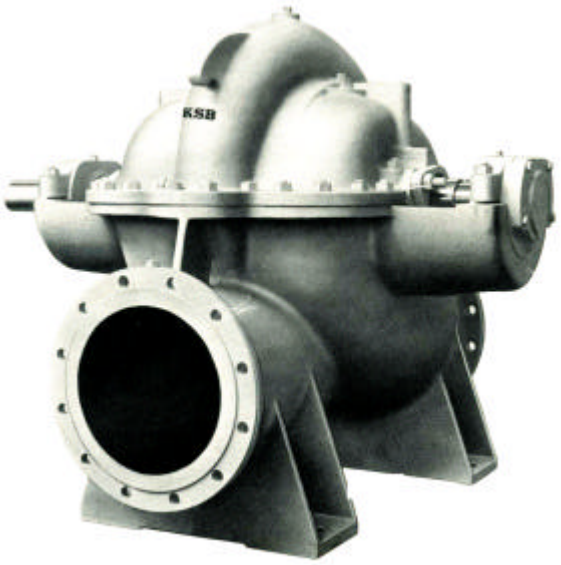
KSB RDL



Axially split volute casing pump acc. to Directive 98/37/EC

Works Nº: _____

Type Series: _____

These operating instructions contain fundamental information and precautionary notes. Please read the manual thoroughly prior to installation of unit, electrical connection and commissioning. It is imperative to comply with all other operating instructions referring to components of individual units.

This manual shall always be kept close to the unit's location of operation or directly on the pump set.

0. Introduction

KSB has supplied you an equipment that has been designed and manufactured with the latest technology.
Due to its simple and tough construction, it will need little maintenance. With the aim to provide our clients with satisfactory, trouble free operation, we recommend to install and maintain our equipment according to the instructions contained in this service manual.

This manual has been prepared to inform the end user about construction and operation of our pumps, describing the proper procedures for handling and maintenance.
We recommend that this manual should be handed over to the maintenance supervision.
The equipment must be used at operation conditions for which it has been selected, such as: flow rate, total head, speed, voltage, frequency and temperature of pumped liquid.

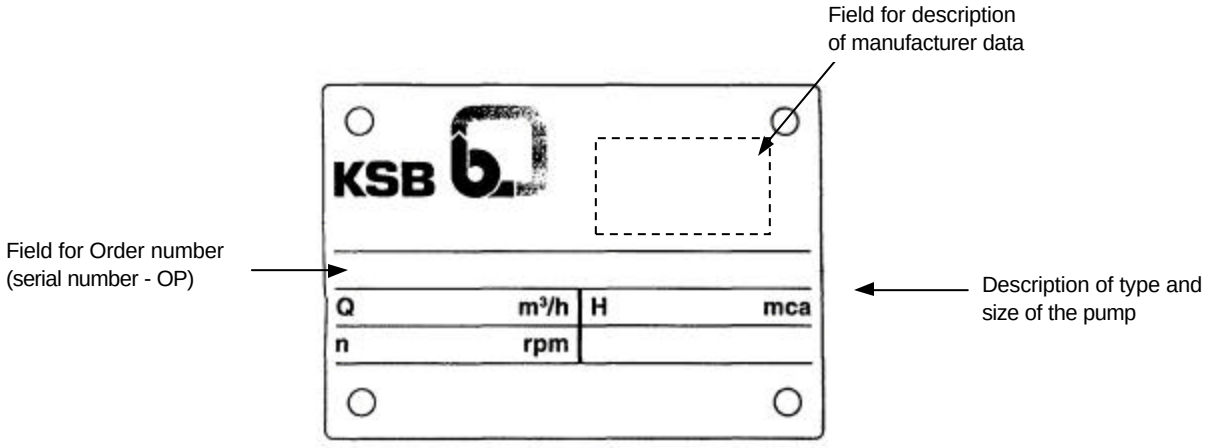


Fig.1 – Nameplate

For requests about the equipment, or when ordering spare parts, please mention the type of pump and the Production Order number. This information can be obtained from the nameplate of each pump. If the nameplate is not available, the OP number is stamped in low relief on the suction flange and on the discharge flange you may find the impeller diameter.

ATTENTION: This instruction manual contains very important recommendations and instructions. Must be carefully read before installation, electrical connection, first start up and maintenance.

1 General

Caution This KSB pump has been developed in accordance with state-of-the-art technology; it is manufactured with utmost care and subject o continuous quality control.

These operating instructions are intended to facilitate familiarization with the pump and its designated use.
The manual contains important information for reliable, proper and efficient operation. Compliance with the operating instructions is of vital importance to ensure reliability and a long service life of the pump and to avoid any risks.
These operating instructions do not take into account local regulations; the operator must ensure that such regulations are strictly observed by all, including the personnel called in for installation.

This pump / unit must not be operated beyond the limit values specified in the technical documentation for The medium handled, capacity, speed, density, pressure, temperature and motor rating. Make sure that operation is in accordance with the instructions laid down in this manual or in the contract documentation. (Contact the manufacturer, if required). The nameplate indicates the type series / size, main operating data and works number; please quote this information in al queries, repeat orders and particularly when ordering spare parts.
If you need any additional information or instructions exceeding the scope of this manual or in case of damage, please contact KSB's nearest customer service center.
For noise characteristics please refer to section 4.4.7.

2 Safety

These operating instructions contain fundamental information which must be complied with during installation, operation and maintenance. Therefore this operating manual must be read and understood both by the installing personnel and the responsible trained personnel / operators prior to installation and commissioning, and it must always be kept dose to the location of operation of the machine / unit for easy access.
Not only must the general safety instructions laid down in this chapter on "Safety" be complied with, but also the safety instructions outlined under specific headings, particularly if the pump/unit is operated in hazardous areas (see section 2.9).

2.1 Marking of instructions in the manual

The safety instructions contained in this manual whose non-observance might cause hazards to persons are specially marked with the symbol

general hazard sign to ISO 7000-0434

The electrical danger warning sign is

safety sign to IEC 417-5036
and special instructions concerning explosion protection are marked

The word

Caution

is used to introduce safety instructions whose non-observance may lead to damage to the machine and its functions.
Instructions attached directly to the machine, e.g.
- arrow indicating the direction of rotation
- markings for fluid connections

must always be complied with and be kept in perfectly legible condition at all times.

2.2 Personnel qualification and training

All personnel involved in the operation, maintenance, inspection and installation of the machine must be fully qualified to carry out the work involved.
Personnel responsibilities, competence and supervision must be clearly defined by the operator. If the personnel in question is not already in possession of the requisite know-how, appropriate training and instruction must be provided. If required, the operator may commission the manufacturer **/** supplier to take care of such training. In addition, the operator is responsible for ensuring that the contents of the operating instructions are fully understood by the responsible personnel.

2.3 Non-compliance with safety instructions

Non-compliance with safety instructions can jeopardize the safety of personnel, the environment and the machine itself. Non-compliance with these safety instructions will also lead to forfeiture of any and all rights to claims for damages.
In particular, non-compliance can, for example, result in:

- failure of important machine **/** plant functions
- failure of prescribed maintenance and servicing practices
- hazard to persons by electrical, mechanical and chemical effects
- hazard to the environment due to leakage of hazardous substances.


Ex symbol relates to additional requirements which must be adhered to when the pump is operated in hazardous areas.

2.4 Safety awareness

It is imperative to comply with the safety instructions contained in this manual, the relevant national health and safety regulations and the operator's own internal work, operation and safety regulations.

2.5 Safety instructions for the operator / user

- Any hot or cold components that could pose a hazard must be equipped with a guard by the operator.
- Guards which are fitted to prevent accidental contact with moving parts (e.g. coupling) must not be removed whilst the machine is operating.
- Leakage (e.g. at the shaft seal) of hazardous media handled (e.g. explosive, toxic, hot) must be contained so as to avoid any danger to persons and the environment. Pertinent legal provisions must be adhered to.
- Electrical hazards must be eliminated. (In this respect refer to the relevant safety regulations applicable to different countries and/or the local energy supply companies.)
- Any components in contact with the pumped product, especially in the case of abrasive products, shall be inspected for wear at regular intervals and replaced by original spare parts (see section 2.7) in due time.


If the pumps/units are located in hazardous areas, it is imperative to make sure that unauthorized modes of operation are prevented. Non-compliance may result in the specified temperature limits being exceeded.

2.6 Safety instructions for maintenance, inspection and installation work

The operator is responsible for ensuring that all maintenance, inspection and installation work be performed by authorized, qualified specialist personnel who are thoroughly familiar with the manual.
The pump must have cooled down to ambient temperature. it must be drained and its pressure must be released.
Work on the machine must be carried out only during standstill. The shutdown procedure described in the manual for taking the machine out of service must be adhered to without fail.
Pumps or pump units handling media injurious to health must be decontaminated.
Immediately following completion of the work, all safety-relevant and protective devices must be re-installed and/or reactivated.
Please observe all instructions set out in the chapter on "Com missioning" before returning the machine to service.

2.7 Unauthorized modification and manufacture of spare parts

Modifications or alterations of the machine are only permitted after consultation with 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.

2.8 Unauthorized modes of operation

The warranty relating to the operational reliability and safety of the pump / unit supplied is only valid if the machine is used in accordance with its designated use as described in the following sections. The limits stated in the data sheet must not be exceeded under any circumstances.

2.9 Explosion protection

If the pumps/units are installed in hazardous areas, the measures and instructions given in the following sections 2.9.1 to 2.9.6 must be adhered without fail, to ensure explosion protection.

2.9.1 Unit fill

It is assumed that the system of suction and discharge lines and thus the wetted pump internal are completely filled with the product to be handled at all times during pump operation, so that an explosive atmosphere is prevented.

If the operator cannot warrant this condition, appropriate monitoring devices must be used.

N.B.: In addition, it is imperative to make sure that the seal chambers, auxiliary systems of the shaft seal and the heating and cooling systems are properly filled.

2.9.2 Marking

The marking on the pump only refers to the pump part, i.e. the coupling and motor must be regarded separately. The coupling must have an EC manufacture's declaration. The driver must be regarded separately.
Example of marking on the pump part: Ex II 2 G T1 - T5.
The marking indicates the theoretically available temperature range as stipulated by the respective temperature classes. The temperatures permitted for the individual pump variants are outlined in section 2.9.5.

2.9.3 Checking the direction of rotation (see also 6.1.4)

If the explosion hazard also exists during the installation phase, the direction of rotation must never be checked by starting starting up the unfilled pump unit, even for a short period, to prevent temperature increases resulting from contact between rotating and stationary components.

2.9.4 Pump operating mode

Make sure that the pump is always started up with the suction-side shut-off valve fully open and the discharge-side shut-off valve slightly open. However, the pump can also be starded up against a closed swing check valve. The discharge-side shut-off valve shall be adjusted to comply with the duty point immediately following the run-up process (see 6.1).
Pump operation with the shut-off valves in the suction and/or discharge pipes closed is not permitted.

N.B.: In this condition, there is a risk of the pump casing taking on high surface temperatures after a very short time, due to a rapid temperature rise in the pumped product inside the pump.
Additionally, the resulting rapid pressure build-up inside the pump may cause excessive stresses on the pump materials or even bursting.
The minimum flows indicated in tables 4.3 and 4.3.1 refer to water and water-like liquids. Longer operating periods with these liquids and at the flow rates indicated will not cause an additional increase in the temperatures on the pump surface. However, if the physical properties of the fluids handled are different from water, it is essential to check if an additional heat build-up may occur and if the minimum flow rate must therefore be increased.
To check, proceed as described in tables 4.3 and 4.3.1.
In addition, the instructions given in section 6 of this operating manual must be observed.

Both gland packings and mechanical seals may exceed the specified temperature limits if run dry. Dry running may not only result from an inadequately filled seal chamber, but also from excessive gas content in the fluid handled.
Pump operation outside its specified operating range may also result in dry running.
In hazardous areas, gland packings shall only be used if combined with a suitable temperature monitoring device.

2.9.5 Temperature limits

In normal pump operation, the highest temperatures are to be expected on the surface of the pump casing, at the shaft seal and in the bearing areas. The surface temperature at the pump casing corresponds to the temperature of the fluid handled.
If the pump is heated, it must be ensured that the temperature classes stipulated for the plant are observed.
In the bearing bracket area, the unit surfaces must be freely exposed to the atmosphere.

In any case, responsibility for compliance with the specified fluid temperature (operating temperature) lies with the plant operator. The maximum permissible fluid temperature depends on the temperature class to be complied with.
Due to its design, temperature limit for pumps RDL could be acc. to temperature class T4 to EN 13463-1 and the resulting theoretical temperature limit of the fluid handled is 120 ºC. In stipulating this temperature, any temperature rise in the shaft seal area has already been taken into account.
Note: operation with liquids above 105 ºC is permitted only after KSB approval.

Safety note:

Caution The permissible operating temperatures of the pump in question is indicated on the data sheet. If the pump is to be operated at a higher temperature, the data sheet is missing or if the pump is part of a pool of pumps, the maximum permissible operating temperature must be inquired from the pump manufacturer.

Based on an ambient temperature of 40ºC and proper maintenance and operation, compliance with temperature class T4 is warranted in the area of the rolling element bearings.
A special design is required for compliance with temperature class T5 in the bearing area. In such cases, and if ambient temperature exceeds 40ºC, contact the manufacturer.

2.9.6 Maintenance

Ex Only a pump unit which is properly serviced and maintained in perfect technical condition will give safe and reliable operation.
This also applies to the reliable function of the rolling element bearings whose actual lifetime largely depends on the operating mode and operating conditions.
Regular checks of the lubricant and the running noises will prevent the risk of excessive temperatures as a result of bearings running hot or defective bearing seals (also see section 7.3).
The correct function of the shaft seal must be checked regularly. Any auxiliary systems installed must be monitored, if necessary, to make sure they function correctly.
Gland packings must be tightened correctly, to prevent excessive temperatures due to packing running hot.

3. Transport and interim storage

3.1 Transport

Transportation of the motor-pump assembly or only pump, should be performed with skill and good sense by trained personnel observing safety regulations. Lift only motor with eyebolt, never use it to lift motor-pump assembly. In the pump upper casing there are 2 hooks, which should be used only for disassembly and transport of this part. Do not transport the pump or motor-pump assembly with these hooks.
The pump can be transported according to fig.2 by ropes or steel cables crossed in the neck of suction and discharge flanges. For transportation of set with common baseframe for pump and motor (according to figure 3), in case of baseframe deformation possibility, transport pump, motor and baseframe separately.

 If the pump/unit slips out of the suspension arrangement, it may cause personal injury and damage to property!

