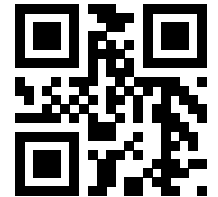
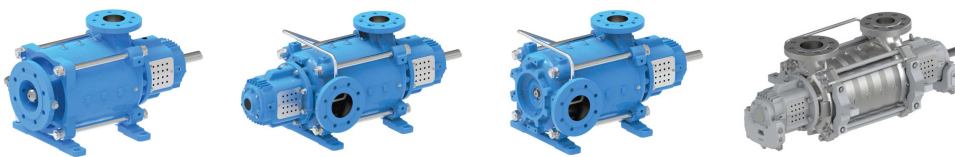


Instruction manual

P7000005\_2.0



# e-MP

## Multistage Pump



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# 1 Introduction and Safety

## 1.1 Introduction

### Purpose of the manual

The purpose of this operating instruction manual is to provide necessary information for:

- Transport
- Storage
- Installation
- Operation
- Maintenance
- Disposal

### Read and keep the manual

This operating instruction manual describes the correct and safe operation in all phases of product life and should be kept in a safe place for future use.

The name plate indicates the type series, size and number of stages, the main operating data and the order configuration number. The order configuration number uniquely identifies the pump (set) and serves as identification for all further business processes.

#### 1.1.1 Target group

This operating instruction manual is aimed at the target group of trained and qualified specialist technical personnel.

#### 1.1.2 General information

- This product corresponds with the requirements of the Machine directive 2006/42/EC.
- The operator is responsible for following the instructions and complying with the safety requirements given in this operating instruction manual.
- Smooth operation of the pump or pump unit can only be achieved if installation and maintenance are carried out carefully in accordance with the rules generally applied in the field of engineering and electrical engineering.
- Safe operation of the delivered pump or pump unit can only be guaranteed when used as designated according to the attached data sheet and / or Order Acknowledgement.
- If not all the information can be found in this operating instruction manual, please contact the local sales and service representative.
- The manufacturer takes no responsibility for the pump or pump unit if the operating instruction manual is not followed.
- If this pump or pump unit is handed on to any third party, it is essential that this operating instruction manual and the operating conditions and working limits given in the data sheet and / or Order Acknowledgement are also passed on in full.
- This operating instruction manual does not take into account all design details and variants nor all the possible chance occurrences and events which might happen during installation, operation and maintenance.
- We retain all copyright in this operating instruction manual; it is intended only for personal use by the owner, or their designee, of the pump or the pump unit. The operating instruction manual contain technical instructions and drawings which may not, as a whole or in part, be reproduced, distributed or used in any unauthorized way for competitive purposes or passed on to others.

### 1.1.3 Warranty

- Warranty information according *Product Warranty* on page 133.
- Repair work during the warranty period may only be carried out by Xylem or Xylem Inc. Service Center, or subject to our written approval. Otherwise the warranty ceases to apply.
- The warranty does not cover natural wear and tear and all parts subject to wear, such as impellers, shaft sealing, shafts, shaft sleeves, bearings, wear rings etc. or damage caused by transport or improper handling.
- In order for the warranty to apply, it is essential that the pump or pump unit is used in accordance with the operating conditions given on the name plate, order acknowledgement and in the data sheet.
- This applies particularly for the endurance of the materials and smooth running of the pump and shaft sealing device.
- If one or more aspects of the actual operating conditions are different, Xylem should be asked to confirm in writing that the pump is suitable for application.

## 1.2 Safety

### 1.2.1 Common safety notes



- This manual contains general installation, operating and maintenance instructions that must be observed to ensure safe pump operation and prevent personal injury and damage to property.
- For this reason, this operating instruction manual must be read by the skilled staff responsible and/or by the operator of the plant before it is installed and commissioned, and they must be kept permanently available at the place where the pump or pump unit is in use.
- This operating instruction manual does not refer to the General Regulations on Accident Prevention or local safety and/or operating regulations. The operator is responsible for complying with these (if necessary by calling in additional installation staff).
- Equally, instructions and safety devices regarding handling and disposal of the pumped media and/or auxiliary media for flushing, lubrication a.s.o., especially if they are explosive, toxically, hot a.s.o., are not part of this operating instruction manual.
- For the competent and prescribed handling only the operator is responsible.

### 1.2.2 Key to safety symbols/markings


Safety symbols are published to help prevent these hazards:

- Personal accidents and health problems
- Damage of the product
- Product malfunction

#### Hazard levels

Hazard level	Indication
 <b>DANGER:</b>	A hazardous situation which, if not avoided, will result in death or serious injury
 <b>WARNING:</b>	A hazardous situation which, if not avoided, could result in death or serious injury



Hazard level	Indication
 <b>CAUTION:</b>	A hazardous situation which, if not avoided, could result in minor or moderate injury
<b>NOTICE:</b>	<ul style="list-style-type: none"> <li>• A potential situation which, if not avoided, could result in undesirable conditions</li> <li>• A practice not related to personal injury</li> </ul>

### Explosion protection



This symbol identifies information about avoiding explosions in potentially explosive atmospheres in accordance with EC Directive 2014/34/EU (ATEX).

- Operation in the EX-zone is allowed only if the data sheet and the order confirmation show explicit allowed.

---

#### NOTICE:

- A potential situation which, if not avoided, could result in undesirable conditions.
  - A practice not related to personal injury.
- 

### Danger classes

Special danger classes can show specific symbols, which replace the standard symbols.




---

#### **DANGER: Danger by electricity**

In conjunction with one of the signal words this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage.

---

### Hot surface hazard

Hot surface hazards are indicated by a specific symbol that replaces the typical hazard level symbols:




---

#### **CAUTION:**

---

### Description of user and technician symbols

Specific information for all, who are responsible for the installation of the product (hydraulic and/or electrical part) or for maintenance.

Specific information for the user.

### Instructions

Instructions and warnings provided in this manual concern the standard version, as described in the sales document. Special version pumps may be supplied with supplementary instruction leaflets.

Refer to sales contract for any modifications or special version characteristics.

For instructions, situations, or events that is not considered in this operating instruction manual or the sales document, contact the local sales and service representative.

### 1.2.3 Dangers of non-observance of safety instructions

Non-observance of the Safety Instructions can lead to loss of any claim for damages.

Further, non-observance can lead to following risks:

- Failure of important functions of the machine or facility.
- Failure of electronic appliances and measuring instruments by magnetic fields.

- Endangering of persons and their personal property by magnetic fields.
- Endangering of persons by electric, mechanic and chemical influences.
- Endangering of persons by electric, mechanic and chemical influences.

#### 1.2.4 Personal qualification

- All personnel involved must be fully qualified to install, operate, maintain and inspect the machinery this manual refers to.
- The responsibilities, competence and supervision of all personnel involved in transport, installation, operation, maintenance and inspection must be clearly defined by the owner.

#### 1.2.5 Intended use

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**NOTICE:**

Never operate the pump without the fluid to be handled.

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- The pump/pump set must only be operated within the operating limits described in the other applicable documents.
- Only operate pump/pump set which are in perfect technical condition.
- Do not operate the pump/pump set in partially assembled condition.
- Only use the pump to handle the fluids described in the data sheet or product literature of the pump model or variant.
- Observe the minimum flow rates indicated in the data sheet or product literature (to prevent overheating, bearing damage, etc).
- Observe the maximum flow rates indicated in the data sheet or product literature (to prevent overheating, mechanical seal damage, cavitation damage, bearing damage, etc).
- Do not throttle the flow rate on the suction side of the pump (to prevent cavitation damage).
- Consult the manufacturer about any use or mode of operation not described in the data sheet or product literature.

#### Prevention of foreseeable misuse

- Never open the discharge-side shut-off elements further than permitted.
  - The maximum flow rates specified in the product literature or data sheet would be exceeded.
  - Risk of cavitation damage
- Never exceed the permissible operating limits specified in the data sheet or product literature regarding pressure, temperature, etc.
- Observe all safety information and instructions in this manual.
- In the case of hazardous media or operating in higher than listed temperatures, ensure the pump is taken out of operation if a barrier, flush or cooling system breaks down.
- Barrier, flush and cooling systems must always be in operation before start-up of the pump. Shutdown only when the pump is at a standstill if this is permissible by the type of operation.
- In plants where pumps operate in a closed system under pressure (gas cushion, vapor pressure), the gas cushion is never allowed to be relieved via the pump, because the return speed can be a multiple of the operating speed and can destroy the pump/pump set.

