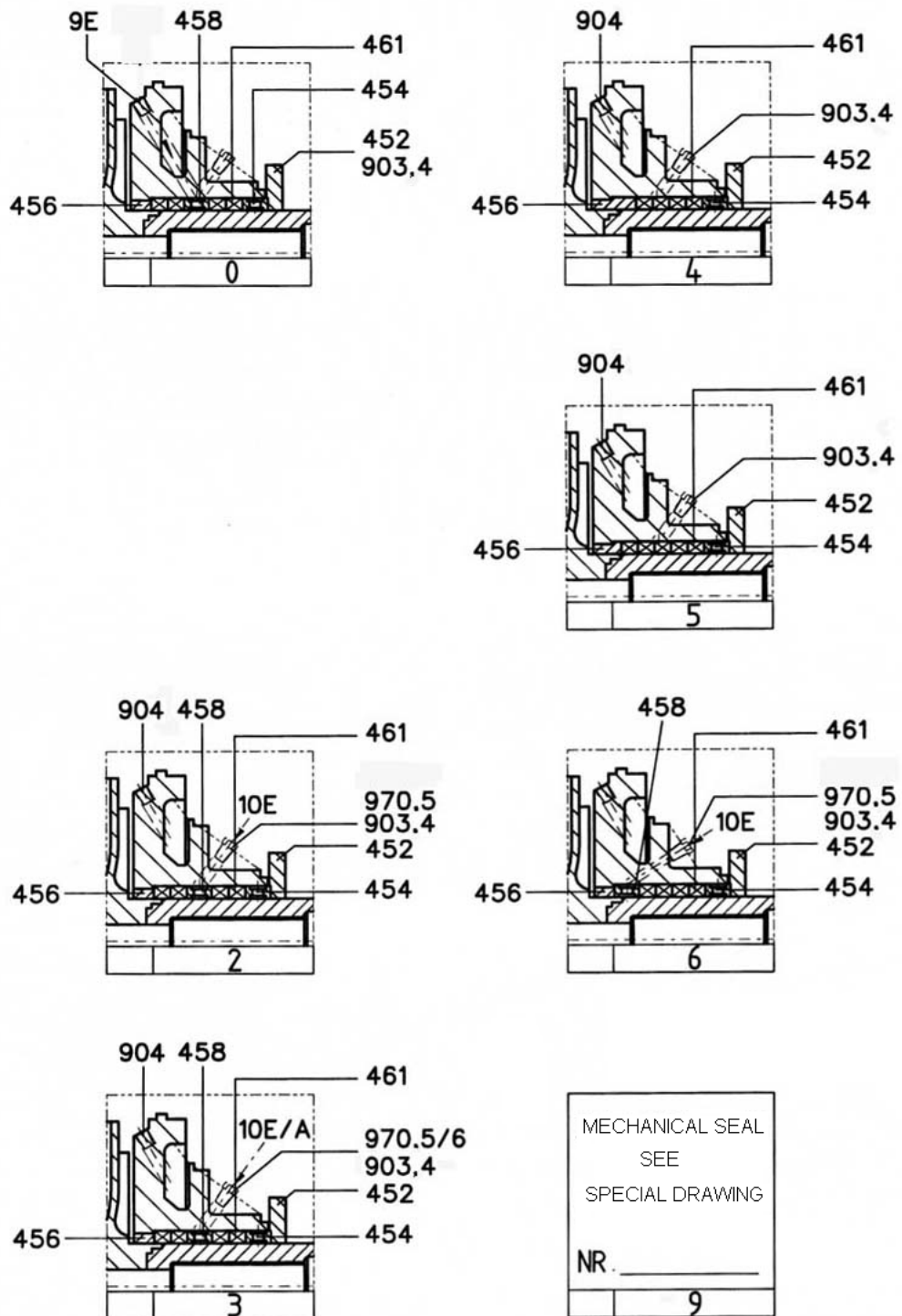


Fig.19 – Sealing detail

26. Parts list / material

Designation	Part n°	Qty	Material combination		
			00	01	07
Volute casing	102	01	A 48 CL30	A 48 CL30	A743 CF8M
Discharge cover	163	01	A 48 CL 30	A 48 CL 30	A743 CF8M
Support foot	183	01	A 48 CL 30	A 48 CL 30	A 48 CL 30
Shaft	210	01	SAE 1045	SAE 1045	SAE 1045
Impeller	230	01	A 48 CL 30	A 743 CF8M	A743 CF8M
Bearing	320	02	Steel	Steel	Steel
Bearing	322	01	Steel	Steel	Steel
Bearing bracket	330	01	A 48 CL 30	A 48 CL 30	A 48 CL 30
Bearing bracket lantern	344	01	A536 60-40-18	A536 60-40-18	A536 60-40-18
Bearing cover	360.1	01	A 48 CL 30	A 48 CL 30	A 48 CL 30
Bearing cover	360.2	01	A 48 CL 30	A 48 CL 30	A 48 CL 30
Flat gasket	400.1	02	Sheet gasket	Sheet gasket	Sheet gasket
Flat gasket	400.2	02	Sheet gasket	Sheet gasket	Sheet gasket
Flat gasket	400.3	(13)	Sheet gasket	Sheet gasket	Sheet gasket
Gasket	411.1	01	Brass	Brass	Brass
Gasket (1)	411.31	01	Graphite / CrNi	Graphite / CrNi	Graphite / CrNi
Gasket (1)	411.32	01	Graphite / CrNi	Graphite / CrNi	Graphite / CrNi
O'Ring	412.1	01	NB 70	NB 70	NB 70
O'Ring (4)	412.2	01	NB 70	NB 70	NB 70
O'Ring (4)	412.3	01	NB 70	NB 70	NB 70
Radial shaft seal ring	421.1	01	NB 70 / Steel	NB 70 / Steel	NB 70 / Steel
Radial shaft seal ring	421.2	01	NB 70 / Steel	NB 70 / A Steel	NB 70 / Steel
