Multitec

High-pressure pumps in ring-section design

Works No.: _____

Type series: _____

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

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

KSB

Contents

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1 General

The **Multitec** pump 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 operation of the pump and help in commissioning and maintenance.

The manual also contains important recommendations for reliable, proper and efficient operation.

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.

Multitec pumps must not be operated beyond the limit values specified in the technical documentation for the fluid 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.

The name plate indicates the type series / size and the main operating data; please quote this information in all correspondence 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 after-sales service.

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, plus:

- the general safety rules for working materials and protective devices,
- the applicable organizational guidelines for the commissioning of working materials and tools
  (work guidelines R233-1 to R233 - 10 and decree No. 93-41 dd. 11/1/93, or country-specific guidelines).

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 general hazard sign, namely:

(safety sign as per ISO 7000 - 0434)

The electrical danger warning sign is

(safety sign as per IEC 417 - 5036).

The word

Caution

is used to introduce safety instructions whose non-observance may lead to damage to the equipment and its functions.

Instructions attached directly to the machine, e.g.

- arrow indicating the direction of rotation
- markings for auxiliary connections

must always be complied with and be kept in a perfectly legible condition at all times. Non-compliance with these safety instructions will lead to forfeiture of manufacturer's warranties.

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 machine/system functions,
- failure of prescribed maintenance and servicing practices,
- hazard to persons by electrical, mechanical, thermal 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 fluids 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.)

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.
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 (section 6.3).

Pumps or pump units handling fluids injurious to health must be decontaminated.

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

Please observe all instructions set out in the chapter on "Commissioning" (6.1) before returning the unit to service.

2.7 Modification and manufacture of spare parts by customer

Modifications or alterations of the equipment supplied are only permitted with KSB's prior approval. Original spare parts and accessories authorized by KSB ensure safety. The use of other parts will 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 pump is only valid if the machine is used in accordance with its designated use, i.e. with the technical data specified. For further details please refer to the information in section 4 of this operating manual. The limits stated in the data sheet must not be exceeded under any circumstances.

3 Transport, storage

3.1 Transport / Handling

Transport of the unit requires proper preparation and handling.

Never use the motor eyebolt for lifting the unit.

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

Do not use lifting gear which may damage the pump (e.g. no chains).

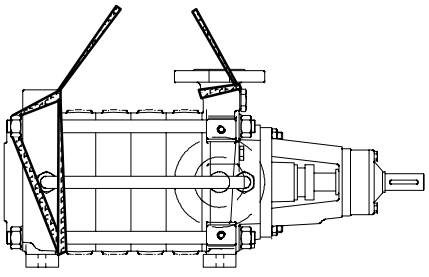


Fig. 1 Transport of pump only

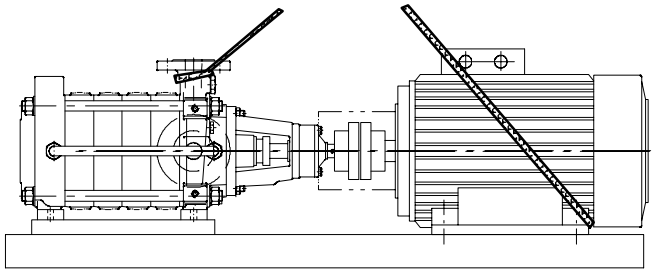


Fig. 2 Transport of pump unit

For transporting the unit, lifting ropes shall be attached to the pump and the motor as shown above. Never use the motor eyebolt for lifting the unit!

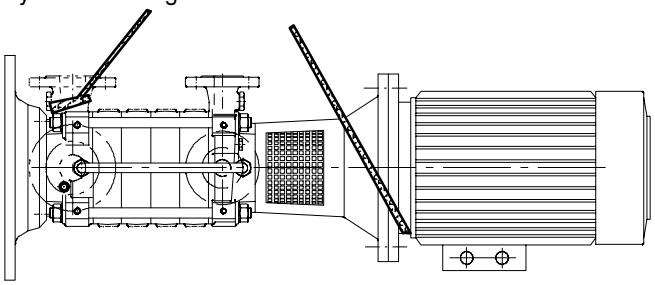


Fig. 3 Transport of close-coupled pumps and vertical pumps

3.2 Storage / Preservation

Unless otherwise stated in the purchase order and order confirmation, the pumps are supplied by our factory duly preserved for a storage period of 3 months from delivery. We recommend to take the following additional measures if the pump is stored for a prolonged period of time prior to commissioning:

Indoor storage of new pumps:
New pumps are preserved for indoor storage in a dry, closed room in their original, unopened packaging for a maximum period of 3 months.

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

Outdoor storage with the packaging unopened:
Protect the pump/unit against moisture, dirt, vermin and unauthorized access.

It is imperative to remove the preservative prior to normal commissioning by flushing through the system.

If the pump is to be stored for more than 3 months
(optional, specified in the purchase order)**:**
New pump/unit:
New pumps/units are specially preserved in the manufacturer's factory.
It is imperative to remove the preservative prior to normal commissioning by flushing through the system.

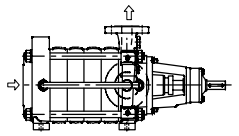
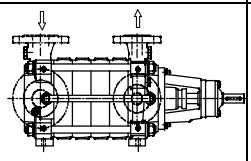
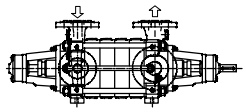
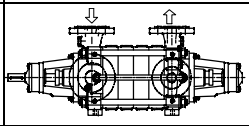
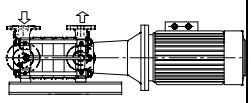
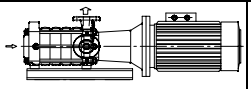
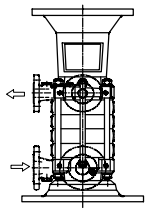
Caution The product used for this purpose is not suitable for potable water systems and must be removed completely by dismantling and subsequent cleaning of all parts of the pump coming into contact with the fluid handled, if required. For further information please refer to the order confirmation.

The unit/pump is installed some time before the system is commissioned:
Special measures have to be taken for prolonged shutdown periods, to make sure that the pump is always ready for instant start-up and to prevent the formation of deposits within the pump's hydraulic system and intake area (see section 6.3.1).

4 Description of the product and accessories

4.1 Technical specification

Multistage centrifugal pumps in ring-section design with suction impeller for low NPSH value (exception: MTC 32).

A		Horizontal design, baseplate mounted 1 casing entry, drive end 1 rolling element bearing, drive end 1 plain bearing, suction end axial suction nozzle for the entire H/Q range
B		same as installation type A, but radial suction nozzle
C		Horizontal design, baseplate mounted, 2 casing entries, drive and suction end 2 rolling element bearings drive on discharge side for the entire H/Q range
D		same as installation type C, but drive on suction side
E **Ex**		Horizontal close-coupled pump, common bearing for pump and motor, rigid coupling, radial suction nozzle H/Q range: up to 100 m^3/h, 25 bar
F **Fx**		same as installation type E, but axial suction nozzle
V **Vx**		Vertical close-coupled pump H/Q range: up to 204 m^3/h 25 bar up to 100 m^3/h 40 bar

4.2 Designation

Multitec A 32 / 8E - 2.1 12 . 65 (SP)

- Type series
- Installation type / pump version
- Discharge nozzle DN
- No. of stages / impeller combination
- Hydraulic system
- Material variant
- Shaft seal code
- Code for special variants (optional)

4.3 Design details

Pump type
High-pressure centrifugal pump in long-coupled (baseplate mounted) or close-coupled design, horizontal or vertical version, axial or radial suction nozzle. Radial suction and discharge nozzles can be turned by 90°.
Bearings:
Radial bearings are silicon carbide plain bearings (not on versions C and D), self-aligning. Plain bearings lubricated by fluid handled. Fixed bearings are rolling element bearings, grease- or oil-lubricated.
Shaft seals:
Uncooled gland packing; with or without barrier fluid.
Standardized mechanical seal (uncooled, cooled) to EN 12756.
Double-acting mechanical seal with standardized mechanical seals to EN 12756 (back-to-back or tandem).
Cartridge seals, special designs.
Drive:
Electric / hydraulic drives, Diesel engines or turbines up to max. 4000 1/min.

4.4 Applications

Municipal water supply: pumping stations, water treatment and pressure boosting systems.
Water treatment: filtration, reverse osmosis.
Pumps in industrial applications: general water supply, cold water, washing systems, recycling, cooling circuits, boiler feed systems, hot water, superheated water, condensate handling, process, organic and inorganic liquids, degreasing agents, washing or alkaline solutions, lubricants, cooling, surface treatment.
Air-conditioning: large-scale air-conditioning systems, high-rise buildings
Irrigation: centre-pivot sprinkling systems, trickle irrigation systems, square sprinkling systems, flood irrigation systems.

5 Installation at site

5.1 Safety regulations / Special instructions

Electrical equipment operated in potentially explosive atmospheres must comply with the relevant explosion protection regulations. This is indicated on the motor rating plate. If the equipment is installed in potentially explosive atmospheres, 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).

Centrifugal pumps will only give trouble-free operation if carefully installed and properly serviced.

Note: The pump's name plate shows the type series, pump size, version, main operating data and the works number (see also section 4.2).

Please quote the type series / version in all queries, repeat orders and particularly when ordering spare parts.

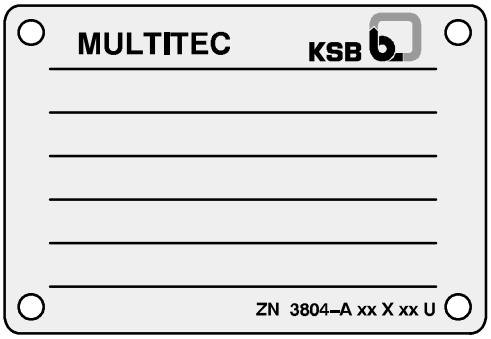


Fig. 4 Name plate

This unit must not be operated beyond the limit values for capacity, speed and temperature specified on the name plate. Make sure that operation is in accordance with the instructions laid down in this manual or in the contract documentation. All values stipulated for electrical connection of the unit as well as instructions given for installation and maintenance must be adhered to without fail. Operation of the unit outside the above-mentioned conditions may result in overloads the unit cannot withstand.

Skilled, properly trained personnel is essential to ensure trouble-free operation of the unit.

KSB shall not accept any liability if the instructions set forth in this manual are not complied with.
In case of damage or if you need further information please contact our nearest customer service centre.

5.2 Foundation / 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) 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.

5.3 Installing the pump/unit

Before placing the baseplate on the foundation, make sure that the concrete foundation is clean and smooth. The complete pump unit must be aligned horizontally with the help of a precision spirit level.
It is imperative that the factory-aligned unit mounted on the baseplate be re-aligned after it has been fastened on the foundation and after the piping has been connected (precision alignment).
After placing the pump unit 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 > 800mm, additional shims shall be used. All shims must lie perfectly flush.

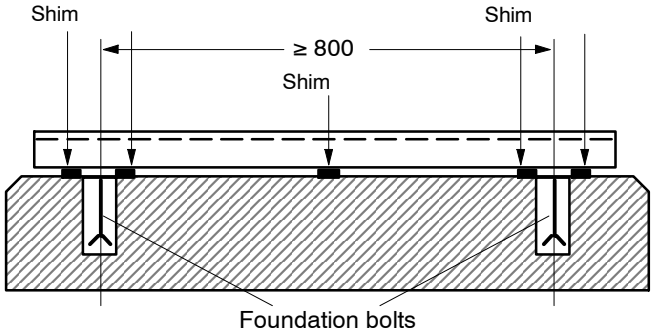


Fig. 5 Fitting required shims

Tighten the foundation bolts evenly and firmly after after the concrete has set.

Caution It is essential to make sure that the baseplate is not warped in axial or radial direction.
Proceed with utmost care when aligning the unit, as the pump unit will only give trouble-free operation when correctly aligned. Non-compliance with these instructions will lead to forfeiture of all warranty claims.
Channel section baseplates (up to 400 mm wide) are torsion-resistant in their own right; they need not be grouted.
After fastening, baseplates more than 400 mm wide shall be grouted up to the upper frame edge using low shrinkage concrete, making sure that no cavities remain.

Close-coupled pumps

It is essential to make sure that the pump is not warped in axial or radial direction.
If pump and motor are supplied separately, place the pump onto the foundation without the motor, align with the help of a precision spirit level (on the upper flange of the drive lantern), then fasten.
To align the pump, shims shall be fitted between the pump foot 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. All shims must lie perfectly flush. Tighten the foundation bolts evenly and firmly.

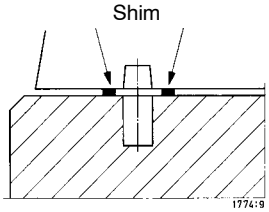


Fig. 6 Fitting required shims

5.3.1 Aligning the pump / drive

Coupling guard

Caution In compliance with **health and safety regulations** the pump must not be operated without a coupling guard / a guard on the drive lantern. If the customer specifically requests not to include a coupling guard / lantern guard in our delivery, then the operator must supply one.

Baseplate-mounted units

⚠ **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/realignment, loosen the pump feet and re-tighten without transmitting any stresses or strains.

Caution Coupling check and realignment must be effected even if pump and motor are supplied completely assembled and aligned on a common baseplate.

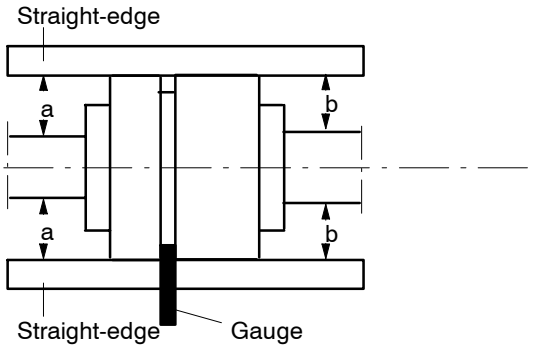


Fig. 7 Aligning the coupling with the help of a gauge and a straight-edge

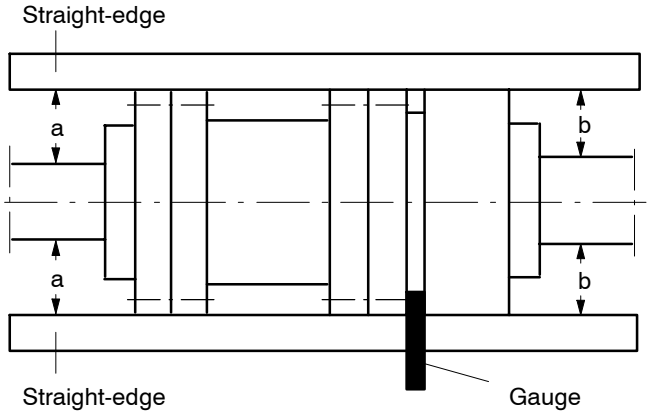


Fig. 8 Aligning a spacer-type coupling

The radial and axial deviation between the two coupling halves must not exceed 0.1 mm.