#### 1.2.6 Safety awareness

In addition to the safety information contained in this manual and the intended use, the following safety regulations shall be complied with:

- Accident prevention, health and safety regulations
- Explosion protection regulations
- Safety regulations for handling hazardous substances
- Applicable standards, directives and laws

### 1.2.7 Safety information for the operator/user

- The operator shall fit contact guards for hot, cold and moving parts and check that the guards function properly.
- Do not remove any contact guards during operation.
- Provide the personnel with protective equipment and make sure it is used.
- Contain leakages (e.g. at the shaft seal) of hazardous fluids handled (e.g. explosive, toxic, hot) so as to avoid any danger to persons and the environment.
- Adhere to all relevant laws.
- Eliminate all electrical hazards. (In this respect refer to the applicable national safety regulations and/or regulations issued by the local energy supply companies.)
- If the sound level of a pump or pump unit is above 85 dB (A) an ear protection has to be used when staying near the pump for some time.

### 1.2.8 Safety information for maintenance, inspection, and installation

- The operator ensures that maintenance, inspection and installation are performed by authorized, qualified specialist personnel who are thoroughly familiar with the manual.
- Only carry out work on the pump set during shutdown/standstill of the pump.
- The pump casing must have cooled down to ambient temperature.
- Pump pressure must have been released and the pump must have been drained.
- When taking the pump out of service always adhere to the procedure described in the manual.
- Decontaminate pumps which handle fluids posing a health hazard.
- As soon as the work has been completed, re-install and/or re-activate any safety relevant and protective devices. Before returning the product to service, observe all instructions on commissioning.

### 1.2.9 Decals

Ensure this safety instruction decal is always clearly visible and readable. If the decal is missing or illegible, contact your local sales and service representative for a replacement.



Figure 1: Grease lubricated pumps



Figure 2: Oil lubricated pumps

### 1.2.10 Unauthorized modification and spare parts production

- Alteration or changes of the machine are permitted after agreement with the manufacturer.
- Original spare parts and accessory authorized by the manufacturer for safety measures.
- The use of other parts can lead to loss of liability.

### 1.2.11 Unauthorized modes of operation

- Never operate the pump (set) outside the limits stated in the data sheet and in this manual.
- The warranty relating to the operating reliability and safety of the supplied pump (set) is only valid if the equipment is used in accordance with its intended use.
- For more information, see [Intended use](#) on page 8.


### 1.2.12 Explosion protection



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**DANGER: Always observe the information on explosion protection given in this section when operating the product in potentially explosive atmospheres**

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- Only pumps/pump sets marked as explosion-proof and identified as such in the data sheet may be used in potentially explosive atmospheres.
-  Special conditions apply to the operation of explosion-proof pump sets to EU Directive 2014/34/EU (ATEX).
- For this, the sections marked with the explosion protection symbol in this operating manual and the following sections must be observed carefully.
- The explosion-proof status of the pump set is only assured if the pump set is used in accordance with its intended use.
- Never operate the pump set outside the limits stated in the data sheet and on the name plate. Prevent impermissible modes of operation at all times.

#### 1.2.12.1 Marking

The marking on the pump refers to the pump end only. For coupling and motor or further components a separate Declaration of Conformity, as well as a corresponding marking must be available.

Example of such marking at pump: Ex II 2 G c T...

The marking shows the theoretically applicable range of temperature classes. The different temperatures, permitted according to pump design, result as shown in [Temperature limits](#) on page 10. The same is valid for the drive.

For a whole unit (pump, coupling, motor) with different temperature classes the lowest class is valid.

#### 1.2.12.2 Temperature limits

Under normal operating conditions the highest temperatures must be expected at the surface of the pump casing and in the area of the bearings.

The surface temperature at pump casing corresponds with the temperature of the pumped liquid. If the pump is heated (example heating jacket), care must be taken, that the temperature classes, prescribed for the plant are observed.

In the area of the bearing bracket free contact from surface to surrounding must be given.

During operation of the pump it must be secured that an overabundant sedimentation of dust is avoided (regular cleaning), to prevent heating of pump surface over the permitted temperature.

The operator of the plant must ensure that the defined operating temperature is observed. The max. allowed temperature of the pumped liquid at suction depends on the particular temperature class.

The following table shows the theoretical temperature limits of the pumped liquid in consideration of the temperature classes according to EN 13463-1.

Table 1:

Temperature class to EN 13463-1	Temperature limit of pumped liquid
T5 (212°F, 100°C)	212°F (100°C) (only after consultation with the manufacturer)
T4 (275°F, 135°C) 275°F (135°C)	275°F (135°C)
T3 (392°F, 200°C)	275°F (135°C)
T2 (572°F, 300°C)	Temperature limit of the pump
T1 (842°F, 450°C)	Temperature limit of the pump

The particular allowed operating temperature of the pump is shown in the data sheet and / or the Order Acknowledgement or the name plate on the pump.

In the area of the bearings the temperature class T4 is guaranteed, provided that the ambient temperature is 113°F (45°C) and the machine is duly operated and maintained.

### 1.2.12.3 Operation of the pump

#### Filling

During operation of the pump the system of the suction and pressure pipe and the pump itself must permanently be filled with the pumped liquid.

All sealing chambers, auxiliary systems of the shaft seal as well as heating and cooling systems must be filled carefully.

If the operator cannot guarantee that, appropriate monitoring measures must be provided.

#### Operation

---

#### NOTICE:

The pump must start up with fully opened suction side and slightly opened pressure side valve. The start-up against closed non-return valve, however, is possible. Immediately after the start-up the discharge side valve must be adjusted to the operating point.

Barrier, flush and cooling systems must be in operation before the start-up of the pump. Shutdown only when the pump stopped, if this is permitted by the nature of the operation.

For more information, see [Start up the pump set](#) on page 58.

---

#### Operation with closed valve in suction and / or discharge pipe is not permitted

In [Limits of operation](#) on page 59 the minimum flow is stated. Longer operating phases with these flows and the named liquids do not cause additional increase of surface temperature at the pump.

Furthermore the references in [Commissioning, Startup, Operation, and Shutdown](#) on page 50 must be taken into consideration.

On pumps with mechanical seals the permitted temperature limits can be exceeded due to dry-run.

Dry run does not only occur on insufficiently filled seal cover, but also in case of excessively high gas fractions in the medium.

Operation of the pump out of the permitted operating range can lead to dry-run, as well.

#### Maintenance

For a secure and reliable operation the pump unit must be maintained by regular inspections and kept in good technical condition.

Example: Roller bearings.

By regular control of the lubricant and the running sound, the danger of going over temperatures by bearings running hot or defect bearing seals is avoided. For more information, see [Lubrication](#) on page 51 and [Grease lubrication](#) on page 66.

The function of the shaft sealing must be secured by regular control.

If auxiliary systems (e.g. external flushing, cooling, heating) are installed, it must be checked, if monitoring devices are necessary to secure the function.

#### 1.2.12.4 Electric switches and control devices, instrumentation, and accessories

Electric switches and control devices, instrumentation and accessories like e.g. flush tanks, a.s.o., must correspond with the valid safety requirements and regulations for explosion protection.

#### 1.2.12.5 Intended use

##### Speed, pressure, and temperature

Suitable safety measures must be taken at the plant to ensure that the speed, pressure and temperature of the pump and the shaft sealing do not exceed the limit values given in the data sheet or order confirmation.

Further, pressure shocks, as can occur on too fast shut down of the operation, must be kept away from the pump (e.g. by non-return valve at pressure side, fly wheel, air tanks). Quick temperature changes must be avoided. They can cause a temperature shock and lead to damage or impair the function of single components.

