Etanorm

Standardized pumps

Works No.: _____

Type series: Etanorm

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.

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Contents

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Index

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1 General

Caution This KSB product has been developed in accordance with state-of-the-art technology; it is manufactured with utmost care and subject to continuous quality control.
These operating instructions are intended to facilitate familiarization with the unit 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 unit 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 for the medium handled, capacity, speed, density, pressure, temperature and motor rating specified in the technical documentation. 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 name plate indicates the type series / size, main operating data and works number; please quote this information in all 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 centre.
Noise characteristics see section 4.5.

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 close 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.

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,
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 a perfectly legible condition at all times.

2.2 Personnel qualification and training

All personnel involved in the operation, maintenance, inspection and installation of the unit 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 / unit 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 unit 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.

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 unit is operating.
- Leakages (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 or the environment. All relevant laws must be heeded.
- 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.)

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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 casing must have cooled down to ambient temperature.

Pump pressure must have been released and the pump must have been drained.
Work on the machine / unit must be carried out only during standstill. The shutdown procedure described in the manual for taking the unit 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 "Commissioning / Start-up" before returning the unit to service.

2.7 Unauthorized modification and manufacture of spare parts

Modifications or alterations of the equipment supplied 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 operating reliability and safety of the unit supplied is only valid if the equipment is used in accordance with its designated use as described in section 4 if this operating manual. The limits stated in the data sheet must not be exceeded under any circumstances.

3 Transport and interim storage

3.1 Transport

Transport of the unit requires proper preparation and handling. Always make sure that the pump or the unit remains in horizontal position during transport and cannot slip out of the transport suspension arrangement. Do not use a lifting sling on the free shaft end of the pump or on the motor eyebolt.

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

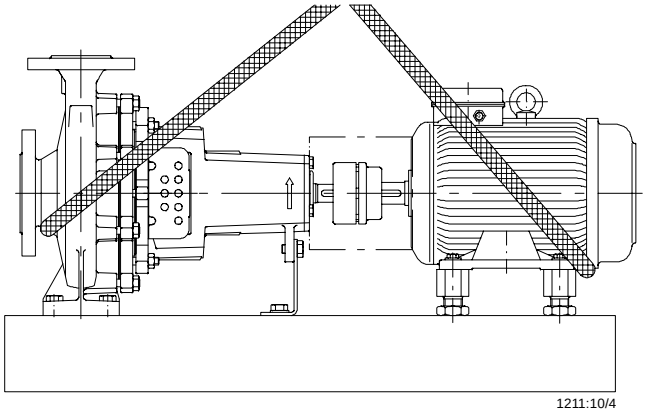

Fig. 3.1-1 Transport of the complete unit

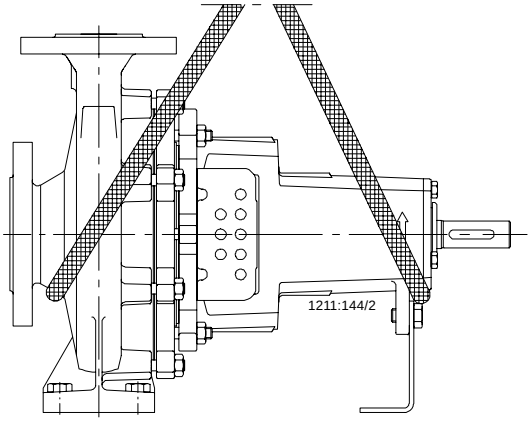

Fig. 3.1-2 Transport of the pump

3.2 Interim storage/Preservation

When the unit is temporarily put into storage, only the wetted low-alloy components (e.g. cast iron JL 1040[1)], nodular cast iron JS 1025[2)], etc.) must be preserved. Commercially available preservatives can be used for this purpose. Please observe the manufacturer's instructions for application/removal.

The unit / pump should be stored in a dry room where the atmospheric humidity is as constant as possible.
If stored outdoors, the unit and crates must be covered by waterproof material to avoid any contact with humidity.

Caution Protect all stored goods against humidity, dirt, vermin and unauthorized access! All openings of the assembled unit components are closed and must only be opened when required during installation.

All blank parts and surfaces of the pump are oiled or greased (silicone-free oil and grease) to protect them against corrosion.

4 Description of the product and accessories

4.1 Technical specification

Volute casing pumps for handling clean or aggressive liquids.

4.2 Designation

EN 40 - 160 43 (6238) G 10

- Etanorm type series
- Pump size, e.g.
- Actual impeller diam. - 100 mm e.g. 143 mm = (angular reduction of impeller vanes)
- e.g. actual diam. 162/138 mm = — — — — — — — —
- Casing material, e.g. cast iron JL 1040 [1)]
- Shaft seal, e.g. mechanical seal Q_1Q_1EX4GG

4.3 Design details

Pump

Design:	horizontal volute casing pump, single-stage, with power ratings and main dimensions to EN 733, long-coupled, in back pull-out design. Shaft equipped with replaceable shaft sleeve/ shaft protecting sleeve in the shaft seal area. Volute casing with integral pump feet. Volute casing and impeller with replaceable casing / impeller wear rings.
Bearings:	grease-lubricated / oil-lubricated deep-groove ball bearings
Shaft seal:	mechanical seal / gland packing

1) to EN 1561 = GJL-250
2) to EN 1563 = GJS-400-18-LT

4.4 Permissible forces and moments at the pump nozzles

Pump size	Etanorm G. M			Etanorm S		
	F_{Vmax}	F_{Hmax}	M_{tmax}	F_{Vmax}	F_{Hmax}	M_{tmax}
	[kN]	[kN]	[kNm]	[kN]	[kN]	[kNm]
32-125.1	2.6	1.8	0.55	3.65	2.59	0.58
32-160.1	2.5	1.7	0.5	3.56	2.51	0.51
32-200.1	2.5	1.7	0.5	3.60	2.43	0.51
32-250.1	2.5	1.7	0.5	--	--	--
32-125	2.6	1.8	0.55	--	--	--
32-160	2.5	1.7	0.5	3.56	2.51	0.51
32-200	2.5	1.7	0.5	3.65	2.43	0.51
32-250	2.5	1.7	0.5	3.73	2.59	0.58
40-125	2.6	1.8	0.6	--	--	--
40-160	2.6	1.8	0.6	3.81	2.67	0.81
40-200	2.6	1.8	0.6	3.81	2.67	0.81
40-250	2.6	1.8	0.6	4.21	2.92	0.58
40-315	2.7	1.9	0.7	4.09	2.84	0.55
50-125	2.7	2.0	0.75	--	--	--
50-160	2.7	1.9	0.7	3.97	2.67	1.11
50-200	2.7	1.9	0.7	4.21	2.92	1.11
50-250	2.7	1.9	0.7	4.58	3.32	0.87
50-315	2.9	2.1	0.75	4.54	3.24	0.84
65-125	3.0	2.2	0.85	--	--	--
65-160	3.0	2.2	0.85	4.42	3.04	1.16
65-200	3.0	2.2	0.85	5.27	3.89	1.79
65-250	3.2	2.4	1.05	5.27	3.89	1.79
65-315	3.2	2.4	1.05	5.43	4.05	1.62
80-160	3.5	2.8	1.2	5.43	4.05	1.91
80-200	4.0	2.9	1.45	6.08	4.74	2.44
80-250	4.0	2.9	1.45	6.16	4.78	2.44
80-315	4.0	2.9	1.45	6.28	4.86	2.78
80-400	4.3	3.2	1.75	--	--	--
100-160	5.4	4.4	2.4	7.70	6.28	3.60
100-200	5.4	4.4	2.4	7.70	6.28	3.60
100-250	5.2	4.0	2.3	7.86	6.48	3.47
100-315	4.6	3.7	1.9	7.57	6.16	3.18
100-400	5.2	4.3	2.35	--	--	--
125-200	6.3	5.6	3.3	9.50	8.50	5.10
125-250	6.7	5.8	3.4	9.84	8.71	5.10
125-315	6.7	6.0	3.4	9.32	8.10	4.75
125-400	6.7	5.8	3.4	9.23	7.90	4.63
150-200	7.4	6.85	4.0	--	--	--
150-250	7.4	6.85	4.0	--	--	--
150-315	7.4	6.85	4.0	10.53	9.72	5.67
150-400	7.4	6.85	4.0	10.53	9.72	5.67

Pump size	Etanorm C			Etanorm B		
	F_{Vmax}	F_{Hmax}	M_{tmax}	F_{Vmax}	F_{Hmax}	M_{tmax}
	[kN]	[kN]	[kNm]	[kN]	[kN]	[kNm]
32-125.1	--	--	--	1.93	1.37	0.41
32-160.1	--	--	--	1.89	1.33	0.36
32-200.1	--	--	--	1.89	1.30	0.36
32-250.1	--	--	--	--	--	--
32-125	--	--	--	--	--	--
32-160	4.10	2.87	0.80	1.89	1.33	0.36
32-200	4.10	2.78	0.80	1.89	1.30	0.36
32-250	4.25	2.96	0.95	--	--	--
40-125	--	--	--	--	--	--
40-160	--	--	--	2.02	1.40	0.45
40-200	--	--	--	2.02	1.40	0.45
40-250	--	--	--	2.20	1.54	0.60
40-315	--	--	--	--	--	--
50-125	--	--	--	--	--	--
50-160	4.53	3.05	1.27	2.10	1.40	0.59
50-200	4.81	3.33	1.27	2.23	1.54	0.60
50-250	5.22	3.80	1.57	2.42	1.76	0.73
50-315	--	--	--	--	--	--
65-125	--	--	--	--	--	--
65-160	5.04	3.47	1.34	2.34	1.61	0.62
65-200	6.00	4.44	2.08	2.80	2.06	0.96
65-250	6.00	4.44	2.08	2.80	2.06	0.96
65-315	6.20	4.62	2.17	--	--	--
80-160	--	--	--	2.88	2.15	1.01
80-200	6.94	5.41	2.77	3.22	2.51	1.29
80-250	7.03	5.45	2.77	3.26	2.53	1.29
80-315	7.16	5.55	2.86	--	--	--
80-400	7.58	6.01	3.23	--	--	--
100-160	--	--	--	4.08	3.33	1.89
100-200	--	--	--	4.08	3.33	1.89
100-250	8.97	7.40	4.25	4.17	3.44	1.97
100-315	8.65	7.03	3.97	4.02	3.26	1.84
100-400	--	--	--	--	--	--
125-200	--	--	--	4.90	4.46	2.64
125-250	11.23	9.94	5.87	5.22	4.62	2.73
125-315	10.63	9.25	5.41	4.94	4.30	2.51
125-400	--	--	--	--	--	--
150-200	--	--	--	--	--	--
150-250	12.02	11.10	6.47	5.59	5.16	3.00
150-315	12.02	11.10	6.47	5.59	5.16	3.00
150-400	--	--	--	5.59	5.16	3.00

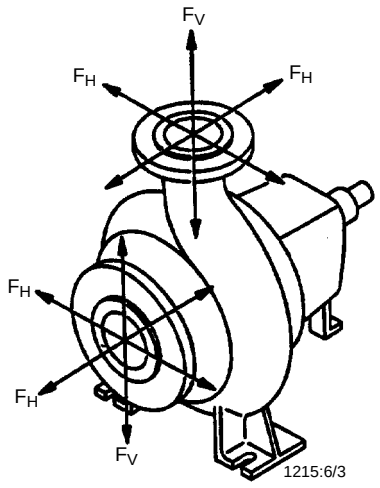

Fig. 4.4-1 Nozzle forces and moments

The following condition must be met:

$$\left[\frac{\Sigma\ |F_V|}{|F_{Vmax}|}\right]^2 + \left[\frac{\Sigma\ |F_H|}{|F_{Hmax}|}\right]^2 + \left[\frac{\Sigma\ |M_t|}{|M_{tmax}|}\right]^2 \leq 1$$

$\Sigma\ |F_V|$, $\Sigma\ |F_H|$ and $\Sigma\ |M_t|$ are the sums of the absolute values of the respective loads acting on the nozzles. Neither the load direction nor the load distribution among the nozzles are taken into account in these sums.