Caution For fluid temperatures of 120°C and higher, the foot bolts holding the pump on the baseplate must be tightened to the following torques:

MTC	Thread	Strength	Tightening torque	
			Drive end	Non-drive end
32	M 12	4.6	**30 Nm**	**15 Nm**
50	M 12	4.6	**30 Nm**	**15 Nm**
65	M 16	4.6	**60 Nm**	**30 Nm**
100	M 20	4.6	**120 Nm**	**60 Nm**
125	M 20	4.6	**120 Nm**	**60 Nm**
150	M 30	4.6	**450 Nm**	**200 Nm**

This will avoid that any increase in pump length due to thermal expansion will lead to warping and deformation.

The increase in height of pump and drive due to thermal expansion may differ; this has to be considered when aligning the coupling of pump units handling temperatures of 100°C and higher.
The following equation can serve as a guide to estimate by how much the motor has to be elevated in relation to the pump:

$$\Delta H\ [mm] = 1/100000 * (\Delta Tp * Hp - \Delta Tm * Hm)$$

ΔTp = Temperature difference pump - ambient (°C)
Hp = Height of pump axis [mm]
ΔTp = Temperature difference motor - ambient (°C)
Hp = Height of motor axis [mm]

Caution In any case, also when using this correction, the coupling has to be re-aligned when the unit has reached operating temperature.

Close-coupled pumps and vertical pumps
Alignment between the motor and the pump is ensured by the centering effect between the motor flange and the drive lantern flange. It must be easy to rotate the shaft.

Caution For MTC V 32-65 please observe the adjusting dimensions for coupling alignment (see page 31).

Final check
Re-check the alignment as described in the sections above. It must be easy to rotate the coupling by hand. Check the integrity and proper functioning of all connections.

5.4 Connecting the piping

Suction lift lines shall be laid with a rising slope towards the pump and suction head lines with a downward slope towards the pump, to prevent the formation of air pockets.

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 pressure losses caused by the formation of air pockets or gas.

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

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.

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.

Caution If welding work must be performed on the piping when the pump is already installed, the electric welding equipment must not be earthed on the pump or baseplate, to prevent current flowing through the rolling element bearings, which could cause their premature destruction (pitting effect).

⚠ Thermal expansions of the pipelines must be compensated by appropriate measures so as not to impose any extra loads on the pump.
Expansion joints may have to be used. An excessive, impermissible increase in the pipeline forces may cause leaks on the pump where the fluid handled can escape into the atmosphere.

Danger to life when hot fluids are handled!

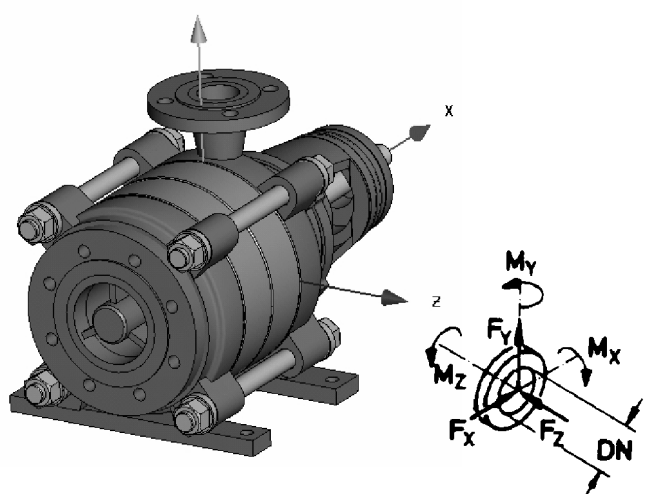


Fig. 9 Max. nozzle forces and moments

Direction of forces:
X = horizontal, parallel to the pump axis
Y = vertical to the pump axis
X = horizontal, at a right angle to the pump axis

Direction of moments:
X = around the horizontal axis, parallel to the pump axis
MY = around the vertical nozzle axis
X = around the horizontal axis, at a right angle to the pump axis
Suction and discharge nozzle are regarded separately.

Max. permissible pipeline forces (material codes 10, 11, 12, 13)

	Nom. nozzle diameter (DN)								
	32	50	65	80	100	125	150	200	250
Vertical nozzle, at a right angle to the shaft (N)									
Fx	245	510	640	700	1015	1470	1780	2700	-
Fy	410	635	800	970	1270	1850	2220	3490	-
Fz	265	415	520	625	830	1220	1465	2220	-
Horizontal nozzle, at a right angle to the shaft (N)									
Fx	245	510	640	800	1015	1470	1780	2700	-
Fy	265	415	520	625	830	1220	1465	2220	-
Fz	410	635	800	970	1270	1850	2220	3490	-
Axial nozzle, parallel to the shaft (N)									
Fx	-	-	800	-	1270	1850	2220	3490	4760
Fy	-	-	520	-	830	1220	1465	2220	3180
Fz	-	-	640	-	1015	1470	1780	2700	3810
Moments for all nozzles (Nm)									
Mx	260	330	460	680	950	1235	1640	2520	3580
My	160	250	350	520	715	930	1260	1840	2710
Mz	190	170	240	340	490	660	840	1260	1740

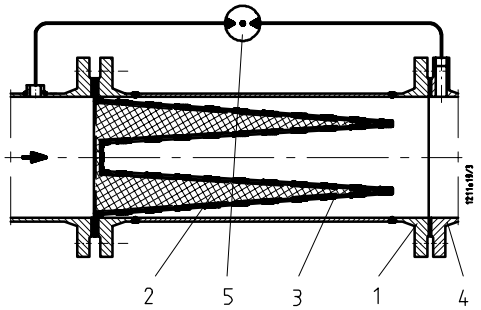
Example:
Multitec 50 with radial suction nozzle
- for the suction nozzle, the values given in table column DN80 apply
- for the discharge nozzle, the values given in table column DN50 apply

Max. permissible pipeline forces (material codes 20 to 30)

The values given for material codes 10, 11, 12,13 shall be multiplied by the factor 1.4.

Protection against foreign matter

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 laid in 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.



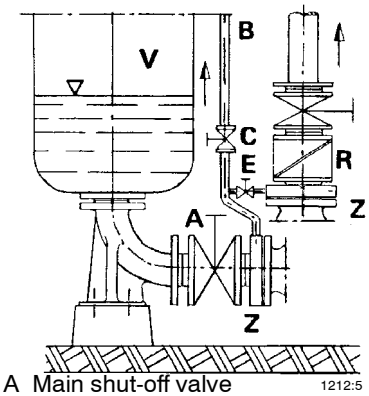
1 Strainer housing
2 Fine screen
3 Perforated plate
4 Pump suction nozzle
5 Differential pressure gauge

Fig. 10 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 minimum nom. diameter of 25 mm and must extend above the highest permissible liquid level of the vessel.

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. 11 Suction line and vacuum balance line

5.5 Connection to power supply

Connection to the power supply must be effected by a trained electrician only (see 5.1)!

The applicable DIN VDE regulations or country-specific guidelines 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 switch.

5.5.1 Connecting the motor

Connect the motor in accordance with the circuit diagram in the terminal box or as illustrated in fig. 12 or fig. 13.

Caution Prior to starting the motor, check whether the wires are firmly connected at the terminals and re-tighten any loose wires.

△ configuration (low voltage)

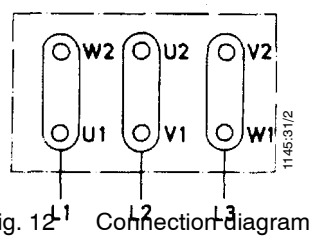


Fig. 12 Connection diagram for three-phase motors, △ configuration

Y configuration (high voltage)

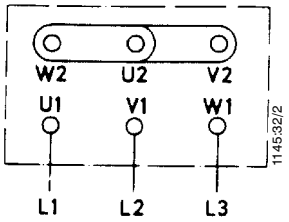


Fig. 13 Connection diagram for three-phase motors, Y configuration

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 switchover intervals may result in pump damage.

Recommended time relay setting for star-delta starting: 3 to 5 seconds, depending on motor rating.
EN 50014 (DIN VDE 0170/0171 Part 1) stipulates that explosion-proof motors, type of protection IP 54, increased safety (Ex)e, thermal class T3, must always be connected via a motor protection switch.

5.5.3 Checking the direction of rotation

Caution On pumps fitted with uni-directional mechanical seals (seal codes 62 and 63) the direction of rotation must never be checked with the pump coupled to the motor. If the pump/motor coupling does not have to be removed, make sure that the pump has been primed before checking the direction of rotation.
The motor's direction of rotation must correspond to the direction indicated by the arrow on the pump or motor (clockwise when seen from the motor end; on version D anti-clockwise). 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

Instructions for boiler feed applications

Limit values for boiler feed water and condensate when using cast iron pump parts: pH value ≥ 9.0 (target: ≥ 9.3)
O_2 content ≤0.02 ppm.
These values must be ensured under all operating conditions before entry into the pump. Max. percentage of fresh water: 25%.
Water treatment shall be in accordance with VdTÜV guidelines for feed and boiler water in steam plants of up to 64 bar.
The penetration of air into the system must be avoided by all means.

6.1 Commissioning

Caution Before starting up the pump make sure that the following requirements have been met:

- The quality of the concrete foundation is in compliance with the applicable regulations.
- The tolerances stipulated for mounting the unit on the foundation, for shims and alignment have been complied with.
- The pipelines have been connected without warping the pump nozzles.
- Electrical connection and relay settings correspond to the motor rating and comply with the applicable regulations.
- All hydraulic, electrical and mechanical protection devices have been set.
- The pump has been fully primed with the fluid to be pumped.
- The unit's direction of rotation corresponds to the rotation arrows.
- All connections are leak-free.

Caution For installation without foundation (e.g. on spring elements) care must be taken that all movements of the pump unit can be compensated, e.g. by fitting expansion joints in the discharge and suction lines.

6.1.1 Lubricants

Grease-lubricated bearings

The grease-lubricated bearings are packed with grease at the factory (see section 7.2.2).

Oil lubricated bearings

Fill oil of ISO VG 46 quality into the bearing cover (see section 7.2.2).

6.1.2 Priming the pump and checks to be carried out

Before each start-up, the pump and the suction line must be completely vented and primed with the fluid to be pumped. The pump has several plugged holes for venting; adequate venting devices can be used in the pipelines. The shut-off valve in the suction or feed line must be fully open.
Fully open all auxiliary connections provided and check the throughflow.
Open shut-off valve "C" in the vacuum balance line (if any), and close the vacuum-tight shut-off valve "E" (see 5.4.1).

Caution Dry running will lead to increased wear on the unit and may eventually damage the pump !

If the discharge line is equipped with an automatic check valve, open the minimum flow valve and secure against inadvertent closing.
Exceptions:

- If there is not enough back pressure in the line prior to start-up, the shut-off element must be closed before pump start-up.
- On pumps fitted with a mechanical seal, the mechanical seal will leak only slightly, i.e. practically invisibly (vapour) during operation. It is maintenance-free.
- If the pump is equipped with a gland packing, leakage during operation is normal (see 6.1.6).

Special notes regarding cooled mechanical seals (seal code 64)

- If the pump is equipped with a cooled mechanical seal, vent the seal chamber by opening the screwed plug 903.11 by a quarter turn, then re-tighten.

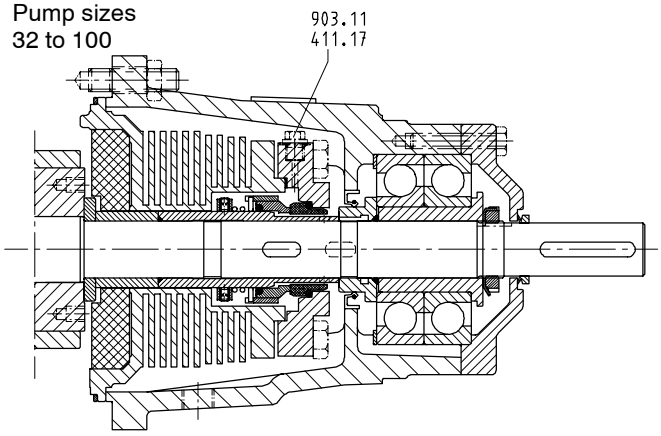


Fig. 14

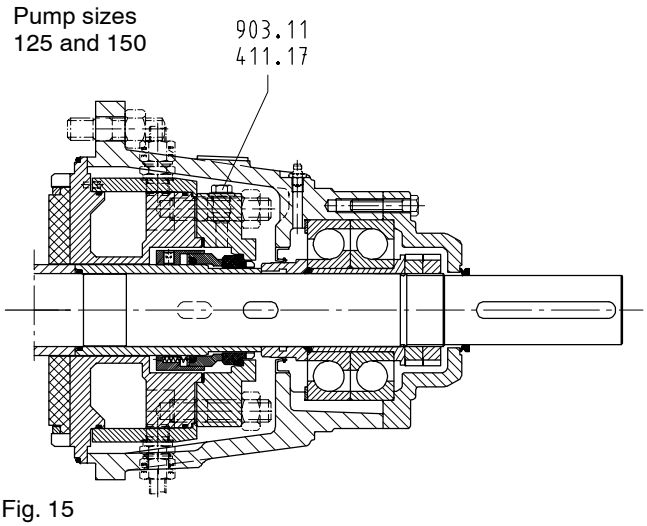


Fig. 15

Caution The seal chamber has to be vented when the pump is in cold condition before start-up. When venting in hot condition, steam will escape at the vent plug during the venting process (risk of scalding!) Should it not be possible to avoid opening the seal chamber in hot condition, due to the situation in the plant, a pipe with valve (not included in KSB's scope of supply) must be installed at the vent hole, in order to lead the steam escaping during venting to another place where there is no danger of scalding. Make sure that this valve cannot be opened during operation.

6.1.3 Contact guard

In compliance with **health and safety 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.

6.1.4 Connection to power supply

If the pump is equipped with an electric motor, 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.
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 > 30 kW	3 sec. ± 30 % 5 sec. ± 30 %

6.1.5 Start-up

Start-up procedure
- The discharge-side shut-off valve must be closed.
- Start-up must proceed without abnormal vibrations or noises.
- An automatic check valve installed must open steadily when the operating speed has been reached, without abnormal noise, vibrations or increased power consumption of the unit.
- Open the discharge-side shut-off valve.
- After the duty point has been reached, check motor input power and bearing temperature.

After the operating temperature has been reached, switch off the pump and re-tighten the bolts at the connecting flanges.