##### Permitted nozzle loads and torques

Basically the suction and discharge piping must be designed in such way, that as little forces as possible are effective to the pump. If that is not possible, the values in [Permitted nozzle loads and torques at the pump nozzles](#) on page 38 must not be exceeded under any circumstances. This is valid for the operation as well as for the shutdown/standstill of the pump and therefore for all possible pressures and temperatures of the unit.

##### NPSH

The pumped liquid must have a minimum pressure NPSH at the impeller inlet; so that cavitation free work is secured or a "break off" of the pump flow is prevented. This condition is fulfilled, when NPSH-value of the system (NPSHA) lies above NPSH-value of the pump (NPSHR) under all operating conditions.

Attention must especially be paid to the NPSH-value on pumping liquids near the vapor pressure. If the NPSH-value of the pump remains under, this can lead from damage of the material due to cavitation to destruction by overheating.

The NPSH-value of the pump (NPSHR) is shown in the curves of every pump type.

##### Back flow

In systems where pumps are operating in closed circuits under pressure (gas cushions, steam pressure), the pressure of the gas cushion must not be reduced via the pump, since the back flow speed may be much higher than the operating speed, which would destroy the unit.

# 2 Transportation and Storage

## 2.1 Inspect the delivery

- Check the outside of the package for evident signs of damage.
- Notify our distributor within eight days of the delivery date, if the product bears visible signs of damage.

### Unpack the unit

1. Follow applicable step:
  - If the unit is packed in a carton, then remove the staples and open the carton.
  - If the unit is packed in a wooden crate, then open the cover while paying attention to the nails and straps.
2. Remove the securing screws or the straps from the wooden base.

### 2.1.1 Examine the unit

1. Remove packing materials from the product.  
Dispose of all packing materials in accordance with local regulations.
2. To determine whether any parts have been damaged or are missing, examine the product.
3. If applicable, unfasten the product by removing any screws, bolts, or straps.  
Use care around nails and straps.
4. If there is any issue, then contact a sales representative.

## 2.2 Transportation guidelines

### Precautions




---

#### WARNING:

- Observe accident prevention regulations in force.
  - Crush hazard. The unit and the components can be heavy. Use proper lifting methods and wear steel-toed shoes at all times.
- 

Check the gross weight that is indicated on the package in order to select proper lifting equipment.

### Position and fastening

Keep the pump / pump unit in the same position in which it was supplied from the factory. Make sure that the pump or pump unit is securely fastened during transportation and cannot roll or fall over.




---

#### WARNING:

- Do not use eyebolts screwed on the motor for handling the whole electric pump unit.
  - Do not use the shaft end of the pump or of the motor to handle the pump, the motor or the unit.
- 
- Eyebolts screwed onto the motor may be exclusively used to handle the individual motor or, in case of a not balanced distribution of weights, to partially lift the unit vertically starting from a horizontal displacement.
  - To move the pump unit, use straps firmly linked to the rear of the motor.
  - Lifting the pump unit with motor and base-frame should be done by utilizing a forklift.
  - Pump unit must always be fixed and transported as shown.

- Always take extra precaution to ensure the weight is balanced and equally distributed across both forks.
- Pump without motor must be fixed and transported as shown.

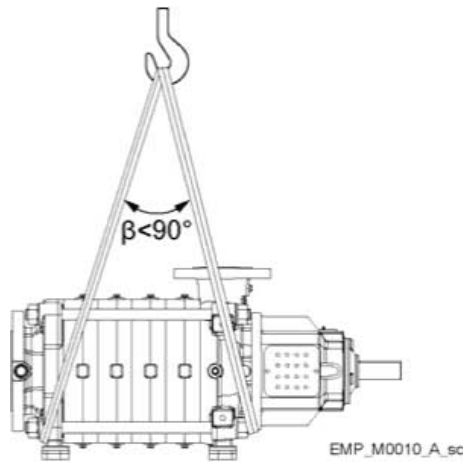


Figure 3: Transport of pump

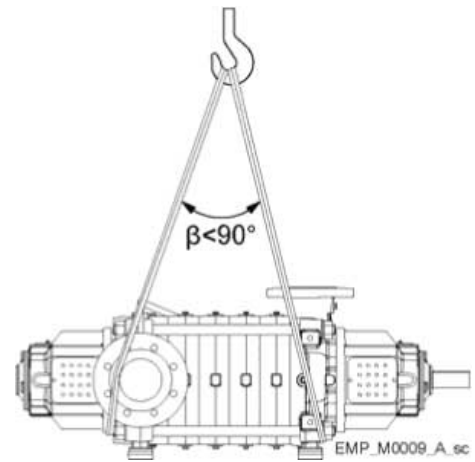


Figure 4: Transport of pump

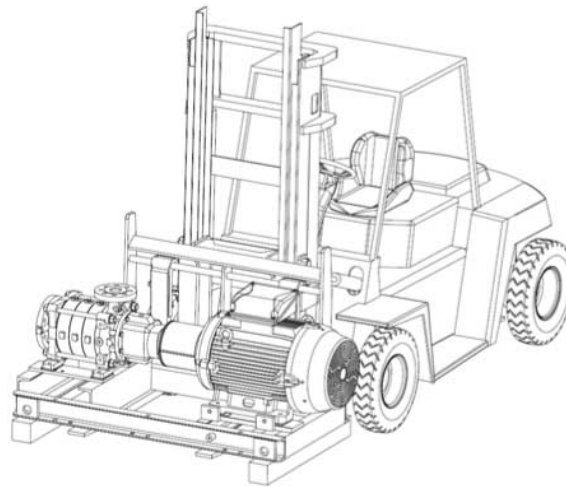


Figure 5: Transport of pump unit

Unit without motor



**WARNING:** A pump and motor that are purchased separately and then coupled together results in a new machine under the Machinery directive 2006/42/EC. The person making the coupling is responsible for all safety aspects of the combined unit.

## 2.3 Storage guidelines

### Short term storage

The product must be stored in a covered and dry location free from heat, dirt, and vibrations. If the pump is stored longer than 8 weeks, the shaft must be rotated manually from this time and once every month.

Pump must be drained of all fluids from all cavities before it is put into storage.

### NOTICE:

Protect the product against humidity, heat sources, and mechanical damage.



**NOTICE:**

Do not place heavy weights on the packed product.

**2.3.1 Long-term storage**

If the unit is stored for more than 6 months, these requirements apply:

- Drain the pump of all fluids from all cavities.
- Store in a covered and dry location.
- Store the unit free from heat, dirt, and vibrations.
- Rotate the shaft by hand several times at least every three months.

When properly installed, protection is provided for a maximum of 12 months.

Treat bearing and machined surfaces so that they are well preserved.

Refer to the drive unit and coupling manufacturers for their long-term storage procedures.

For questions about possible long-term storage treatment services, please contact your local sales and service representative.

**Ambient temperature**

The product must be stored at an ambient temperature from 23°F to 104°F (-5°C to +40°C).

**2.3.2 Return to supplier**

1. Drain the pump as per operating instructions.  
For more information, see [Drainage](#) on page 70.
2. Always flush and clean the pump, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids.
3. If the pump set has handled fluids whose residues could lead to corrosion damage in the presence of atmospheric humidity or could ignite upon contact with oxygen, the pump set must also be neutralised, and anhydrous inert gas must be blown through the pump to ensure drying.
4. Always complete and enclose a certificate of decontamination when returning the pump or pump unit.

**2.3.3 Disposal****WARNING:**

Fluids, consumables and supplies which are hot and/or pose a health hazard to persons and the environment !

- Collect and properly dispose of flushing fluid and any residues of the fluid handled.
  - If required, wear safety clothing and a protective mask.
  - Observe all legal regulations on the disposal of fluids posing a health hazard.
1. Dismantle the pump/pump unit.
  2. Collect the greases and other lubricants during dismantling.
  3. Separate and sort the pump materials, in the following categories:
    - Metal
    - Plastics
    - Electronic waste
    - Greases and other lubricants

Dispose of materials in accordance with local regulations or in another controlled manner.

# 3 Product Description

## 3.1 Product overview

The pump is a multistage centrifugal ring section pump with suction impeller for low NPSH value.