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4.5 Noise characteristics

Rated power input P_N (kW)	'A'-weighted surface sound pressure level $\overline{L}$ pA [dB]			
	Pump only		Pump with motor	
	1450 1/min dB [1]	2900 1/min dB [1]	1450 1/min dB [2]	2900 1/min dB [2]
0.55	47	48	55	64
0.75	48	50	56	66
1.1	50	52	57	66
1.5	52	54	58	67
2.2	54	56	59	67
3.0	55	57	60	68
4.0	57	59	61	68
5.5	59	61	62	70
7.5	60	62	64	71
11.0	62	64	65	73
15.0	64	66	67	74
18.5	65	67	68	75
22.0	66	68	69	76
30.0	67	70	70	77
37.0	68	71	71	78
45.0	69	72	73	78
55.0	70	73	74	79
75.0	72	75	75	80
90.0	73	76	76	81
110.0	74	77	77	81

1) measured at a distance of 1 m from the pump outline (as per ISO 3744)
2) measured at a distance of 1 m from the unit outline (as per ISO 3744)

The above noise characteristics apply to non-cavitating pump operation in the Q_{opt} range.

4.6 Accessories

Drive — surface-cooled IEC three-phase squirrel-cage motor

Coupling Design: — flexible coupling with/without spacer sleeve

Baseplate — channel section or folded steel plate for the complete unit (pump and motor) in torsion-resistant design.

Drive, coupling and baseplate can be supplied either by KSB or by the operator.

5 Installation at site

5.1 Safety regulations

Electrical equipment operated in hazardous locations must comply with explosion protection regulations. This is indicated on the motor rating plate.
If the equipment is installed in hazardous locations, the applicable local explosion protection regulations and the regulations of the test certificate supplied with the equipment and issued by the responsible approval authorities must be observed and complied with. The test certificate supplied must be kept close to the location of operation for easy access (e.g. foreman's office).

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 / general arrangement drawing.
The concrete foundations shall have sufficient strength (min. class X0) in accordance with DIN 1045.

Make sure that the concrete foundation has set firmly before placing the unit on it. Its surface shall be truly horizontal and even.

5.3 Installing the pump/unit

After placing the pump on the foundation, align it with the help of a spirit level placed on the shaft/discharge nozzle. The correct distance between the coupling halves as specified in the general arrangement drawing must be observed. Shims shall be fitted between the baseplate/foundation frame 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.

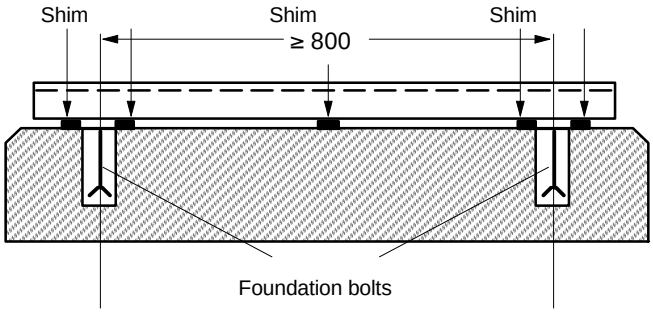

Fig 5.3-1 Fitting required shims

Tighten the foundation bolts evenly and firmly.

Baseplates up to 400 mm wide are made of channel section and torsion-resistant in their own right; they need not be grouted.

Baseplates more than 400 mm wide are made of folded steel plate and shall be grouted up to the upper edge through the holes 120 mm using low shrinkage concrete.

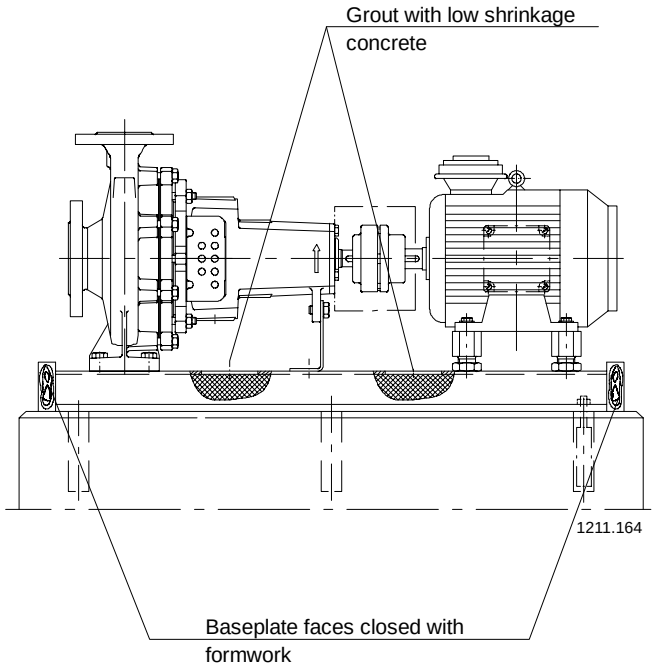

Fig. 5.3-2 Grouting the baseplate

5.3.1 Place of installation

The volute casing and discharge cover take on roughly the same temperature as the medium handled. The discharge cover and the bearing bracket must not be insulated. Take the necessary precautions to avoid burns!

5.3.2 Aligning the pump/drive

Caution After fastening the baseplate on the foundation, the coupling must be thoroughly checked and the pump set be re-aligned (at the motor), if required .
Prior to checking the alignment/re-alignment, loosen support foot 183 and re-tighten without transmitting any stresses or strains.
Coupling check and re-alignment must be effected even if pump and motor are supplied completely assembled and aligned on a common baseplate.

Motors with adjusting screw:
In order to re-align the coupling, first loosen the 4 hex. head bolts on the motor as well as the lock nuts.
Turn adjusting screw by hand or by means of an open-jawed wrench until the coupling alignment is correct. Then re-tighten the 4 hex. head bolts and the lock nuts.

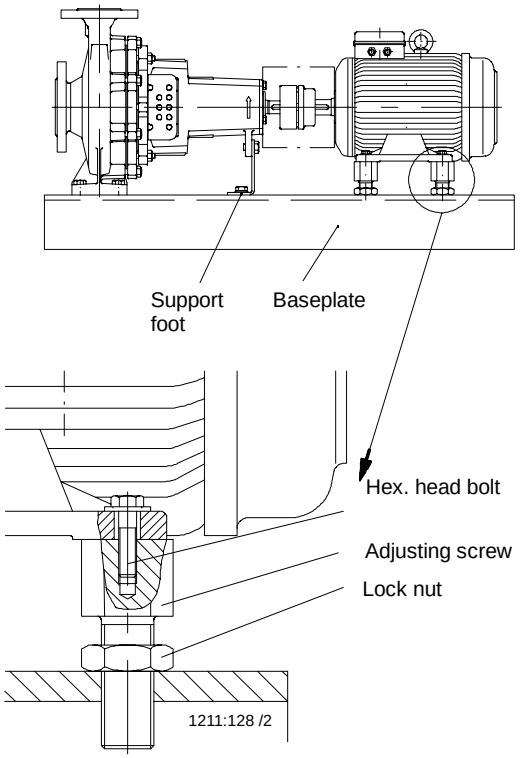

Fig. 5.3-3 Motor with adjusting screws

Motors without adjusting screws

Any differences in shaft centre height between the pump and the motor are compensated by means of appropriately sized bases. If pump and motor shaft centres are the same height, pump and motor are mounted directly on the baseplate.
In order to re-align the coupling, loosen the four hex. head bolts on the motor. Re-adjustment is effected by adding appropriately sized sheet packs as per ZN 9 under the motor feet until the coupling is correctly aligned.
Then re-tighten the four hex. head bolts.

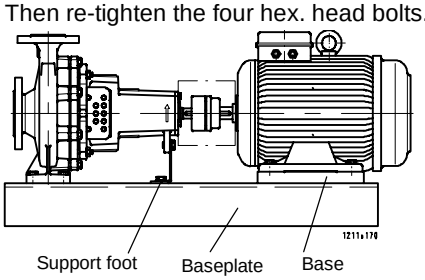

Fig. 5.3-4 Motor without adjusting screws

The pump set is correctly aligned if a straight-edge placed axially on both coupling halves is the same distance from each shaft at all points around the circumference. Make sure to turn the measuring point by hand all the time. In addition, the distance between the two coupling halves must remain the same all around the circumference. Use a gauge to verify (see figs. 5.3-4 and 5.3-5).

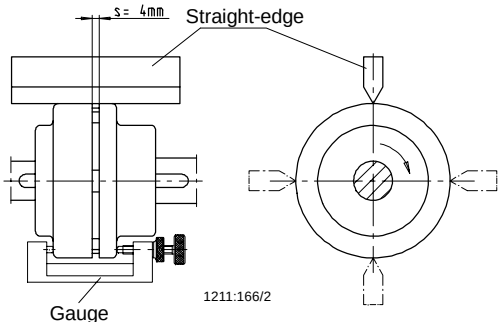

Fig. 5.3-5 Aligning a flexible coupling without spacer sleeve

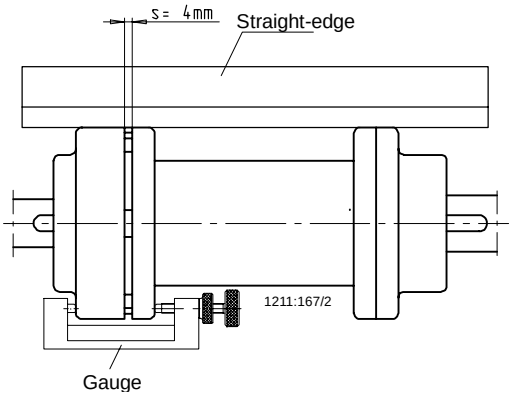

Fig. 5.3-6 Aligning a flexible coupling with spacer sleeve

The radial and axial deviation between the two coupling halves must not exceed 0.1 mm.
This must also be ensured at operating temperature and under inlet pressure.
Improper alignment of the unit can cause damage to both the coupling and the unit itself!