Caution In the event of abnormal noise, vibrations, temperatures or leakage, switch off the unit immediately and re-start it only after the cause for the problem has been eliminated.

Increased temperatures at the rolling element bearings after commissioning are caused by the running-in process. The final bearing temperature will be reached only after a certain operating period (up to 48 h, depending on operating conditions).

6.1.6 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 sufficient backpressure.
- Switch off the motor, making sure that the unit runs down smoothly to a standstill.
- For prolonged shutdown, close the shut-off valve in the suction line. Also close the auxiliary feed lines.
- 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.

If the pump has to remain operational during shutdown periods, it must be started up regularly for at least 5 minutes (see also 6.3):
- fire-fighting pumps at least once a month
- drinking water pumps at least once in 48 hours
- stand-by pumps at least once a week
  (It is better to operate the pumps by alternating daily.)

During these periodic check runs also check the integrity and proper functioning of the auxiliary feed lines.

6.1.7 Final check

After the pump has been primed, it must be easy to rotate the coupling/ shaft by hand.
There must be no impermissible leakage at the shaft seal during pump operation.

Gland packing

The gland packing has been fitted in the factory. Its permanent compression can only be set after several hours of pump operation. During this running-in period, gland leakage will be higher than during normal pump operation. Check the temperature of the leakage.
Final adjustment of the gland packing is made gradually after having allowed for a sufficient running-in period, so that leakage is reduced to individual drops (approx. 20 drops per minute). Tightening the gland cover too early or too hard without allowing for a sufficient running-in period would cause a local temperature rise and insufficient lubrication, resulting in the destruction of the gland packing, premature wear on the shaft protecting sleeve and higher, uncontrollable leakage.

For speed controlled pumps or fluctuating inlet pressure, no gland packing should be used, if possible. Changing pressures make it difficult to set an even and controlled leakage rate.

Caution Should such conditions occur, leakage of the gland packing must not be prevented under any operating conditions. At increased inlet pressure and/or increased speed, the inevitably higher leakage of the gland packing must not be reduced by re-tightening the gland bolts. The minimum leakage rate must only be set at the lowest speed and/or lowest inlet pressure.

Mechanical seal

The mechanical seal assembly has been adjusted and installed in the factory. It is maintenance-free. Check the seal for leakage occasionally.
During commissioning, increased leakage may occur for a short period of time. If leakage remains high, immediately switch off the pump and investigate the leakage cause, e.g. contaminated fluid handled or previous dry running due to inadequate venting of the pump unit.

Cooled mechanical seal (seal code 64)

If the pump is fitted with a cooled mechanical seal (seal code 64), vent the seal chamber as described in 6.1.1.

6.2 Operating limits

The hydraulic system is designed for pure or slightly contaminated liquids (max. solids content: 20 ppm). Make sure that the operating limits indicated in the order confirmation are complied with.

6.2.1 Temperature of the fluid pumped

The pump must not be operated at temperatures exceeding those specified on the name plate or in the technical data sheet.

6.2.2 Switching frequency

The permissible number of start-ups in a given period of time depends on the circumstances prevailing in the plant and the operating conditions. Overloading of the motor may generally result in:

- an abnormal increase in motor temperature exceeding the temperature limit of the winding or bearing grease
- premature coupling wear
- reduced service life of the pump components
- irregularities or malfunctions in the plant

To prevent abnormal temperature increases in the motor and excessive loads on the motor, coupling, pump, seals and bearings, the switching frequency must not exceed the following number of start-ups per hour (h):

Motor rating	Max. start-ups/h
up to 3 kW	20
from 4 to 11 kW	15
from 11 to 45 kW	10
45 kW and higher	5

6.2.3 Minimum flows

The pump must not be operated against a closed gate valve. The minimum flows required are defined as follows.

For MTC 32, MTC 50 and MTC 65, the required minimum flow for continuous operation is:

t -10 to + 100 °C	15 % of Qopt
t > 100 to + 140 °C	20 % of Qopt
t > 140 to + 200 °C	25 % of Qopt

For MTC 100, MTC 125 and MTC 150, the minimum flow required for continuous operation, independent of the temperature, is:

0.35 x Qopt.

For MTC 100, MTC 125 and MTC 150 an additional, short-term minimum flow of 0.25 x Qopt. has been defined, which is permitted for up to 1 hour's uninterrupted operation and approx. 200 h/year.
The minimum flows indicated for MTC 32 to 150 above are for single pump operation and will prevent thermal and mechanical overloading of the pump. In case of parallel operation with pumps of identical or different design higher flow rates may be required in some cases, to guarantee a stable operating behaviour.

6.2.4 Density of fluid pumped

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

6.3 Shutdown / Storage / Preservation

6.3.1 The unit / 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. Follow the instructions for commissioning (see 6.1).

Prolonged shutdown periods should be avoided in the case of pumps in material variants 10, 13, 20 and 21 (cast-iron variants), particularly if the pumps are handling aggressive water qualities (high oxygen content). In such cases, the pump should remain filled, and the operation check run should be performed at least every other day, instead of once a month or once every 3 months (see also 6.1.5).
In the event of frost and/or prolonged shutdowns, the pump must be drained and protected against freezing and corrosion. To drain the pump, open drain plug 6B.

Caution In the case of horizontal pumps, virtually complete drainage of the stage casings in installed condition can only be ensured by opening the plugs on the stage casings (optional). If this is not possible, it is recommended to remove the pump from the system and proceed according to section 6.3.2.

6.3.2 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 preserve as follows:
Drain the pump as completely as possible. On vertical pumps, this can be done by opening the drain plugs on the suction casing.
Horizontal pumps with drain holes in the stage casings (optional) can be drained almost completely by opening the drain plugs. The pump can also be drained by bringing it into a vertical position - suction nozzle pointing downwards - by crane (see 3.1). Turn the rotor by hand. However, the seal housing must still be drained separately by opening the respective drain plug.
⚠ If the pump cannot be drained completely, we recommend to dismantle it and dry the individual components.
Afterwards fill the pump with a water-repellent preservative, e.g.
RUSTELO DEWATERING 924 (producer CASTROL)
OSYRIS DW (producer TOTAL) or equivalent.
Turn the pump rotor by hand several times, to ensure even distribution of the preservative. Then drain the pump and close the suction and discharge nozzle.

Exposed blank metal parts must be treated with a suitable anti-corrosive agent.

Caution If the pump is preserved for a prolonged storage period with KLÜBERTOP K 01-601 or another glycol-base preservative, the preservative must not be drained. In this case, the pump must be completely filled with preservative for storage. The preservative must be drained before the pump is returned to service. It can be re-used. Before re-use, make sure that the water content in the preservative does not exceed 20%.

6.4 Returning to service after storage

Before returning the pump to service, carry out all instructions laid down in the sections on "Commissioning" (6.1) and "Operating limits" (6.2).
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 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.

Before commencing any work on the unit, always make sure that the drive unit (electric motor, turbine, I.C. engine, ...) cannot be started up.

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.

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), see also section 7.4.4.1.

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.

Caution: 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 mechanical seal shows only slight or invisible (vapour) leakage during operation. It is maintenance-free.

Gland packings must leak slightly (individual drops).

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.

7.2.2 Bearings and lubrication

On grease-lubricated units, the rolling element bearings of the MTC32 and the non-drive end rolling element bearings of the MTC50 and MTC65 in design C and D are lubricated for life and do not require re-lubrication. For this reason, no lubricating nipples are provided on the bearing brackets.

Pump

Depending on the pump version, the rolling element bearings are either grease-lubricated or oil-lubricated.

Grease quality / Grease change

The bearings are packed with high-quality lithium-soap grease. Depending on the size and the operating hours of the pump, the rolling element bearings must be re-lubricated or the grease in the rolling element bearings must be replaced.

	Speed (1/min)		
Size MTC	< 1800	≈ 2950	≈ 3550
32-50-65	10000h	7200h	5700h
100-125	9000h	5700h	3900h
150	8300h	4000h	3100h

If re-lubrication intervals are short, we recommend to completely replace the grease once a year. If this is not the case, the grease fill must be replaced completely at least every two years. For this purpose, the rolling element bearings must be removed, cleaned and packed with new grease.

Under unfavourable operating conditions, e.g. high ambient temperature, high atmospheric humidity, dust-laden air, aggressive industrial atmosphere etc., the bearings shall be checked earlier and cleaned and packed with new grease, 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 (NLGI class) 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.

Oil quality / Oil change
Quality: ISO VG 46.
The first oil change shall be carried out after 300 operating hours, the following ones every 3000 operating hours.
Unscrew the screwed plug in the re-fill hole and in the drain hole. Allow the bearing housing to drain completely, then plug the drain hole again.

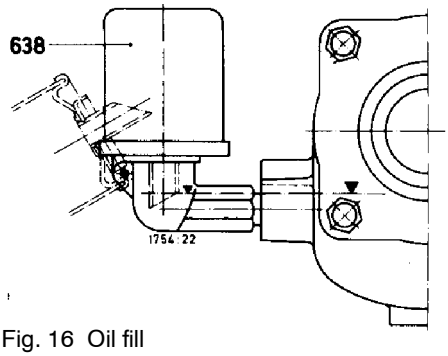


Fig. 16 Oil fill

Hinge down the constant-level oiler 638.
Pour in the oil through the hole after having hinged down the reservoir of the constant-level oiler until oil appears in the vertical portion of the connection elbow (Fig. 16). Then fill the reservoir of the constant-level oiler with oil and snap it back into operating position. After a short time check whether the oil level in the reservoir has dropped.
It is important to keep the reservoir two thirds full at all times!

Lubricant quantities

Grease quantities

Pump size	Quantity per bearing unit in g	
	Drive end	Non-drive end
32	-	-
50 / 65	15	-
100 / 125	25	15
150	40	30

Note: On some pump designs the rolling element bearings are lubricated for life. These pumps are not provided with a lubricating nipple on the bearing bracket.

Oil quantities

Pump size	Oil quantity in ml *)	
	Drive end	Non-drive end
32	330	330
50	500	330
65	490	510
100 / 125	880	920
150	1000	1040
*) oil quantity without oil fill in the reservoir of the constant-level oiler		

Motor
Motors without lubricating nipple: The rolling element bearings have been lubricated in the supplier's factory for an operating period of 15,000 h or 2 years under normal operating conditions.
Motors with lubricating nipple: The rolling element bearings must be re-lubricated at the intervals indicated on the motor name plate (approx. 500 h).

7.2.3 Shaft seal

Mechanical seal:
The mechanical seal is maintenance-free.

Gland packing:
The nuts at the gland cover must only be tightened slightly. The gland cover must be at right angles to the shaft. After the pump has been primed and prior to start-up, make sure the gland packing is set to allow a larger amount of leakage. After approximately 1 operating hour, tighten the nuts at the gland cover gradually until leakage has been reduced to individual drops (approx. 7 l/H).

7.2.4 Coupling

If the flexible coupling elements begin to show signs of wear, they must be replaced in due time and pump/motor alignment must be checked.

7.3 Dismantling

If you need additional information or instructions please contact KSB's customer service !

7.3.1 General instructions

Drainage / Cleaning

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 fluid. 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.

7.3.2 Preparations for dismantling

Caution Make sure to switch off the pump unit before starting any dismantling activities. Secure the pump 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 and secured against inadvertent opening.
The pump must have cooled down to ambient temperature.
Pump pressure must have been released and the pump must have been drained.
Noxious, explosive, hot or other hazardous fluids shall be drained without posing any risk to persons or the environment.
We strongly recommend to flush the pump after drainage.
Flushing and cleaning the pump is an absolute necessity before sending the pump to the workshop. In addition, the pump must be supplied with a cleaning certificate.
After a prolonged period of operation the individual components may be hard to pull off. We recommend to use a brand name penetrating agent or a suitable puller.
Under no circumstances use force.
Dismantling must only be carried out in accordance with the sectional drawings at the end of these operating instructions. (see section 9 "General assembly drawings")
Heavy components must be sufficiently supported during dismantling. The components shall be marked with their sequence of dismantling, to make sure they will be re-assembled in the correct sequence.
Thoroughly clean all dismantled components and check their condition. Careful examination may help to find the cause for pump failure, if any. If in doubt, replace the components. Always replace parts which are subject to wear (gaskets, O-rings, casing wear rings, rolling element bearings).

7.3.3 Dismantling the bearings

The sections below describe partial dismantling (bearings, seals, etc.) and complete dismantling of the pump unit.

7.3.3.1 Dismantling the non-drive-end bearings

Plain bearing

The plain bearing is removed without dismantling the hydraulic section of the pump.

Axial suction nozzle:

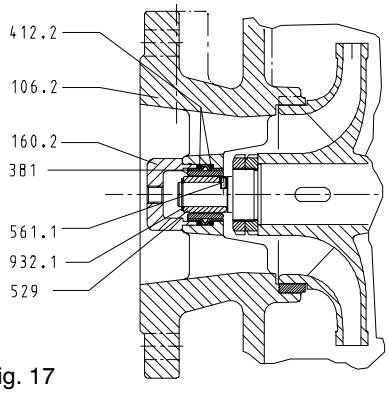


Fig. 17

- Pull off bearing cover 160.2 using forcing screw.
- Remove circlip 932.1 (shaft in C45) or bolt 901.2 and disc 550.7 (shaft in 1.4021 / 1.4462).
- Take out bearing sleeve 529.
- Pull out bearing cartridge 381 with its two O-rings 412.2.

N.B.: Anti-rotation pin 561.1 remains in position.

Radial suction nozzle:

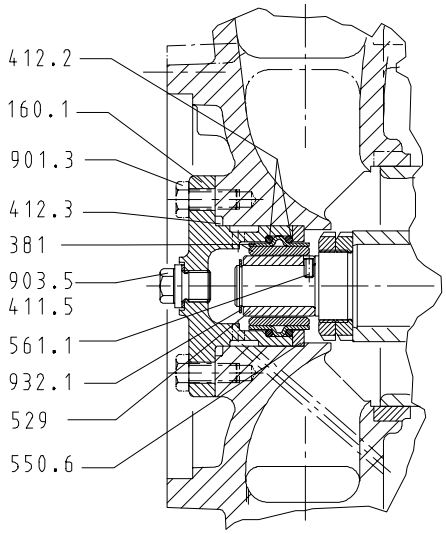


Fig. 18

- Undo bolts 901.3 and remove cover 160.1 with O-ring 412.3 and bearing cartridge 381 with O-rings 412.2.
- Remove circlip 932.1 (shaft in C45) or bolt 901.2 and disc 550.7 (shaft in 1.4021 / 1.4462).
- Pull out bearing sleeve 529.
- Remove disc 550.6.

N.B.: Anti-rotation pin 561.1 remains in position.