### Intended use

- Water supply and water treatment
- Cooling and hot water supply in industries and building services
- Irrigation and sprinkler systems
- Heating systems
- Snow making applications
- Nano filtrations
- Boiler feed

### Improper use



---

**WARNING:**

Improper use of the pump may create dangerous conditions and cause personal injury and damage to property.

---

An improper use of the product leads to the loss of the warranty.

Examples of improper use:

- Liquids not compatible with the pump construction materials
- Hazardous liquids (such as toxic, explosive, flammable, or corrosive liquids)
- Potable liquids other than water (for example, wine or milk)

Examples of improper installation:

- Hazardous locations (such as explosive, or corrosive atmospheres).
  - Location where the air temperature is very high or there is poor ventilation.
  - Outdoor installations where there is no protection against rain or freezing temperatures.
- 

**DANGER:**

Do not use this pump to handle flammable and/or explosive liquids.

---

**NOTICE:**

- Do not use the pump for flow rates beyond the specified flow rates on the data sheet or Order Acknowledgement.  
For more information, see [Limits of operation](#) on page 59.
  - Do not use this pump to handle liquids containing abrasive, solid, or fibrous substances.
- 

### Special applications

Contact the local sales and service representative in the following cases:

- If the density or viscosity value of the pumped liquid exceeds the value of water, such as water with glycol; as it may require a more powerful motor.
- If the pumped liquid is chemically treated (for example softened, deionized, demineralized etc.).
- Any situation that is different from the ones that is described and relate to the nature of the liquid.

## 3.2 Types



Figure 6: MPA and MPAE

- Horizontal shaft design
- Axial suction nozzle
- Radial discharge nozzle (left, top, right)
- Drive on discharge side
- Radial or Axial roller bearing on drive side
- Plain bearing on suction side
- Axial thrust balancing by drum design
- Shaft sealing on discharge side only
- Bare shaft pump or pump unit
- Driver: electric motor - NEMA standard or IEC
- Temperature range: 14°F to 248°F (-10°C to 120°C)
- Inlet pressure: up to 145 psi (10 bar)

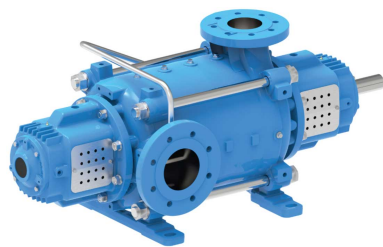


Figure 7: MPD and MPDE

- Horizontal shaft design
- Radial suction nozzle (left, top, right)
- Radial discharge nozzle (left, top, right)
- Drive on discharge side (optional suction side drive)
- Radial or Axial roller bearing on discharge side
- Radial roller bearing on suction side
- Axial thrust balancing by drum design
- Shaft sealing on suction and discharge side
- Bare shaft pump or pump unit
- Driver: electric motor - NEMA standard or IEC
- Temperature range: 14°F to 284°F (-10°C to 140°C)
- Inlet pressure: up to 580 psi (40 bar)

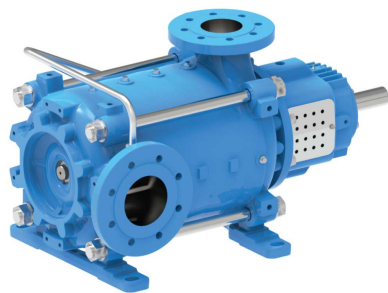


Figure 8: MPR and MPRE

- Horizontal shaft design
- Radial suction nozzle (left, top, right)
- Radial discharge nozzle (left, top, right)
- Drive on discharge side
- Radial or Axial roller bearing on drive side
- Slide bearing on suction side
- Axial thrust balancing by drum design
- Shaft sealing on discharge side only
- Bare shaft pump or pump unit
- Driver: electric motor - NEMA standard or IEC
- Temperature range: 14°F to 248°F (-10°C to 120°C)
- Inlet pressure: up to 145 psi (10 bar)



Figure 9: MPDP

- Horizontal shaft design
- Radial suction nozzle (left, top, right)
- Radial discharge nozzle (left, top, right)
- Drive on discharge side (optional on suction side)
- Pump feet in axis
- Radial or Axial roller bearing on discharge side
- Radial roller bearing on suction side
- Axial thrust balancing by drum design
- Shaft sealing on suction and discharge side
- Bare shaft pump or pump unit
- Driver: electric motor - NEMA standard or IEC
- Temperature range: 284°F to 365°F (140°C to 180°C)
- Inlet pressure: up to 580 psi (40 bar)

Optional -13°F (-25°C) pump design on demand.

The pump can be used for handling:

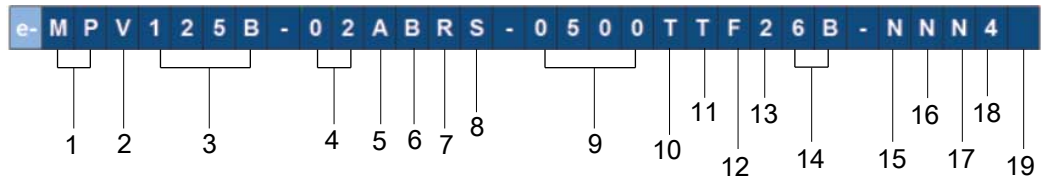
- Cold and warm water
- Clean liquids
- Aggressive liquids which are not chemically and mechanically aggressive to the pump materials.

The product can be supplied as a pump unit (pump, base-frame and electric motor) or pump end only.

**NOTICE:**

If you have purchased a pump without motor, make sure that the motor is suitable for coupling to the pump.

### 3.3 Product name key



1. Pump type (2 characters)
2. Configuration (1 character)
3. Pump size (3 to 4 characters)
4. Number of stages/ impellers (2 characters)
5. Combination of full diameter and trimmed impellers (1 character)
6. Flange orientation (1 character)
7. ANSI suction flange class (1 character)
8. ANSI discharge flange class (1 character)
9. Motor HP (2 to 4 characters)
10. Motor enclosure (1 character)
11. Frame size (1 character)
12. Motor type (1 character)
13. No. of poles (1 character)
14. Motor frequency and voltage (2 characters)
15. Casing material (1 character)
16. Impeller material (1 character)
17. Diffuser material (1 character)

18. Mechanical seal and O-ring materials (1 character)

19. Seal type (1 character)

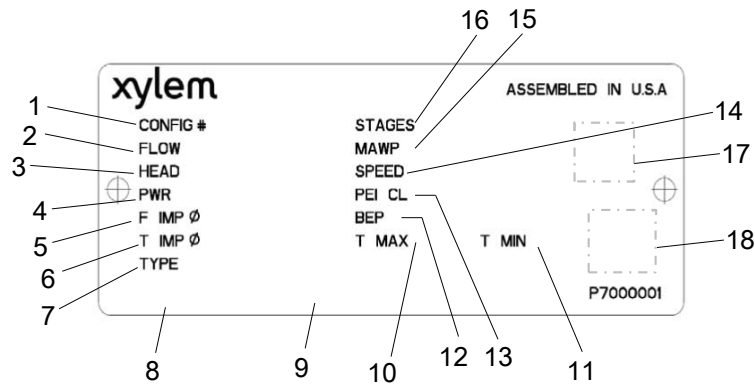
Table 2: Available pump models

Pump Model	580 PSI (40 bar)	914 PSI (63 bar)	1450 PSI (100 bar)	Up to 212°F (100°C) Bottom feet	212°F-248 °F (100°C-12 0°C) Bottom feet	248°F-284 °F (120°C-14 0°C) Bottom feet	284°F-320 °F (140°C-16 0°C) Bottom feet	320°F-356 °F (160°C-18 0°C) Feet in axis	Multi- outlet	Hydrovar
MPA	X	X			X					
MPAE			X		X					
MPAT		X					X			
MPAT			X				X			
MPD	X	X				X				
MPDE			X			X				
MPDT		X					X			
MPDT			X				X			
MPDP		X						X		
MPDP			X					X		
MPR	X	X			X					
MPRE			X		X					
MPRT		X					X			
MPRT			X				X			
MPAM	X	X			X				X	
MPDM	X	X				X			X	
MPRM	X	X			X				X	
MPV	X	X		X	X					
MPVH	X	X		X						X

MPAE, MPDE, MPRE	Designation for 1450 psi (100 bar) pumps
MPAT, MPDT, MPRT	Designation for pumps with temperature range of 284°F - 320°F
MPAM, MPDM, MPRM	Designation for multi-outlet pumps
MPVH	Designation for pumps with Hydrovar

### 3.4 Name plate

The name plate is a metal label that is located on the bearing bracket. The name plate lists key product specifications.