Gland cover	452	01	A 48 CL 30	A 48 CL 30	A743 CF8M
Stuffing box ring	454	01	A 48 CL 30	A 48 CL 30	AISI 316
Neck bush	456	01	A 48 CL 30	A 48 CL 30	AISI 316
Lantern ring (1)	458	01	A 48 CL30	A 48 CL30	AISI 316
Gland packing	461	(2)	(3)	(3)	(3)
Casing wear ring	502	01	A 48 CL 30	A 48 CL 30	A743 CF 8M
Thower	507	01	A743 CF8M	A743 CF8M	A743 CF 8M
Sleeve (4)	520	01	SAE 1045	SAE 1045	AISI 316
Shaft protecting sleeve	524	01	A 48 CL 30	A 48 CL 30	AISI 316
Washer (4)	550.1	02	AISI 316	AISI 316	AISI 316
Washer	550.2	01	SAE 1020	SAE 1020	SAE 1020
Spacer disc	551	01	SAE 1035	SAE 1035	SAE 1035
Spacer disc (1)	551.31	01	AISI 316	AISI 316	AISI 316
Spacer disc (1)	551.32	01	AISI 316	AISI 316	AISI 316
Grooved pin	561.1	01	AISI 316	AISI 316	AISI 316
Constant level oiler	638	01	Glass	Glass	Glass
Venting	672	01	Aluminium / steel	Aluminium / steel	Aluminium / steel
Hexagon head bolt	901.1	(5)	SAE 1020/5.6	SAE 1020/5.6	AISI 316
Hexagon head bolt	901.2	(6)	SAE 1020/5.6	SAE 1020/5.6	SAE 1020/5.6
Hexagon head bolt	901.3	01	SAE 1020/5.6	SAE 1020/5.6	SAE 1020/5.6
Stud	902.1	(7)	SAE 1020	SAE 1020	AISI 316
Stud	902.2	(8)	AISI 316	AISI 316	AISI 316
Stud	902.3	04	SAE 1020/5.6	SAE 1020/5.6	SAE 1020/5.6
Threaded plug	903.1	01	SAE 1020/5.6	SAE1020/5.6	AISI 316
Threaded plug	903.2	02	SAE 1020/5.6	SAE 1020/5.6	AISI 316