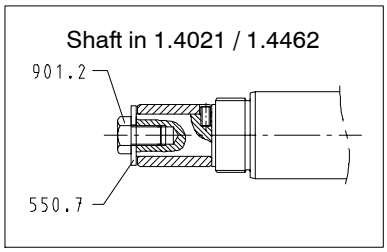


Fig. 19

Rolling element bearings:

If the pump is oil-lubricated, drain the oil before dismantling.

- Unscrew bolts 901.4 or 914.5 and remove non-drive-end bearing cover 361.1 or 361.2.
- Unscrew nut 920.7 with lockwasher 931 or the nut with castellated nut 920.6.
- Pull out sleeve 520.2 with rolling element bearing 320.2.

Grease lubrication with lip seal

Multitec 32 - 125

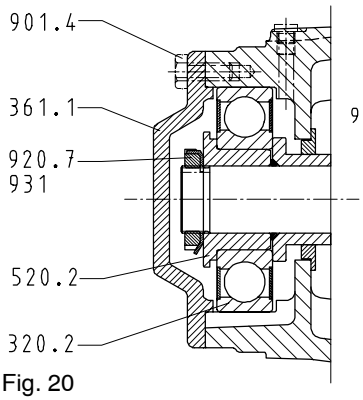


Fig. 20

Multitec 150

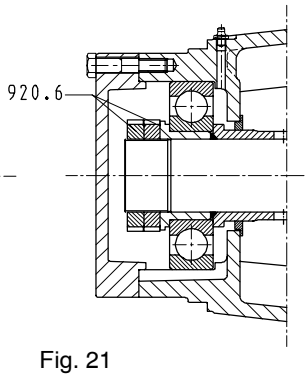


Fig. 21

Oil lubrication with lip seal

Multitec 32 - 125

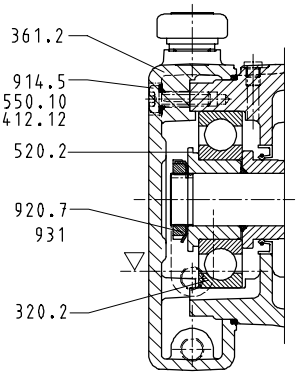


Fig. 22

Multitec 150

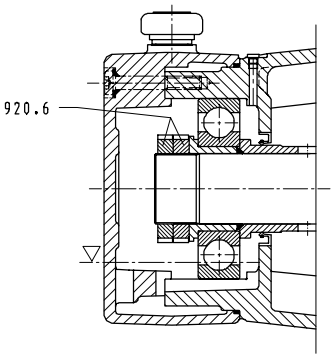


Fig. 23

Oil lubrication with labyrinth seal

Multitec 32 - 125

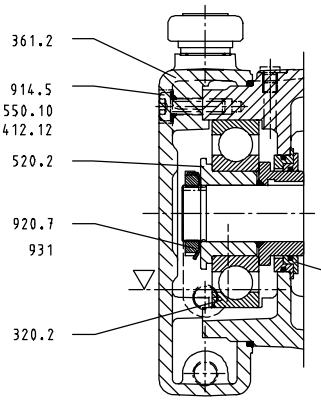


Fig. 24

Multitec 150

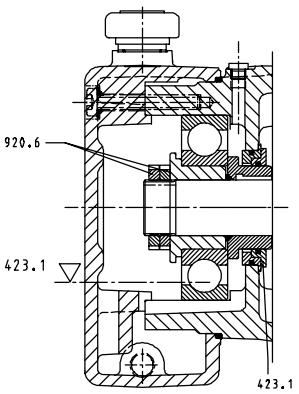


Fig. 25

7.3.3.2 Dismantling the drive-end rolling element bearings

N.B.: The ceramic bearing installed at the non-drive end need not be dismantled in order to remove the drive-end rolling element bearings. If the pump is oil-lubricated, the oil must be drained before dismantling.

- After loosening the grub screw in the coupling hub pull out coupling half with key 940.3.

Grease lubrication (figs. 26 and 27)

- Remove joint ring (V-ring) 411.7.
- Undo bolts 901.1.
- Remove bearing cover 360.1.

Oil lubrication with lip seal (fig. 28)

- Undo screws 914.4 and pull out together with washer 550.10 and O-ring 412.12.
- Remove bearing cover 360.2.
- Pull off sleeve 520.4 with ring 500.1 (tolerance ring) and O-ring 412.11.

Oil lubrication with labyrinth seal (fig. 29)

- Pull out labyrinth ring 423.2.
- Undo screws 914.4 and pull out together with washer 550.10 and O-ring 412.12.
- Remove bearing cover 360.2.

Grease lubrication

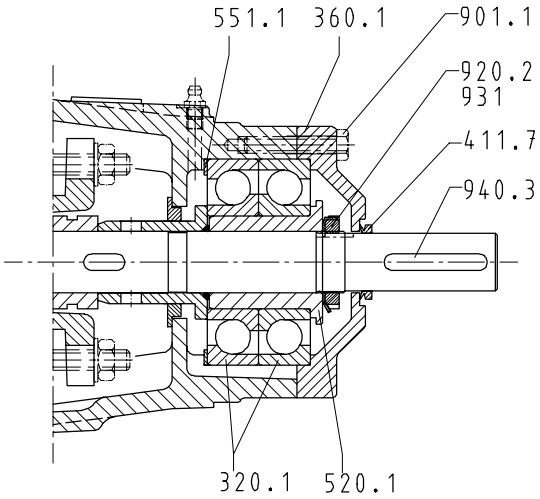


Fig. 26

Caution The rotating unit is adjusted axially by means of spacers 551.1. When reassembling the pump after partial dismantling (bearing or seal replacement), the same spacer discs 551.1 must be mounted on the bearing side to reproduce the original rotor adjustment.

When dismantling keywayed nut 920.6, all relevant positions such as sequence and orientation of the contact face must be marked accordingly, to ensure identical reassembly (see also section 7.4.4).

- Undo nut 920.2 with lockwasher 931 or nut with locknut 920.6, depending on the pump size. To undo the nut, hold onto shaft with key 940.3.
- Pull off sleeve 520.1 with rolling element bearing(s) 320.1. (The shaft is centered in the sleeve without locking device.)
- Remove spacers 551.1, see text above.

Note: Pump versions V, Vx, E, Ex, F, Fx of sizes 32, 50,65 do not have a fixed bearing as this function is taken over by the motor bearings.

On pump versions Multitec V100, 125 and 150 the fixed bearing is located in the support lantern 342. Dismantling and installation shall be performed in analogy with the horizontal versions.

Pump version V, MTC 100/125/150

(grease lubrication only)

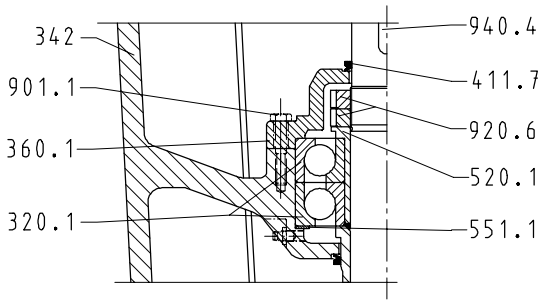


Fig. 27

Oil lubrication with lip seal

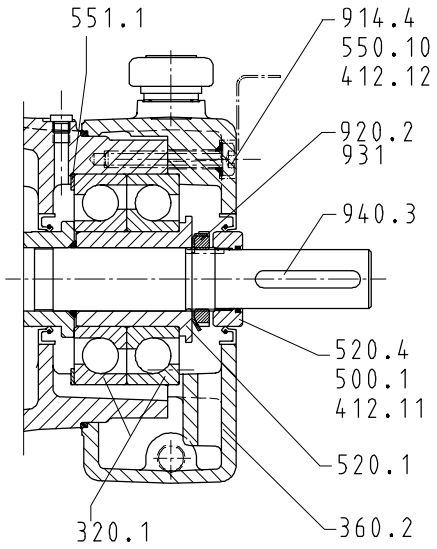


Fig. 28

Oil lubrication with labyrinth seal

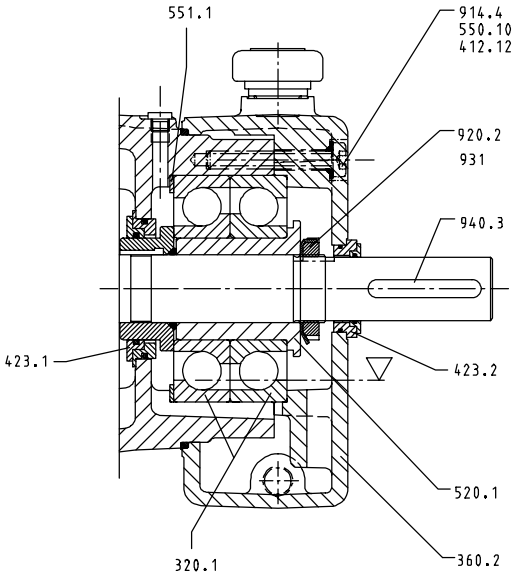


Fig. 29

7.3.4 Dismantling and replacement of shaft seal

Gland packings

7.3.4.1 Replacing the packing rings

Access to packing rings without removing the bearing or the lantern:

- Undo both nuts 920.3 and pull gland cover 452 out of seal housing 441.1.
- Remove packing rings 461.

7.3.4.1 Replacing the shaft protecting sleeve

- Remove the bearing as described in sections 7.3.3.1 and 7.3.3.2.
- Remove packing rings as described in section 7.3.4.1.
- On grease-lubricated pumps, pull V-ring 411.6 off spacer sleeve 525.1.
- Remove O-ring 412.10.
- Pull off spacer sleeve 525.1.
- Remove bearing housing 350.1.
- Remove seal housing 441.1 with gland cover 452.
- Remove key 940.2.
- Take off sleeve 524 with a puller, using the groove provided in the sleeve.
- Remove O-ring 412.4.

N.B.: If sleeve 524 is hard to remove, the balance drum can be used for leverage.

- Remove balance drum 59-4, disc 550.3 and sleeve 524 with a puller engaged in the threaded holes on the drum.

This is not possible on pumps without balance drum.

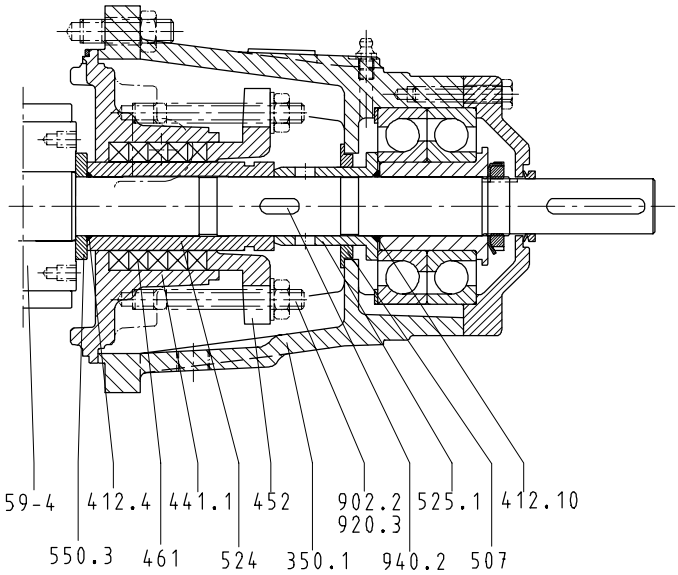


Fig. 30

Pump design without balance drum

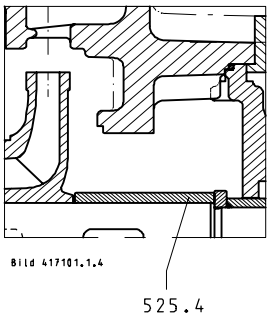


Fig. 31

7.3.5 Dismantling the mechanical seal

7.3.5.1 Dismantling the mechanical seal

- Remove the bearing as described in sections 7.3.3.1 and 7.3.3.2.
- On grease-lubricated pumps, pull V-ring 411.6 off spacer sleeve 525.1.
- Remove O-ring 412.10.
- Pull off spacer sleeve 525.1.
- Remove any auxiliary pipework (circulation, etc.), depending on the pump version.
- Loosen the nuts 920.3 on the mechanical seal cover until the spring is relaxed.
- Remove bearing housing 350.1.
- Take off mechanical seal cover 471.1 with the seat ring and gasket 400.1, remove spring-loaded ring (not in case of bellows-type seals).
- Remove key 940.2.
- Pull off sleeve 523.1 with the rotating assembly of the mechanical seal. (Two holes are provided in the sleeve for engaging a puller.)
- Take off seal housing 441.1.
- Remove O-ring 412.4.

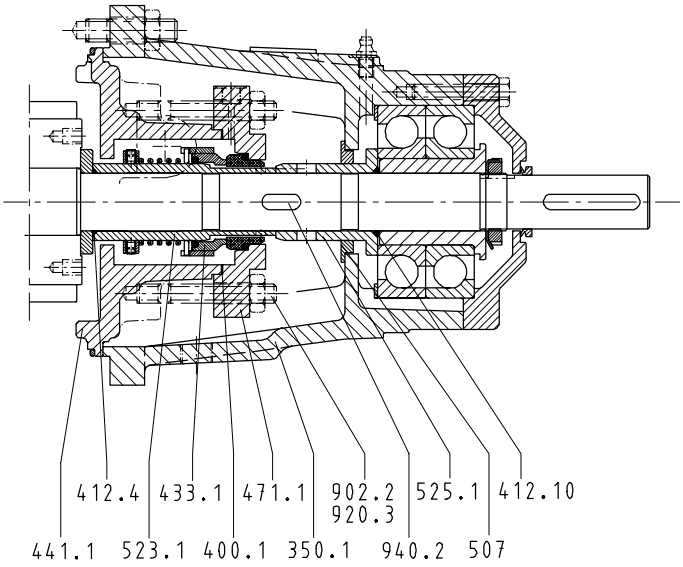


Fig. 32

7.3.5.2 Removing an air-cooled mechanical seal (seal code 64)

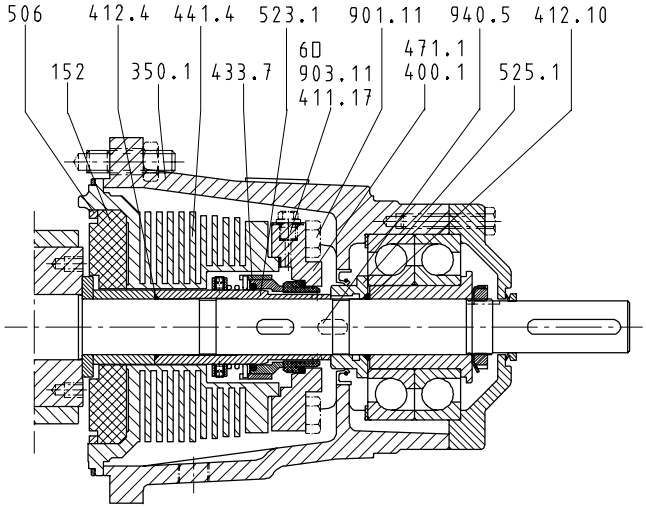


Fig. 33

N.B.: This mechanical seal design is used for application temperatures from 140 to 200°C and Multitec sizes 32 to 100. The pump shall only be coupled to a motor with enclosure IP 55.