1. Order configuration number
2. Flow
3. Head
4. Motor HP
5. Full impeller diameter (specification only if full impeller available)
6. Trimmed impeller diameter (only if trimmed impeller available)
7. Pump type
8. Production date
9. Weight
10. Maximum operating temperature
11. Minimum operating temperature
12. Hydraulic efficiency in the best efficiency point
13. Pump Energy Index – constant load (if applicable)
14. Speed
15. Maximum allowable working pressure
16. Number of stages
17. QR Code (if applicable)
18. Approval Block (if applicable)

**NOTICE:**

For pump with motor the electrical data is shown on the motor name plate.

**IMQ, TÜV or IRAM or other symbols (only for electro pump)**

The approval for products with approval marks for electrical safety refers exclusively to the electrical pump.

### 3.5 Design details

- Dimensions are not standardized
- Model e-MP complies with the requirements of EN ISO 5199

#### Design

- The pump has an axial or radial flow inlet, one or more stages and a radial outlet.
- The hydraulics are guided in separate bearings, either on drive side with a bearing bracket and a slide bearing integrated in the suction casing or on both sides with a bearing bracket.

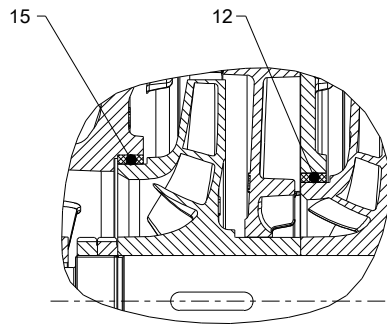


Figure 10: MPA

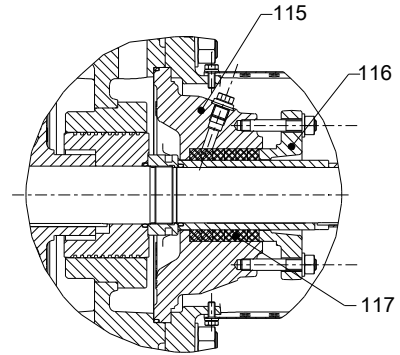


Figure 11: MPA

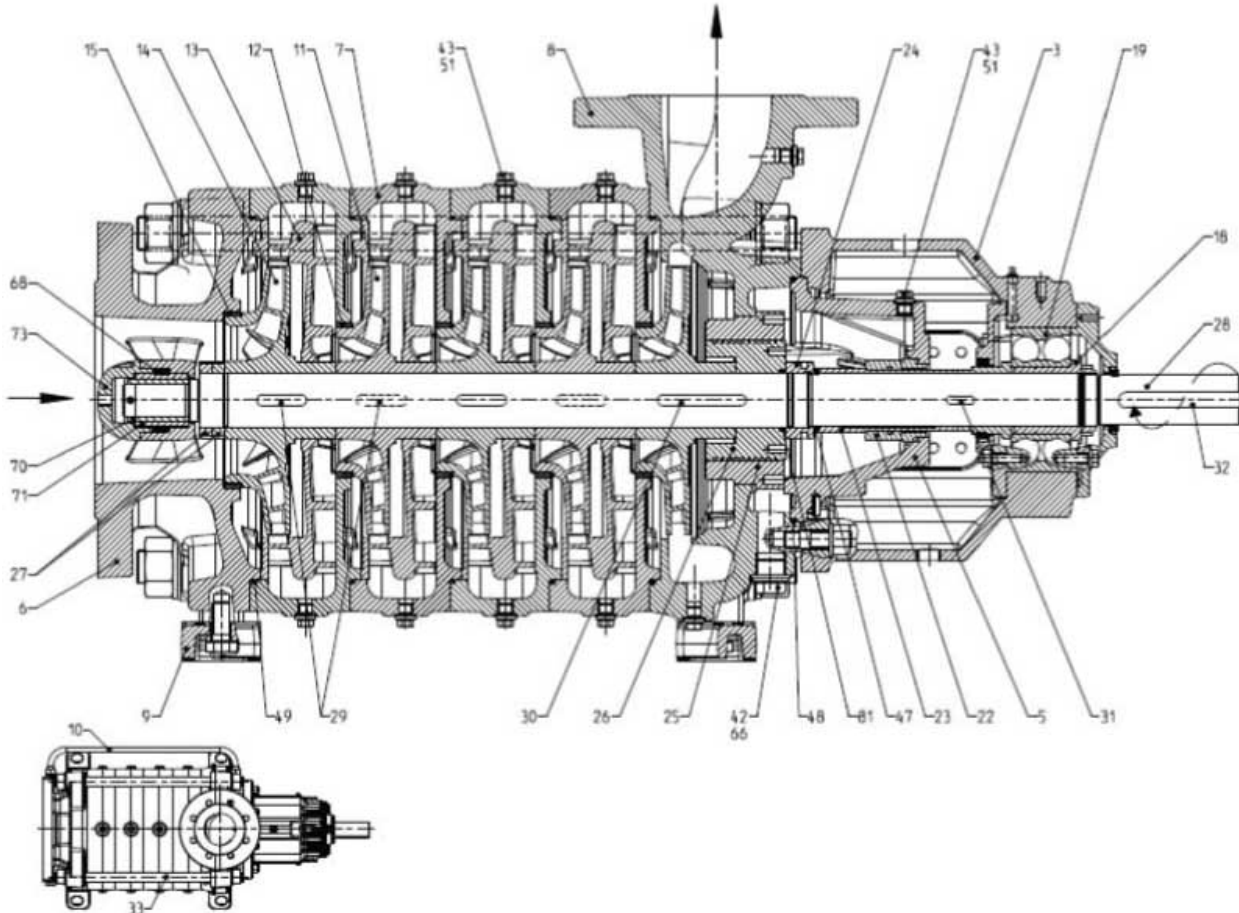


Figure 12: MPA

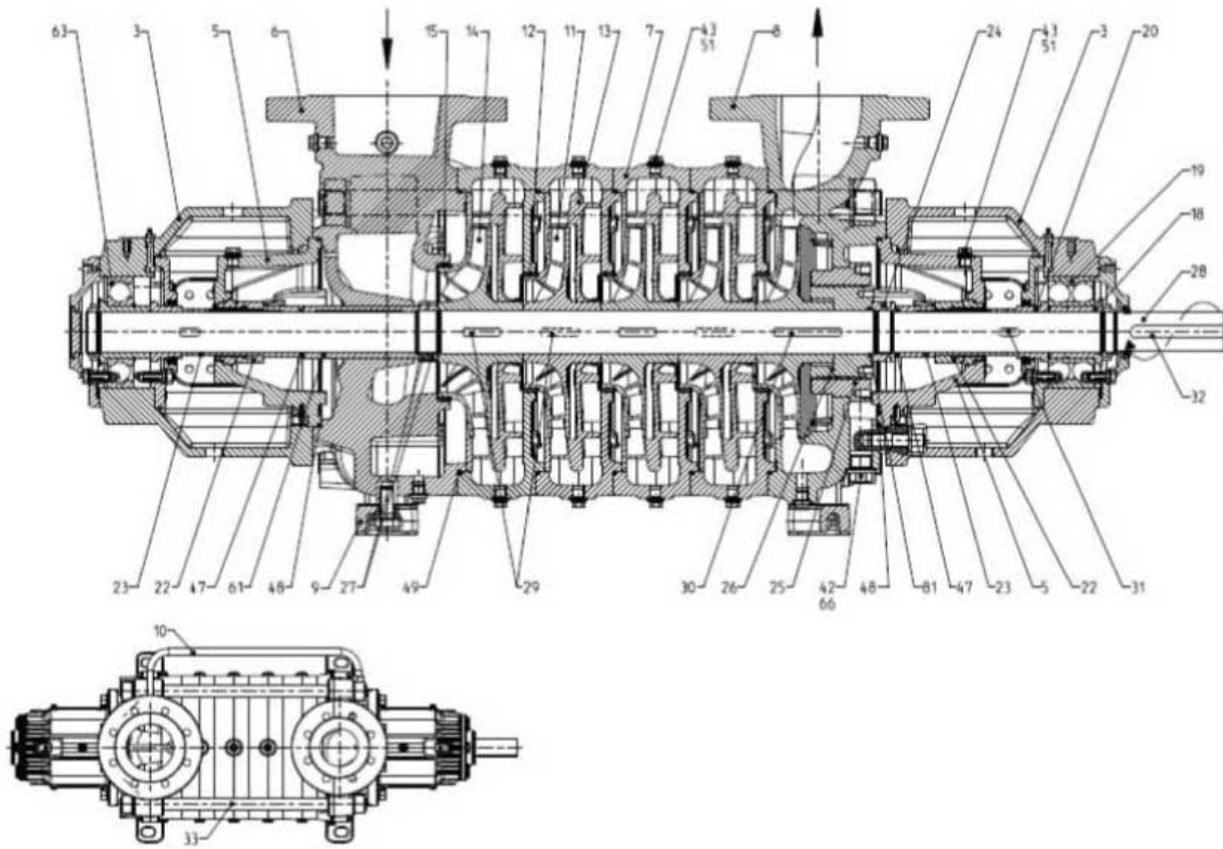


Figure 13: MPD



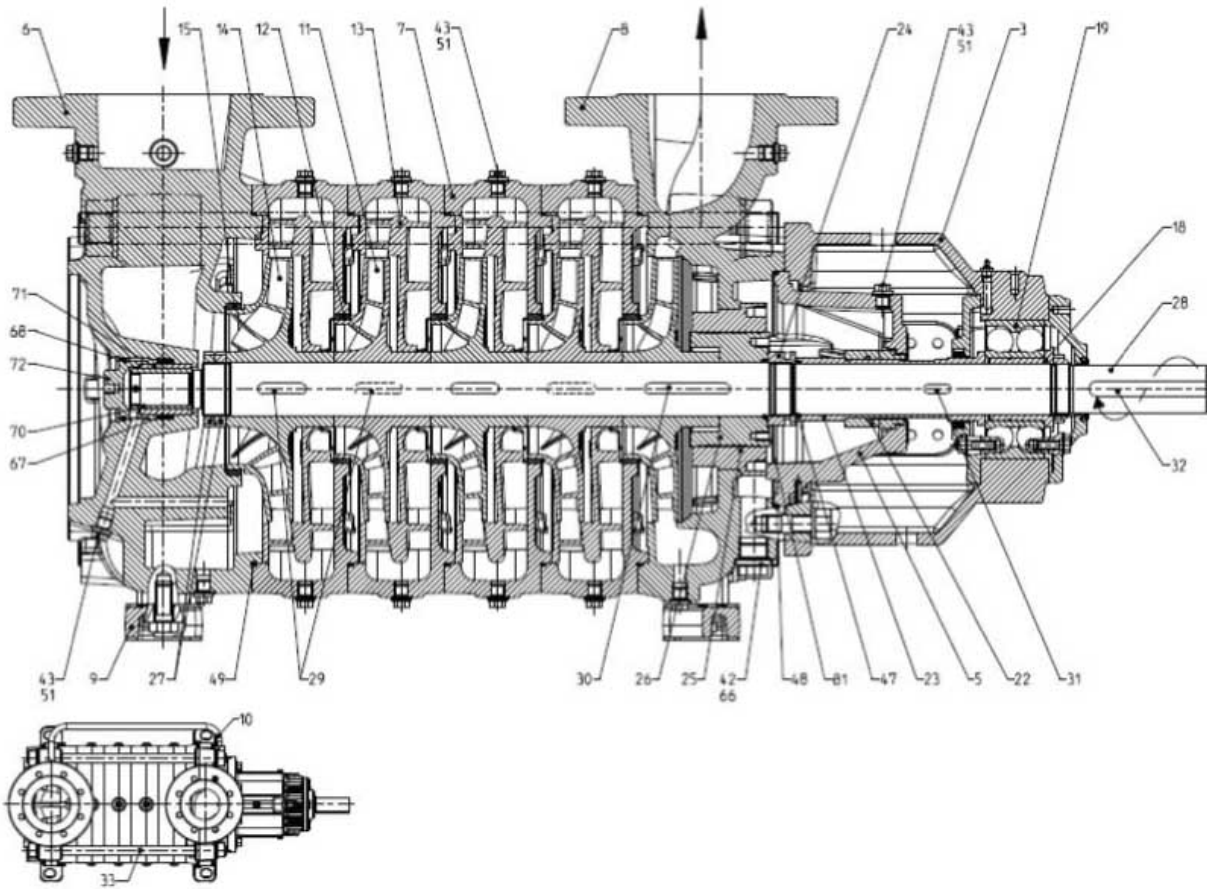


Figure 14: MPR

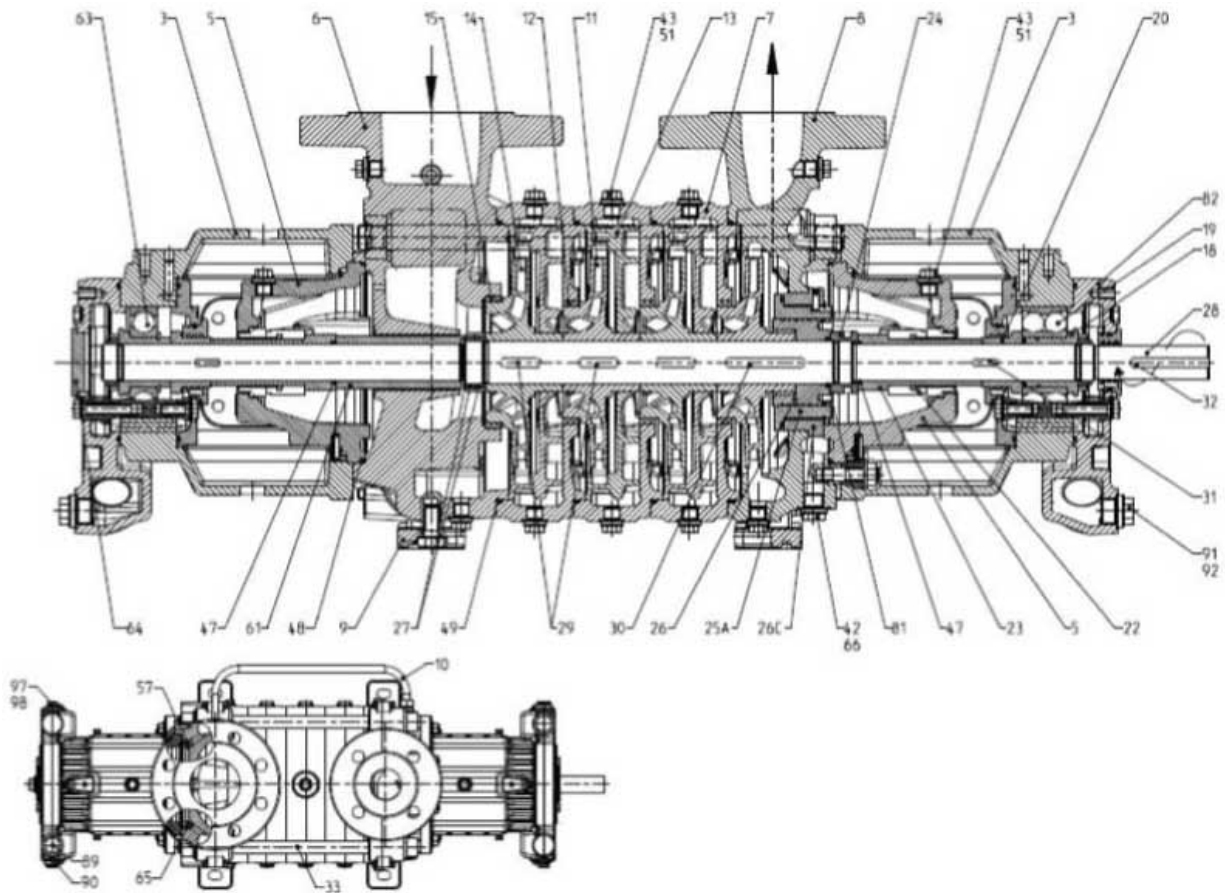


Figure 15: MPD Oil Lubricated

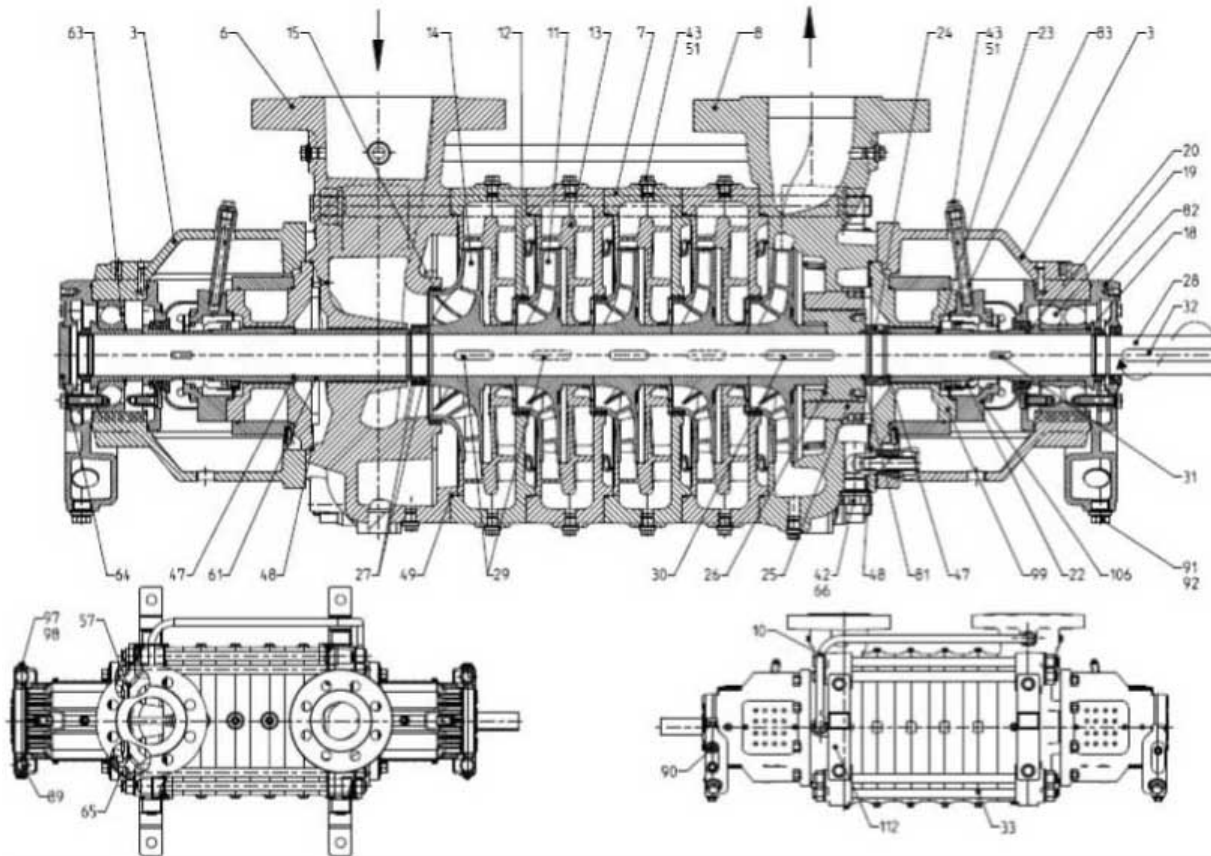


Figure 16: MPDP

Table 3:

Position	Component
3	Bearing bracket
5, 106	Seal cover