5.4 Connecting the piping

Caution Never use the pump itself as an anchorage point for the piping.

The piping-induced forces and moments acting on the pump flanges (e.g. due to warped pipelines or thermal expansion) must not exceed the permissible forces and moments specified in section 4.4.

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 close proximity to the pump and connected without transmitting any stresses or strains. Their weight must not be carried by the pump.

With short pipelines, the nominal diameters should be at least equal to the nominal diameters of the pump nozzles. For long pipelines, the most economical nominal diameter has to be determined from case to case.

Adapters to larger diameters should have a diffuser angle of approx. 8 in order to avoid any increase in pressure losses.

It is recommended to install check and shut-off elements in the system, depending on the type of plant and pump.

Thermal expansions of the pipelines must be compensated by appropriate measures so as not to impose any extra loads on the pump.

⚠ An excessive, impermissible increase in the pipeline forces may cause leaks on the pump where the medium handled can escape into the atmosphere.
Danger to life when hot media are handled!

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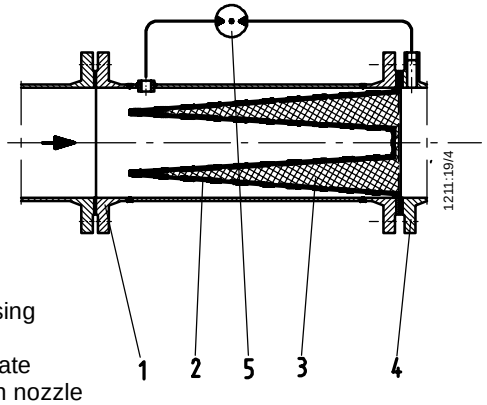
The flange covers on the pump suction and discharge nozzles must be removed prior to installation in the piping.

Before commissioning new installations thoroughly clean, flush and blow through all vessels, pipelines and connections. Often welding beads, scale and other impurities only come off after a certain period of operation. Fit a strainer in the suction line to prevent them from entering the pump. The total cross-section of the holes in the strainer shall be three times the cross-section of the pipeline in order to avoid excessive pressure loss across the strainer due to clogging. Conical strainers with laidin wire mesh having a mesh width of 0.5 mm and a wire diameter of 0.25 mm, of corrosion-resistant material, shall be used.



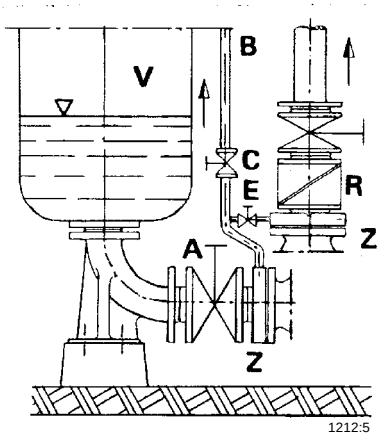
1 Strainer housing
2 Fine screen
3 Perforated plate
4 Pump suction nozzle
5 Differential pressure gauge

Bild 5.4-1 Conical strainer for the suction line

5.4.1 Vacuum balance line

Where liquid has to be pumped out of a vessel under vacuum, it is advisable to install a vacuum balance line. This line shall have a nominal diameter of at least 25 mm and must be arranged to lead into the vessel at a point above the highest permissible liquid level.

An additional pipeline fitted with a shut-off valve – from the pump discharge nozzle to the balance line – facilitates venting of the pump before start-up.



A Main shut-off valve
B Vacuum balance line
C Shut-off valve
E Vacuum-tight shut-off valve
R Swing check valve
V Vessel under vacuum
Z Intermediate flange

Fig. 5.4-2 Suction line and vacuum balance line

5.4.2 Auxiliary connections

The dimensions and locations of the auxiliary connections (barrier liquid, flushing liquid, controlled leakage etc.) are indicated in the general arrangement drawing or piping layout.

Caution Connecting and activating the auxiliary feed lines is required for proper functioning of the pump and therefore of vital importance!

5.5 Connection to power supply

Connection to the power supply must be effected by a trained electrician only.

The applicable DIN VDE regulations 0100 and, for explosion-proof units, 0165 must be complied with.

Check available mains voltage against the data on the motor rating plate and select appropriate start-up method.

All connections shall be effected in accordance with the technical specifications issued by the local energy supply company.

We strongly recommend to use a motor protection device.

DIN VDE 0170/0171 stipulates that explosion-proof motors, type of protection IP 54, increased safety Ex EEx, temperature class T3, must always be connected via a motor protection switch.

5.5.1 Motor connection

In compliance with DIN VDE 0530 – Part 8, the three-phase motors are always wired for clockwise rotation (looking at the motor shaft stub).

The pump's direction of rotation is anti-clockwise (looking at the suction flange).

For the motor's direction of rotation to match the pump's direction of rotation, the motor must be connected as shown in fig. 5.6-1 or 5.6-2, as applicable.

Δ configuration (low voltage)

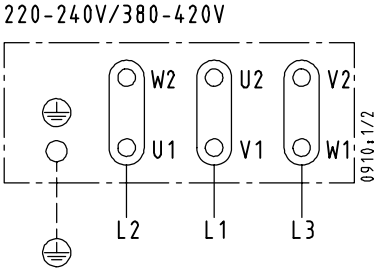


Fig. 5.5-1 Connection diagram for three phase motors, Δ configuration

Y configuration (high voltage)

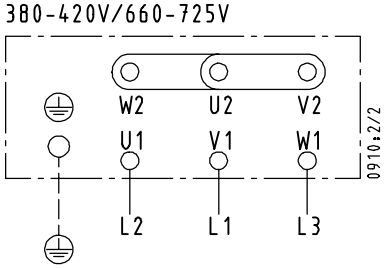


Fig. 5.5-2 Connection diagram for three phase motors, Y configuration

If required, connect the PTC resistors as per DIN 44081/44082 with the tripping unit in accordance with fig. 5.5-3.

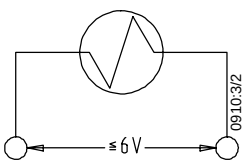


Fig. 5.5-3 Connection diagram for PTC resistors

5.5.2 Setting the time relay

Make sure that in the case of three-phase motors with star-delta starting method switching over from star to delta will be effected at very short intervals. Prolonged switch-over intervals will result in pump damage.
Time relay setting for star-delta starting:

Motor rating	Y time to be set
≤ 30 kW	< 3 s.
> 30 kW	< 5 s.

5.5.3 Checking the direction of rotation

The motor's direction of rotation must correspond to the direction indicated by the arrow on the pump's volute casing (clockwise seen from the motor end). Verify by switching the motor on and then off again immediately.
If the pump runs in the wrong direction of rotation, interchange any two phases L1, L2 or L3 of the power cable in the motor terminal box.

6 Commissioning, start-up / Shutdown

6.1 Commissioning

Caution Before starting up the pump make sure that

- the pump unit has been properly connected to the electric power supply and is equipped with all protection devices;
- the pump has been primed with the liquid to be pumped;
- the direction of rotation has been checked;
- all auxiliary lines have been properly connected.

6.1.1 Lubricants

Grease-lubricated bearings
Grease-lubricated bearings have been packed with grease at the factory.

Oillubricated bearings

The bearing bracket has to be filled with lubricating oil. Quality C, CL, CLP46 as per DIN 51517.

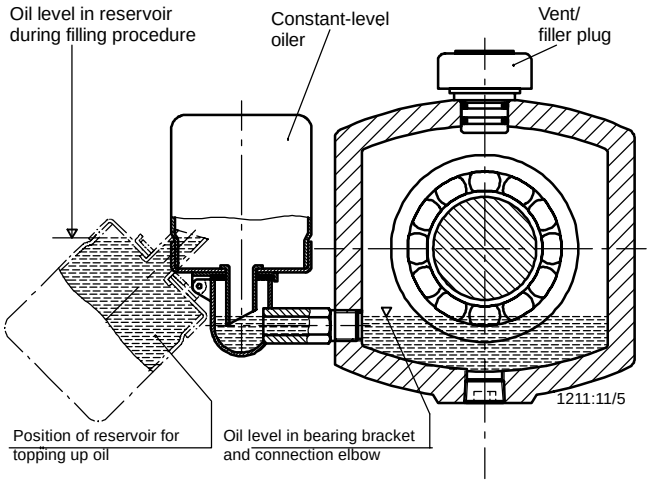


Fig. 6.1-1 Oil fill

Procedure:

Remove vent plug 672. 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 (Fig. 6.1-1). Then fill the reservoir of the constant-level oiler with oil and snap it back into operating position. Fit vent plug 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 shall always be below the the level of the vent opening arranged at the top edge of the connection elbow.

To check the oil level, we recommend to slowly drain oil through the drain plug until the constant-level oiler starts to operate, i.e. until air bubbles can be seen in the oiler.
If no constant-level oiler is provided on the bearing bracket, make sure that the oil level reaches the centreline of the oil level sight glass arranged at the side of the bearing bracket.

6.1.2 Shaft seal

Shaft seal (see sections 7.4.4 and 7.5.2)

6.1.3 Priming the pump and checks to be carried out

Before start-up, the pump and the suction line must be vented and primed with the liquid to be pumped. The shut-off valve in the suction line must be fully open.
Fully open all auxiliary lines provided (barrier, flushing liquid, etc.) and check the throughflow. Open the shut-off valve in the vacuum balance line (if any), and close the vacuum-tight shut-off valve E (fig. 5.4-2).

Caution **Dry-running will result in increased wear and must be avoided.**

6.1.4 Final check

Re-check the alignment as described in section 5.3.2. It must be easy to rotate the coupling/shaft by hand.

Caution Check the integrity and proper functioning of all connections.

6.1.5 Contact guard

In compliance with the accident prevention regulations the pump must not be operated without a coupling guard.
If the customer specifically requests not to include a coupling guard in our delivery, then the operator must supply one!

6.1.6 Start-up

Always make sure that the shut-off valve in the discharge line is closed before the pump is started up! Only after the pump has reached full rotational speed shall the shut-off valve in the discharge line be opened slowly and adjusted to comply with the duty point.

Caution After the operating temperature has been reached and/or in the event of leakage, switch off the unit and re-tighten hex. nuts 920.3 and 920.5.
Check the coupling alignment as described in section 5.3.2 and re-align, if necessary. For leakage at the gland packing please refer to section 7.2.1.

6.1.7 Shutdown

Close the shut-off valve 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 there is back-pressure.

The shut-off valve in the suction line must not be closed when switching off the pump.

Switch off the motor, making sure that the unit runs down smoothly to a standstill.

Depending on the type of installation, the pump should have a sufficient after-run time – with the heat source shut off – until the medium handled has cooled down sufficiently to avoid a heat build-up in the pump.

For prolonged shutdown, close the shut-off valve in the suction line. Close the auxiliary connections.