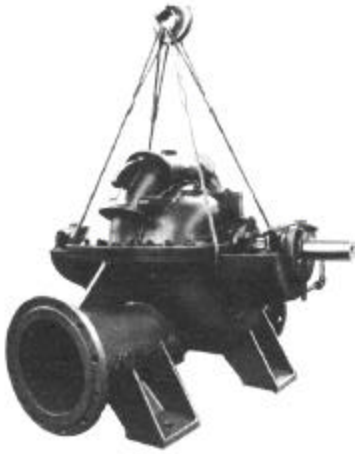


Fig.2 – Transport of pump through seats of bearing casings

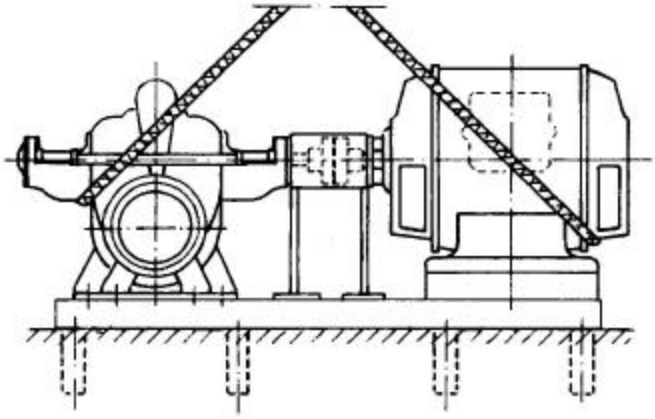


Fig.3 – Transport of complete set with common baseframe for pump and motor (since there is no possibility of baseframe deformation due to its excessive length)

Note: Take care to not lose or damage coupling guard or foundation bolts during transport.

3.2 Interim Storage (indoors) / Preservation

KSB and its Dealer Network perform the following procedures of service and storage until effective delivery of the pump. It is client responsibility to continue with these procedures after receiving the pump.
When a performance test after the pump sale is not applied, the machined areas in contact with the pumped liquid which are not painted, receive an application of RUSTILO DW-301 by brush.
When the pump is equipped with gland packing subject to a performance test, it is drained after test without disassembling it, and then filled up with RUSTILO DW-301 rotating its rotor assembly to improve the RUSTILO application. After that the pump is drained again.
On the shaft exposed areas, a brush application of TECTYL 506 is made.
On oil lubricated pump bearing brackets, bearings receive a layer of MOBILARMA 524 by spray.

3.2.1 Additional procedure for storage

- Pumps stored for periods exceeding one year should be re-protected every 12 months. They must be disassembled, cleaned and the whole process described above should be repeated.
- Grease lubricated bearings are charged with grease and do not need maintenance.
- Gland packing equipped pumps should have their packing removed before storage.
- Mechanical seals should be cleaned with dry compressed air. No other liquid or material must be applied to them, in order to prevent damage to the secondary sealing parts, such as o-rings and gaskets.
- All connections, such as inlets for liquids from external sources, priming, draining, flushing / quench and cooling should be closed. Suction and discharge flanges should be covered to prevent the entry of foreign bodies.
- Stored pumps should be turned by hand every 15 days. If it is difficult to move them by hand, use a pipe adjustable spanner wrench, protecting the shaft surface at the place of application.
- Wash exposed surfaces with gasoline or kerosene before applying the protecting liquids.
- Characteristics of the used protecting liquids:

Protecting Liquid	Thickness of applied layer mm (in)	Drying Time	Removal	Manufacturer
TECTYL 506	80 to100 (.003 to .004)	½ up to 1 hour	Gasoline/Benzene/Diesel Oil	BRASCOLA
RUSTILO DW301	6 to 10 (.0002 to .0004)	1 up to 2 hours	Gasoline/Benzene	CASTROL
MOBILARMA 524	≤ 6 (.0002)	Does not dry	Not necessary	MOBIL OIL

Table 2 – Protecting liquids

4. Description of the product

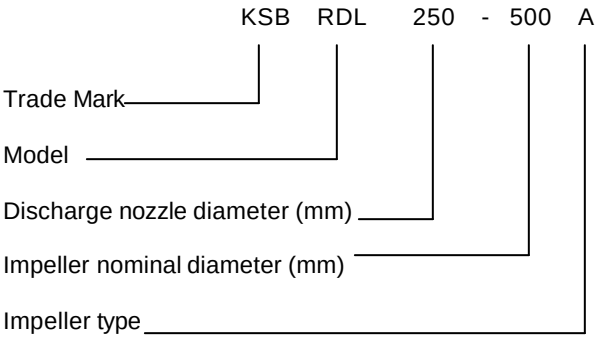
Horizontal single stage, axially split volute casing pump with double entry radial impeller.
Drive shaft end of the pump can be fitted either on the left or right end side.
Flanges according to DIN or ANSI.

4.1 Technical specification

It is recommended for pumping clean or cloudy liquids in the following application:

- water supply
- drainage
- irrigation
- chemical and petrochemical industry
- air conditioning
- paper and cellulose industry
- fire-fighting

4.2 Designation



4.3. Technical data (Metric units)

Constructive data \ Pump size		Unities	125-140	125-170	125-200	125-250	125-310	150-250	150-280	150-310	150-340	150-400	150-430	150-500	200-280	200-340	200-400	200-500	200-620	250-280	250-340	250-400	250-500	250-620	300-280	300-340	300-400	300-500	300-620	350-500	350-620	400-390	400-440	400-480	400-540	400-620	400-850	500-510	500-640	500-700	500-790	500-890	600-540	600-620	600-710	600-830	700-590	700-710	700-820	800-740	800-840	800-970
Maximum discharge pressure	A48CL30	bar	10	10	16	25	25	16	10	25	10	10	16	16	10	10	16	16	25	10	10	10	16	25	10	10	16	16	25	16	25	10	10	16	16	25	25	10	10	16	25	25	10	10	16	16	10	10	16	10	10	10
	A536-60-40-18		25	25	25	40	40	40	16	40	16	25	25	40	16	16	25	25	40	16	16	25	25	40	16	25	25	25	40	25	40	16	16	25	25	40	40	16	25	25	25	25	16	16	25	25	16	16	16	16	16	16
Maximum pressure hydrostatic test	A48CL30	bar	According to Hydraulic Institute																																			11	18	18	25	28	11	13,5	18	18	10	12	18	10	11	13
	A536-60-40-18																																					18	25	28	35	36	20	22	27	27	18	20	24	16	17	20
Double volute pump													X					X	X					X				X	X	X	X				X	X	X		X	X	X			X			X				
Minimum flow	With single volute H≤50m		Q > 0,25 Qot.																																																
	With single volute H>50m		Q > 0,40 Qot.																																																
	With double volute		Q > 0,25 Qot.																																																
Maximum temperature		ºC	105º ⑤																																																
Maximum rotation ①②	A	rpm	3650						1800	3650	1800								② 1800				② 1800				② 1800	② ②	1800 ②		1800			1450	1200	⑥	1200		---	1200										900			
	B																												1800	---	---				1800																		
Width in the impeller end (b2) see fig. 4	A	mm	40,8	40,8	---	28	24	44	50,6	26	38,4	40	22	33	66	50,4	38	39	30	76	65,5	60	54,8	43	102	80	64	62	53	70	84	112	93	86	89,4	80	45	136	100	116	100	---	153	146	130	115	231	165	134	210	206	174
	B		33	---	24	22	16	---	40	31	36,8	32	19	30	52	56,6	26	26	30	85,4	56	50	42	32	86	84	62	58,8	47	---	---	106	94	100	85	81	---	129	108	100	104	88	143	138	120	103	148	157	128	190	193	160
Maximum diameter for solid crossing	A	mm	23	22	---	16	17	23	28	17	29	26	22	21	36	33	26	25	23	43	39	38	39	34	55	48	43	42	43	48	55	56	61	51	56	58	48	75	50	75	68	---	86	73	75	72	114	82	---	---	---	87
	B		18	---	16	13	17	---	30	22	25	26	18	17	30	30	24	24	20	48	33	32	33	30	46	42	31	40	40	---	---	76	47	58	50	56	---	57	54	50	71	63	47	77	60	65	79	78	--	95	114	81
Interchangeability between impellers A and B			simple - change																											Wear ring change without machining							Wear ring change with re-machining														
Sealing clearance in the diameter (d2 – d1) see fig.4	A	mm	0,70				0,75	0,85	0,75	0,85	0,80	0,85				0,95					1,0				1,1		1,2	1,1				1,2	---	1,2	1,3	1,2	1,4	1,4	---	1,4	1,4	1,4	1,5	1,5	1,5	1,5	1,6	1,7	1,7
	B																															1,2	1,2	---	1,2	1,2	---	1,4	1,5	1,3	1,3	1,4	1,3	1,4	1,5	1,5	1,6	1,6	1,6
Rotation direction			Clockwise or counter clockwise according to position of drive (see fig. 14 and 15)																																															
Flanges (function of end pressure)	DIN		DIN EN 1092 – 2 types 21 Form B - PN16 or DIN EN1092 – 2 types 21 Form B – PN25																																															
	ANSI		B 16.1 125 lb FF or 250 lb RF																																														
Permissible forces and moments in the flanges (see fig.5) ④	Fx, Fy, Fz	N	1470					2450						2940			3920										4900							5390				5880					7840			9800				10780		11760
	Mx, My, Mz	Nm	980					1470		1960							2695									2940							3430				3920					4900			7840				8820		
Bearings (Clearance C3)	Free side		6307					6308				6307		6310				6312					6314				6316		6320	6314	6316		6318	6320	6324	6316	6320	6322	6324	6328	6316	6318	6322	6324	6320	6322	6326	6322	6324	6328
	Drive side		6307					9308				6307		6310				6312					6314				6316		NU																					
																													320	314	316		318	320	324	316	320	322	324	328	316	318	322	324	320	322	326	322	324	328
Lubrication	type		grease ③																																															
	Capacity for bearing	g	27					36				27		54				72					90				110		600	90	110		380	535	780	110	635	670	780	940	110	380	670	780	535	670	870	670	780	940
Max. admissible P/n ⑦	CV rpm		0,074					0,113				0,074		0,228				0,386					0,63				0,93		0,53	0,83	0,50	0,78		1,12	1,59	2,83	0,78	1,59	2,16	2,83	4,62	0,78	1,12	2,16	2,83	1,59	2,16	2,36	2,16	2,83	4,63
GD_2 with water		kgm^2	0,07	0,12	0,17	0,30	0,53	0,41	0,56	0,75	0,97	1,49	1,89	2,94	0,88	1,57	2,55	5,03	9,53	1,2	2,22	3,64	7,37	14,27	1,68	3,0	4,97	10,22	19,97	14,0	24,0	6,25	9,42	12,3	17,9	27,9	105	19,5	41,4	55,8	83,3	125	29,1	46,4	72,8	121	51,5	94,0	141	127	185	289
Shaft seal housing	ØD	mm	80					85				80		95				112					122				150		170	122	150		160	170	200	150	170	180	200	230	150	160	180	200	170	200	210		230	
	Ød		55					60				55		70				80					90				110		130	90	110		120	130	150	110	130	140	150	180	110	120	140	150	130	150	160		180	
	L		95					95				95		95				125					125				150		150	125	150		150	150	180	150	150	150	180	180	150	150	150	180	150	180	180		180	
	⍁		12 x 12															16 x 16									20 x 20			16x16	20 x 20				25x25	20 x 20			25x25	20 x 20			25x25	20x20	25 x 25					
Net weight		kg	155	156	158	160	165	241	242	263	265	276	337	360	338	356	373	524	797	465	504	520	725	985	695	785	926	1165	1515	1506	2120	1077	1375	1460	1777	2135	4500	1528	2301	2967	3483	4659	2725	2961	3427	4700	4043	5329	6075	6557	6624	7809

Table 1

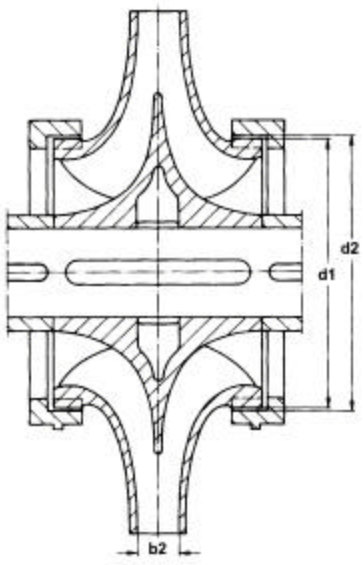
① See item 6.2.1, peripherical speed
② Pumps 200-620A, 250-620A, 300-500A, 300-620A and 350-620A can operate in 1750rpm, with reinforced bearings, subject to release by the KSB Product Department
③ For lubrication with oil, please consult KSB Product Department
④ Values valid for materials A48CL30 and NI-Resist
For material: A536 60-40-18 multiply the values by 1.4
Casted carbon steel multiply values by 1.7
Casted chrome steel, please consult KSB
⑤ For higher temperatures, consult KSB
⑥ Maximum rotation = 880rpm for hydraulic A
⑦ For material SAE 1045