- Remove the bearing as described in sections 7.3.3.1 and 7.3.3.2.
- Remove O-ring 412.10.
- Pull off spacer sleeve 525.1.
- Loosen bolts 901.11.
- Remove bearing housing 350.1.
- Remove mechanical seal cover 471.1 with the seat ring and gasket 400.1.
- Remove key 940.5.
- Pull off sleeve 523.1 with the rotating assembly of mechanical seal 433.7. (Two holes are provided in the sleeve for engaging a puller.)
- Take off seal housing 441.4.
- Remove O-ring 412.4.

On between-bearings pumps (pump version C or D) the mechanical seal shall be removed as follows:

- Remove screws 900.2 and hood 683.1.
- Undo axis 87-5 with fan impeller 831.1.
- The threaded insert 915 must remain in the shaft 210.

Caution On previous versions (prior to 03/2002) and if assembled in the factory, the fan shaft 87-5 was fitted using Loctite 222.

Caution On previous versions and when re-assembling, secure fan shaft 87-5 and fan impeller 831.1 with Loctite 222.

- Remove support 59-7.
- Remove the bearing as described in section 7.3.3.1 as well as spacer sleeve 525.1 and bearing housing 350.1.

Remove the mechanical seal as described above.

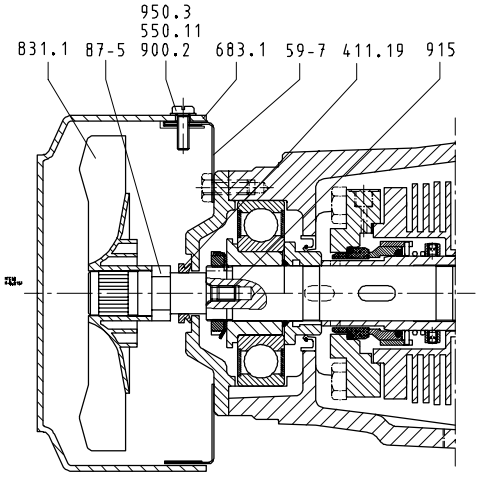


Fig. 34

7.3.5.3 Removing a water-cooled mechanical seal (seal code 64)

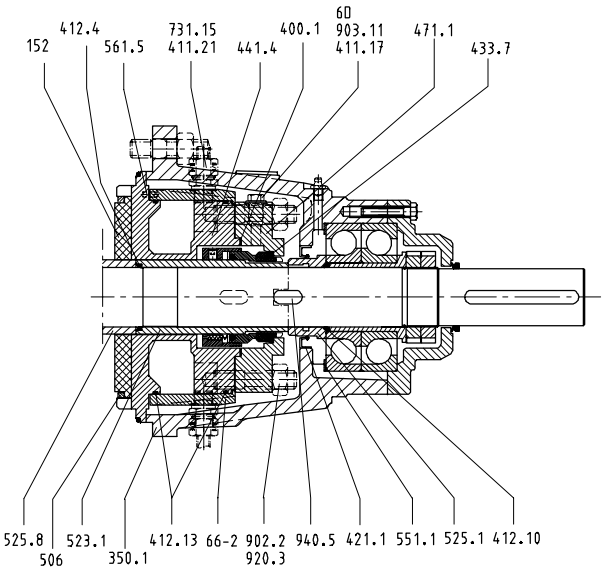


Fig. 35

Note: This mechanical seal design is used for temperatures from 140 to 200°C and sizes 125 and 150 (optional for sizes 32 to 100).

- Drain the pump and remove the circulation line at the pipe union 731.15.
- Remove the rolling element bearing as described in sections 7.3.3.1 and 7.3.3.2.
- Remove O-ring 412.10.
- Pull off spacer sleeve 525.1.
- Undo nuts 920.3.
- Remove bearing housing 350.1.
- Remove mechanical seal cover 471.1 with the seat ring and gasket 400.1.
- Remove key 940.5.
- Pull off sleeve 523.1 with the rotating assembly of mechanical seal 433.7. (Two holes are provided in the sleeve for engaging a puller.)
- Remove cooling jacket 66-2.
- Take off seal housing 441.4.
- Remove O-ring 412.4.

7.3.5.4 Removing a double-acting mechanical seal

Mechanical seals in tandem and back-to-back arrangement are fitted as per customer specifications. There is a wide variety of variants, types and brands. Please refer to the general assembly drawing and the documentation supplied with the pump for orientation.

7.3.6 Dismantling the hydraulic system

- Remove the bearings as described in sections 7.3.3.1 and 7.3.3.2 and the shaft seals as described in sections 7.3.4 and 7.3.5.

If possible, place the hydraulic system in vertical position and start dismantling it from the discharge end.

- Undo the four tie bolts 905.
- Remove discharge casing 107, then dismantle the hydraulic elements.

Note: Pump versions A/B/C/D in material variants 22/23/30 have an intermediate bearing in the middle stage as of the number of stages given in the table (see fig. 36).

Pump size	32	50	65	100	125	150
No. of stages	8	7	6	6	5	6

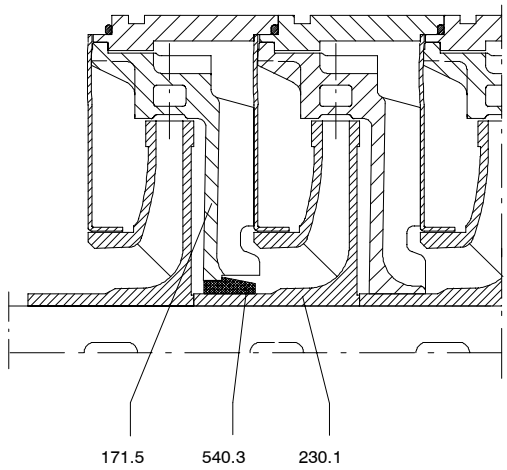


Fig. 36

540.3 Intermediate bearing - bush
171.5 Intermediate bearing - diffuser

7.3.7 Recommended spare parts stock for 2 years' continuous operation

Caution We recommend to replace various wear parts, e.g. rolling element bearings, sealing elements, circlips, etc.) whenever the hydraulic system has been completely dismantled.

Part No.	Description	Number of pumps (including stand-by pumps)						
		2	3	4	5	6+7	8+9	10 and more
For shaft seal codes 65 and 66 (gland packing)								
210	Shaft with small parts	1	1	2	2	2	3	30 %
230	Impeller (set = S)	1	1	1	2	2	3	30 %
231	Suction stage impeller	1	1	1	2	2	3	30 %
320.1	Fixed bearing (set)	1	1	2	2	3	4	50 %
320.2	Radial bearing	1	1	2	2	3	4	50 %
381	Bearing cartridge	1	1	2	2	3	4	50 %
411	V-ring (set)	4	8	8	8	9	12	150 %
412	O-ring (set = S)	4	8	8	8	9	12	150 %
461	Gland packing (set)	4	6	8	8	9	12	150 %
502 [1]	Casing wear ring (set)	2	2	2	3	3	4	50 %
520	Sleeve	1	1	2	2	3	4	50 %
524	Shaft protecting sleeve	2	2	2	3	3	4	50 %
525	Spacer sleeve	2	2	2	3	3	4	50 %
529	Bearing sleeve	1	1	2	2	3	4	50 %
540	Bush	1	1	1	2	2	3	30 %
550.1 [2]	Disc	2	2	2	3	3	4	50 %
59-4	Balance drum	1	1	1	2	2	3	30 %
For shaft seal codes 61, 62, 63 and 64 (with mechanical seal)								
433	Mechanical seal (compl.) [3]	2	3	4	5	6	7	90 %
523	Shaft sleeve (set)	2	2	2	3	3	4	50 %
For oil lubrication								
421 [4]	Lip seal	4	8	8	8	9	12	150 %
423 [4]	Labyrinth ring	2	3	4	5	6	7	90 %

1) pump sizes 125 and 150 only
2) pump sizes 32 to 100 only
3) parts 461 and 524 are not fitted
4) depending on pump version

Note: Please always indicate the works number stamped onto the pump name plate when ordering spare parts.

7.4 Reassembly

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

- Under no circumstances use force.
- Due to their weight, some pump components must be supported during reassembly.
- Before reassembly, the locating surfaces of the individual components must be coated with a mounting aid in compliance with hygienic and safety regulations.
- The properties of new pump components must not be altered without prior consultation with our technical departments.
- The parts must be clean and free from shavings or dust.
- Reassembly is effected in reverse order to dismantling.
- The tightening torques indicated must be complied with. 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, Hylomar or Epple 33, after prior consultation with our technical departments. The adhesive shall only be applied at selected points and in thin layers. Do not use cyanoacrylate adhesives (quick-setting adhesives).

7.4.1 Tightening torques - Tie bolts, part No. 905

Material codes 10, 11, 12, 13 (casing: cast iron)

Pump size	Tightening torque Nm
Multitec 32	85
Multitec 50	140
Multitec 65	250
Multitec 100	395
Multitec 125	600
Multitec 150	700

Material code 20 to 30
(Casing: steel or stainless steel)

Pump size	Operating pressure (bar)	Tightening torque Nm
Multitec 32	All	150
Multitec 50		240
Multitec 65		430
Multitec 100		680
Multitec 125		1370
Multitec 150	≤ 40	1500
	> 40	2000

7.4.2 Reassembly of hydraulic system

Reassembly of the hydraulic system starts at the suction end and proceeds towards the discharge end. It is advisable to place the pump in vertical position for reassembly. The sequence of reassembly does not pose any special problems and shall be realized in accordance with the detailed sectional drawing and list of components. The components shall be re-installed in the same place as before dismantling.
A clearance of 0.7 to 1.2 mm shall be set between the last impeller 230.1 or 230.3 and the balance drum 59-4 (or spacer sleeve 525.4).
When tightening the tie bolts, proceed as follows:

- Tighten the nuts of tie bolts 905 gently, with the pump in vertical position.
- Set the pump horizontally onto its feet on the assembly table.
- Tighten the nuts of tie bolts 905 in two steps (first step: 50% of nominal torque, second step: nominal torque) in the sequence 1.4.2.3.

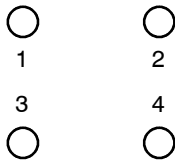


Fig. 37

7.4.3 Seals

Gland packing

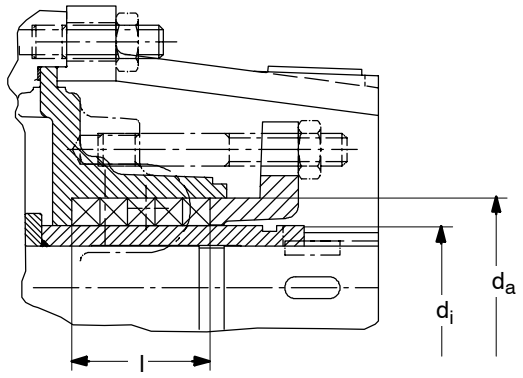
Before re-packing, thoroughly clean the packing chamber and the gland cover.

Caution Packing rings must be inserted so that the cut edge of each ring is displaced by approx. 90° to 120° in relation to the previous one.
Slip the pre-stressed packing rings onto the shaft protecting sleeve, press home the first packing ring with the help of the gland cover. Each packing ring must be pressed into the packing chamber individually, using the gland cover.
On gland packings with lantern ring (for vacuum operation), the lantern ring is mounted instead of the next to last packing ring (the last packing ring is located in the seal chamber on the pump side).

Tighten the gland cover by hand at first. Use a feeler gauge to check the level position of the gland cover. It must be easy to turn the rotor by hand.
Leakage is normal during pump commissioning. After approx. 5 minutes' operating period, the amount of leakage can be reduced by steadily tightening the nuts of the gland cover by 1/6 of a turn. Keep an eye on the amount of leakage and the water temperature. It takes several hours of pump operation for the gland to be adjusted completely. There must be a high leakage rate during the running-in period.
Repeat this procedure every 5 minutes until a minimum value is reached.

Dimensions in mm	Pump size			
	32 - 50 - 65	100	125	150
Packing cross-section	10 □	12,5 □		16 □
Length of packing cord	≈181	≈223	≈254	≈306
Number of packing rings	5		6	

Stuffing box housing



Pump size	d_i	d_a	l
32 - 50 - 65	45	65	50
100	56	80	60
125	66	90	72
150	78	110	96

Fig. 38 Gland chamber dimensions

Mechanical seals

Caution Mechanical seals are precision components. The seat ring and the spring-loaded ring must always be replaced together, i.e. always replace the entire mechanical seal.
To ensure trouble-free operation of the mechanical seal, the seal faces and the tools must be absolutely clean. Mechanical seals must be installed with utmost care.
The contact faces shall only be cleaned immediately before assembly takes place. They must not be greasy (grease, smudges ...) or damaged.
Individual seal components such as O-rings made of EPDM must never come into contact with oil or grease.
Mechanical seal reassembly is effected in reverse order to dismantling.
When mounting the spring-loaded ring, we recommend to wet the shaft protecting sleeve with clean fluid handled.
The seat ring and the spring-loaded ring shall always be mounted by hand resp. fingers, making sure that pressure is applied evenly, without tilting.

Horizontal baseplate-mounted pump units

Caution On pump versions C and D, the correct direction of rotation must be observed for mechanical seals with uni-directional springs.

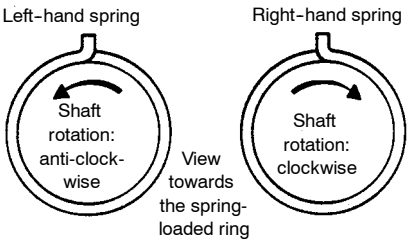


Fig. 39

Sealing elements

Caution Sealing elements made of EPDM must never come into contact with oil or grease.
Defective O-rings (which have sustained mechanical damage such as cuts, cracks and deformation as well as changes in properties from deposits or embrittlement) must be replaced. Gaskets shall always be replaced by new ones.
If possible, the gasket shall be mounted without the use of mounting aids like grease or adhesives, unless authorized mounting aids are used.

7.4.3.1 Leakage at the mechanical seal

- Check axial alignment of the seal.
- Inspect gasket 400.1.
- Remove seal cover 471.1 (471.2 for bellows-type seals) and check position of seat ring in the seal cover.
- Check the O-ring on sleeve 523.1.
- Check O-ring 412.4.