6	Suction casing
7	Stage casing
8	Discharge casing
9, 112	Pump foot
10	Balancing pipe
11	Impeller
12, 15	wear ring (optional)
13	Diffuser
14	Impeller-suction
18	Bearing sleeve
19, 63	Ball bearing
20, 61	Spacer sleeve
22	Mechanical seal
23	Shaft sleeve
24	Drum nut
25	Drum bushing
26	Drum
25A	Drum bushing

Position	Component
26C	Drum body
27	Impeller nut
28	Shaft
29, 30, 31, 32	Key
33	Tie bolt
42	Drain thread plug
43	Vent thread plug
47, 48, 49, 67, 68, 81	O-ring
51, 66, 92, 98	Gasket
57	Grub screw, suction casing
64	Bearing cover plug
65	Throttle, suction casing
70	Slide bearing sleeve
71	Slide bearing bush
72	Slide bearing cover
73	Cap suction
82	Oil bearing cover
83	Adapter
89	Oil filling plug
90	Oil level sight glass
91, 97	Oil bearing cover plug
99	Casing cover
115	Stuffing box housing
116	Stuffing box gland
117	Gland packing

- The pump is connected to the motor through the shaft coupling.
- The pumped medium enters the pump through the suction casing 6 and is accelerated by a suction impeller 14.
- The flow is lead by a diffuser 13 and return vanes inside a stage casing 7 to the next impeller 11.
- After the pressure of the pumped medium has been increased by a plurality of impellers, the fluid passes from the last impeller into the discharge casing 8.
- There the speed energy gets converted into pressure energy. The fluid leaves the discharge casing 8 through the discharge nozzle.
- Tight clearances reduce the back flow of the fluid from one impeller to the previous one.
- The impellers have no axial thrust relief. The axial thrust relief of the thrust bearing (installed in the bearing bracket 3) and the pressure reduction before the mechanical seal 22 take place in the throttle gap of the balancing drum 26 and balancing bush 25.