4.3.1 Technical data (English units)

Constructive data \ Pump size		Units	125-140	125-170	125-200	125-250	125-310	150-250	150-280	150-310	150-340	150-400	150-430	150-500	200-280	200-340	200-400	200-500	200-620	250-280	250-340	250-400	250-500	250-620	300-280	300-340	300-400	300-500	300-620	350-500	350-620	400-390	400-440	400-480	400-540	400-620	400-850	500-510	500-640	500-700	500-790	500-890	600-540	600-620	600-710	600-830	700-590	700-710	700-820	800-740	800-840	800-970
Maximum discharge pressure	A48CL30	psi	145	145	232	362	362	232	145	362	145	145	232	232	145	145	232	232	362	145	145	145	232	362	145	145	232	232	362	232	362	145	145	232	232	362	362	145	145	232	362	362	145	145	232	232	145	145	232	145	145	145
	A536-60-40-18		362	362	362	580	580	580	232	580	232	362	362	580	232	232	362	362	580	232	232	362	362	580	232	362	362	362	580	362	580	232	232	362	362	580	580	232	362	362	362	362	232	232	362	362	232	232	232	232	232	232
Maximum pressure hydrostatic test	A48CL30	psi	According to Hydraulic Institute																																			160	260	260	362	28	160	13,5	260	260	145	174	260	145	160	188
	A536-60-40-18																																					260	362	406	507	522	290	319	390	390	260	290	348	232	246	290
Double volute pump													X					X	X				X				X	X	X	X					X	X	X		X	X	X			X			X				
Minimum flow	With single volute H≤164ft		Q > 0,25 Qot.																																																	
	With single volute H>164ft		Q > 0,40 Qot.																																																	
	With double volute		Q > 0,25 Qot.																																																	
Maximum temperature		ºF	221º ⑤																																																	
Maximum rotation ①②	A	rpm	3650					1800	3650	1800									② 1800					② 1800				② ②	1800	②	1800				1450	1200	⑥	1200			---	1200									900		
	B																												1800	---	---				1800																			
Width in the impeller end (b2) see fig. 4	A	in	1.61	1.61	---	1.10	.945	1.73	1.99	1.02	1.51	1.57	.866	1.30	2.60	1.98	1.50	1.54	1.18	2.99	2.58	2.36	2.16	1.69	4.02	3.15	2.52	2.44	2.09	2.76	3.31	4.41	3.66	3.39	3.52	3.15	1.77	5.35	3.94	4.57	3.94	---	6.02	5.75	5.12	4.53	9.09	6.50	5.28	8.27	8.11	6.85
	B		1.30	---	.945	.866	.630	---	1.57	1.22	1.45	1.26	.748	1.18	2.04	2.23	1.02	1.02	1.18	3.36	2.20	1.97	1.65	1.26	3.39	3.31	2.44	2.31	1.85	---	---	4.17	3.70	3.94	3.35	3.19	---	5.08	4.25	3.94	4.09	3.46	5.63	5.43	4.72	4.06	5.83	6.18	5.04	7.48	7.60	6.30
Maximum diameter for solid crossing	A	in	.906	.866	---	.630	.669	.906	1.10	.669	1.14	1.02	.866	.827	1.42	1.30	1.02	.984	.906	1.69	1.54	1.50	1.54	1.34	2.17	1.89	1.69	1.65	1.69	1.89	2.17	2.20	2.40	2.01	2.20	2.28	1.89	2.95	1.97	2.95	2.68	---	3.39	2.87	2.95	2.83	4.49	3.23	---	---	---	3.43
	B		.709	---	.630	.512	.669	---	1.18	.866	.984	1.02	.709	.669	1.18	1.18	.945	.945	.787	1.89	1.30	1.26	1.30	1.18	1.81	1.65	1.22	1.57	1.57	---	---	2.99	1.85	2.28	1.97	2.20	---	2.24	2.13	1.97	2.80	2.48	1.85	3.03	2.36	2.56	3.11	3.07	--	3.74	4.49	3.19
Interchangeability between impellers A and B			simple - change																													Wear ring change without machining							Wear ring change with re-machining														
Sealing clearance in the diameter (d2 – d1) see fig.4	A	in	.028					.030	.033	.030	.033	.031	.033					.037				.039					.043		.047	.043				.047	---	.047	.051	.047	.055	.055	---	.055	.055	.055	.059	.059	.059	.059	.063	.067	.067
	B																																	.047	.047	---	.047	.047	---	.055	.059	.051	.051	.055	.051	.055	.059	.059	.063	.063	.063
Rotation direction			Clockwise or counter clockwise according to position of drive (see fig. 14 and 15)																																																	
Flanges (function of end pressure)	DIN		DIN EN 1092 – 2 types 21 Form B - PN16 or DIN EN1092 – 2 types 21 Form B – PN25																																																
	ANSI		B 16.1 125 lb FF or 250 lb RF																																															
Permissible forces and moments in the flanges (see fig.5) ④	Fx, Fy, Fz	lbf	330					550					660		880													1100					1210				1320					1760		2200				2420		2640	
	Mx, My, Mz	ft-lb	720			1080		1440					1980							2160												2530				2890					3610		5780					6500		
Bearings (Clearance C3)	Free side		6307			6308						6307	6310					6312				6314					6316		6320	6314	6316	6318	6320	6324	6316	6320	6322	6324	6328	6316	6318	6322	6324	6320	6322	6326	6322	6324	6328
	Drive side		6307			6308						6307	6310					6312				6314					6316		NU 320	314	316	318	320	324	316	320	322	324	328	316	318	322	324	320	322	326	322	324	328
Lubrication	type		grease ③																																																
	Capacity for bearing	oz	.95			1.27						.95	1.90					2.54				3.17					3.88		21.2	3.17	3.88	13.4	18.9	27.5	3.88	23.4	23.6	27.5	33.2	3.88	13.4	23.6	27.5	18.9	23.6	30.7	23.6	27.5	33.2
Maximum admissible P/n (7)		hp/rpm	.073			.111						.073	.225					.381				.621					.917		.523	.818	.493	.769	1.10	1.57	2.79	.769	1.57	2.13	2.79	4.55	.769	1.10	2.13	2.79	1.57	2.13	2.33	2.13	2.79	4.56
GD_2 with water		lbft²	1.66	2.85	4.03	7.12	12.6	9.73	13.3	17.8	23.0	35.4	44.9	69.8	20.9	37.3	60.5	119	226	28.5	52.7	86.4	175	339	39.9	71.2	118	243	474	332	570	148	224	292	425	662	2490	463	982	1320	1980	2970	690	1100	1730	2870	1220	2230	3350	3010	4390	6860
Shaft seal housing	ØD	in	3.15			3.35						3.15	3.74					4.41				4.80					5.91		6.69	4.80	5.91	6.30	6.69	7.87	5.91	6.69	7.09	7.87	9.06	5.91	6.30	7.09	7.87	6.69	7.87	8.27			9.06
	Ød		2.17			2.36						2.17	2.76					3.15				3.54					4.33		5.12	3.54	4.33	4.72	5.12	5.91	4.33	5.12	5.51	5.91	7.09	4.33	4.72	5.51	5.91	5.12	5.91	6.30			7.09
	L		3.74			3.74						3.74	3.74					4.92				4.92					5.91		5.91	4.92	5.91	5.91	5.91	7.09	5.91	5.91	5.91	7.09	7.09	5.91	5.91	5.91	7.09	5.91	7.09	7.09			7.09
	/		.47 x .47															.63 x .63									.79 x .79			.63x.63	.79 x .79				.98x.98	.79 x .79				.98x.98	.79 x .79			.98x.98	.79x.79	.98 x .98			
Net weight		lb	342	344	348	353	364	531	534	580	584	608	743	794	745	785	822	1155	1760	1025	1110	1145	1600	2170	1530	1730	2040	2570	3340	3320	4670	2370	3030	3220	3920	4700	9920	3370	5070	6540	7680	10270	6010	6530	7555	10360	8910	11750	13390	14460	14600	17220

Table 1

① See item 6.2.1, peripherical speed
② Pumps 200-620A, 250-620A, 300-500A, 300-620A and 350-620A can operate in 1750rpm, with reinforced bearings, subject to release by the KSB Product Department
③ For lubrication with oil, please consult KSB Product Department
④ Values valid for materials A48CL30 and NI-Resist
For material: A536 60-40-18 multiply the values by 1.4
Casted carbon steel multiply values by 1.7
Casted chrome steel, please consult KSB
⑤ For higher temperatures, consult KSB
⑥ Maximum rotation = 880rpm for hydraulic A
⑦ For material SAE 1045



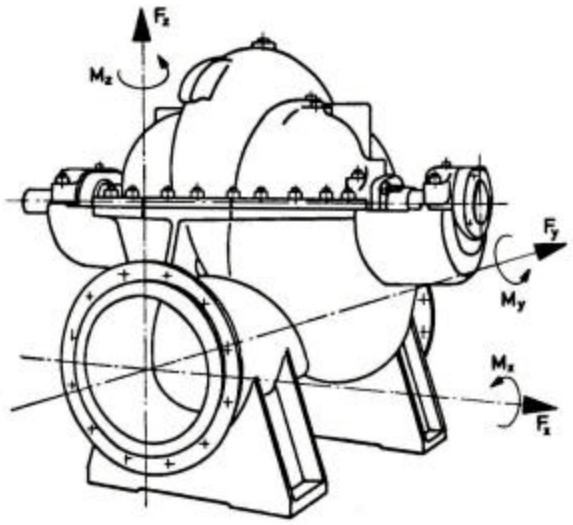


Fig.4 – Sealing clearance and impeller diameter

Fig.5 – Permissible forces and moments on the flanges (see table 1)

4.4 Design details

4.4.1 Casing

Horizontal, axially split volute casing, with upper and lower casing. Horizontal and opposite suction and discharge nozzle, in the lower casing. The surfaces between the casings are properly machined and the sealing is done with seal bandage of silicone (598 HB Loctite). This design allows disassembly of the impeller, shaft and sleeves without disassembly of the piping. The protection of pump casing against wear caused by impeller rotation is made through replaceable wear rings fixed in machined channels in the lower casing. This system prevents rotation and axial displacement of wear rings.

4.4.2 Impeller

Impeller is radial, double suction, with vanes of wide curvature, fixed on the shaft by means of two symmetric parts set (space sleeve, shaft protecting sleeve and shaft nut). Shaft nuts are out of flow area and are locked to the shaft by means of threaded screw and pins. From size 600-540 inclusive the impeller is produced with replaceable wear rings. In special execution up to size 500-890 inclusive impeller wear rings can also be provided. Usually two different standard and interchangeable hydraulics (A and B), are available for each pump size. Axial thrust is hydraulically compensated.

4.4.2.1 Peripheral Speed

When determining pump rotation, always check if impeller material is appropriate for the peripheral speed. (Fig.6).

4.4.3 Shaft

Pump shaft is supported between bearings. Bearing casings are fixed to their brackets to facilitate the disassembly of rotor together with the bearing. Up to size 500-890 the bearing casing is part integrated to the lower casing. For bigger sizes bearing brackets are fixed to the lower casing through studs and nuts. Bearings are protected by sealing rings on shaft against drop from the stuffing box. Pumps up to DN 300 have ball bearings in both sides. For bigger sizes, bearings have cylindrical roller bearing at the drive end, and a deep groove ball bearing at the N.D.E.

4.4.4 Shaft Sealing

Pump is shaft sealed by gland packing (standard) or optionally by mechanical seal. In the sealing area, the shaft is provided with easily replaceable protective sleeves.
Usually gland packing is lubricated by pumped liquid, except on applications which the fluid is inadequate for these functions. In these cases, use an external source with clean liquid, with a pressure of 1,5 to 3,0 bar (20 to 40 psi) over the suction pressure. The volume of lubrication / sealing liquid of external source is obtained through the diagram according to fig. 7, and for wash use the same pressure and flow 10 times higher than that used for lubricating / sealing.
Pressure and flow refer to values for each chamber.

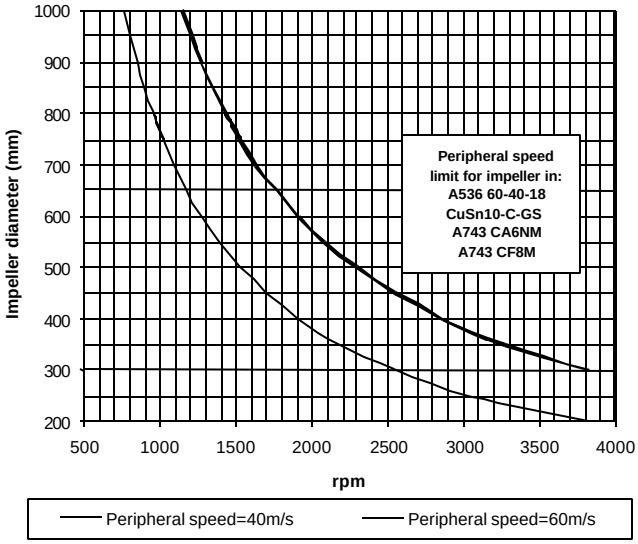


Fig.6 – Peripheral Speed

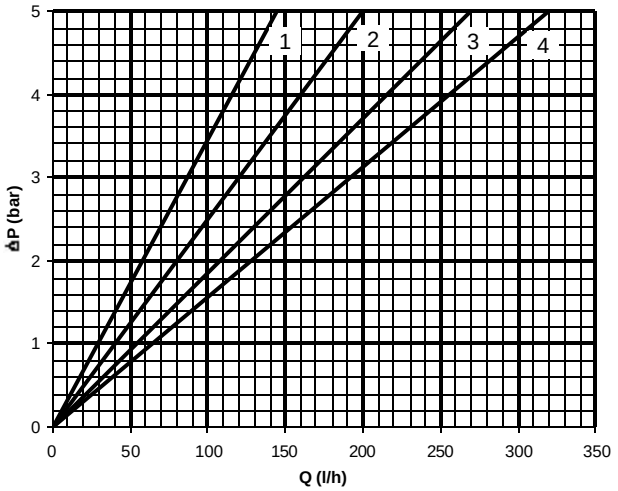


Fig.7 – Liquid flow of external source

size	curve	size	curve	size	curve	size	curve	size	curve
125-140	1	150-430	1	250-500	3	400-440	3	600-620	2
125-170	1	150-500	2	250-620	3	400-480	3	600-710	3
125-200	1	200-280	2	300-280	3	400-540	4	600-830	3
125-250	1	200-340	2	300-340	3	400-620	4	700-590	3
125-310	1	200-400	2	300-400	3	500-510	2	700-710	3
150-250	1	200-500	2	300-500	3	500-640	3	700-820	3
150-280	1	200-620	2	300-620	3	500-700	3	800-740	2
150-310	1	250-280	2	350-500	3	500-790	3	800-840	2
150-340	1	250-340	2	350-620	3	500-890	4	800-970	3
150-400	1	250-400	2	400-390	3	600-540	2		

$\Delta p = P - ps$

where: P = pressure of external source liquid (bar)
ps = suction pressure (bar)

4.4.5 Packing rings

Usually shaft sealing is done with packing rings. Position of neck ring, packing rings and lantern ring are shown on fig. 8. Dimensions of seal chamber, packing rings are mentioned on table 1. The lantern ring, disposed between packing rings receives the liquid from the region of pump high pressure. Lantern ring makes the distribution of liquid which lubricates the packing and avoid the entrance of air in the pump. Liquid flow to the lantern ring is controlled by a valve installed in the pump external piping.

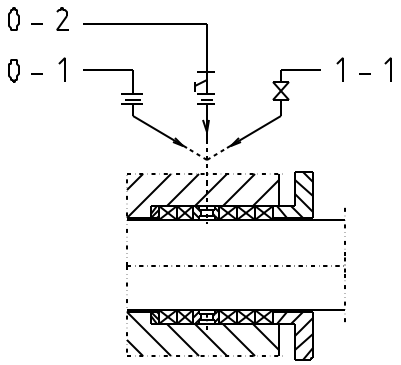
Code	Description	
0	Sealing by liquid being pumped 0-1 with external piping 0-2 with external piping + filter ①	
1	1-1 Sealing through clean liquid of external source	
9	Sealing with mechanical seal (2 seals)	

Fig.8 – Shaft sealing

① When pumped liquid contains solid in suspension.

4.4.6 Mechanical seal

Please refer to the mechanical seal drawing for details of the mechanical seal installed in the pump. Other seal configurations and types may only be used in exceptional cases and after consultation with KSB. The relevant seal version is shown in the mechanical seal drawing.

After a short period of accommodation during operation, there is no more leakage.
Mechanical seal is composed fundamentally of one stationary face and one rotating face, which polished surfaces are kept together by spring pressure.
Sealing materials should be compatible with pumped liquid.
Condition for safety and long operation, is based on a film of the liquid between the sealing faces and the generated heat being appropriately absorbed by liquid circulation.
Depending on the pumping condition, this circulation can be of pumped liquid or liquid of external source.
Mechanical seals are constructed in many different materials and assembly arrangement, covering almost all of chemical and physical characteristics of liquid to be pumped.
When requested, shaft sealing by mechanical seal additional information will follow separately.