7.4.4 Bearings

Plain bearing
in installation types A - B - E / Ex - F / Fx - V / Vx are re-installed in reverse order to dismantling.

Rolling element bearings
The rolling element bearings are generally mounted on the bearing sleeve and tightened with shaft nut 920.2 / 920.6 / 920.7.
They are re-installed in reverse order to dismantling. The position of the keywayed nuts 920.6 (contact surface = plane surface with recess) marked during dismantling (7.3.3.2) must be complied with.
Check the concentricity and face run-out of ring 500.1 with a dial gauge for variants with oil lubrications.

Caution When tightening the shaft nuts, please observe the following:

The shaft nuts must be tightened to the torques indicated in the table ”Tightening torques for shaft nuts”.

Tightening the shaft nuts on Multitec pumps

Shaft nuts without lockwasher

Caution **Not applicable to drive end on MTC 32/50/65 with self-locking shaft nut**

Tightening torques for shaft nuts

Pump size	Drive end				Non-drive end			
	A, B, C, D		E,F,V		A,B,E,F,V		C,D	
	Nut	Nm	Nut	Nm	Nut	Nm	Nut	Nm
MTC 32	M 25x1,5	80 1) 40 (***) 	M 25x1,5	80 1) 40 (***) 	M 25x1,5	 40 100 (*)	M 25x1,5	80 1) 40
MTC 50	M 30x1,5	80 1) 40 (***) 	M 25x1,5	80 1) 40 (***) 	M 30x1,5	 40 120 (*)	M 30x1,5	80 1) 40
MTC 65	M 35x1,5	100 1) 50 (***) 	M 30x1,5	80 1) 40 (***) 	M 35x1,5	 50 150 (*)	M 35x1,5	100 50
MTC 100	M 42x1,5 (2x)	150 1) 50 150 (*)	M 42x1,5 (2x)	150 1) 50 150 (*)	M 42x1,5	 50 150(*)	M 42x1,5	150 1) 50 (***)
MTC 125	M 52x1,5 (2x)	200 1) 60 200 (*)	M 52x1,5 (2x)	200 1) 60 200 (*)	M 50x1,5	 60 200 (*)	M 52x1,5	200 1) 60 (***)
MTC 150	M 62x1,5 (2x)	250 1) 80 250 (*)	M 62x1,5 (2x)	250 1) 80 250 (*)	M 60x1,5	 80 250 (*)	M 62x1,5 (2x)	250 1) 80 250 (*)

1) loosen after first tightening
(*) block first nut when tightening
(**) self-locking nut
(***) bend over lockwasher

Tightening the shaft nuts on Multitec pumps

Nut with lockwasher - (drive end and non-drive end on versions C and D)

M1
M2

1.) Tighten nut to torque **M1**, then loosen again

2.) Tighten to torque **M2** and bend over lockwasher

Nut with locknut - drive end (and non-drive end on versions C and D)

M1
M2
M3

1.) Tighten first nut to torque **M1**, then loosen again

2.) Tighten first nut to torque **M2**

3.) Tighten second nut to torque **M3**, at the same time blocking first nut

Nut with locknut - non-drive end (except versions C and D)

M1
M2

1.) Tighten first nut to torque **M1**

2.) Tighten second nut to torque **M2**, at the same time blocking first nut

Self-locking nut - old version MTC E/F/V 32/50/65 (drive end)

No torques given

If there is no suitable torque wrench available for tightening the shaft nuts, proceed as follows, depending on the pump version:

Self-locking nut on drive end (or non-drive end on versions C und D)

- Tighten the shaft nut firmly
- Loosen the shaft nut again
- Apply thread-locking agent to the thread (e.g. LOCTITE)
- Moderately tighten the shaft nut

Nut with lockwasher on drive end (or non-drive end on versions C und D)

- Tighten the shaft nut firmly
- Loosen the shaft nut again
- Moderately tighten the shaft nut
- Bend over lockwasher

Nut with locknut on drive end (or non-drive end on versions C und D)

- Tighten the first shaft nut firmly
- Loosen the first shaft nut again
- Moderately tighten the first shaft nut
- Block the first shaft nut with a suitable tool and tighten the locknut firmly against the first shaft nut

Nut with locknut on non-drive end (all versions except C and D)

- Moderately tighten the first shaft nut
- Block the first shaft nut with a suitable tool and tighten the locknut firmly against the first shaft nut

Fixed bearing

The fixed bearing is the coupling-side bearing at the coupling end. Pump size 32 is equipped with deep-groove ball bearings. The other pump sizes are fitted with angular contact ball bearings in X arrangement (see sectional drawing).
The spacer discs 551.1 serve to position the rotor in axial direction.

Axial adjustment of the rotor is not required. The correct axial position of the rotor is achieved by inserting spacer discs 551.1 to a total thickness of 1.6 mm (1 x 1 mm + 3 x 0.2 mm) in bearing housing 350.1 on the side of the bearing (or angular contact ball bearings).

Caution On the old versions, the rotor is axially positioned by inserting spacer discs 551.1 on both sides of the bearing (or angular contact ball bearings) to a total thickness of 1.6 mm each.

Cover bolts 901.1 (or 901.8 for oil-lubricated bearings) must be tightened in diagonally opposite sequence to the following torques:

MTC 32/50/65 :	30 Nm
MTC 100/125/150 :	40 Nm

After installation of the bearings, the following checks shall be made:

- **Grease-lubricated bearings:** Check the clearance between cover 360.1 and bearing housing 350.1 after having tightened bolts 901.1. There should be a clearance between 0.2 mm and 0.8 mm. Cover 360.1 must not rest on the bearing housing 350.1.
- **Oil lubricated bearings:** Check the clearance between cover 360.2 and bearing housing 350.1 by verifying the dimensions prior to re-assembly (if bearings or cover have to be replaced).

Rolling element bearing sizes
Grease-lubricated bearings

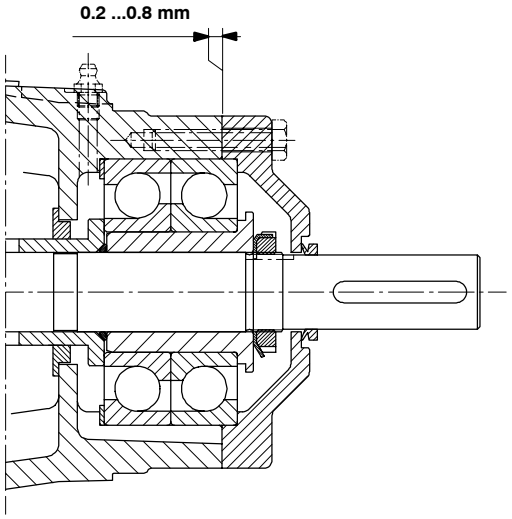


Fig. 40

Pump size	Fixed bearing 320.1	Radial bearing 320.2
32	6309 ZZ C3-HT	6309 ZZ C3-HT
50	2 x 7309 BUA	6309 ZZ C3-HT
65	2 x 7309 BUA	6309 ZZ C3-HT
100	2 x 7312 BUA	6312 C3
125	2 x 7312 BUA	6312 C3
150	2 x 7315 BUA	6315 C3

Oil lubricated bearings

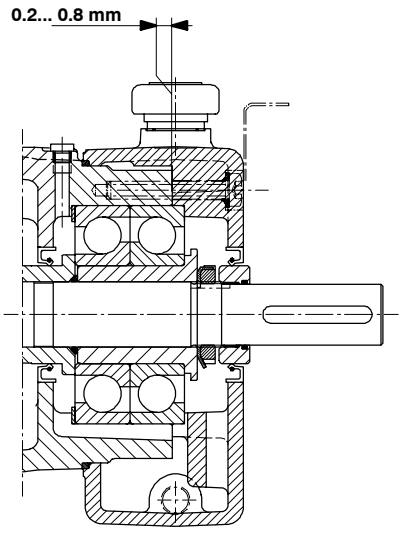


Fig. 41

The same rolling element bearings are installed for oil lubrication as for grease lubrication.
Exception: Instead of bearing type 6309 ZZ C3-HT, rolling element bearing type 6309C3 is used for oil lubrication.

Radial bearing
Versions C and D are equipped with a deep-groove ball bearing as radial bearing. (The other versions are fitted with a plain bearing in the suction casing). The outer race of the deep-groove ball bearing must have axial play. The bearing is installed without spacer discs 551.1.

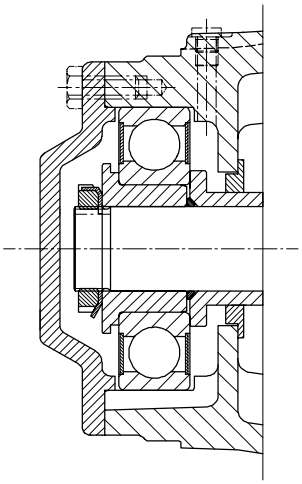


Fig. 42

7.4.4.1 Temperature of the rolling element bearings

Caution The temperature of the rolling element bearings, which run at 3000 1/min and more, can be 90°C.

Manual temperature checks are not sufficient !
- The bearings only reach their normal operating temperature after several hours of operation.
- When a new pump is started up, the bearing temperature may exceed 95°C. After 2 or 3 operating hours it will sink slowly and level out to a constant value after approx. 1 week.
- A temperature rise may occur after service activities comprising replacement of the bearings or dismantling of the hydraulic system.

Should the temperature exceed 100°C during start-up, switch off the pump and perform the following checks:
- Check whether the unit is correctly aligned.
- Remove the bearings, check grease quantity. Excessive amounts of grease will cause increased temperatures.
- Verify bearing type and arrangement (see 7.4.4.4)
- Re-start the pump. Ensure tight press fit between outer races and cover (fixed bearing).

7.5 Re-adjusting the clearance gaps

7.5.1 Maximum clearance gaps

The following max. clearances on the gap diameter apply:

D	
Impellers 230 and 231	
Suction side clearance gap	0.8 mm
Clearance gap at the hub	0.8 mm
Balance drum 59-4	0.8 mm
Suction casing 106.1 and spacer sleeve 525.2 (C and D versions only)	1.0 mm if the fluid is pumped from a vessel under vacuum conditions 2.5 mm for all other operating conditions

Should wider clearances be found, the parts subject to wear must be replaced.
Note: Pump performance is adversely affected by excessive clearances. Losses in efficiency and discharge head will occur.

7.5.2 Repairs

Clearance between impeller 231 and suction casing:
Sizes 32 to 65 for material codes 10,11, 12, 13:
Re-working the suction casing and mounting a spare casing wear ring as per ZN 1095 and re-working the impeller.
For other pump sizes and material codes:
Replacing the casing wear ring 502.1 with a spare ring as per ZN 1095 and re-working the impeller.

Clearance between impeller 230 and disc 550.1 or casing wear ring 502.2
(Sizes 125 and 150):
Replacing the casing wear ring 502.2 with a spare ring as per ZN 1095 and re-working the impeller.
(Sizes 32 to 100):
Two repair methods are possible:
a) Replacing the impellers 230 and discs 550.1 by new ones. Quick repair method, no re-work of parts required.
b) Re-working the impellers 230 at the impeller eye by deposit welding and subsequently machining to the original diameter. This repair method is used for impellers made of stainless steel.

Clearance gaps between impeller 230 and diffuser:
a) Re-working the impellers at the sealing gaps of the hubs. Re-working the diffusers and installing an interstage bush as per ZN 140.
b) Should hub thickness be insufficient after re-working, replace the impeller or fit a spacer sleeve (see drawing below). The spacer sleeve must be driven by the impeller key. Make sure that the load-carrying key length in the impeller is at least 2/3 of the total (load-carrying) key length.

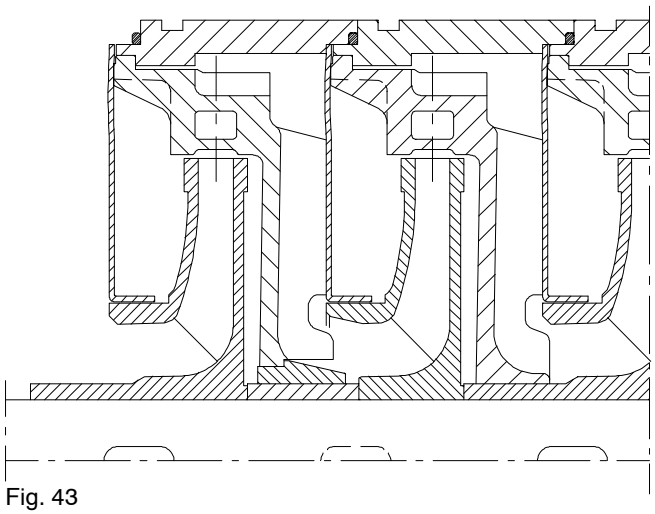


Fig. 43

Installation and returning to service
Please refer to the appropriate sections of these operating instructions.