- The relief medium is returned by the balancing pipe 10 to the suction casing 6.
- The shaft 28 is guided through a seal cover 5 or 106 out of the pressurized casings.
- The shaft feed through of the seal cover 5 or 106 is sealed against the environment with a mechanical seal 22, cartridge mechanical seal 118 or packing 117.
- The shaft is supported in a bearing bracket 3 and by a plain bearing 70 which is integrated in the suction casing 6 (design MPA, MPR and MPV) or in 2 bearing brackets 3 (design MPD) on both sides of the pump.

## 3.6 Pressure rating and material

Metal parts of the pump, that can get into contact with water, are made of following materials:

Table 4:

Casing Pressure	Material Designation	Material Casings	Material Impeller	Material Diffuser
580 psi (40 bar)	NNN	Stainless Steel	Stainless Steel	Stainless Steel
914 psi (63 bar)	DNC	Ductile Iron	Stainless Steel	Cast Iron
914 psi (63 bar)	RNN	Duplex	Stainless Steel	Stainless Steel
580 / 914 psi (40 / 63 bar)	RRR	Duplex	Duplex	Duplex
1450 psi (100 bar)	DNC	Ductile Iron	Stainless Steel	Cast Iron
1450 psi (100 bar)	RNN	Duplex	Stainless Steel	Stainless Steel
1450 psi (100 bar)	RRR	Duplex	Duplex	Duplex

Table 5: On request

580 / 914 psi (40 / 63 bar)	TTT	Super Duplex	Super Duplex	Super Duplex
1450 psi (100 bar)	TTT	Super Duplex	Super Duplex	Super Duplex

## 3.7 Mechanical seal

### Standard for 580 psi (40 bar) design:

Balanced mechanical seal acc. EN12756, Version K

### Standard for 914 psi (63 bar) design:

Balanced mechanical seal acc. EN12756, Version K.

### Standard for 1450 psi (100 bar) design:

Balanced mechanical seal acc. EN12756, Version K.