4.4.7 Noise characteristics

Rated Power input P_N (kW)	Sound pressure level L pA (dB) [1) 2)]					
	Pump only			Pump with motor		
	2900	1450	960/760	2900	1450	960/760
	1/min	1/min	1/min	1/min	1/min	1/min
11,0	69	67,5	-	74,5	69,5	-
15,0	70,5	68,5	-	75,5	70,5	-
18,5	71,0	69	-	76	71,5	-
22,0	71,5	69,5	-	76,5	72	-
30,0	72,5	70,5	-	77,5	73	-
37,0	73,5	71,5	-	78	73,5	-
45,0	74	72	-	78,5	74,5	-
55,0	74,5	72,5	70,5	79	75	71
75,0	76	74	71,5	80	76	72,5
90,0	76,5	74,5	72	80,5	77	73,5
110	77	75	72,5	81,5	77,5	74
132	77,5	75,5	73	82	78	75
160	78	76	73,5	82,5	79	75,5
200	79	77	74,5	83	79,5	76,5
250	-	77,5	75	-	80	77,5
400	-	79	76,5	-	82	-
500	-	80	77,5	-	-	-
750	-	81	78,5	-	-	-
1000	-	82	79,5	-	-	-
1500	-	-	81	-	-	-
2000	-	-	83	-	-	-

1) Measured at a distance of 1m from the pump outline (as per DIN 45635 Part 1 and 24). Room and foundation influences have not been included. The tolerance for these factors is 1 to 2 dB.
2) Increase for 60Hz operation
Pump without motor: ---
Pump with motor:
3500min^{-1}: +3dB, 1750min^{-1}: +1dB, 1160min^{-1}: ---dB

4.5 Accessories

4.5.1 Coupling

RDL pumps can be equipped with standard coupling type KSB, or from other manufacturers. KSB standard couplings do not require maintenance, only periodical inspection (every 30 days) of elastic component condition and replacement, if necessary. Elastic component cannot be exposed to oil or grease contact. For maintenance of other coupling type, see manufacturer instruction.

4.5.2 Baseplate

KSB standard is a structural welded baseplate. Common baseplate for pump and driver for sizes up to 500-890 and separated one for the pump, for bigger sizes.

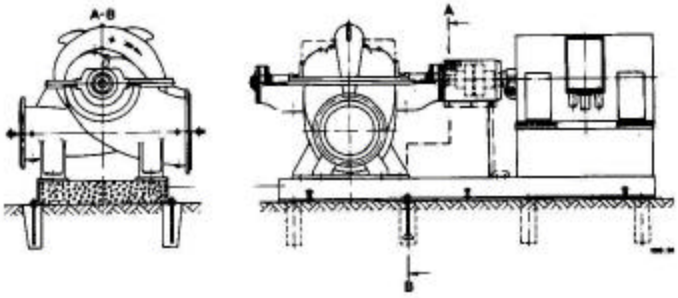


Fig.9 – Common baseplate for pump and motor

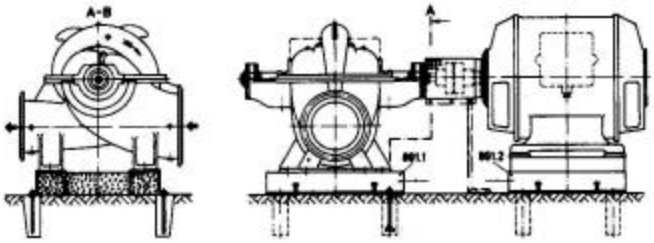


Fig.10 – Baseplate only for pump

4.5.3 Coupling guard

For a safety operation a coupling guard should be installed. Made according to KSB standards, of steel or brass. Installed on the transversal beam in case of common baseplate (see fig. 9) or on the foundation floor (see fig. 10).
Coupling guard does not touch the rotating elements.

5. Installation at site

Our pumps should be installed, leveled and aligned by trained personnel. If this work is done incorrectly it may cause operational problems, premature wear and damage beyond repair.

5.1 Safety regulations

Equipment operated in hazardous locations must comply with the relevant explosion protection regulations. This is indicated on the pump name plate and motor name plate (see 2.9).

5.2 Checks to be carried out prior to installation

All structural work required must have been prepared in accordance with the dimensions stated in the dimension table / G.A. drawing.
The concrete foundations shall have sufficient strength (min. BN 150) to ensure safe and functional installation in accordance with DIN 1045 or equivalent standards.
Make sure that the concrete foundation has set firmly before placing the unit on it. Its surface shall be truly horizontal and even.
The foundation bolts shall be inserted in the baseplate holes.

5.3 Installing the pump/unit

After placing the baseplate (preferably without the pump and driver) on the foundation, level it with the help of a spirit level placed on the pump and driver pads. Permissible deviation: 0.2 mm/m. Shims should be fitted between the baseplate and the foundation itself; they shall always be inserted to the left and right of the foundation bolts and in close proximity to these bolts. For a bolt-to-bolt clearance of more than 800 mm, additional shims shall be inserted halfway between the adjoining holes. All shims must lie perfectly flush.
Insert the foundation bolts and set them into the foundation using concrete. When the mortar has set, level the baseplate as described in section 5.3.1 and tighten the foundation bolts evenly and firmly. Then grout the baseplate (see also 5.3.2) using low shrinkage concrete with a standard particle size and a water/concrete ratio of 0.5. The flowability must be produced with the help of a solvent. Secondary treatment of the concrete to DIN 1045 is an absolute necessity.

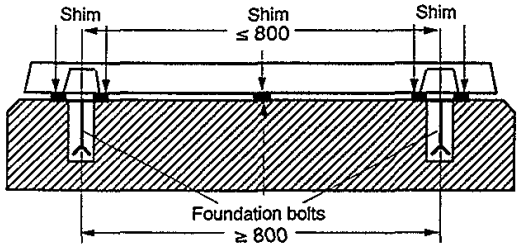


Fig. 11: Fitting required shims

To ensure low-noise operation, the unit can be mounted on vibration dampers (please confirm with KSB first). Expansion joints can be fitted between pump and suction/discharge line.

5.3.1 Base Leveling

Check if the baseframe is equally leveled on its metallic shims. Place and tighten uniformly the nuts on the foundation bolts. Using a spirit level, check the leveling of the baseframe longitudinally and transversally.
If the baseframe is unleveled, loosen the anchor bolts nuts and insert additional shims as necessary between the metallic chocks and the baseframe, so as to correct the leveling. See Fig. 12.
Maximum leveling deviation: 0,2 mm/m.

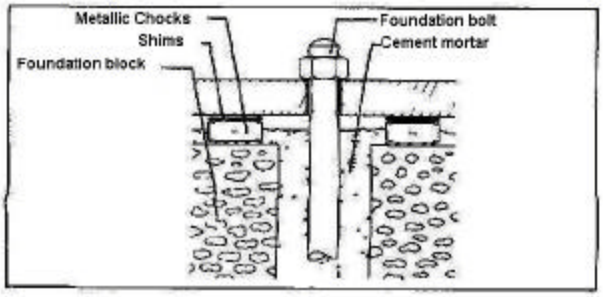


Fig.12 – Base Leveling

5.3.2 Grouting

In order to obtain a rigidity structure and vibration free operation, the inner side of the baseframe should be filled with grout.
This grout should be prepared with specific products available in the civil construction market, non-shrinking type in order to avoid contraction during the hardening process and also provide sufficient fluidity to fill the baseframe and prevent from cavities formation. See Fig.13

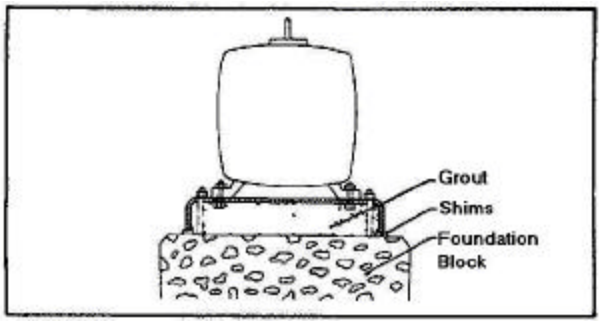


Fig.13 – Grouting

5.4 Rotation direction

KSB RDL Pumps can be coupled to the drive on both shaft ends. The rotation can be clockwise or counter-clockwise, a function of drive position and suction and discharge nozzles. To determine the rotation direction, be in front of the shaft drive side and look at the pump, follow the pumped liquid flow, which enters through the suction flange (bigger diameter), makes a complete turn inside the pump and goes out through the discharge flange (smaller diameter). See figures 14 and 15.
If the shaft is assembled in one determined position, it can be reversed without special adaptation.

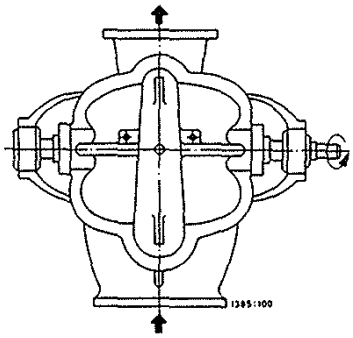


Fig.14 – Counter Clockwise rotation

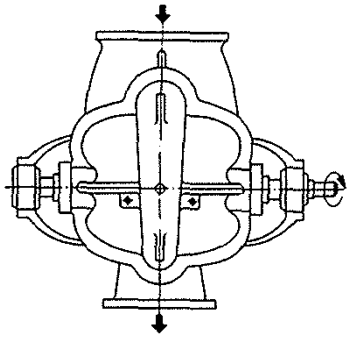


Fig.15 – Clockwise rotation

5.5 Coupling Alignment

The useful life of the rotor assembly and its operation free of irregular vibrations will rely on the perfect alignment between the pump and the driver.
The alignment performed at the factory must be re checked due to the fact that during transportation and handling, the motor-pump assembly is exposed to deformations, which may affect the initial alignment.
The following instructions also apply to units not mounted on a common baseplate.

Caution After connecting the piping and priming the system, it is essential to re-check the alignment at operating temperature.

Caution Incorrect alignment and inadmissible coupling displacement will affect the operating behavior and may result in damage to the bearings and shaft seals as well as premature coupling wear.

After the grouting has set hard, perform the alignment, if possible, with the suction and discharge pipe lines already connected.

This alignment should be performed with the help of a dial indicator for the control of the radial and axial displacements. Fix the bottom of the instrument to the periphery of one of the coupling halves, adjust the position of the dial indicator perpendicular to the periphery of the another half of the coupling. Move the dial to zero and move by hand the coupling half in which the instrument bottom is fixed, making the dial indicator to complete a 360°. turn. See Fig. 16.
The same procedure should be performed to control the axial displacement. See Fig. 17.

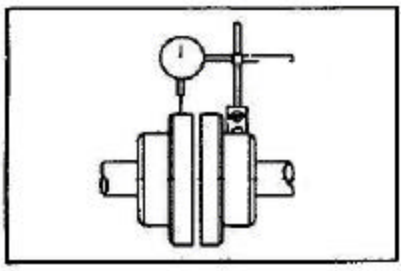


Fig.16 – Radial control

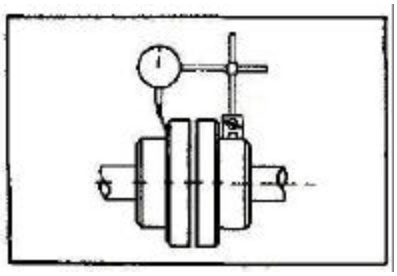


Fig.17 – Axial Control

To correct the alignment, loosen the driver bolts, sliding it laterally or inserting shims to correct its height as necessary.
Axial and radial alignments should be within the tolerance of 0,1 mm (0.004") with the driver and pump fixing bolts tightened.
If there is no dial indicator available, use a straight edge across the two parts of coupling sleeve. The control should be done on the horizontal and vertical planes. To control axially use a feeler gauge. See Fig. 18. Observe the coupling sleeve hub clearance specified by the manufacturer.

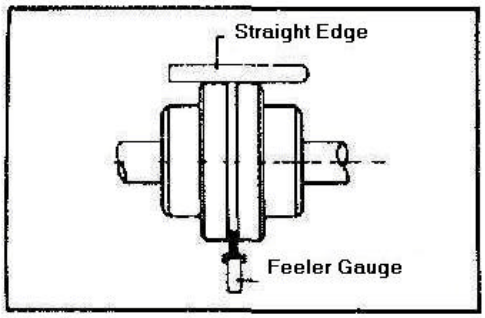


Fig.18 – Alignment with straight edge and feeler gauge

5.6 Connecting the piping

Caution Never use the pump itself as an anchorage point for the piping. The permissible pipeline forces must not be exceeded (see table 1).
Suction lift lines shall be laid with a rising slope towards the pump and suction head lines with a downward slope towards the pump. The pipelines shall be anchored in dose proximity to the pump and connected without transmitting any stresses or strains. The nominal diameters of the pipelines shall be at least equal to the nominal diameters of the pump nozzles. Connection flanges must be parallel to the pump flanges it is recommended to install check and shut-off elements in the system, depending on the type of plant and pump. It must be ensured, however, that the pump can still be drained and dismantled without problems. Thermal expansions of the pipelines must be compensated by appropriate measures so as not to impose any extra loads on the pump exceeding the permissible pipeline forces and moments.

An excessive, impermissible increase in the pipeline forces may cause leaks on the pump where the medium handled can escape into the atmosphere.

This may lead to danger to human life when toxic or hot media are handled!

The flange covers on the pump suction and discharge nozzles must be removed prior to installation in the piping.

Caution Please check if a strainer/filter should be fitted in the suction line during the commissioning stage, in order to protect both the pump and the shaft seal from damage due to contamination from the plant.
In order to avoid any marked deterioration of the NPSH available, which would have an adverse effect on the pump, the strainer has to be cleaned whenever required. It is recommended to use a differential pressure gauge to detect any strainer clogging (see 6.1.6).

For installation on a foundation with vibration insulation please take into account the when connecting the piping that the flexible elements at the baseplate may only compensate compressive and shearing strains within the admissible limits. Tensile strains cannot be compensated for, therefore the flexible elements shall only be firmly fastened to the foundation after connecting the piping.

5.6.1 Recommendation for suction piping

Assembly of suction piping should comply with the following consideration:

a) only after completing the grout set, piping can be connected to the pump flange;
b) suction piping, as much as possible, should be short and straight, avoiding losses, and totally drained preventing air from entering;
c) to be free of air pockets, in case of horizontal and negative suction, the piping should be installed with a slope in direction to the suction;
d) nominal diameter of pump suction flange does not determine the nominal diameter of suction piping. For calculation of ideal diameter, as referential, use the flow speed established between 1 and 2,5 m/s (3 and 8 ft/s);
e) when reducer is necessary, this should be eccentric and with the flat side located on the top as fig. 18. in order to avoid formation of air pockets;
f) elbows, when necessary, should be designed and installed providing lower losses. Ex.: prefer elbow of long or medium radius;
g) piping flange should adjust to the pump suction nozzle, totally free of tensions, without transmitting any stress to the pump casing. Pump should never be support for the piping. If it is not observed misalignment can occur and its consequences like parts scratch and other serious damages;
h) in installation where foot valve is applicable observe that the passage area should be 1.5 time bigger than the piping area. Usually coupled to the foot valve should exist a strainer with a free passage of 3 to 4 times bigger than the piping area;
i) when the pumped liquid is subject to high temperature variation expansion joints should be installed to avoid piping stresses caused by dilation and contraction of the pump;
j) in positive suction it is recommended to install a valve in order to close the flow as necessary. During pump operation it must be totally opened. Suction with only one suction header for several pumps must have one valve for each pump and the connection between the suction header and the suction piping should always be with changes of direction lower than 45º. In all these cases with use of gate valve, the shaft of it should be disposed horizontally or vertically down;
k) In order to avoid turbulence, air entering, sand or mud in the pump suction use HI the recommendations;
l) Check coupling alignment after tightening piping;
m) To facilitate piping assembly and parts adjustment, install, when necessary, Dresser type assembly joint, common or special type with tie bolts.