Designation	Part nº	Qty	Material combination		
			00	01	07
Threaded plug	903.3	01	SAE 1020/5.6	SAE 1020/5.6	AISI 316
Threaded plug	903.4	02	SAE 1020/5.6	SAE 1020/5.6	AISI 316
Threaded plug	903.5	01	SAE 1020/5.6	SAE 1020/5.6	SAE 1020/5.6
Grub screw	904	01	AISI 316	AISI 316	AISI 316
Plug	916	02	Plastic	Plastic	Plastic
Nut	920.1	(7)	SAE 1020	SAE 1020	AISI 304
Nut	920.2	(8)	AISI 304	AISI 304	AISI 304
Nut	920.3	04	SAE 1020/6	SAE 1020/6	SAE 1020/6
Impeller nut (4)	922.1	01	SAE 1045	SAE 1045	AISI 316
Counter nut (4)	922.2	01	SAE 1045	SAE 1045	AISI 316
Impeller nut (34)	922.3	01	SAE 1045	SAE 1045	AISI 316
Bearing nut	923	01	SAE 1045	SAE 1045	SAE 1045
Lockwasher	931.1	01	Spring steel	Spring steel	Spring steel
Lockwasher (4)	931.2	01	Spring steel	Spring steel	Spring steel
Circlip	932.1/2	02	Spring steel	Spring steel	Spring steel
Key	940.1	01	SAE 1045	SAE 1045	SAE 1045
Key	940.2	01	SAE 1045	SAE 1045	SAE 1045
Plate	970.1/2	02	AISI 304	AISI 304	AISI 304
Plate (10)	970.3/4	02	AISI 304	AISI 304	AISI 304
Plate (9)	970.5	01	AISI 304	AISI 304	AISI 304
Plate (11)	970.6	01	AISI 304	AISI 304	AISI 304

Table 05

- (1) No applicable for sealing code 4 and 5.
- (2) Quantity = 4 for sealing code 0, 2, 3, 4 and 6.
Quantity = 5 for sealing code 5.
- (3) Applicable for the follow materials: • Acrylic fibre with PTFE
• PTFE with graphite • Lubricated PTFE • Carbon yarn
• Aramid yarn with PTFE and graphite • Flexible graphite
- (4) Applicable only for packing execution
- (5) Quantity = 2 for size 250-315;
Quantity = 4 for pumps with impeller diameter 315, 400 and 500 mm
- (6) Quantity = 6 for bearing brackets: P25/62S, P35/80S and P45/120S / 8 for bearing brackets P55/140S and P65/160S
- (7) Quantity = 16 for pumps with impeller diameters 400 mm
Quantity = 12 for pumps with impeller diameters 315 mm
Quantity = 20 for pumps with impeller diameters 500 mm.
- (8) Quantity = 2 for pumps with packing and 4 for pumps with mechanical seal
- (9) Applicable only for sealing code 2, 3 and 6.
- (10) Applicable for cooling execution.
- (11) Applicable only for sealing code 3.
- (12) Applicable only for sizes 40-315 and 50-315.
- (13) Quantity = 2 for every sizes, except for sizes 40-315 and 50-315 (Quantity = 0) y 150-500 (Quantity = 1).
- (14) No applicable for size 150-500.
- (15) Applicable only for size 150-500.
- (16) Applicable only for sealing codes 2, 3, 4 and 5.