The shaft seal in pumps where the liquid is fed in under vacuum must also be supplied with barrier liquid during standstill.

In the event of frost and/or prolonged shutdowns, the pump must be drained or otherwise protected against freezing.

6.2 Operating limits

6.2.1 Temperature of the medium handled

Caution Do not operate the pump at product temperatures exceeding those specified on the data sheet or the name plate.

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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 shall not exceed the following number of start-ups per hour (h).
Etanorm G, M, S: 15 start-ups/h
Etanorm B, C: 6 start-ups/h

6.2.3 Minimum flow

If the plant configuration is such that the pump might be operated against a closed discharge side valve, a minimum flow of

t - 30 to +70 °C ≈ 15 % of $Q_{opt.}$
t >70 to +140 °C ≈25 % of $Q_{opt.}$
must be ensured during this period.

6.2.4 Density of medium handled

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

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 pump storage.

6.3.1 Storage of new pumps

- New pumps are supplied by our factory duly prepared for storage.
  Maximum protection for up to 12 months, if the pumps are properly stored indoors.
- Store the pump in a dry location.

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 and maintenance work 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 pump nozzles (e.g. with plastic caps or similar).

6.4 Returning to service after storage

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

In addition, the instructions laid down in the sections on "Commissioning" (6.1) and "Operating limits" (6.2) must be observed.

Immediately following completion of the work, all safety-relevant and protective devices must be re-installed and/or re-activated.

7 Servicing / Maintenance

7.1 General instructions

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.

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.

Pumps handling liquids posing health hazards must be decontaminated. When draining the fluid pumped see to it that there is no risk to persons or the environment. All relevant laws must be heeded.

7.2 Servicing / Inspection

7.2.1 Supervision of operation

Caution The pump must run quietly and free from vibrations at all times.

The pump must never be allowed to run dry.

Do not run the pump against a closed shut-off valve for prolonged periods of time so as to avoid heating up of the fluid pumped.

Max. permissible room temperature 40 °C.

The bearing temperature may exceed room temperature by up to 50 °C, but must never rise above 90 °C (measured on the outside of the bearing bracket).
Verify correct oil level as described in section 6.1.1.

For required minimum flows please refer to section 6.2.3.

During pump operation the shut-off valve in the suction line must not be closed.

The gland packing, if fitted, must drip slightly during operation. The gland cover shall only be tightened gently.

Undo hex. head bolt(s) 901.3, then remove cover plate 81-92 at bearing bracket 330 before carrying out any maintenance work on the gland packing.

Make sure to fit the cover plate again before re-starting the pump.

If pure graphite packings are used, there must always be leakage. For permissible leakage rates please refer to section 7.5.2.3. If the gland shows excessive leakage after a significant period of operation, evenly tighten the gland nuts by 1/6 of a turn, then check the leakage. If the gland cover cannot be tightened any further, add a new packing ring. Normally it will not be necessary to replace the complete packing.

The mechanical seal, if fitted, shows only slight or invisible (vapour) leakage during operation. It is maintenance-free.

Any stand-by pumps installed shall be switched on and then immediately off again once a week to keep them operational.

Attention shall be paid to the correct functioning of the auxiliary connections.

Caution If the flexible coupling elements begin to show signs of wear, they must be replaced in due time.

7.2.2 Lubrication and lubricant change

7.2.2.1 Lubrication

The rolling element bearings are lubricated with grease or mineral oil. For the required quantity please refer to section 7.2.2.4.

7.2.2.2 Grease quality / Grease change

The bearings are packed with high-quality lithium-soap grease. Under normal conditions the grease-lubricated bearings will run for 15,000 operating hours or 2 years. Under unfavourable operating conditions, e.g. high room temperature, high atmospheric humidity, dust-laden air, aggressive industrial atmosphere etc., the bearings shall be checked earlier and cleaned and re-lubricated, if required.

Use a high-quality lithium-soap grease, free of resin and acid, not liable to crumble and with good rust-preventive characteristics. The grease should have a penetration number between 2 and 3, corresponding to a worked penetration between 220 and 295 mm/10. Its drop point must not be below 175°C. The bearing cavities must only be half-filled with grease.
If required, the bearings may be lubricated with greases of other soap bases. Since greases of differing soap bases must not be mixed, the bearings must be thoroughly cleaned beforehand. The re-lubrication intervals required must then be adjusted to the greases used.

7.2.2.3 Oil change

The first oil change shall be carried out after 300 operating hours, the following ones after every 3000 operating hours, at least once a year.

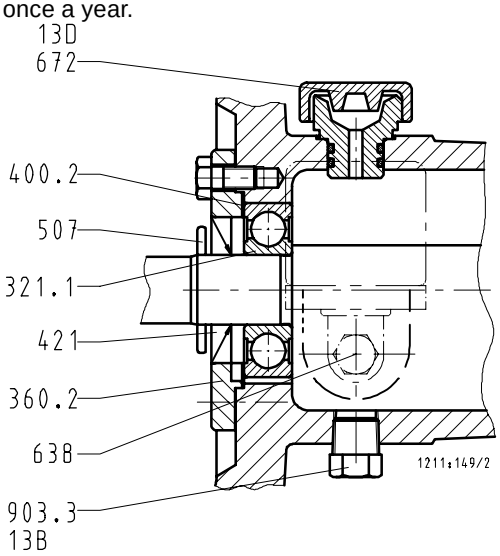

Fig. 7.2-1 Oil lubrication

Part No.	Description	Part No.	Description
321.1	Deep-groove ball bearing	638	Constant-level oiler
360.2	Bearing cover	672	Vent plug
400.2	Gasket	903.3	Screwed plug
421	Lip seal	13 B	Oil drain
507	Thrower	13 D	Oil – filling and venting

Procedure:
Remove screwed plug 903.3 below constant-level oiler 638 and drain off the oil into a suitable vessel. After drainage of the bearing bracket, screw in the plug again and fill with fresh oil as described in section 6.1.1.

Caution Please observe the local laws applicable to the disposal of such substances!

7.2.2.4 Deep-groove ball bearings / Lubricant quantity

Pump

	Deep-groove ball bearing to DIN 625			
Shaft unit 1)	Grease lubrication		Oil lubrication	
	Code	Grease per bearing (approx. qty. in grams)	Code	Oil per bearing bracket approx. qty. in litres
25	6305 Z C3	5	6305 C3	0.2
35	6307 Z C3	10	6307 C3	0.35
55	6311 Z C3	15	6311 C3	0.65

1) For shaft unit / pump size combinations refer to section 7.6.1

for KSB IEC motor

Deep-groove ball bearings to DIN 625	
Code	Grease per bearing (approx. qty. in grams)
6004 C3	2
6205 C3	3
6206 C3	4
6208 C3	6
6209 C3	7
6210 C3	7
6212 C3	7
6213 C3	11
6215 C3	13
6216 C3	15
6317 C3	17
6217 C3	17
6319 C3	22

Closed bearings greased for life (2 Z or 2 RS bearings) cannot be washed out and refilled. They will have to be replaced by new ones.

7.3 Drainage / Disposal

⚠ If the pump was used for handling liquids posing health hazards, see to it that there is no risk to persons or the environment when draining the medium. All relevant laws must be heeded. If required, wear safety clothing and a protective mask!

The flushing liquid used and any liquid residues in the pump must be properly collected and disposed of without posing any risk to persons or the environment.

7.4 Dismantling

Caution Before dismantling the pump, secure it so as to make sure it cannot be switched on accidentally.

The shut-off valves in the inlet / suction and discharge pipes must be closed.

The pump casing must have cooled down to ambient temperature.

Pump pressure must have been released and the pump must have been drained.

7.4.1 Fundamental instructions and recommendations

Repair and maintenance work to the pump must only be carried out by specially trained personnel, using **original spare parts** (see 2.7).

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Observe the safety regulations laid down in section 7.1. Any work on the motor shall be governed by the specifications and regulations of the respective motor supplier. Dismantling and reassembly must always be carried out in the sequence shown in the relevant exploded views on pages 19 to 23.

In the case of damage or pump failure please contact our nearest customer service centre.

For customer service centres please refer to the attached list of addresses.

7.4.2 Preparations for dismantling

1 Interrupt power supply.
2 On oil-lubricated pumps drain off the oil as described in 7.2.2.3.
3 Disconnect and remove all auxiliary pipework.
4 Remove the coupling guard.
5 **Coupling without spacer sleeve.**
5.1 Dismantling of pump unit:
5.1.1 Disconnect the motor from the power supply.
5.1.2 Unbolt the motor from the baseplate.
5.1.3 Shift the motor to decouple it from the pump.
5.1.4 Unbolt the discharge and suction nozzle from the piping.
5.1.5 Unbolt the pump from the baseplate.
5.2 Volute casing remains on the baseplate and in the pipeline when the unit is dismantled:
5.2.1 Disconnect the motor from the power supply.
5.2.2 Unbolt the motor from the baseplate.
5.2.3 Shift the motor to decouple it from the pump.
5.2.4 Detach support foot 183 from the baseplate and undo hex. nuts 920.3 or 920.5 on the discharge cover.
5.2.5 Pull the bearing bracket with discharge cover and cpl. rotor out of the casing (back pull-out unit).

Caution On larger pumps suspend or support the bearing bracket end in order to prevent the back pull-out unit from tilting.

6 **Spacer-type coupling.**
6.1 Dismantling the pump unit:
6.1.1 Disconnect the motor from the power supply.
6.1.2 Remove the coupling spacer.
6.1.3 Unbolt the discharge and suction nozzle from the piping.
6.1.4 Unbolt the pump from the baseplate.
6.2 Volute casing remains on the baseplate and in the pipeline when the unit is dismantled:
6.2.1 Disconnect the motor from the power supply.
6.2.2 Remove the coupling spacer.
6.2.3 Detach support foot 183 from the baseplate and undo hex. nuts 920.3 or 920.5 on the discharge cover.
6.2.4 Pull the bearing bracket with discharge cover and cpl. rotor out of the casing (back pull-out unit).

Caution On larger pumps suspend or support the bearing bracket end in order to prevent the back pull-out unit from tilting.

After a prolonged period of operation the individual components may be hard to pull off the shaft. If this is the case, use a brand name penetrating agent and/or - if possible - an appropriate pull-off device.
Under no circumstances use force.

7.4.3 Pump

Dismantle the pump in the sequence shown in the exploded views on pages 19 to 23.

7.4.4 Mechanical seal

In order to replace the mechanical seal the pump must be dismantled.

After removing the impeller 230 pull the mechanical seal 433 off the shaft by hand.

Prior to reassembly, clean the shaft sleeve 523 and touch up grooves or scratches, if any, with a polishing cloth. If the score marks are still visible, fit a new shaft sleeve. Clean seat ring location in seat ring holder 476.

7.5 Reassembly

7.5.1 Pump

The pump shall be reassembled in accordance with the rules of sound engineering practice.