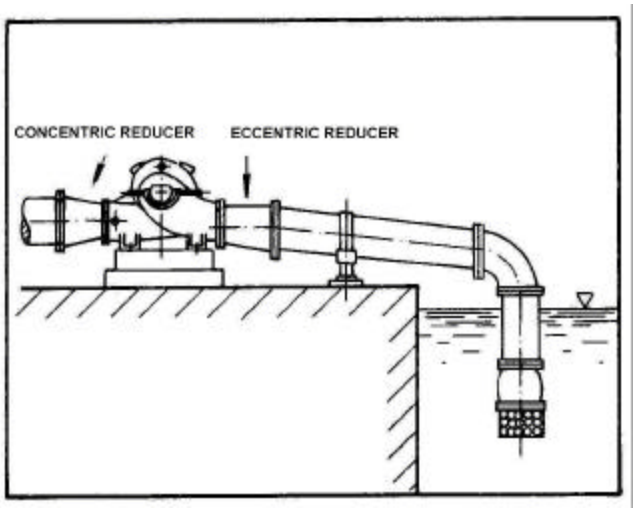


Fig. 17 – Negative suction

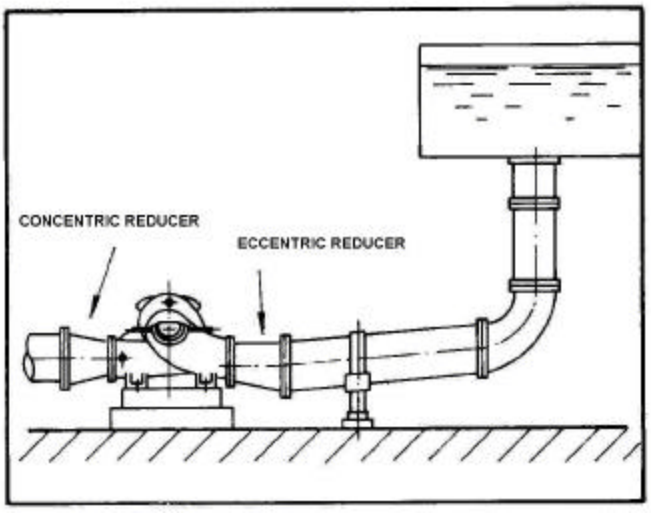


Fig. 18 – Positive suction

5.6.2 Recommendation for discharge piping

Mounting of discharge piping should consider following items:

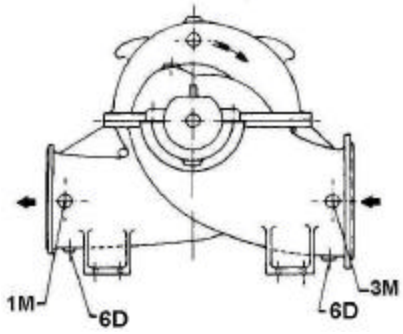
a) Should have devices for control of water hammer when the pressure values from liquid return in long pipes exceed the recommended limits for piping and pump;
b) Junction between discharge piping and pump flange should be made with a concentric reducer, when nominal diameters are different;
c) Install vent valves to remove the air;
d) Install a discharge valve, just after pump discharge nozzle , in order to adjust of flow and pumping pressure, or prevent driver overload;
e) Check valve, when installed should be placed between the pump and the discharge valve. This location is preferable in relation to item d;
f) Expansion joints with tie bolts should be considered to absorb system stresses;
g) Safety valves or relief devices and other operation valves should be installed when necessary;
h) Same recommendations a, b, f, g i, l, m, regarding suction piping.

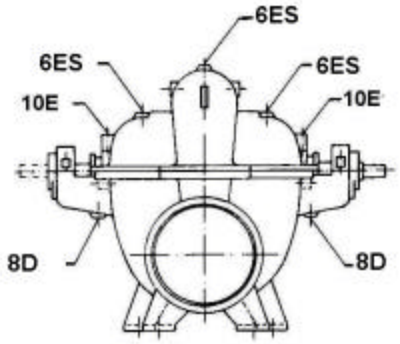
5.6.3 Auxiliary connections

The dimensions and locations of the auxiliary connections (sealing liquid, flushing liquid etc.) are indicated on the G.A. drawing and below.

Caution These connections are required for proper functioning of the pump and are therefore of vital importance! Modifications are only permitted after consulting KSB (see 2.7)!

Description of piping and auxiliary connection





	Up to RDL 150-500	From RDL 200-280 up to 400-850
1M Manometer	R ½"	R ½"
3M Vacuometer	R ½"	R ½"
6ES Priming	R ½"	R ¾"
6D Drain	R ½"	R ¾"
10E Inlet for water of external source	R ½"	R ½"
8D Leakage	R ¾"	R ¾"

	From RDL 500-510 up to 600-830	From RDL 700-590 up to 800-970
1M Manometer	R ½"	R ½"
3M Vacuometer	R ½"	R ½"
6ES Priming	R 1"	R 1 ½"
6D Drain	R 1"	R 1 ½"
10E Inlet for water of external source	R 1"	R 1 ½"
8D Leakage	R 1"	R 1"

Fig.19 – Standard piping and auxiliary connection

Note:

1) Suction piping for liquid of external source should have valve and sight glass to control and observe flow.
2) For pumps with mechanical seal other connections can be installed on the seal gland. In this case, complementary instructions will follow.
3) Optionally connections with NPT can be supplied.

5.6.4 Coupling guard

In compliance with the accident prevention regulations the pump must not operate without a coupling guard.

If the customer specifically requests not to include a coupling guard in our delivery, then the operator must supply one. In this case, it is important to make sure that the materials selected for coupling and coupling guard are non-sparking in the event of mechanical contact. KSB's scope of supply meets this requirement.

5.7 Final check

Re-check the alignment as described in section 5.3.
It must be easy to rotate the shaft by hand at the coupling.

5.8 Connection to power supply

Connection to the power supply must be effected by a trained electrician only. Check available mains voltage against the data on the motor rating plate and select appropriate start-up method.
We strongly recommend to use a motor protection device.

In hazardous areas, compliance with EC60079-14 is an additional requirement for electrical connection.

6. Comissioning, start-up/shutdown

Commissioning, Start-up / Shutdown

Caution Compliance with the following requirements is of paramount importance. Damage resulting from non-compliance shall not be covered by the scope of warranty.

6.1 Commissioning

Before starting up the pump make sure that the following requirements have been checked and fulfilled.
If a constant-level oiler is provided, screw same into the upper tapping hole of the bearing bracket prior to adding the oil (see 6.1.1). Seal with PTFE tape, if necessary.
The operating data, the oil level, if required (6.1.1), and the direction of rotation (6.1.4) must have been checked. The pump set must have been primed (6.1.3).
Also verify the following:
- Make sure that the unit has been properly connected to the electric power supply and is equipped with all protection devices.
- Make sure that all auxiliary lines (5.6.3) are connected and functioning.
- If the pump has been out of service for a longer period of time, proceed in accordance with section 6.4.

6.1.1 Lubricants

Oil-lubricated bearings
The bearing bracket has to be filled with lubricating oil, the quality of oil required is outlined in section 7.3.2.

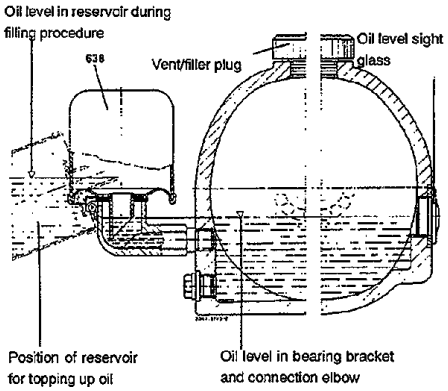


Fig. 20: Oil fill

Procedure:
Remove the protective cage of the constant-level oiler. Unscrew vent plug. Pour in the oil through the vent plug tapping hole after having hinged down the reservoir of the constant level oiler until oil appears in the vertical portion of the connection elbow (see Fig. 20). Then fill the reservoir of the constant-level oiler with oil and snap it back into operating position. Screw vent plug in again. After a short time check whether the oil level in the reservoir has dropped. It is important to keep the reservoir properly filled at all times.

Caution The oil level should be checked with tie help of oil level sight glass & markings on bearing bracket when the pump is in standstill condition.

6.1.2 Shaft seal

Caution Usually, mechanical seals are fitted prior to delivery. On variants with quench supply tank, the tank must be fitted in accordance with the G.A. drawing (see 6.1.3). Quench feed must also be provided during pump shutdown. On variants with double-acting mechanical seals, apply sealing pressure as specified in the G.A. drawing/data-sheet prior to starting up the pump (see 6.1.3). Sealing pressure must also be provided during pump shutdown.

Caution For external liquid supply, the quantities and pressures specified in the data-sheet and G.A. drawing should be applied.

6.1.3 Priming the pump and checks to be carried out

Before start-up, the pump, the suction line and (if applicable) the thermosiphon tank must be vented and primed. The shut-off element in the suction line must be fully open.
Fully open all auxiliary lines provided (flushing, sealing, cooling liquid etc.) and check the through flow.
For water cooling, use suitable non-aggressive cooling water not liable to form deposits and not containing suspended solids. (Hardness: on average 5dH (ca. 1 mmol/l*);* pH **>** 8, or conditioned and neutral with regard to mechanical corrosion).
Inlet temperature tE = 10 to 30 °C
Outlet temperature tA = max. 45 °C

Caution **Dry-running will result in failure of the mechanical seal and must be avoided!**

6.1.4 Checking the direction of rotation

When the unit has been connected to the electric power supply, verify the following (local and national regulations have to be taken into account separately):

Caution For trouble-free operation of the pump, the correct direction of rotation of the impeller is of paramount importance. If running in the wrong direction of rotation, the pump cannot reach its duty point; vibrations and overheating will be the consequence. The unit or the shaft seal might be damaged.

Correct direction of rotation:
The direction of rotation must correspond to the direction indicated by the arrow on the pump. This can be verified by switching the pump on and then off again immediately.

Before checking the direction of rotation make sure that there is no foreign matter in the pump casing.

Never hold your hands or any other objects into the pump.

Caution Ex Do not run the pump without iquid while checking the direction of rotation. If there is no medium handled available, the motor's direction of rotation must be checked with the pump de-coupled.
If the pump runs in the wrong direction of rotation, interchange two of the three phases in the control cabinet or motor terminal box.

6.1.5 Cleaning the plant piping

The cleaning operation mode and duration for flushing pickling service must be matched to the casing and seal materials used.

6.1.6 Start-up strainer

If a start-up strainer has been fitted to protect the pumps against dirt and/or to retain contamination from the plant, the strainer's contamination level must be monitored by measuring the differential pressure so as to ensure adequate inlet pressure for the pump.
For installation and monitoring, see additional instruction sheet.

6.1.7 Start-up

Before starting the pump ensure that the shut-off element in the suction line is fully open! The pump may be started up against a closed discharge-side swing check valve or shut-off element. Only after the pump has reached full rotational speed shall the shut-off element be opened slowly and adjusted to comply with the duty point. When starting up against an open discharge side shut-off element, take the resulting increase in input power into account.

Caution Ex Pump operation with the shut-off valves in the discharge and suction pipes closer is not permitted.
The permissible pressure and temperature limits might be exceeded. In extreme cases, the pump may burst.

Caution After the operating temperature has been reached and/or in the event of leakage, switch off the unit, allow to cool down, then re-tighten the bolts between upper and lower volute casing.

Caution After the operating temperature has been reached, re-check the coupling alignment as described in section 5.5 and re-align, if necessary.

6.1.7.1 Necessary steps for 1st operation

a) Tighten the pump and driver on the baseplate;
b) Set suction and discharge piping;
c) Connect and run piping and auxiliary connections (when required);
d) Make electric connection assuring that all motor protection devices are appropriately adjusted and working;
e) Assure that bearings are properly lubricated. For details see chapter 7.3;
f) Check drive rotation with pump not coupled to avoid pump dry operation;
g) Certify manually that rotor rotates free;
h) Assure that coupling alignment was executed according to chapter 5.5
i) Install the coupling guard (if any);
j) Prime the pump, that means, fill the pump and suction piping with water or pumped liquid, eliminating air from inside the pump. See chapter 6.1.3;
k) Assure that packing is not completely tightened;
l) Open totally the suction valve (if any) and close discharge one.

Check carefully above mentioned points, start the drive machine and turn it off immediately. Check the equipment stop which should be slow and smooth. If the pump is normal, start up definitely.

6.1.7.1.1 Methods for pump priming

a) Installation with positive suction.
In case of installation with positive suction, that means, pump is installed below the suction reservoir level, plugs 916.6, 903.5, 903.1 and 903.4 (if any) should be removed and suction valve opened so the pumped liquid comes to the higher part of the pump.
Place the threaded plugs back and the pump will be primed.

b) Installation with negative suction
In case of installation with negative suction, that means, pump is installed above the suction reservoir level, for priming it is necessary to have a foot valve or to prime by partial vacuum.

b1) Priming with filling and foot valve
Remove threaded plugs 916.6, 903.5, 903.1 and 903.4 (if any). Fill the pump and suction piping with water or pumped liquid through the plug located in the higher point of the pump. The foot valve will prevent the liquid to return to the suction reservoir. When leaking through the higher point of the pump starts, equipment used to fill (filler, hose, piping with register, etc) must be removed and place threaded plugs back.

b2) Priming with by-pass of check valve.
In large installations, pump and discharge piping can be filled
Remove threaded plugs 916.6, 903.5, 903.1 and 903.4. Open partially the discharge valve. Open by-pass line of check valve until the liquid reaches the higher part of the pump. Close valves, place threaded plugs back and pump will be primed.

b3) Priming with partial vacuum (ejector)
The principle of ejector working is based on the pressure condition created by the passage of a pressurized flow through a piping with different sections. This condition allows air extraction from the pump casing and suction piping, creating a vacuum and making the pumped liquid lift to suction reservoir. When tank level starts rising it means that the main pump is already primed. After start up of main pump, turn the auxiliary pump off and close “R” register.