27. Parts interchangeability table

Pump size	Bearing bracket	Designation		Part N°	Volute casing 1)	Discharge cover	Support foot	Shaft	Impeller 1)	Bearing	Bearing	Bearing bracket	Bearing bracket lantern	Bearing cover	Gland cover	Stuffing box ring	Neck bush	Lantern ring	Gland packing	Casing wear ring	Thrower	Shaft protecting sleeve	Impeller nut
32-125	P 25/62S			102		1	1						1							1			
32-160				163		2	2						2							1			
40-160						2	2						2							2			
50-160						2	3	1			1	1	1	2	1	1	1	1	1	3	1	1	1
32-200						3	3							3						1			
40-200						3	3							3						2			
50-200						3	3							3						3			
65-160	P 35/80S					4	4						4							7			
80-160						4	5						4							9			
65-200						5	5						5							8			
80-200						5	5						5							10			
100-200						5	6						5							12			
32-250						6	5	2			1	1	2	6	2	2	2	2	2	6	2	2	2
40-250						6	5							6						5			
50-250						6	5							6						4			
65-250						6	6							6						8			
80-250						6	7							6						11			
40-315						7	6							7						5			
50-315						7	7							7						7			
100-250	P 45/120S					8	8						6							13			
125-250						8	9						6							15			
150-250						8	10						6							16			
65-315						9	8						7							9			
80-315						9	9						7							12			
100-315						9	9	3			2	2	3	7	3	3	3	3	3	14	3	3	3
125-315						9	10							7						16			
80-400						10	10							8						27			
100-400						10	10							8						14			
125-400						10	11							8						15			

Pump size	Bearing bracket	Designation		Part N°	Volute casing 1)	Discharge cover	Support foot	Shaft	Impeller 1)	Bearing	Bearing	Bearing bracket	Bearing bracket lantern	Bearing cover	Gland cover	Stuffing box ring	Neck bush	Lantern ring	Gland packing	Casing wear ring	Thrower	Shaft protecting sleeve	Impeller nut
200-250	P 55/140S			11	13	4							9							17			
150-315				12	12	4							10							18			
200-315				12	13	4							10							19			
250-315				12	16	5							10							21			
150-400				13	12	4		3	3	4	11	4	4	4	4	4	4	4	4	18	4	4	4
200-400				13	13	4							11							20			
150-500				14	14	4							12							18			
200-500				14	17	4							12							28			
250-400	P 65/160S			15	17	6			4	4	5	11	5	5	5	5	5	5	5	22	5	5	5
250-500				16	15							12								23			
300-400	P 80/200S			17	15	7			5	5	6	13	6	6	6	6	6	6	6	22	6	6	6

Table 06

1) Components cannot be used for other pump sizes.

1	1
---	---

 Same numbers
(interchangeable parts)

1	2
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 Different numbers
(non interchangeable parts)

28. Recommended spare parts

Spare parts recommended for a continuous service of 2 years according to Standard DIN 24296

Part n°	Designation	Number of pumps (including stand-by ones)							
		1	2	3	4	5	6 e 7	8 e 9	10 or more
		Quantity of spare parts							
210	Shaft	1	1	1	2	2	2	3	30%
230	Impeller	1	1	1	2	2	2	3	30%
320 / 322	Radial ball bearing	1	1	1	2	2	2	4	50%
330	Bearing bracket	-	-	-	-	-	-	1	2 units.
421	Radial shaft seal ring	1	2	3	4	5	6	8	50%
461	Gland packing	1	4	4	6	6	6	8	40%
502	Casing wear ring	1	2	2	2	3	3	4	50%
524	Shaft protecting sleeve	1	1	1	1	2	2	2	20%
	Gasket repair set	4	4	6	8	8	9	12	150%
	O-Ring repair set	4	4	6	8	8	9	12	150%
Version with mechanical seal									
	Gasket repair set	4	4	6	8	8	9	10	150%
	O-ring repair set	4	4	6	8	8	9	12	150%
	Complete mec.seal	2	2	2	3	3	3	4	20%

Table 07 – Recommended spare parts

KSB reserves the right to modify the information presented in this manual without prior notice.

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