The locating surfaces of the individual components must be coated with graphite or similar before reassembly. The same applies to bolted connections.

O-rings shall be examined for signs of damage and replaced by new ones, if necessary.

Gaskets shall always be replaced by new ones. Make sure that new gaskets have the same thickness as the old ones.

Gaskets of asbestos-free materials or graphite must always be fitted without using lubricants.

Avoid the use of mounting aids as far as possible. Should a mounting aid be required after all, use a commercially available contact adhesive (e.g. Pattex) or sealing agent (HYLOMAR or Epple 33). The adhesive shall only be applied at selected points and in thin layers. Do not use cyanoacrylate adhesives (quick-setting adhesives).
When fitting the deep-groove ball bearings, make sure that the bearing side with cover plate rests against the shaft shoulder.

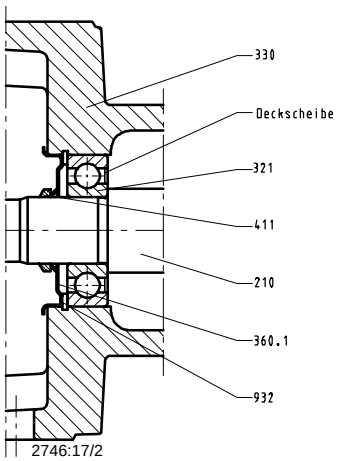

Fig. 7.5-1 Fitting the deep-groove ball bearings

If the seal area between the impeller neck and the casing wear ring is worn, the casing wear rings 502.1 and 502.2 (if fitted) must be replaced by new ones.

Clearances:
Etanorm G, M, S, B
as-new condition 0.3 mm in diameter, max. permissible enlargement to 0.9 mm in diameter
Etanorm C
as-new condition 0.5 mm in diameter, max. permissible enlargement to 1.5 mm in diameter

Reassembly is effected in reverse order to dismantling. Make sure to assemble the components in their correct sequence.

7.5.2 Shaft seal

Thoroughly clean the packing chamber and shaft protecting sleeve before packing the gland.

7.5.2.1 Gland packing chamber

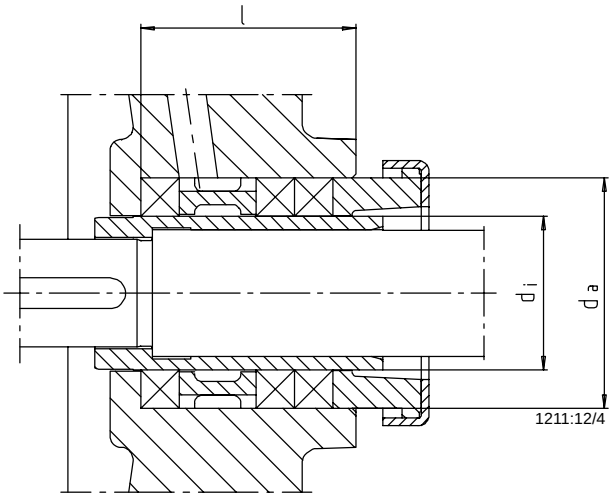

Fig. 7.5-2 Gland packing chamber

Dimensions in mm

Shaft unit 1)	Gland packing chamber			Packing ring	No. of rings 2)
	d_i	d_a	l		
25	30	46	45	V 8 x 126	3 packing rings 1 lantern ring
35	40	60	56	V 10 x 165	3 packing rings 1 lantern ring
55	50	70	56	V 10 x 196	3 packing rings 1 lantern ring

1) For shaft unit / pump size combinations please refer to section 7.6.1
2) For operation with positive suction head and suction pressure > 0.5 bar, the lantern ring is replaced by 2 packing rings.

7.5.2.2 Packing ring cut to size

Fig. 7.5-3 Packing ring cut to size

The first packing ring 461 is inserted and pushed home using stuffing box ring 454.

Each subsequent packing ring is inserted separately with its joint displaced by approx. 90 in relation to the previous one and pushed into the packing chamber using the stuffing box ring.

Tighten the gland cover gently and evenly. It must be easy to rotate the rotor.

7.5.2.3 Pure graphite packing ring

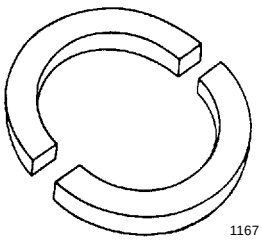

Fig. 7.5-4 Split packing ring, pure graphite

The pure graphite gland packing is a high-quality precision sealing element which requires careful handling during installation.

Follow the installation instructions for packing rings cut to size.

The packing rings made of pure graphite must always fit snugly in the stuffing box. There must be a gap between the shaft protecting sleeve and the packing rings.

Before starting up the pump, tighten the gland nuts evenly by hand only (check that the cover is mounted in central position and at right angles using a feeler gauge). The gland must leak after the pump has been primed. Allow the pump to run for about 5 minutes with steady leakage before tightening the gland cover nuts by 1/6 of a turn and then check the leakage for about 5 minutes. Continue tightening at 5 minute intervals until the leakage rate is acceptable.

Leakage rate:
min. 10 cm^3/minute, max. 20 cm^3/minute.

Slightly slacken the gland nuts if leakage is insuffient.

If there is no leakage at all:

- switch off the pump immediately
- slacken the gland nuts and repeat the start-up procedure.

After adjustment observe the leakage for approx. 2 hours at max. product temperature 120 °C/140 °C.

Then check – with product pressure at its minimum – whether there is sufficient leakage.

7.5.2.4 Mechanical seal

Reassembly is effected in reverse order to dismantling.
The following rules must be observed when fitting a mechanical seal:
Extreme care and cleanliness.
The protective wrapping of the contact faces shall only be removed immediately before assembly takes place.
Take care not to damage the seal faces and O-rings.
Clean the shaft and the seat ring seat in the discharge cover and gently remove any deposits.
When fitting the seal, shaft sleeve 523 may be wetted with water to reduce the friction forces.

Caution Ethylene propylene rubber elastomers must never come into contact with oil or grease. Water shall be used as a lubricant during fitting.

Press the seat ring into discharge cover 163 by hand or fingers only. Make sure that the pressure is applied evenly.

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7.5.3 Tightening torques

7.5.3.1 Pump

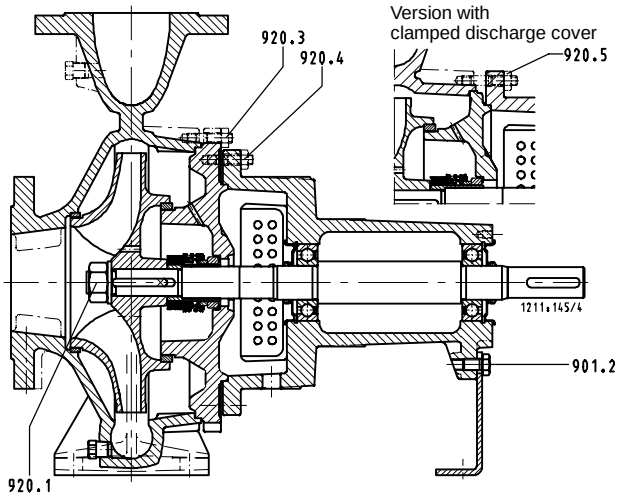

Fig. 7.5-5 Tightening points, pump

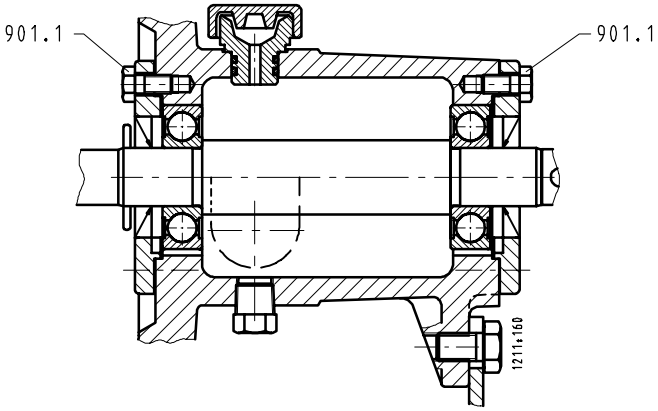

Fig. 7.5-6 Tightening points, bearing bracket, oil lubrication

Part No.	Thread size [mm]	Tightening torque [1] M_A [Nm]
901.1	M 8	8
	M 10	15
901.2	M 12	125
920.1	M 12 x 1.5	25
	M 24 x 1.5	85
	M 30 x 1.5	140
920.3 /.4/.5	M 10	40
	M 12	55

1) for unlubricated threads

7.5.3.2 Pump/motor assembly

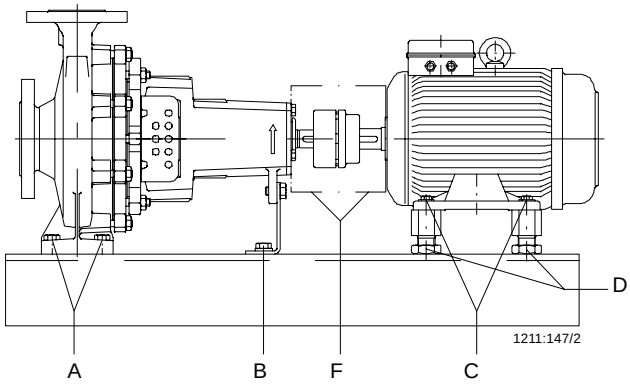

Fig. 7.5-7 Tightening points, pump set

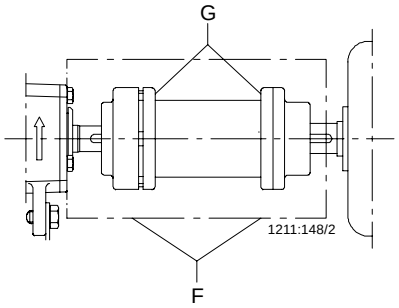

Fig. 7.5-8 Tightening points, spacer-type coupling

Pump on baseplate

Position	Thread size mm	Tightening torque [1] M_A [Nm]
A	M12 M16 M20	30 75 75
B	M12	30

Motor on baseplate

Position	Thread size mm	Tightening torque [1] M_A [Nm]
C	M6 M8 M10 M12 M16 M20 M24	10 10 15 30 75 140 140
D	M24 x 1,5	140

Coupling and coupling guard

Position	Thread size mm	Tightening torque [1] M_A [Nm]
F	M6	10
G	M6 M8 M10	13 17.5 44

1) for unlubricated threads

7.6 Spare parts stock

7.6.1 Ordering spare parts

When ordering spare parts please always quote the following data stated on the name plate.

e.g.:

Type	Etanorm G 50-250
Ident No.	48 819 673
Design	G1
Works No.	4-917-451 778

or on the volute casing, e.g. .: EN 50-250

7.6.2 Recommended spare parts stock for 2 years' continuous operation to DIN 24 296

Part No.	Description	Number of pumps (including stand-by pumps)						
		2	3	4	5	6 and 7	8 and 9	10 and more
Pumps with mechanical seals:		Quantity of spare parts						
210	Shaft	1	1	1	2	2	2	20 %
230	Impeller (including casing wear ring 502.2)	1	1	1	2	2	2	20 %
321	Deep-groove ball bearing (set)	1	1	2	2	2	3	25 %
330	Bearing bracket	-	-	-	-	-	1	2 off
433	Mechanical seal:	1	1	2	2	2	3	25 %
502.1	Casing wear ring	2	2	2	3	3	4	50 %
523	Shaft sleeve	2	2	2	3	3	4	50 %
-	Gaskets (set)	4	6	8	8	9	10	100 %
Pump with gland packing								
461	Gland packing (set) instead of parts	4	4	6	6	6	8	100 %
524	Shaft protecting sleeve 433, 523	2	2	2	3	3	4	50 %

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7.6.3 Interchangeability of Etanorm and Etabloc components and interchangeability of components among each other

Etanorm	Shaft units	Description: Volute casing	Discharge cover - gland packing	Discharge cover - mechanical seal	Shaft	Impeller	Deep-groove ball bearing	Mechanical seal	Gland packing	Casing wear ring suction side	Casing wear ring discharge side	Shaft sleeve	Shaft protecting sleeve
		Part No. 102	163.1	163.2	210	230	321	433	461	502.1	502.2	523	524
32-125.1	25	○	1	12	1	○	1	1	1	1	X	1	1
32-160.1	25	○	1	12	1	1	1	1	1	1	3	1	1
32-200.1	25	○	4	15	1	2	1	1	1	1	3	1	1
32-250.1	25	○	6	17	1	3	1	1	1	1	4	1	1
32-125	25	○	1	12	1	○	1	1	1	1	X	1	1
32-160	25	○	1	12	1	1	1	1	1	1	3	1	1
32-200	25	○	4	15	1	2	1	1	1	1	3	1	1
32-250	25	○	6	17	1	3	1	1	1	1	4	1	1
40-125	25	○	1	12	1	○	1	1	1	2	X	1	1
40-160	25	○	1	12	1	○	1	1	1	2	3	1	1
40-200	25	○	4	15	1	○	1	1	1	○	3	1	1
40-250	25	○	6	17	1	○	1	1	1	2	4	1	1
40-315	35	○	○	○	2	○	2	2	2	2	13	2	2
50-125	25	○	1	12	1	○	1	1	1	3	3	1	1
50-160	25	○	1	12	1	○	1	1	1	3	3	1	1
50-200	25	○	4	15	1	○	1	1	1	3	3	1	1
50-250	25	○	6	17	1	○	1	1	1	3	4	1	1
50-315	35	○	9	20	2	○	2	2	2	5	10	2	2
65-125	25	○	1	12	1	○	1	1	1	5	3	1	1
65-160	25	○	2	13	1	○	1	1	1	5	9	1	1
65-200	25	○	○	○	1	○	1	1	1	5	9	1	1
65-250	35	○	○	○	2	○	2	2	2	9	13	2	2
65-315	35	○	9	20	2	○	2	2	2	9	10	2	2
80-160	25	○	2	13	1	○	1	1	1	6	9	1	1
80-200	35	○	3	14	2	○	2	2	2	6	10	2	2
80-250	35	○	7	18	2	○	2	2	2	6	10	2	2
80-315	35	○	9	20	2	○	2	2	2	6	10	2	2
80-400	55	○	11	22	3	○	3	3	3	10	8	3	3
100-160	35	○	3	14	2	○	2	2	2	7	10	2	2
100-200	35	○	3	14	2	○	2	2	2	7	10	2	2
100-250	35	○	7	18	2	○	2	2	2	7	10	2	2
100-315	35	○	9	20	2	○	2	2	2	7	10	2	2
100-400	55	○	11	22	3	○	3	3	3	7	8	3	3
125-200	35	○	5	16	2	○	2	2	2	8	11	2	2
125-250	35	○	8	19	2	○	2	2	2	8	14	2	2
125-315	55	○	10	21	3	○	3	3	3	8	8	3	3
125-400	55	○	11	22	3	○	3	3	3	8	8	3	3
150-200	35	○	5	16	2	○	2	2	2	○	11	2	2
150-250	35	○	8	19	2	○	2	2	2	12	14	2	2
150-315	55	○	10	21	3	○	3	3	3	12	8	3	3
150-400	55	○	11	22	3	○	3	3	3	12	8	3	3

1 / 1 Same number means same component

○ Components differ

X Component not fitted

Component interchangeable with Etabloc

8 Trouble-shooting

Pump delivers insufficient flow rate	Motor is overloaded	Excessive pump discharge pressure	Excessive bearing temperature	Leakage at the pump	Excessive leakage at the shaft seal	Vibrations during pump operation	Excessive rise of temperature inside the pump	Cause	Remedy [1]
*								Pump delivers against an excessively high discharge pressure.	Re-adjust to duty point.
*								Excessively high back pressure.	Check plant for impurities. Fit a larger impeller. [2] Increase the speed (turbine, I.C. engine).
*						*	*	Pump or piping are not completely vented or primed.	Vent and/or prime.
*								Supply line or impeller clogged.	Remove deposits in the pump and/or piping.
*								Formation of air pockets in the piping.	Alter piping layout. Fit a vent valve.
*						*	*	Suction head is too high/NPSH- $_{available}$ (positive suction head) is too low.	Check/alter liquid level. Install pump at a lower level. Fully open shut-off valve in the suction line. Change suction line, if the friction losses in the suction line are too high. Check any strainers installed/suction opening. Observe permissible speed of pressure fall.
*								Air intake at the shaft seal.	Clean barrier liquid duct, supply external barrier liquid, if necessary, or increase its pressure. Fit new shaft seal.
*								Wrong direction of rotation.	Interchange two of the phases of the power supply cable.
*								Speed is too low. [2]	Increase speed.
*						*		Wear of internal pump parts.	Replace worn components by new ones.
	*					*		Pump back pressure is lower than specified in the purchase order.	Adjust duty point accurately. In the case of persistent overloading, turn down impeller.[2]
	*							The density or viscosity of the fluid pumped is higher than specified in the order.	2)
	*				*			Gland cover too tight or askew.	Correct.
	*	*						Speed is too high.	Reduce speed. [2]
				*				Defective seal element	Replace the gasket between volute casing and discharge cover.
					*			Worn shaft seal.	Fit new shaft seal. Check flushing or barrier liquid pressure.
*					*			Score marks or roughness on shaft protecting sleeve / shaft sleeve.	Replace shaft protecting sleeve / shaft sleeve. Fit new shaft seal.
					*			Vibrations during pump operation.	Improve suction conditions. Re-align the pump. Re-balance the impeller. Increase pressure at the pump suction nozzle.
			*		*	*		The unit is misaligned.	Re-align.
			*		*	*		Pump is warped or sympathetic vibrations in the piping.	Check piping connections and secure fixing of pump. If required, reduce the distances between the pipe clamps. Fix the pipelines using anti-vibration material.
			*					Increased axial thrust. [2]	Clean balancing holes in the impeller. Fit new wear rings.
			*			*		Insufficient or excessive quantity of lubricant or unsuitable lubricant.	Top up, reduce or change lubricant.
			*					Non-compliance with specified coupling distance.	Correct distance according to the general arrangement drawing.
*	*							Motor is running on two phases only.	Replace the defective fuse. Check the electric cable connections.
						*		Rotor is out of balance.	Clean the impeller. Re-balance the impeller.
						*		Defective bearing(s).	Fit new bearings.
						*	*	Insufficient rate of flow.	Increase the minimum rate of flow.
					*			Incorrect inflow of circulation liquid.	Increase the free cross-section.

1) Pump pressure must be released before attempting to remedy faults on parts which are subjected to pressure.

2) Request particulars.

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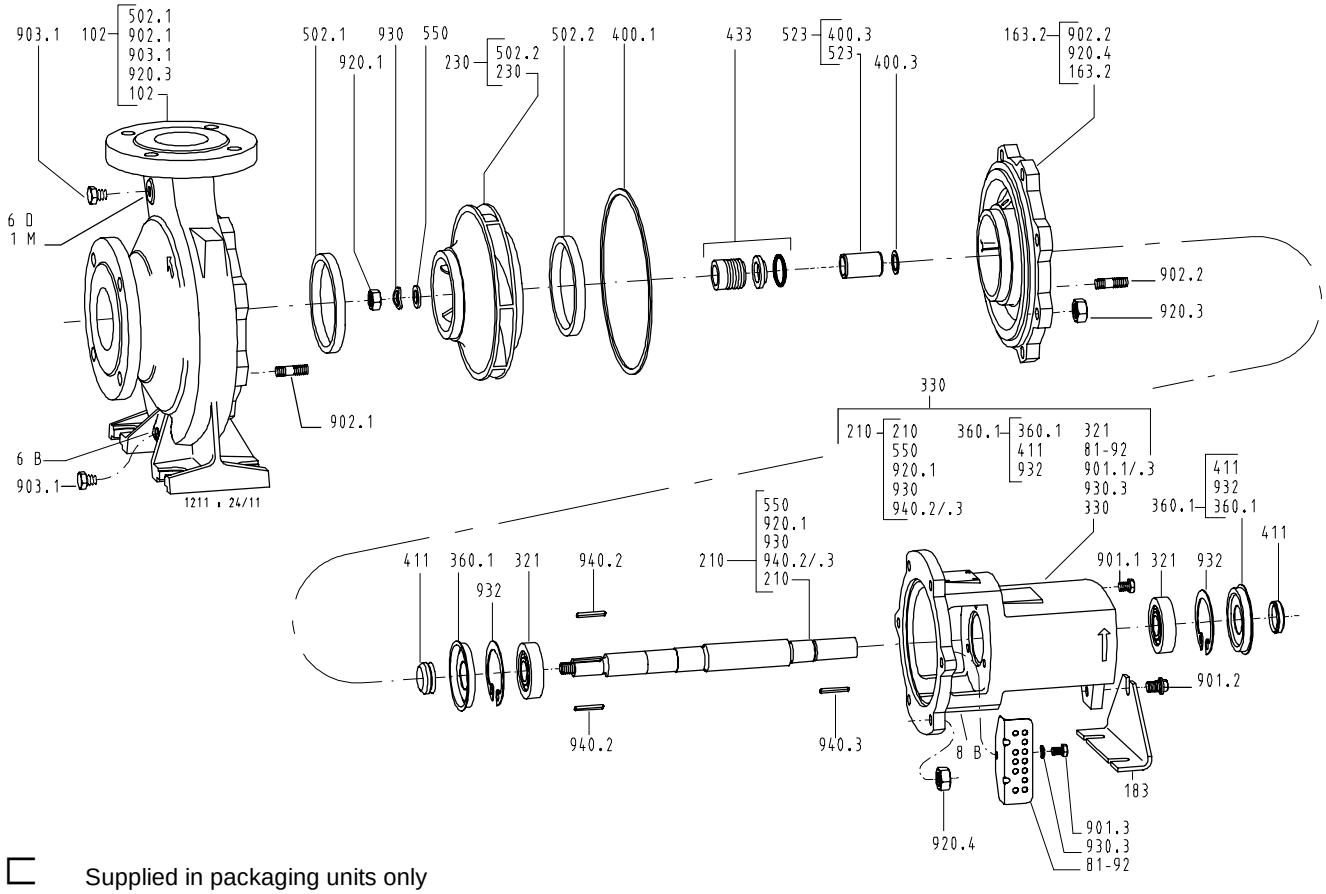
9 Related documents