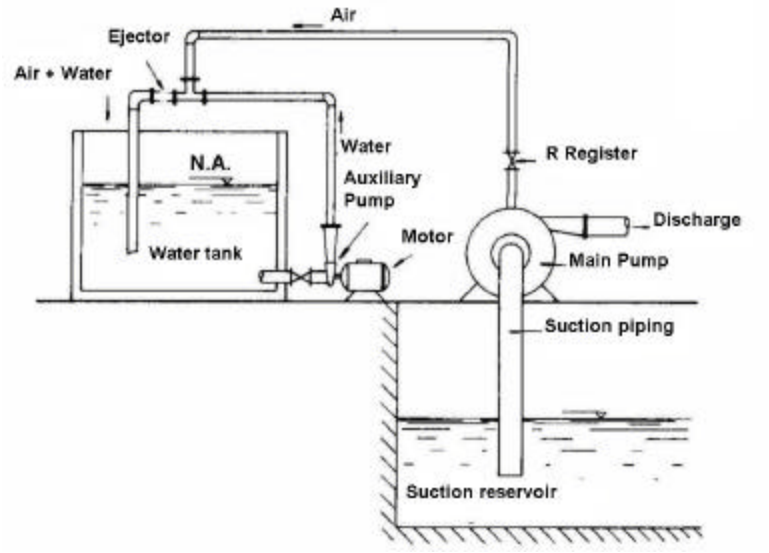


Fig.21 – Ejector functioning

6.1.8 Shutdown

Close the shut-off element in the discharge line.
If the discharge line is equipped with a non-return or check valve, the shut-off element may remain open. If shut-off is not possible, the pump will run in reverse rotation.

Caution This may cause damage to mechanical seals which are not bi-directional!

The reverse runaway speed must be lower than the rated speed.
Switch off the drive, making sure that the unit runs smoothly down to a standstill. Close the auxiliary lines but only turn off the cooling liquid supply (if applicable) after the pump has cooled down. Please refer to section 6.1.2!
In the event of frost and/or prolonged shutdowns, the pump must be drained or otherwise protected against freezing.

6.2 Operating limits

The pumps/units application limits regarding pressure, temperature and speed are stated on the data sheet and must be strictly adhered to.

If a data sheet is not available, contact KSB.

6.2.1 Temperature of the medium handled, ambient temperature, bearing temperature

Caution Do not operate the pump at temperatures exceeding those specified on the data sheet unless the written consent of the KSB has been obtained.
Damage resulting from disregarding this warning will not be covered by the KSB warranty. Bearing bracket temperatures as described in section 7.2.1 must be observed.

The safety instructions set forth in section 2.9 must be complied with.

6.2.2 Switching frequency

To prevent high temperature increases in the motor and excessive loads on the pump, coupling, motor, seals and bearings, the switching frequency should not exceed the following number of start-ups per hour (S).

Motor rating (kW)	max. S (switchings/h)
Up to 12	15
Up to 100	10
More than 100	5

6.2.3 Density of the medium handled

The power input of the pump will increase in proportion to the density of the medium handled. To avoid over loading of the motor, pump and coupling, the density of the medium must comply with the data specified on the purchase order.

6.2.4 Abrasive media handled

When the pump handles liquids containing abrasive substances, increased wear of the hydraulic system and the shaft seal are to be expected. The intervals recommended for servicing and maintenance shall be shortened.

6.3 Shutdown / Storage / Preservation

Each KSB pump leaves the factory carefully assembled. If commissioning is to take place some time after delivery, we recommend that the following measures be taken for indoors pump storage.
For others storage conditions, consult KSB.

6.3.1 Storage of new pumps

- New pumps are supplied by our factory duly prepared for storage. Maximum protection for up to 6 months, if the pump is properly stored indoors.
- Store the pump in a dry location.
- Rotate the rotor by hand once a month.

6.3.2 Measures to be taken for prolonged shutdown

1. The pump remains installed; periodic check of operation.
In order to make sure that the pump is always ready for instant start-up and to prevent the formation of deposits within the pump and the pump intake area, start up the pump set regularly once a month or once every 3 months for a short time (approx. 5 minutes) during prolonged shutdown periods. Prior to an operation check run ensure that there is sufficient liquid available for operating the pump.
2. The pump is removed from the pipe and stored
Before putting the pump into storage carry out all checks specified in section 7.1. Then apply appropriate preservatives:
- Spray-coat the inside wall of the pump casing, and in particular the impeller clearance areas, with a preservative. Spray the preservative through the suction and discharge nozzles. It is advisable to close the nozzles (for ex. with plastic caps or similar).

6.4 Returning to service after storage

Before returning the pump to service carry out all checks an maintenance work specified in sections 7.1 and 7.2.

In addition, the instructions laid down in the sections or “Commissioning” (6.1) and “Operating Limits” (6.2) must be observed.

Upon completion of the work, all safety-related and protective equipment must be properly refitted and/or reactivated before starting the pump set

7. Maintenance/Repair

7.1 General instructions

The operator is responsible for ensuring that all maintenance inspection and installation work is carried out by authorized duly qualified staff who are thoroughly familiar with these operating instructions.
A regular maintenance schedule will help avoid expensive repairs and contribute to trouble-free, reliable operation of the pump with a minimum of maintenance expenditure and work.

Work on the unit must only be carried out with the electrical connections disconnected. Make sure that the pump set cannot be switched on accidentally (danger of life!).

Pumps handling liquids posing health hazards must be decontaminated. When draining the medium see to it that there is no risk to persons or the environment. All relevant laws must be adhered to (danger of life!).

7.2 Supervision during operation

After start up and if pump is operating consider the following items.

a) Adjust pump for the operation point (pressure and flow) opening the discharge valve slowly just after driver has reached its nominal speed.
b) Control current (amperage) of electric motor.
c) Assure that pump operates free of vibration and abnormal noises.
d) Control bearing temperature. It can reach up to 50ºC (122ºF) above ambient temperature, however total temperature can not exceed 90ºC (194ºF).
e) Adjust the auxiliary valves and packing tight in order to avoid an excessive leakage on shaft seal.

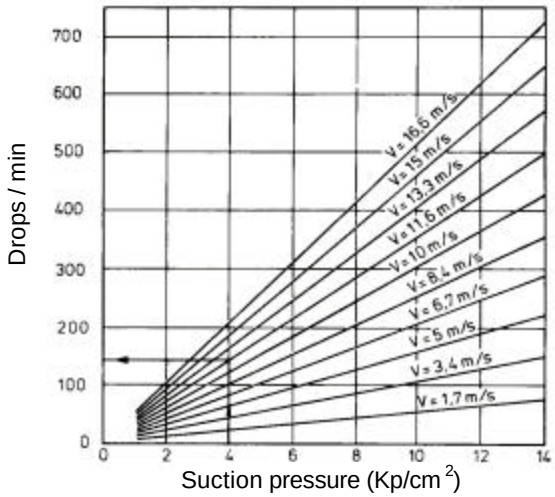


Fig.22 – Approximate number of drops

On fig.23 “V” corresponds to the peripheral speed (in m/s) calculated by formula:

$$V = \frac{\pi \times d \times n}{60}$$ where:

d = external diameter of the shaft protecting sleeve (in m) = “∅ d” of shaft seal housing of table 1
n = rotation per minute that pump is working (rpm)

7.3 Bearing maintenance

Maintenance objective is to extend the useful life of the bearing system. It includes observation of general condition of bearings, cleaning, lubricating and bearing detailed examination.
Lubricant properties decrease due to age and mechanical work, besides all lubricants are contaminated during work, therefore must be changed at intervals.
For the 1st set-up assure that bearings are free of dirt and moisture.

7.3.1 Bearings lubricated with grease

During assembly in our factory bearings receive a grease charge and after lubricating interval (number of hours of continuous functioning) they must be lubricated to avoid metallic contact between rolling parts and also to protect them against corrosion and wear.

Bearing type		Lubricating interval (Functioning hours)								
		II poles		IV poles		VI poles		VIII poles		Grease qty per bearing (g)
		60 Hz 3500 rpm	50 Hz 2900 rpm	60 Hz 1750 rpm	50 Hz 1450 rpm	60 Hz 1160 rpm	50 Hz 950 rpm	60 Hz 880 rpm	50 Hz 730 rpm	
	6307	4000	5000	7000	7500	8000	8500	9000	9500	10
	6308	3500	4000	6000	6500	7000	7500	9000	9500	15
	6310	3000	3500	5000	5500	6000	6500	8000	8500	25
	6312			5500	6000	7000	7500	8000	8500	35
NU 314	6314			5000	5500	6500	7000	7500	8000	45
NU 316	6316			4000	4500	6000	6500	7000	7500	55
NU 318	6318			3300	4000	5500	6000	6500	7000	65
NU 320	6320			2500	3000	5000	5500	6000	6500	75
NU 322	6322					5000	5500	6000	6500	85
NU 324	6324					4500	5000	5500	6000	105
NU 326	6326					4000	4500	5000	5500	115
NU 328	6328					3000	3500	4000	4500	125

Table 3 – Lubricating interval and grease quantity as function of rotation.

Apply the correct grease in the indicated quantity through the grease nipple located in the upper part of the bearing housing, acc. to defined intervals. An excessive quantity causes a harmful effect. Every 2 years bearings should be disassembled and washed and all lubricant replaced.
We recommend use of lithium soap grease and do not mix with other types like sodium or calcium.

Manufacturer	**Grease**	**Oil**	
		VG 68	**VG 46**
ATLANTIC	Litholine 2	Eureka-68	Eureka-46
CASTROL	Graxa Lm 2	Hyspin AWS-68	Hyspin AWS-46
ESSO	Beacon 2	Oil for Turbine-68	Oil for Turbine-46
IPIRANGA	Isaflex 2	Ipitur AW 68	Ipitur AW 46
MOBIL	Mobil Grease 77	DTE-26	DTE-24
PETROBRÁS	Lubrax GM A2	Marbrax TR 68	Marbrax TR 46
SHELL	Alvania R2	Tellus 68	Tellus 46
TEXACO	Marfak MP2	Regal 68	Regal 46
PROMAX BARDAHL	Bardahl General Purpose Grease	Maxlub MA-20	Maxlub MA-15

Table 4 – Grease and oil specification

7.3.2 Bearings lubricated with oil (optional)

Bearing housings must be filled with mineral oil of good quality. Type ISO VG 68 for speeds below 3000 rpm and ISO VG 46 for speed higher than 3000 rpm. See table 4. Correct level is controlled by a constant level oiler. Oil change must be done according to the following:

1- 1st oil change after 300h of service.
2- Next change after additional 2000h of service.
3- Subsequent changes each 8000h of service or after 1 year of service (whichever comes first).

7.4 Shaft Seal Maintenance

7.4.1 Mechanical Seal Maintenance

In case of supply of pump with mechanical seal, additional instructions from seal manufacturer should be followed.

7.4.2 Packing Maintenance

If shaft sealing has already been tightened equivalent to a packing ring thickness and even so it presents excessive leakage, it must be checked as follow:

- Stop the pump
- Loosen nuts of gland cover and push it to the bearing housing direction in order to have enough space for work
- Extract, with the help of a deflective spindle, all the packing rings and lantern ring
- Clean all shaft seal chamber
- Check surface of protective sleeves. If they present roughness or grooves replace them
- Cut new packing rings with oblique end (see fig. 23). To facilitate cut, a disposal of easy construction can be used (see fig. 24).

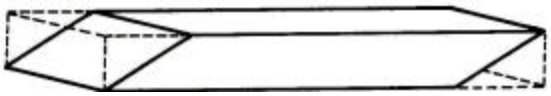


Fig.23 – Oblique cut of the gasket

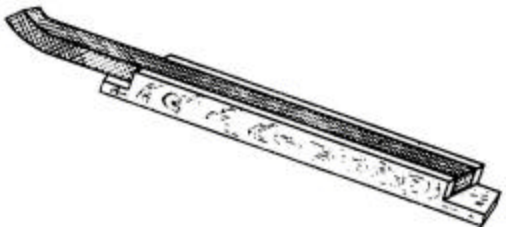


Fig.24 – Device to cut packing rings

- Lubricate internal diameter of each packing ring with grease
- Lubricate external diameter of lantern ring with Molykote paste G
- Proceed the assembly in the reverse sequence of the disassembly, introducing each part inside the chamber with auxiliary of gland cover. Packing rings should be assembled with their extremity displaced about 90º from each other. See fig.25

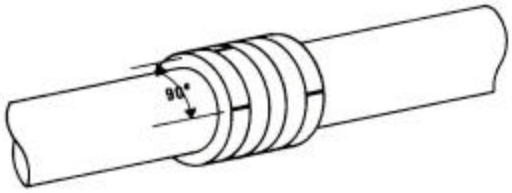


Fig.25 – Position of displaced rings in 90º

After assembling of all rings in the chamber there should remain about 5 mm (3/16”) to gland cover guide.

7.5 Maintenance of wear areas

Maintenance of wear areas, that means, clearances between impeller (234) and casing wear ring (502) or between this and the impeller wear ring (503) should be made after reaching sealing clearance values mentioned on table 1.

7.6 Instruction for Disassembly

Note: Part numbers indicated in parentheses after the name of each part refer to the parts lists and sectional drawings of chapter 9.

7.6.1 Disassembly sequence for pumps with packing

Close suction (if any) and discharge valves. Drain pump removing threaded plugs (903.3) and (903.1).
Close valves and disconnect auxiliary pipings, manometers and vacuometers (if any). Remove coupling guard (if any). Disconnect coupling sleeve of driver. Loosen nuts (920.4) and gland cover (452) of its studs (902.4), displacing into bearing direction.
Loosen nuts (920.2), (920.3) and (920.5), (if any). Tighten nuts (920.6) to extract both guide pins (560.1). Separate upper casing (105.2) from lower casing (105.1) tightening extractor bolts uniformly (901.1). Pull extractor bolts back to not hinder during assembly. Pass the string around each eyebolt of upper casing and lift it. Thereafter pump inside is available for inspection. See fig. 26

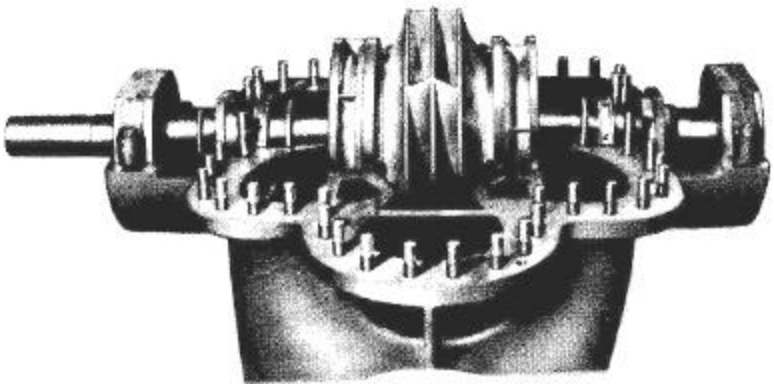


Fig.26 – Pump with upper casing removed, available for inspection

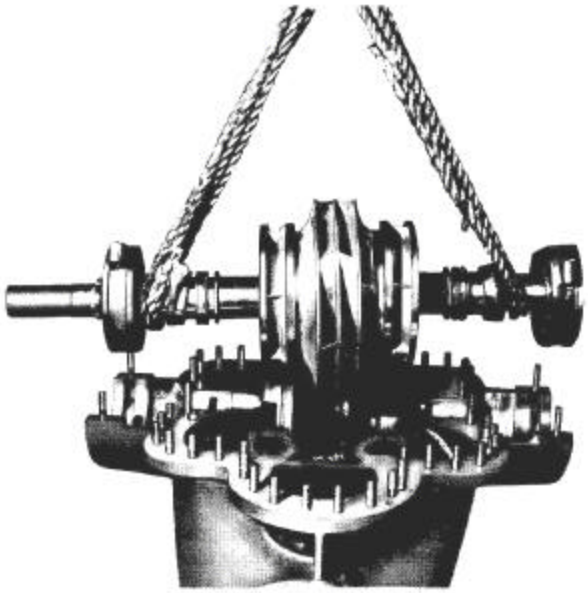


Fig.27 – Lift and extracting of rotor from inside the lower casing

Pass a rope around the shaft between the gland covers and bearing housings and lift the rotor to extract it from lower casing. See fig. 27. Take care to not damage the studs (902.1) and that the extracting is done without effort due to friction or bent position of rotor. Extract coupling sleeve with a pull out device and the key (940.3). Loosen nuts (901.2) and bearing cover of drive side (360.1). For pumps with DN 400 mm or above, there are two extract holes M8 (5/16") in the rear part of bearing housings. By means of uniform tighten of two bolts relatively long in these tapped holes, remove external ring of bearing. See fig. 28. With a pull out device extract bearing housing for pumps DN 400 mm (16") or bigger, extract also internal ring of bearing and spacer ring (504). For pumps up to 300 mm extract bearing housing and also ball bearings.
Loosen bolts (901.2) and bearing cover N.D. side (360.2). Unlock lockwasher (931) from bearing nut (923). Loosen bearing nut with key type nail or with pin. Extract with pull out device shaft from bearing housing, bearing (321) and spacer ring (504). Thereafter parts are symmetrical in both sides of rotating element and disassembly is similar.
Extract wear rings (502); sealing rings for shaft (420); gland cover (452); gasket rings (461); lantern ring (458) and neck ring (457).
Loosen screwed pins (940.1) and thereafter shaft nuts (921). Extract shaft protective sleeves (524), taking care not to damage the O-rings (412). Remove the keys (940.1); spacer sleeves (525.2) if any; spacer sleeves (525.1), except for pumps 200-500, 200-620 and 250-340 which do not have them. Take out the impeller (234) from the shaft and the key (940.2).
Pumps DN 600mm (24") up to DN 800mm (32") have bearing brackets (330) fixed in the lower casing which can be disassembled loosening the nuts (920.8) and guide pins.