8 Trouble-shooting

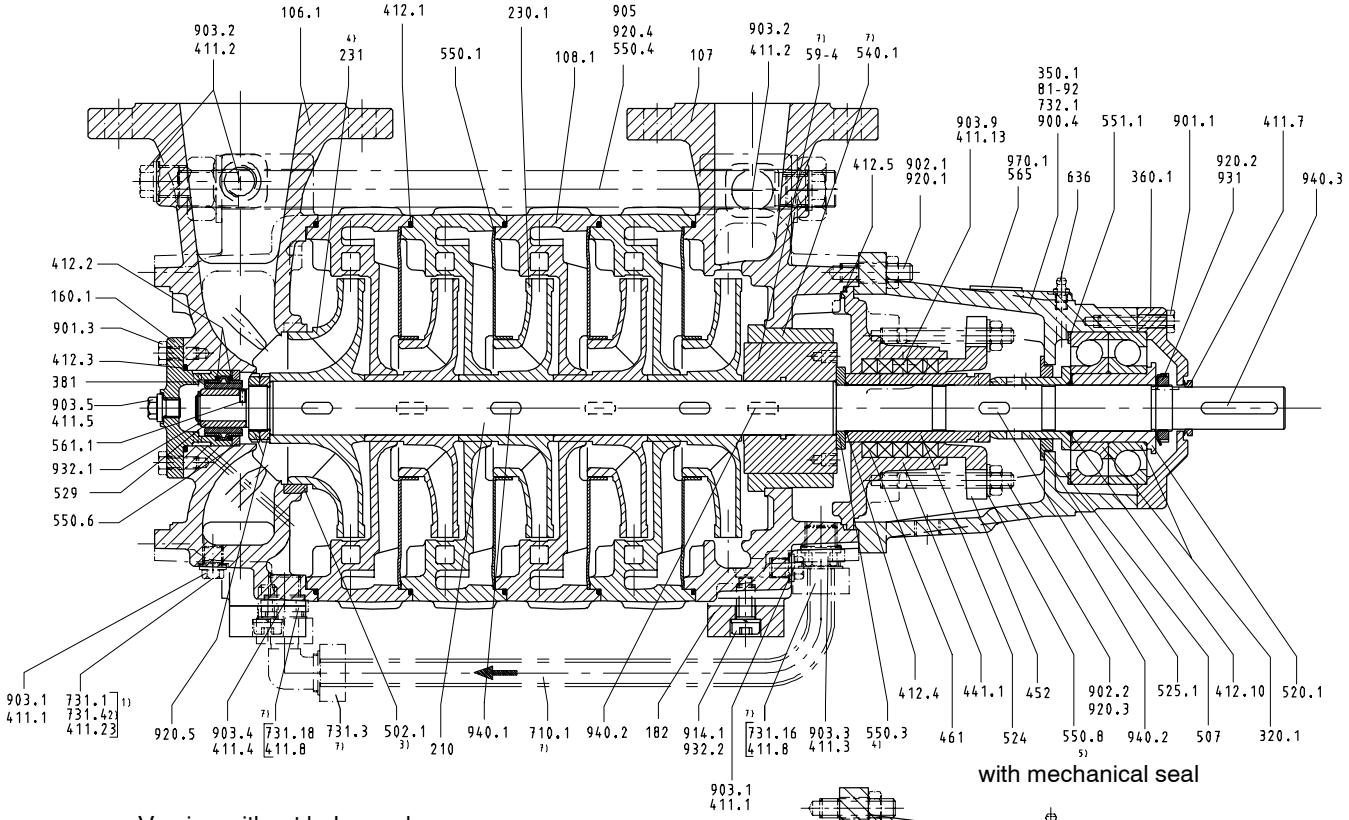
Pump delivers insufficient flow rate	Motor is overloaded	Pump is running, but does not deliver	Excessive bearing temperature	Leakage at the pump	Excessive leakage at the shaft seal	Vibrations during pump operation	Excessive rise of temperature inside the pump	Cause	Remedy [1]
*		*					*	Pump delivers against an excessively high discharge pressure.	Re-adjust to duty point. Check plant for impurities. Fit one or several larger impellers. 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. Fully open shut-off valve in the suction line. Change suction line, if the friction losses in the suction line are too high. Check suction strainer/foot valve and suction line for clogging.
*		*						Air intake at the shaft seal.	Clean barrier liquid duct, supply external barrier liquid, if necessary[2) 3)] , 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.
*	*							Density or viscosity of the fluid pumped is higher than stated in the purchase order.	2)
	*				*		*	Gland cover too tight or askew.	Correct. Increase leakage slightly.
	*							Speed is too high.	Reduce speed. [2)]
				*				Tie bolts / gaskets	Tighten the bolts. Fit new gaskets.
					*			Worn shaft seal.	Fit new shaft seal. Check barrier liquid pressure [2) 3)]
					*			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 pipeline connections and secure fixing of pump; if required, reduce the distances between the pipe clamps. Fix the pipelines using anti-vibration material.
			*					Outer bearing races of fixed bearing are loose.	Clamp outer bearing races axially.
			*					Increased axial thrust. [2)]	Check rotor clearances, axial adjustment and clearance on throttling bush / balance drum.
			*			*		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 impellers. Re-balance the impeller.
			*		*	*		Defective bearing(s).	Fit new bearing(s).
			*			*	*	Insufficient rate of flow.	Increase the minimum rate of flow.
					*			Incorrect inflow of circulation liquid.	Increase the free cross-section.
*	*	*				*		In case of parallel operation, check valve defective or missing.	Check.
					*			Incorrect installation of gland packing, unsuitable packing material	Check.
			*		*		*	Inadequate cooling of shaft seal chamber	Check the free cross-section of the cooling liquid feed line.
*			*		*			Change in the free cross-section of the return line of the balancing liquid Wear in balancing device	Check the balancing line. Check throttling bush / balance drum clearances.

1) Pump pressure must be released before attempting to remedy faults on parts which are subjected to pressure.
2) Contact KSB
3) Pump version with barrier liquid supply on request only

9 General assembly drawing

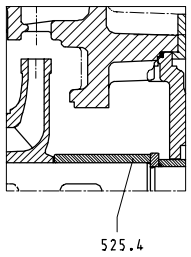
Pump sizes 32 to 100

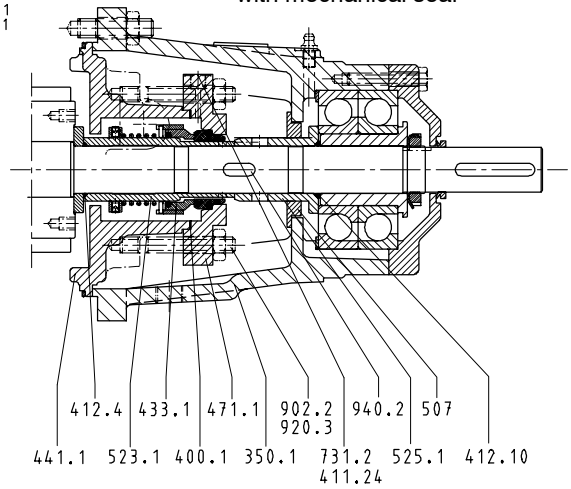
Radial suction nozzle



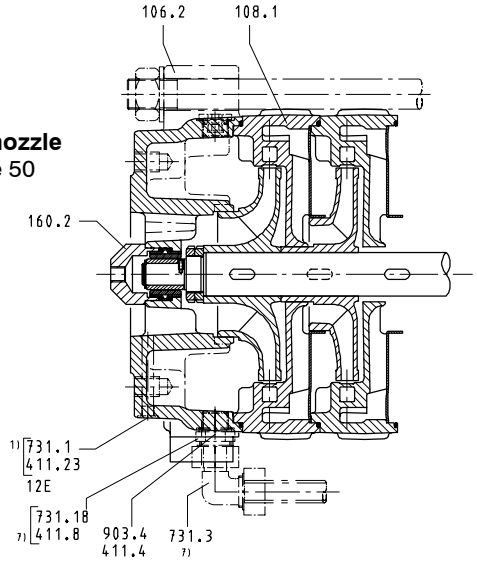
with mechanical seal

Version without balance drum

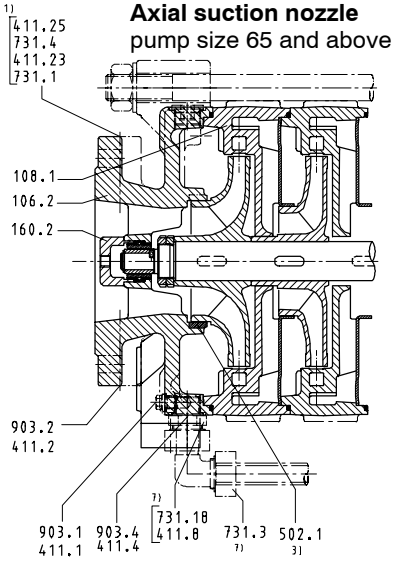




Axial suction nozzle
up to pump size 50



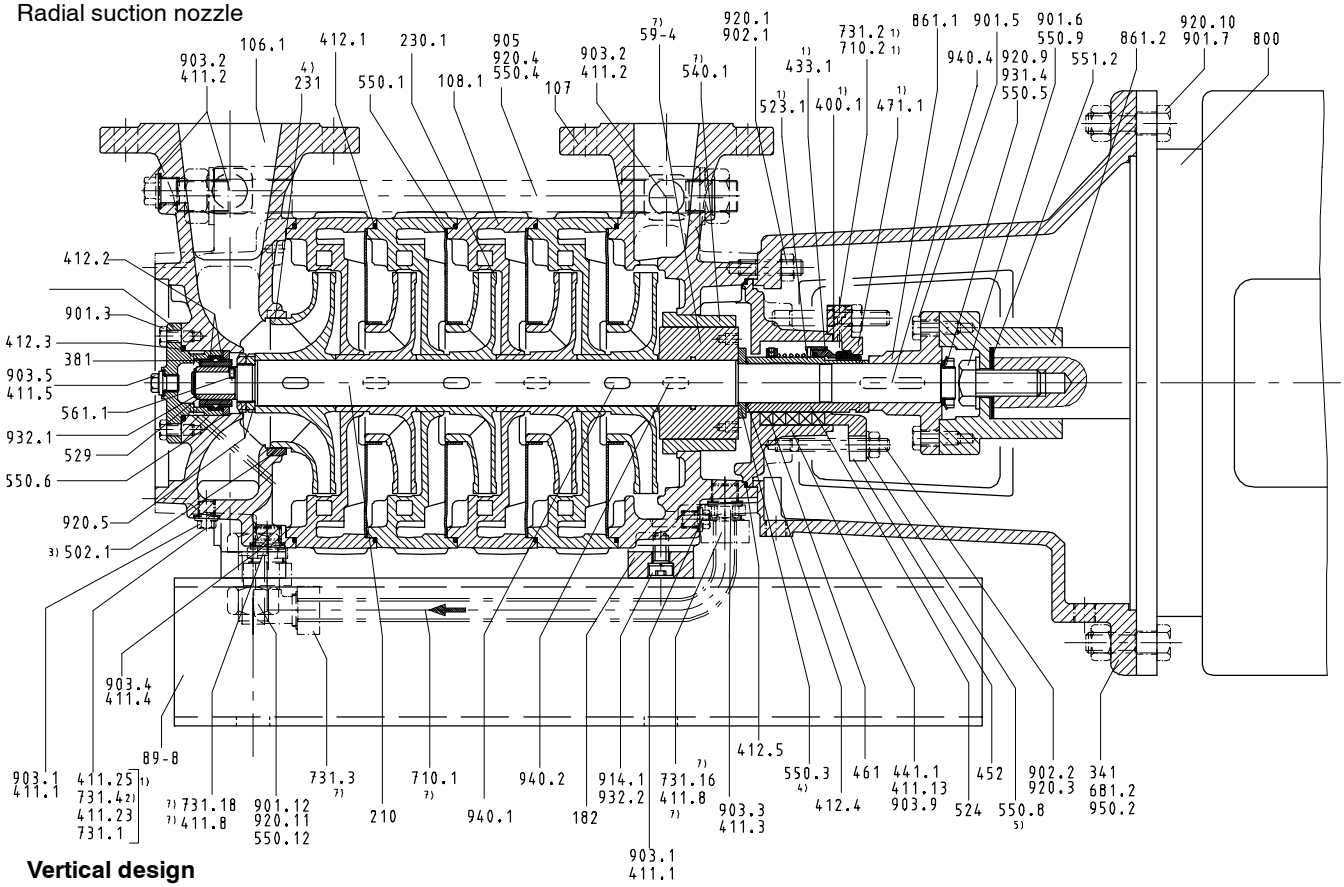
Axial suction nozzle
pump size 65 and above



1) for pump models with mechanical seal only
2) pump size 65 and above
3) pump size 100 and above
4) except pump size 32
5) pump sizes 32 and 50 only
6) hydraulics 9.2/10.2/11.1 and 12.1 only
7) for variant with balance drum only