9.1 Exploded view / List of components Etanorm with standardized mechanical seal and bolted-on discharge cover

Etanorm				
	32-200.1	50-200	80-250	125-250
	32-250.1	50-250	80-315	125-400
	32-200	50-315	80-400	150-250
	32-250	65-200	100-250	150-400
	40-200	65-250	100-315	
	40-250	65-315	100-400	
	40-315			



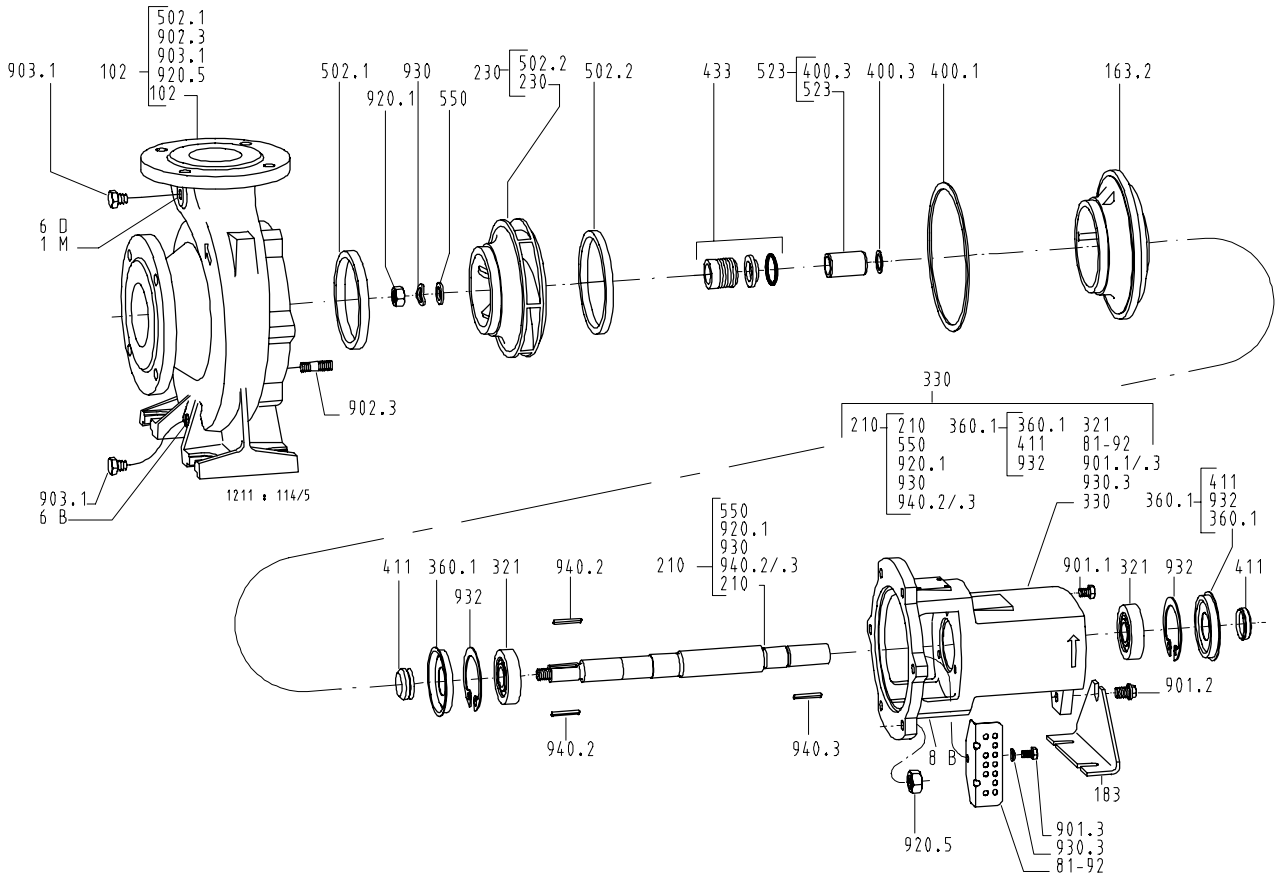
⊏ Supplied in packaging units only

Part No.	Description	Part No.	Description	Part No.	Description
102	Volute casing	433	Mechanical seal	932	Circlip
163.2	Discharge cover	502.1/.2	Casing wear ring	940.2	Key [2]
183	Support foot	523	Shaft sleeve	940.3	Key
210	Shaft	550	Disc [1]	1M	Pressure gauge connection
230	Impeller	81-92	Cover plate	6B	Casing drain
321	Deep-groove ball bearing	901.1-3	Hex. head bolt	6D	Medium priming
330	Bearing bracket	902.1/.2	Stud	8B	Leakage drain
360.1	Bearing cover	903.1	Screwed plug [3]		
400.1/.3	Gasket	920.1/.3/.4	Hex. nut		
411	Joint ring	930.3	Spring washer		

[1] only on Etanorm with shaft unit 25 [5]
[2] On Etanorm with shaft unit 55 [5] = 2 keys
[3] On Etanorm C, S: additional joint ring 411.5 (not shown in drawing)
[5] For shaft unit / pump size combinations please refer to section 7.6.3

9.2 Exploded view / List of components Etanorm with standardized mechanical seal and clamped discharge cover

Etanorm			
	32-125.1	50-125	100-160
	32-160.1	50-160	100-200
	32-125	65-125	125-200
	32-160	65-160	125-315
	40-125	80-160	150-200
	40-160	80-200	150-315



⊏ Supplied in packaging units only

Part No.	Description
102	Volute casing
163.2	Discharge cover
183	Support foot
210	Shaft
230	Impeller
321	Deep-groove ball bearing
330	Bearing bracket
360.1	Bearing cover
400.1/.3	Gasket
411	Joint ring

Part No.	Description
433	Mechanical seal
502.1/.2	Casing wear ring
523	Shaft sleeve
550	Disc [1]
81-92	Cover plate
901.1-3	Hex. head bolt
902.1-3	Stud
903.1	Screwed plug [3]
920.1/.5	Hex. nut
930.3	Spring washer

Part No.	Description
932	Circlip
940.2	Key [2]
940.3	Key
1M	Pressure gauge connection
6B	Casing drain
6D	Medium priming
8B	Leakage drain

1) only on Etanorm with shaft unit 25 [5]
2) On Etanorm with shaft unit 55 [5] = 2 keys
3) On Etanorm C, S: additional joint ring 411.5 (not shown in drawing)
5) For shaft unit / pump size combinations please refer to section 7.6.3

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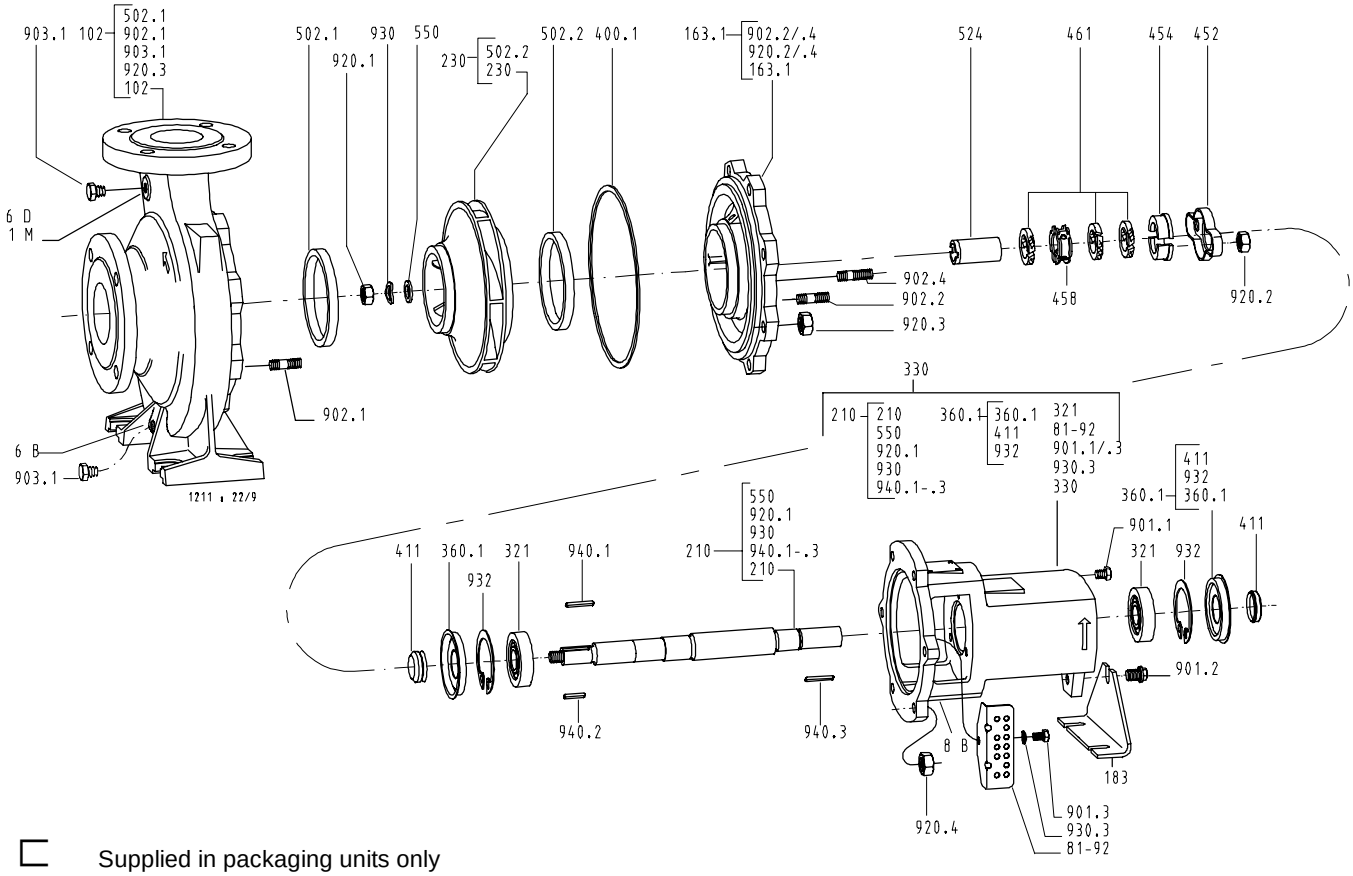
9.3 Exploded view / List of components Etanorm with gland packing and bolted-on discharge cover