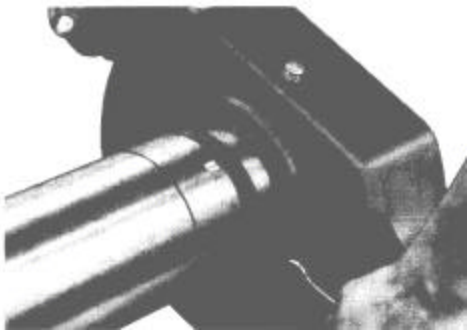


Fig.28 – Extracting of external ring of bearing with screw

Note:
a) When extracting bearing housings, avoid uneven effort or blows, that can damage the bearings.
b) If applicable, extract the impeller wear rings (503) loosening threaded pins (904.2).

7.6.2 Disassembly sequence for pumps with mechanical seal

Loosen auxiliary piping (if any) and gland. Apply specific instructions of mechanical seal manufacturer.

7.7 Assembly sequence

All parts must be cleaned and deburred before assembly.

7.7.1 Pump with gasket

Place the key (940.2) on the shaft (211); assemble the impeller (234), spacer sleeves (525.1), except for pumps 200-500, 200-620 and 250-340; assemble spacer sleeves (525.2), if any. Place the keys (940.1) and assemble shaft protective sleeves (524) with respective o'rings. Take care to not damage o'rings during assembly. Mount and tighten the two shaft nuts (921) against the protective sleeves.
Shaft nuts must be only definitely positioned and locked after centering the impeller.
Place the casing wear rings (502) on the external diameter of impeller entrance hub. Mount on the shaft neck rings (457); lantern ring (458) and gland cover placing them so as not hinder the assembly.
Mount sealing rings for shaft (420).
For pumps sizes 125 up to 300 place radial ball bearing inside the bearing housings pressing them by the external ring. In the bearing housing, mount the spacer ring (504) at the bottom, before bearing assembly. Heat two sets in the furnace in a temperature of 120ºC (250ºF) for 30 minutes.
Place them heated on the shaft with the housing (321). Spacer ring (504) must touch in the shaft step. Mount lockwasher (931) and bearing nut (923). Tighten bearing nut and lock it with one little tongue of lockwasher. Mount also at high temperature bearing housing drive side with respective bearing (321). The exact position will be defined during the placement of the rotor on

the lower casing when fixing the studs (902.1). For pumps sizes 400 up to 800 assembly procedure for D.E. changes. Mount spacer ring (504) on the shaft. Mount heated the internal ring of bearing on the shaft (120ºC, 30 minutes). Mount the external ring of bearing inside the bore of the bearing housing (use uniform pressure) and mount the set in the shaft. Lock the set with lockwasher and bearing nut. Lubricate the two bearings properly.
Mount bearing covers (360.1) and (360.2) fixing them with screws (901.2). For pumps sizes 600 up to 800 mount the bearing brackets (330) on the lower casing positioning them to the studs (902.8) and fixing them with the nuts (920.8). Assure that the contact surfaces between the lower and upper casing are free of dirt. Install studs (902.3), (902.2) and (902.5), if any.
Mount rotating element inside the lower casing according to following steps:

a) Place the bearing housings on the correct position of the studs (902.1).
b) Mount the wear rings in the lower casing.
c) Remove gland covers (452) and lantern rings (458) towards the bearing housings in order to not cause any trouble during assembly.
d) Leave neck rings (457) already positioned towards of shaft seal chamber.
e) Unfasten rope which maintains the rotating element suspended during assembly.

Center the impeller in the lower casing according to the specific description below. Apply silicone sealing adhesive (598 HB of Loctite), on the contact surface of lower casing.
Place the upper casing, lifting it through its hooks and guiding it by the studs (902.2), (902.3) and (902.5). Place the guide pin (560.1). Uniformly tighten in a crosswise pattern the nuts (920.2), (920.3) and (920.5), if any.
Fix the bearing housings through the nut (920.1) observing that the bearing housing be **leveled**.
Place the studs (902.4) and execute shaft seal according to fig. 6 and instructions of chapter 11.2.2.
Install grease nipple on the bearing housings. Place the sealing rings (420) close to the bearing housings.

Centering impeller in the casing

After placing the rotor in the lower casing and fixed the bearing housings it is important to center the impeller.
The clearance between the impeller and the internal walls of spiral on both sides must be the same. Unequal clearance will cause higher axial thrust and excessive load on the fixed bearing N.D.E., reducing its useful life, or even damaging it.
For centering, loosen the correct shaft nut (921) to which the set must be dislocated. Tighten the shaft nut on the opposite side and the set (sleeves and impeller) will dislocate until the shaft nut was unscrewed. When centering is ready tighten the nuts with key nail type or hook type. Mark the shaft with manual drilling machine, using the existents holes of the shaft nut. Mount and tighten the grubscrews (904.1) which will seat on the shaft and will lock the nuts.

Note:

Before assembling, lubricate internal diameter with Molykote paste G, the following parts: impeller, protective sleeves, spacer sleeves and shaft nuts.

7.7.2 Assembly sequence for pumps with mechanical seal

See specific instruction for detailed assembly of mechanical seals.

8. Spare Parts

Recommended spare parts for 2 years operation, according to DIN 24296 standard.

Part nº	Denomination	Nº of Pumps (including stand-by ones)							
		1	2	3	4	5	6 and 7	8 and 9	10 or more
		Spare parts quantity							
234	Impeller	1	1	1	1	2	2	3	30%
321 322	Bearing set (pair) ①	1	1	1	2	2	3	4	50%
457	Neck ring (pair)	1	1	1	2	2	2	3	30%
458	Lantern ring (pair)	1	1	1	2	2	2	3	30%
461	Packing (5 rings)	6	6	10	15	15	15	20	40%
502	Wear rings (pair)	1	2	2	2	3	3	4	50%
503	Impeller wear ring (pair) ②	1	2	2	2	3	3	4	50%
524	Shaft protective sleeve (pair)	1	2	2	2	3	3	4	50%
525.1	Spacer sleeve (pair) ③	1	1	1	2	2	2	3	30%
525.2	Spacer sleeve (pair) ③	1	1	1	2	2	2	3	30%
	Sealing rings set ②	2	4	6	8	8	9	12	150%
Set: Shaft + 3 keys + 2 shaft nuts + 1 or 2 bearing nuts + 1 or 2 lockwashers		1	1	1	2	2	2	3	30%

Table 5 – Recommended spare parts

Notes:
① When pump uses only bearing 321 supply one pair of them. When use one bearing 321 and one bearing 322 supply one of each part.
② Optional for sizes up to 500-890 inclusive.
③ If any.
④ In this table it was considered necessity of some parts in duplicate.

9. Sectional Drawing

9.1 Sizes 125 up to 300

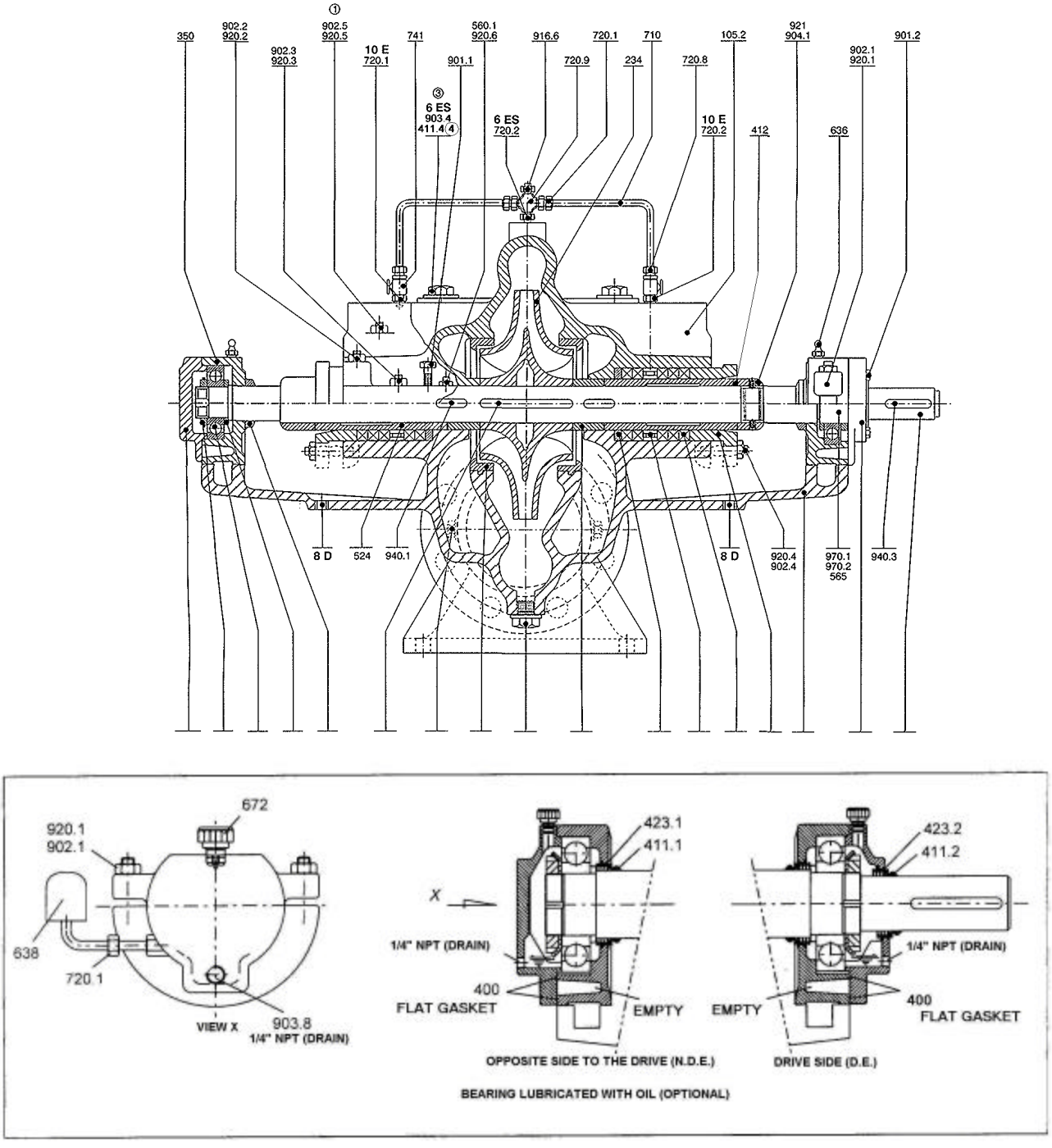
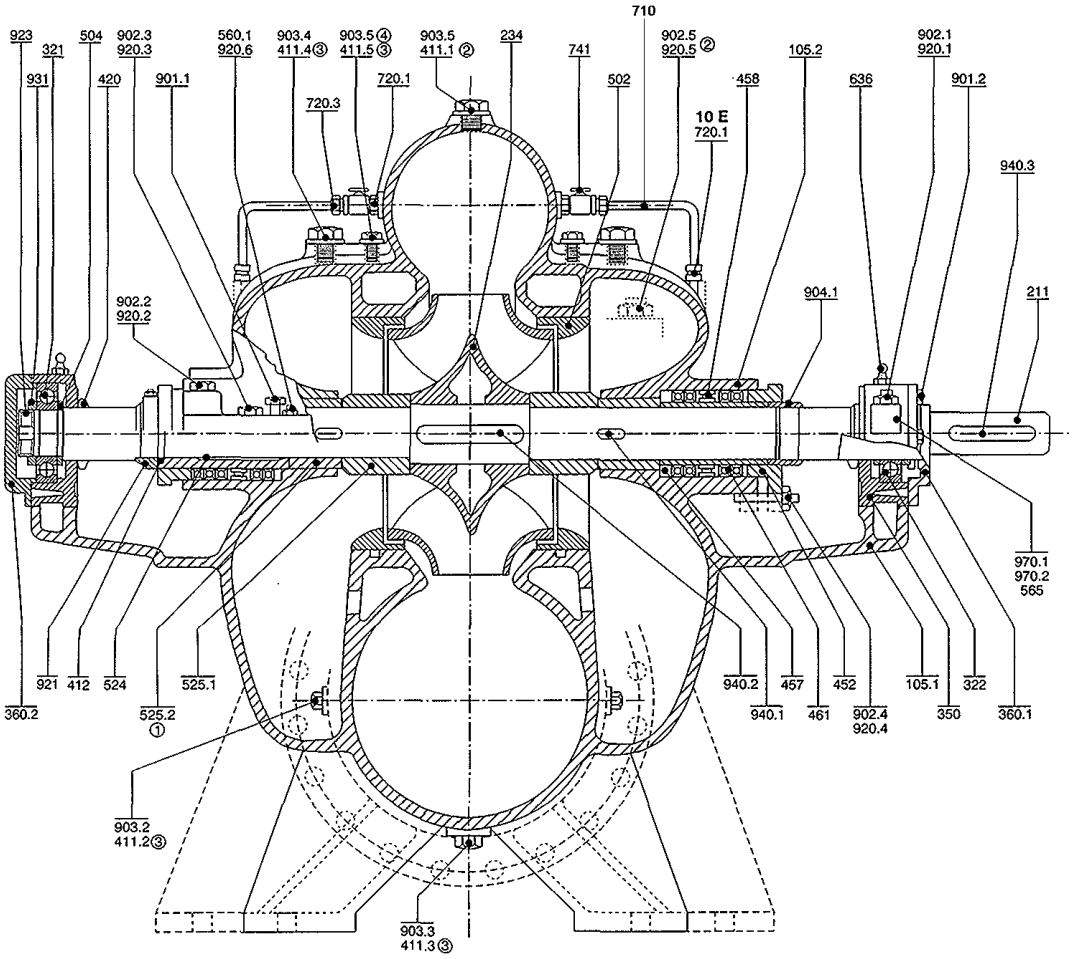


Figure 29

Note:

① Not used at pump sizes 125-250/310, 150-430, 200-340/620, 300-340/400.
② Not used at pump sizes 200-500/620, 250-340/400.
③ Only for pump size 300-400.
④ Not used for pumps with ANSI flanges.