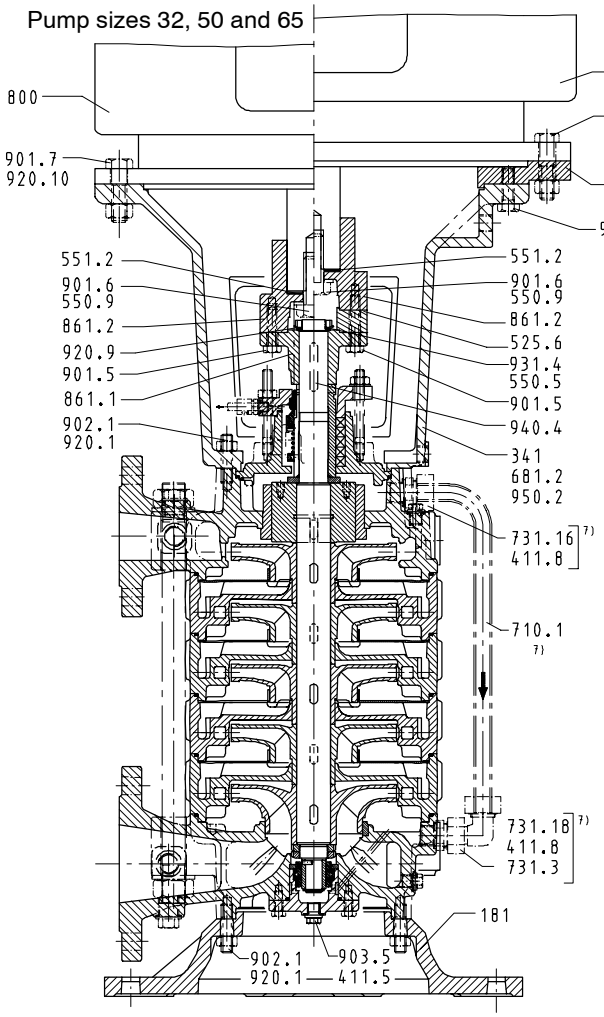
Close-coupled pump up to pump size 65

Radial suction nozzle



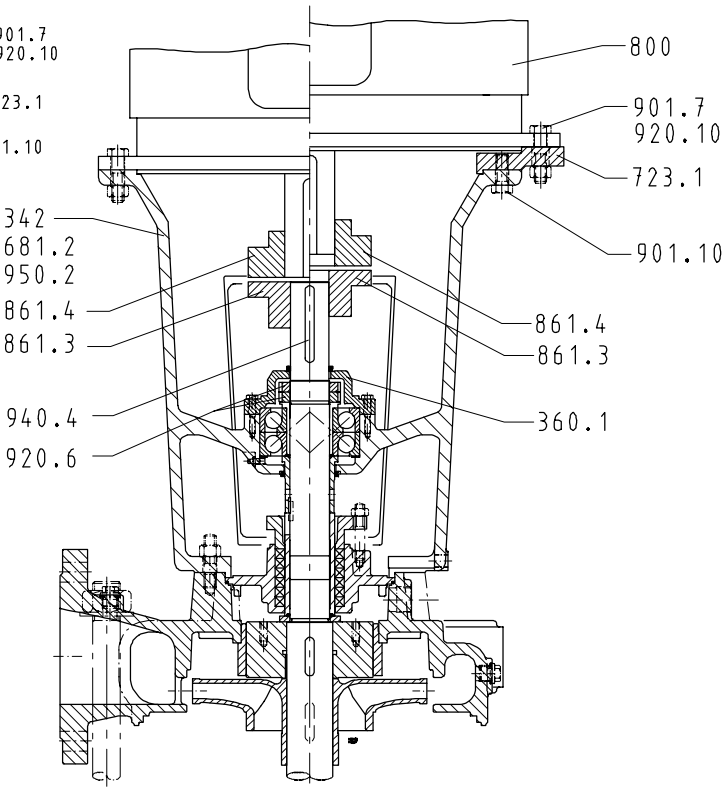
Vertical design

Pump sizes 32, 50 and 65



Vertical design

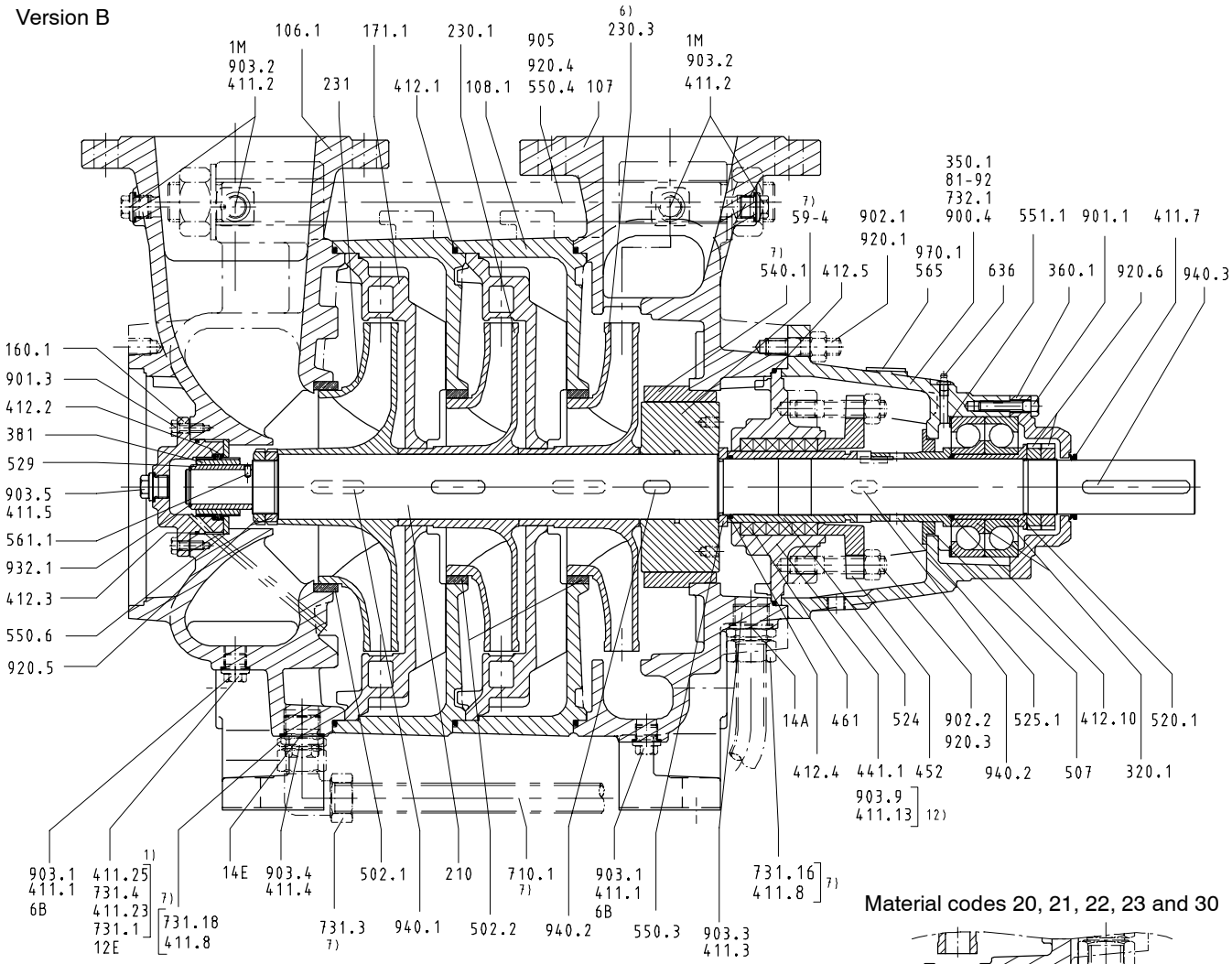
Pump sizes 100, 125 and 150



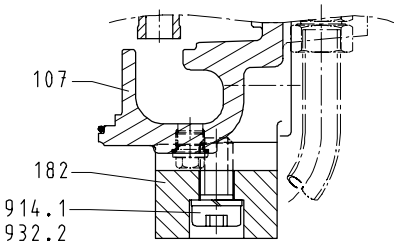
1) for pump models with mechanical seal only
2) pump size 65 and above
3) pump size 100 and above
4) except pump size 32
5) pump sizes 32 and 50 only
6) hydraulics 9.2/10.2/11.1 and 12.1 only
7) for variant with balance drum only

Pump sizes 125 and 150

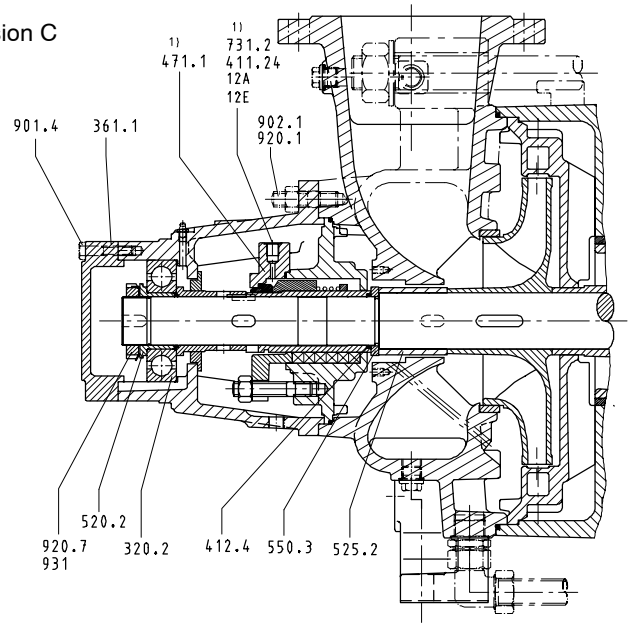
Version B



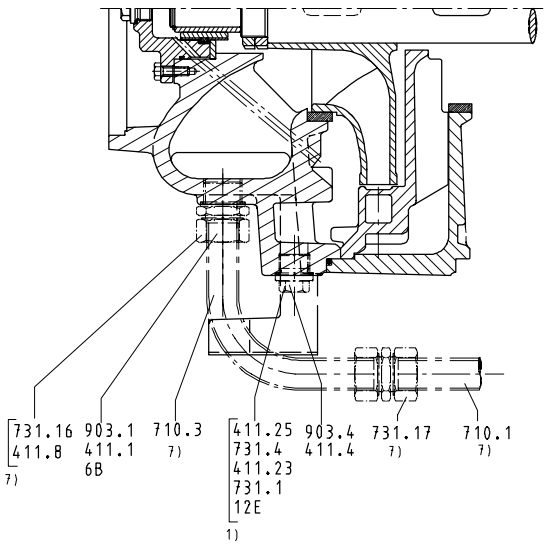
Material codes 20, 21, 22, 23 and 30



Version C



Return of balancing line MTC 150, 2-pole



1) for pump models with mechanical seal only
2) pump size 65 and above
3) pump size 100 and above
4) except pump size 32
5) pump sizes 32 and 50 only
6) hydraulics 9.2/10.2/11.1 and 12.1 only
7) for variant with balance drum only

9.1 List of components

This list includes all components mentioned in this document

Part No.	Description
106.1/2	Suction casing
107	Discharge casing
108.1	Stage casing
160.1/2	Cover
171.1	Diffuser
181	Pump stool
182	Foot
210	Shaft 1)
230.1/3	Impeller 1)
231	Suction stage impeller 1)
320.1/2	Rolling element bearing 1)
341	Drive lantern
342	Thrust bearing lantern
350.1	Bearing housing
360.1/2	Bearing cover
361.1/2	Non-drive end bearing cover
381	Bearing cartridge 1)
400.1	Gasket
411.1/2/3/4/5/6/7/8/13	Joint ring 1)
412. 1/2/3/4/5/10/11/12	O-ring 1)
421.1/2/3	Lip seal
423.1/2	Labyrinth ring
433.1/7/10	Mech. seal
441.1/4	Shaft seal housing
452	Gland cover
461	Gland packing1)
471.1/2	Seal cover
500.1	Ring
502.1/2	Casing wear ring 1)
520.1/2/3/4	Sleeve 1)
523.1	Shaft sleeve
524	Shaft protecting sleeve 1)
525.1/2/4	Spacer sleeve 1)
Part No.	**Description**
529	Bearing sleeve SiC 1)
540.1/3	Bush 1)
550. 1/2/3/4/6/8/9/10/11	Disc 1)
551.1/2	Spacer disc
561.1	Grooved pin
565	Rivet
59-4	Balance drum 1)
59-7	Support
636	Lubricating nipple
638	Constant level oiler
681.2	Coupling guard
683.1	Hood
710.1/2	Pipe
723.1	Flange
731. 1/2/3/4/16/17/18	Pipe union
800	Motor
831.1	Fan impeller
861.1/2/3/4	Coupling half
87-5	Axle
89-8	Foundation rail
900.2	Screw
901.1/2/3/4/5/6/7/8/9/10/11/12	Hex. head bolt
902.1/2	Stud
903.1/2/3/4/5/9/10/11/14	Screwed plug
905	Tie bolt
914.1	Hex. socket head cap screw
920.1/2/3/4/5/6/7/9/10/11	Nut
931	Lockwasher
932.1/2	Circlip
940.1/2/3/4/5	Key
950.2/3	Spring
971.1	Plate

1) recommended spare parts (see 7.3.7 on page 20)

Adjusting Dimensions for Coupling Alignment, Pump sizes 32 to 65, Pump versions E, Ex, F, Fx, V, Vx
Cotes de réglage pour alignement de l'accouplement tailles 32 jusqu'à 65, Exécutions E, Ex, F, Fx, V, Vx
Einstellmaße für Kupplungsausrichtung Baugrößen 32 bis 65 Ausführung E, Ex, F, Fx, V, Vx

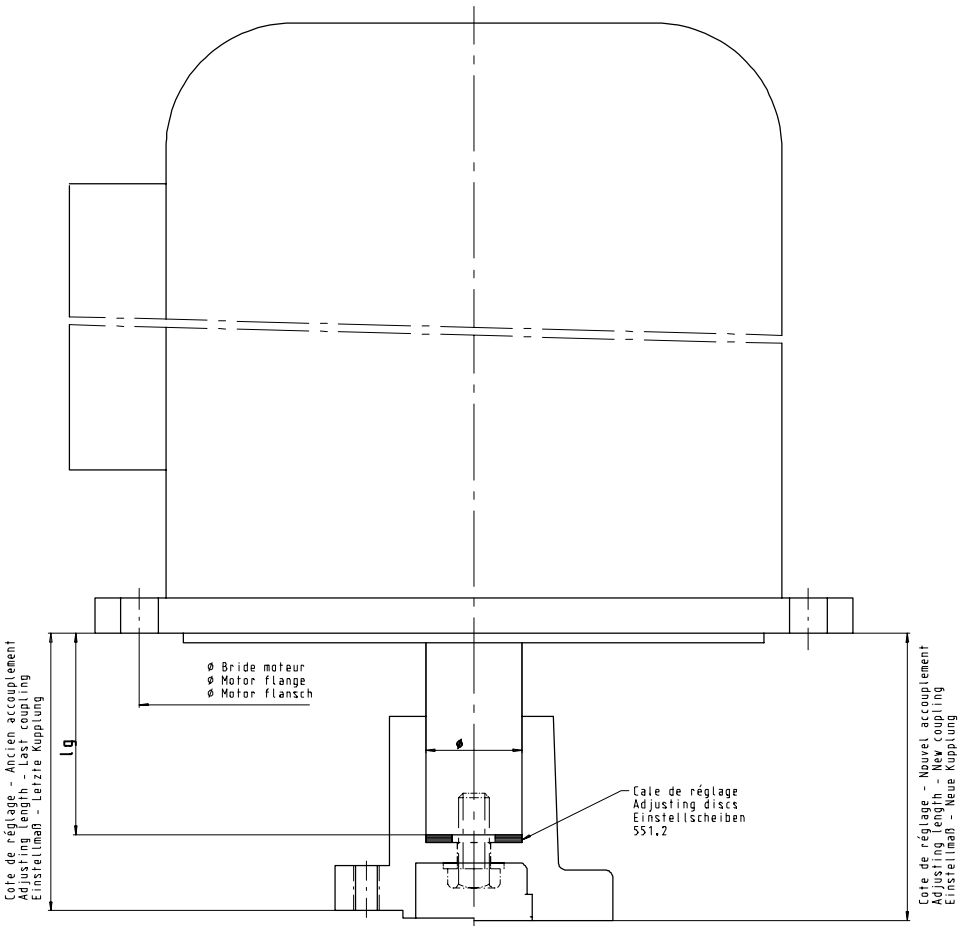


Bild 44
Fig. 44

Ø Bride moteur Ø Motor flange Ø Motor flansch	MULTITEC	Arbre moteur Shaftend motor Wellende motor		Cote de reglage Adjusting length Einstellmaß +0.25 -0.25
		ø	lg	
F165	32-50	24	50	80
F215	32-50-65	28	60	90
F265	32-50-65	38	80	110
F300	32-50-65	42/48	110	140
F350	65	48/55	110	140
F350	32-50	48/55	110	143
F400	32-50-65	55	110	143
F400/500	32-50-65	60	140	173
F500/600	65	65	140	173
F600	65	80	170	203

Ø Bride moteur Ø Motor flange Ø Motor flansch	MULTITEC	Arbre moteur Shaftend motor Wellende motor		Cote de réglage Adjusting length Einstellmaß +0.25 -0.25
		ø	lg	
F165	32-50	24	50	90
F215	32-50-65	28	60	100
F265	32-50-65	38	80	120
F300	32-50-65	42/48	110	150
F350	65	48/55	110	150
F350	32-50	48/55	110	153
F400	32-50-65	55	110	153
F400/500	32-50-65	60	140	183
F500/600	65	65	140	183
F600	65	80	170	213

Achtung Bei den Motoren für die Version Ex, Fx und Vx handelt es sich um Sondermotoren mit verstärkter Lagerung , die nicht durch Standard-Motoren ersetzt werden können!

Attenzion Les moteurs pour les versions Ex, Fx et Vx sont des moteurs spéciaux à paliers renforcés qui ne peuvent pas être remplacés par des moteurs standard!

Caution The motors of versions Ex, Fx and Vx are special motors with reinforced bearing which cannot be replaced by standard motors!

01.06.2006

1777.8/7-10

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