Etanorm				
	32-200.1	50-200	80-250	125-250
	32-250.1	50-250	80-315	125-400
	32-200	50-315	80-400	150-250
	32-250	65-200	100-250	150-400
	40-200	65-250	100-315	
	40-250	65-315	100-400	
	40-315			



⊏ Supplied in packaging units only

Part No.	Description
102	Volute casing
163.1	Discharge cover
183	Support foot
210	Shaft
230	Impeller
321	Deep-groove ball bearing
330	Bearing bracket
360.1	Bearing cover
400.1	Gasket
411	Joint ring

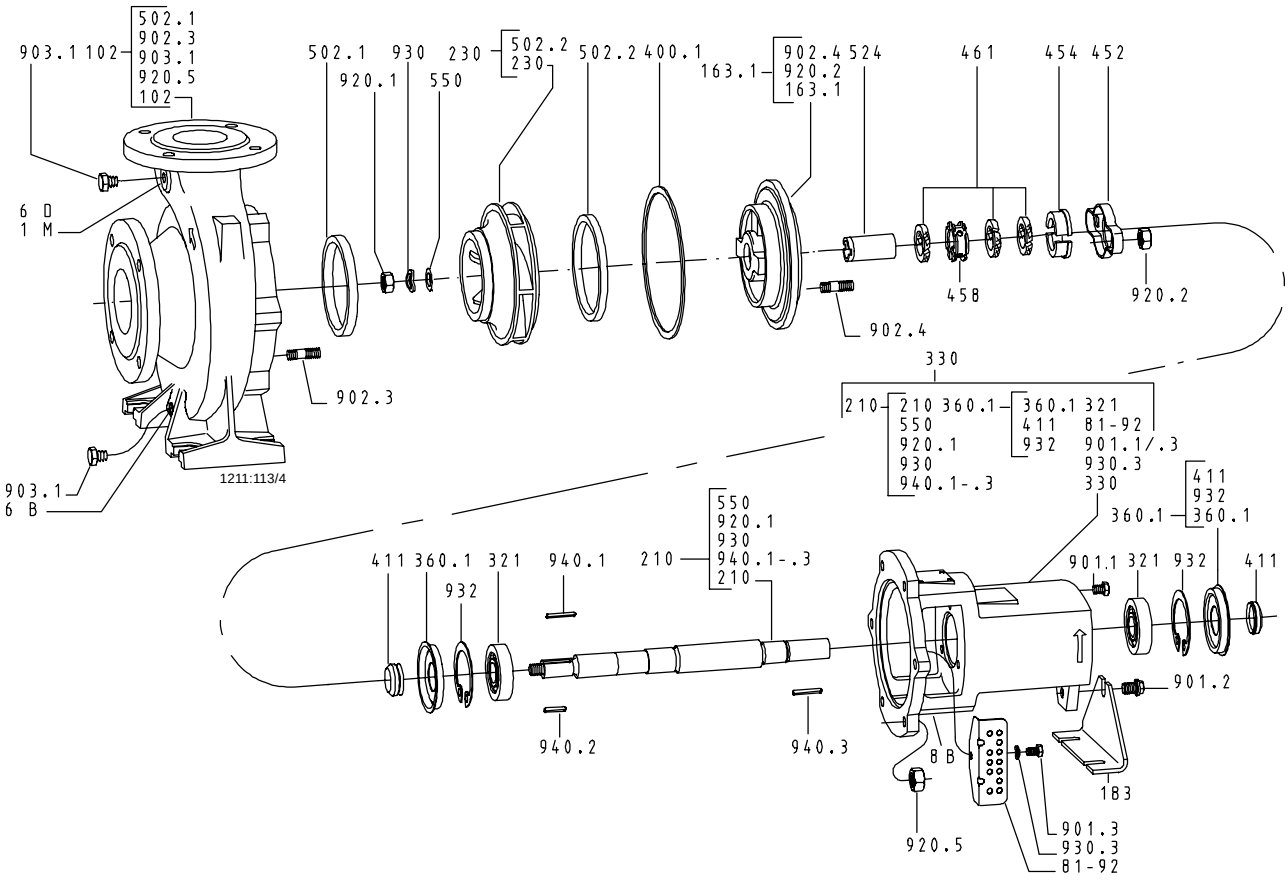
Part No.	Description
452	Gland cover
454	Stuffing box ring
458	Lantern ring
461	Gland packing
502.1/.2	Casing wear ring
524	Shaft protecting sleeve
550	Disc [1]
81-92	Cover plate
901.1-.3	Hex. head bolt
902.1/.2/.4	Stud

Part No.	Description
903.1	Screwed plug [2]
920.1-.3	Hex. nut
930.3	Spring washer
932	Circlip
940.1-.3	Key
1M	Pressure gauge connection
6B	Casing drain
6D	Medium priming
8B	Leakage drain

1) only on Etanorm with shaft unit 25 5)
2) On Etanorm C, S: additional joint ring 411.5 (not shown in drawing)
3) For shaft unit / pump size combinations please refer to section 7.6.3

9.4 Exploded view / List of components Etanorm with gland packing and clamped discharge cover

Etanorm			
	32-125.1	50-125	100-160
	32-160.1	50-160	100-200
	32-125	65-125	125-200
	32-160	65-160	125-315
	40-125	80-160	150-200
	40-160	80-200	150-315



⊏ Supplied in packaging units only

Part No.	Description
102	Volute casing
163.1	Discharge cover
183	Support foot
210	Shaft
230	Impeller
321	Deep-groove ball bearing
330	Bearing bracket
360.1	Bearing cover
400.1	Gasket
411	Joint ring [2]

Part No.	Description
452	Gland cover
454	Stuffing box ring
458	Lantern ring
461	Gland packing
502.1/.2	Casing wear ring
524	Shaft protecting sleeve
550	Disc [1]
81-92	Cover plate
901.1-.3	Hex. head bolt
902.3/.4	Stud

Part No.	Description
903.1	Screwed plug [2]
920.1	Hex. nut
930.3	Spring washer
932.1-.3	Circlip
940.1-.3	Key
1M	Pressure gauge connection
6B	Casing drain
6D	Medium priming
8B	Leakage drain

[1] only on Etanorm with shaft unit 25 [5]
[2] On Etanorm C: additional joint ring 411 (not shown in drawing)
[3] For shaft unit / pump size combinations please refer to section 7.6.3

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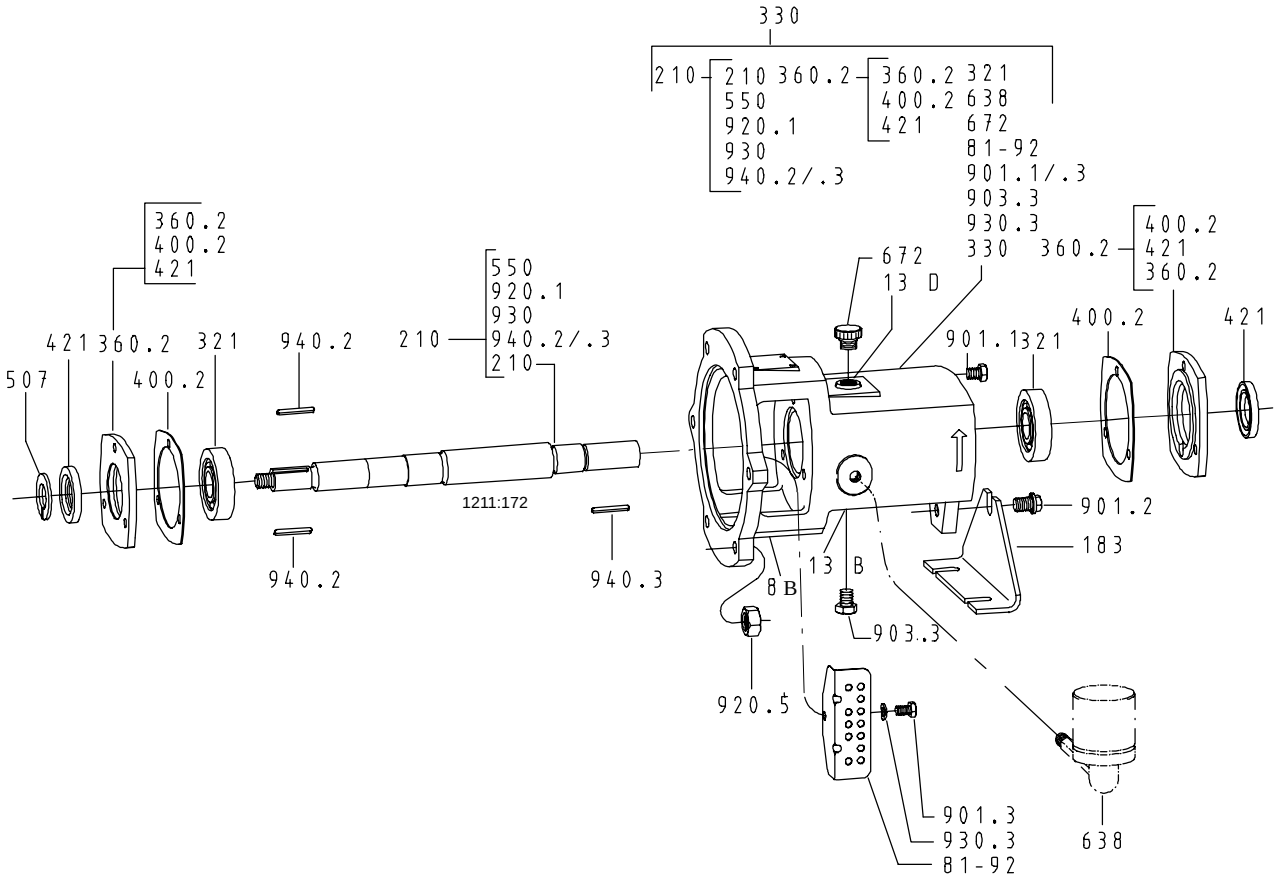
9.5 Exploded view / List of components Etanorm with constant-level oiler



⊏ Supplied in packaging units only

Part No.	Description
183	Support foot
210	Shaft
321	Deep-groove ball bearing
330	Bearing bracket
360.2	Bearing cover
400.2	Gasket
421	Lip seal

Part No.	Description
507	Thrower
550	Disc [1)3)]
638	Constant-level oiler
672	Vent plug
81-92	Cover plate
901.1-3	Hex. head bolt
903.3	Screwed plug

Part No.	Description
920.1[3)]/.5	Hex. nut
930.3[3)]	Spring washer
932	Circlip
940.2	Key [2)]
940.3	Key
8B	Leakage drain
13B	Oil drain
13D	Oil-filling and venting

1) On Etanorm with shaft unit 25 only [4)]
2) On Etanorm with shaft unit 55 [4)] = 2 keys
3) Not shown in drawing
4) For shaft unit / pump size combinations please refer to section 7.6.3