9.2 Sizes 400 up to 500



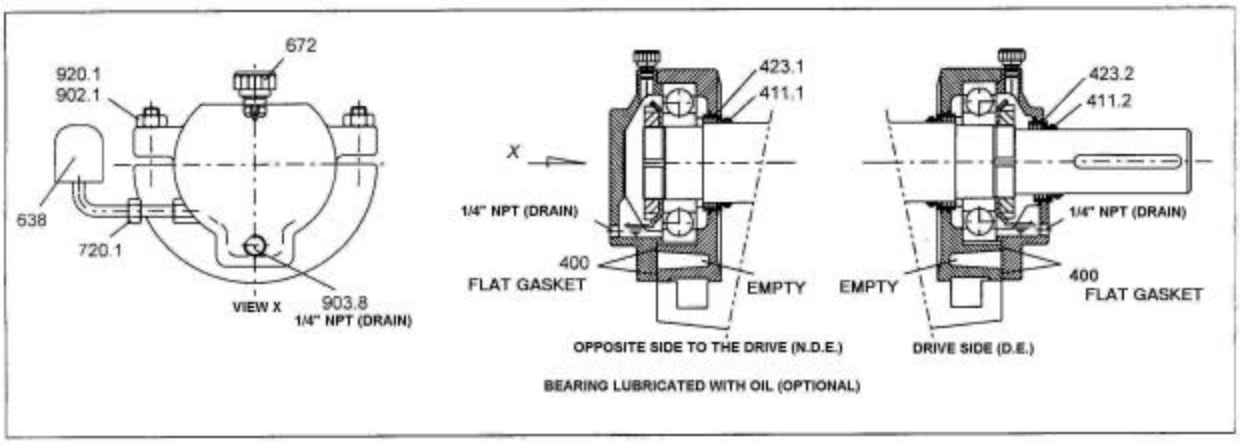


Figure 30

Note:
① Applicable for pump size 400-390, 500-510/640/790.
② Used only for pumps 400-480/620.
③ Not used for pumps with ANSI flanges.
④ Not used for pump size 400-480.

9.3 Sizes 600 up to 800

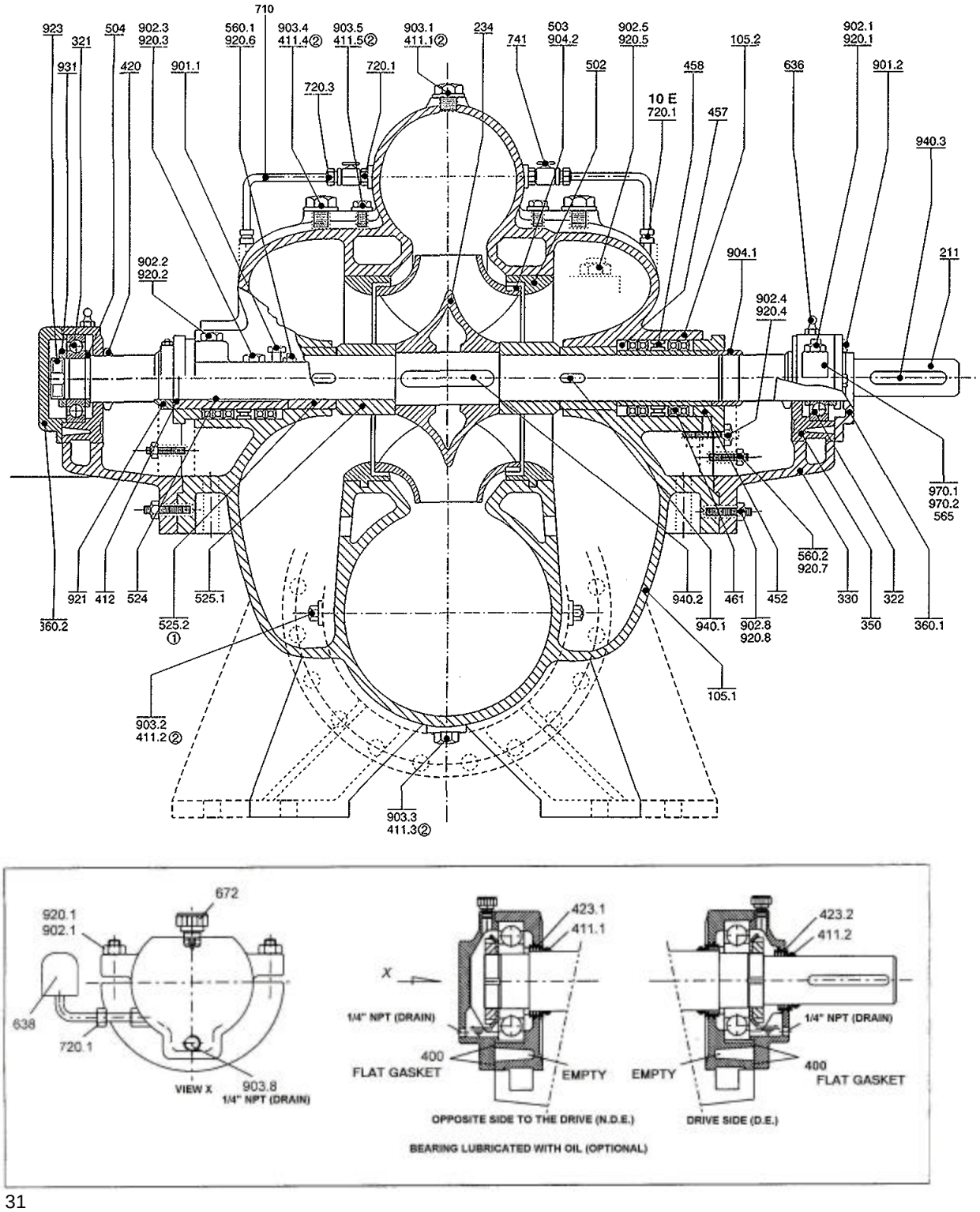


Figure 31

Note:
① Not used for pump size 800-840.
② Not used for pumps with ANSI flanges.

10. Parts List

Denomination	Part nº	Qtty.	00	01	02	03
Lower casing	105.1	1	A48CL30	A48CL30	A536-60-40-18	
Upper casing	105.2	1	A48CL35	A48CL35		
Shaft	211	1	SAE1045			
Double entry impeller	234	1	A48CL30	A743CF8M	A48CL30	A743CF8M
Radial ball bearing	321	1 (1)	STEEL			
Radial roller bearing (2)	322	1				
Bearing bracket (3)	330	2	A48CL30			
Bearing housing	350	2				
Bearing cover (L.A.)	360.1	1				
Bearing cover (L.B.)	360.2	1				
Sealing ring (2) (4)	411.1	1	COPPER			
Sealing ring (4)	411.2	1				
Sealing ring (4)	411.3 / 411.4	2				
Sealing ring (2) (4)	411.5	2				
"O" ring	412	2	NB70			
Sealing ring for shaft	420	2	NB50			
Gland cover	452	2	A48CL30			
Neck ring	457	2	TM23			
Lantern ring	458	2				
Packing	461	10	Aramid packing			
Wear ring	502	2	CuSn10-C-GS	A743CA6NM A743CF8M	CuSn10-C-GS	
Impeller wear ring (6)	503	2				
Spacer ring	504	2	SAE1035			
Shaft protective sleeve	524	2	A48CL30	AISI420	A48CL30	AISI420
Spacer sleeve (7)	525.1	2				
Spacer sleeve (2) (8)	525.2	2				
Conic pin	560.1	2	SAE1045			
Conic pin (3)	560.2	4				
Grease nipple	636	2	STEEL			
Hexagonal head bolt	901.1	2	SAE1020/5.6			
Hexagonal head bolt	901.2	8				
Stud	902.1	4				
Stud	902.2	4				
Stud	902.3	(11)				
Stud	902.4	4				
Stud	902.5	4				
Stud	902.8	16				
Threaded plug (2)	903.1	1	STEEL			
Threaded plug	903.2	4				
Threaded plug	903.3	2				
Threaded plug	903.4	2				
Threaded plug (2) (13)	903.5	1				
Threaded plug (5)	903.6	2				
Grub screw	904.1	8	SAE1045/8.8			
Grub screw (3)	904.2	6				
Nut	920.1 / 920.2	4	SAE1020/6			
Nut	920.3	(11)				
Nut	920.4	4				
Nut (9) (12)	920.5	4				
Nut	920.6	2				
Nut (3)	920.7	4				
Nut (3)	920.8	16				
Shaft nut	921	2	TM23			
Bearing nut	923	2	SAE1045			
Lockwasher	931	2	SPRING STEEL			
Key	940.1	2	SAE1045			
Key	940.2 / 940.3	1				
Plate	970.1 / 970.2	1	AISI304			
Rivet	565	6				
Valve	741	2	BRONZE			
Connection	720.9	2	STEEL			
Piping	710	2				
Constant level oiler (14)	638	2	STEEL / GLASS			
Connection (14)	720.1	2	STEEL			
Threaded plug (14)	903.8	2	STEEL			
Flat gasket (14)	400	2	Compressed fiber jointing sheet			
Vent plug (14)	672	2	ZAMAC			
Labyrinth ring (14)	423.1	2	STEEL			
Labyrinth ring (14)	423.2	1	STEEL			
O-ring (14)	411.1	2	NB70			
O-ring (14)	411.2	1	NB70			

Table 6

(1) Quantity=2 for pumps size 125 up to 300
(2) Not applicable for pump size 125 up to 300
(3) Applicable only for pump size 600 up to 800
(4) Not applicable for pumps with flanges ANSI
(5) Applicable only for pump size 300-400
(6) Applicable for pumps size from 600-540
(7) Not applicable for pumps sizes 200-500; 200-620; 250-340 and 250-400
(8) For pumps sizes 400 up to 500, applicable only for pumps sizes 400-390; 500-510; 500-640 and 500-790. For pumps sizes 600 up to 800, not applicable for pump size 800-400
(9) Not applicable for pumps sizes 600 up to 800
(10) Applicable only for pumps sizes 125 up to 300
(11) Variable quantity according to pumps sizes
(12) For pumps sizes 125 up to 300, not applicable for pumps 125-250; 125-310; 150-490; 200-340; 250-500; 250-620; 300-340 and 300-400. For pumps sizes 400 up to 500, applicable only for pumps sizes 400-480 and 400-620
(13) Not applicable for pumps sizes 400-480
(14) Applicable for pump lubricated with oil.

11. Trouble shooting

Fault	Possible causes
Pump fails to deliver liquid after being switched on	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 14, 16, 17, 22, 23, 24, 34, 39
Pump ceases to deliver liquid	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 22, 23, 24, 34, 39
Pump overheat and/or fails to deliver liquid	1, 3, 9, 10, 11, 21, 22, 27, 29, 30, 31, 33, 34, 40, 41
Flow capacity too low	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 14, 16, 17, 20, 21, 22, 23, 24, 25, 26, 34
Flow capacity too high	15, 18, 20, 34
Pump pressure too low	4, 14, 16, 18, 20, 22, 23, 24, 25, 26, 34
Excessive leakage at shaft seal	27, 28, 29, 30, 33, 34, 35, 36, 38, 39, 41
Excessive wear on gaskets	12, 13, 27, 28, 29, 30, 33, 34, 35, 36, 37, 38, 39, 41
Drive machine overload	12, 13, 15, 18, 19, 20, 23, 25, 27, 28, 31, 33, 34, 35, 37, 44
Pump does not run smooth (noise)	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 15, 17, 18, 21, 23, 24, 27, 28, 29, 30, 31, 32, 33, 34, 40, 41, 42, 45, 46
Bearings temperature too high	27, 28, 29, 30, 31, 32, 33, 34, 40, 41, 42, 43, 44, 45, 46

Table 6 – Faults and possible causes

Probable Causes

1. Pump was not appropriately primed.
2. Pump and suction piping are not totally filled with liquid to be pumped.
3. Suction is too high, that means NPSHr is higher than NPSHd.
4. Pumped liquid contain air or gas.
5. Air pocket in the suction piping.
6. Air entrance in the suction piping.
7. Air entrance through shaft sealing.
8. Suction piping is not enough submerged.
9. Suction valve is closed or partially opened.
10. Foot valve or strainer of suction piping is dirty, or clogged.
11. Foot valve is too small or it is clogged.
12. None, or insufficient quantity of sealing / lubricating liquid in the shaft seal housing.
13. Lantern ring is not located according to the designed, below the sealing liquid hole, this way the shaft seal chamber is irregularly feed by insufficient quantity of sealing / lubricating liquid.
14. Too low speed.
15. Too high speed.
16. Speed in reverse side.
17. Total installation height (counter pressure) higher than head.
18. Total installation height (counter pressure) lower than head.
19. Liquid specific gravity is different from specified.
20. Liquid viscosity is different from specified.
21. Pump functioning with too low flow (discharge of valve piping probably partially closed).
22. Parallel operation with different hydraulic characteristics.
23. Foreign particles in the impeller.
24. Defective or worn impeller.
25. Casing and/or impeller wear rings worn.
26. Pump internal leakage from pressure chamber to the suction, due to worn wear rings.
27. Misalignment of coupling.
28. Shaft vibration.
29. Shaft vibration due to absence of rotor balance.
30. Shaft runs eccentric due to wear of bearings or misalignment.
31. Impeller friction with casing parts.
32. Foundation is not rigid enough.
33. Pump is not aligned.
34. Operation conditions are not according to the indicated data of the Purchase order.
35. Incorrect assembly of shaft seal or mechanical seal.
36. Wear of shaft protective sleeve, due to abrasive solids of the sealing liquid.
37. Insufficient packing lubrication, due to gland cover being over tightened.
38. Excessive clearance between shaft and neck ring, or between shaft and shaft passage diameter in the seal chamber.
39. Damaged mechanical seal due to dry operation.
40. High axial thrust, due to defect inside the pump.
41. Worn bearings.
42. Defective assembly of bearings.
43. Excessive quantity of grease in the bearing housing.
44. Defective lubrication of the bearings.
45. Dirty bearings.
46. Oxidation of bearings due to water or moisture in bearing housings.

KSB has the right to change any information contained in this manual without previous notice.

14.05.2007

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