For more information about mechanical seal sizes, see [Pump data Mechanical Seals and Coupling sizes](#) on page 116.

### 3.7.1 Mechanical seal selection - Pressure-/Temperature limits

Mechanical seal selection depending on inlet pressure and temperature.

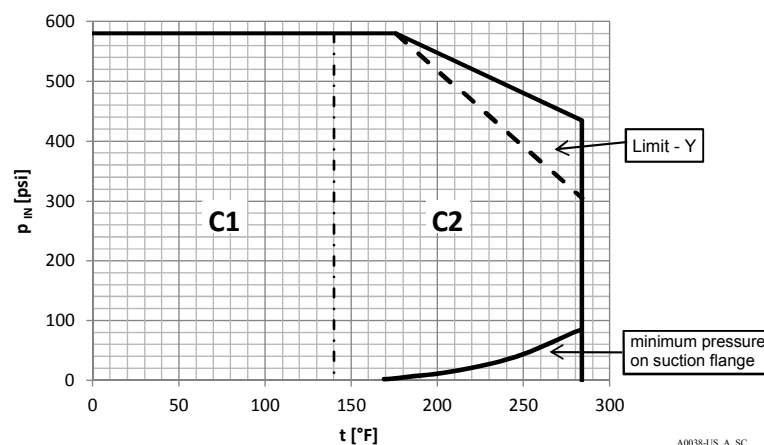


Figure 17

$P_{IN}$  - Pump inlet pressure at suction flange (psi)

Table 6:

Range	Description	Mechanical Seal type
C1	Up to 580 psi (40 bar) suction pressure at maximum 140°F (60°C) Standard Mechanical Seal: Carbon/SiC/EPDM with drinking water approval	B Q1 EGG-WA (Balanced)
C2	Up to 580 psi (40 bar) suction pressure at maximum 284°F (140°C) Standard Mechanical Seal: Carbon/SiC/EPDM	A Q1 EGG (Balanced)

Limit Y for pump size 100 and 125 at 3550 rpm only.

### 3.8 Expected noise values

Table 7:

Nominal Power PN		Pump				Pump with electro motor			
		Speed in rpm				Speed in rpm			
HP	kW	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)
3	2,2	57,2	56,2	57,4	56,5	63,2	57,9	65,7	58,4
4	3	58,6	57,7	58,9	58,0	67,6	59,0	70,3	59,5
5	4	60,0	59,1	60,2	59,3	65,5	60,8	67,8	61,3
7	5,5	61,5	60,5	61,7	60,8	68,1	61,8	70,6	62,3
10	7,5	62,9	62,0	63,2	62,3	68,4	63,0	70,8	63,4
15	11	64,8	63,8	65,0	64,1	69,0	65,6	71,2	66,2
20	15	66,2	65,3	66,5	65,6	69,6	66,7	71,6	67,2
25	18,5	67,2	66,3	67,5	66,6	70,1	67,4	71,9	67,9
30	22	68,1	67,1	68,3	67,4	70,6	68,1	72,2	68,5
40	30	69,5	68,6	69,8	68,9	73,9	69,7	76,1	70,1
50	37	70,5	69,6	70,8	69,9	74,3	70,5	76,4	70,9
60	45	71,5	70,5	71,7	70,8	75,9	71,2	78,1	71,6
74	55	72,4	71,4	72,6	71,7	76,3	72,1	78,3	72,5
101	75	73,8	72,9	74,1	73,2	78,7	74,4	81,0	74,9
121	90	74,8	73,8	75,0	74,1	79,0	75,0	81,2	75,5
148	110	75,7	74,7	75,9	75,0	79,4	76,2	81,4	76,8
177	132	76,5	75,6	76,7	75,8	79,8	76,9	81,7	77,3
215	160	77,4	76,5	77,6	76,7	80,2	77,6	82,0	78,0
268	200	78,5	77,6	78,7	77,8	81,3	78,9	83,0	79,3
335	250	79,5	78,6	79,8	78,8	81,8	79,7	83,5	80,0
422	315	80,6	79,7	80,9	79,9	83,3	80,7	85,1	81,1
476	355	81,2	-	81,4	80,5	83,7	-	85,3	81,6
536	400	81,8	-	82,0	81,1	85,5	-	87,5	82,5
603	450	82,4	-	82,6	-	85,7	-	87,6	-
671	500	82,8	-	83,1	-	84,0	-	85,2	-
751	560	83,4	-	83,6	-	84,5	-	85,5	-
845	630	83,9	-	84,2	-	84,9	-	85,9	-
952	710	84,5	-	84,7	-	85,8	-	86,9	-

Nominal Power PN		Pump				Pump with electro motor			
		Speed in rpm				Speed in rpm			
HP	kW	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)
1073	800	85,0	-	85,2	-	86,2	-	87,2	-
1207	900	85,7	-	85,9	-	86,7	-	87,7	-
1341	1000	86,1	-	86,4	-	87,1	-	88,0	-
1475	1100	86,6	-	86,8	-	87,9	-	89,0	-
1676	1250	87,2	-	87,5	-	88,3	-	89,4	-

Sound pressure level  $L_{pA}$  valid for measurement in 3.33 ft. (1 m) distance of the pump silhouette acc. DIN 45635, part 1 and 24.

Environmental and base effects are not considered.

The tolerance for these values is  $\pm 3$  dB (A).




---

**WARNING:**

Always wear hearing protection when operating or near the pump set.

---

### 3.9 Dimensions and weight

For dimensions and weights, see the submittal sheet or dimension sheet of the pump or the pump unit.

# 4 Installation

## Precautions




---

### WARNING:

- Observe accident prevention regulations in force.
  - Use suitable equipment and protection.
  - Always refer to the local and/or national regulations, legislation, and codes in force regarding the selection of the installation site, plumbing, and power connections.
- 




---

### DANGER: Improper installation in potentially explosive atmospheres can lead to explosions hazard and damage to the pump set.

Comply with the applicable local explosion protection regulations. Observe the information in the data sheet and on the name plates of pump and motor.

---




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### Electrical Hazard:

- Make sure that all connections are performed by qualified installation technicians and in compliance with the regulations in force.
  - Before starting work on the unit, make sure that the unit and the control panel are isolated from the power supply and cannot be energized. This applies to the control circuit as well.
- 

## Grounding (earthing)




---

### Electrical Hazard:

- Always connect the external protection conductor to ground (earth) terminal before making other electrical connections.
  - You must ground (earth) all electrical equipment. This applies to the pump equipment, the driver, and any monitoring equipment. Test the ground (earth) lead to verify that it is connected correctly.
  - If the motor cable is jerked loose by mistake, the ground (earth) conductor should be the last conductor to come loose from its terminal. Make sure that the ground (earth) conductor is longer than the phase conductors. This applies to both ends of the motor cable.
  - Add additional protection against lethal shock. Install a high-sensitivity differential switch (30 mA) [residual current device RCD].
- 




---

### CAUTION:

Observe the regulations in NFPA 70 (National Electric Code) or IEC 303645 (DIN VDE 0100) and in the case of explosion protection IEC 60079 (DIN VDE 0165).

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- All cables must be connected carefully and mechanically unloaded.
  - Dimension cable cross sections sufficiently.
  - Before switching on measure for possible short circuit.
  - Do not leave any foreign objects in the terminal box.
- 




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### DANGER: Improper installation in potentially explosive atmospheres can lead to explosions hazard and damage to the pump set.

Comply with the applicable local explosion protection regulations. Observe the information in the data sheet and on the name plates of pump and motor.

---



## 4.1 Pump location

### Guidelines

Observe the following guidelines regarding the location of the product:

- Make sure that no obstructions hinder the normal flow of the cooling air that is delivered by the motor fan.
- Make sure that the installation area is protected from any fluid leaks, or flooding.
- If possible, place the pump slightly higher than the floor level.
- The ambient temperature must be between +32°F (0°C) and +104°F (+40°C).
- The relative humidity of the ambient air must be less than 50% at +104°F (+40°C).
- Contact the sales and service department if:
  - The relative air humidity conditions exceed the guidelines.
  - The room temperature exceeds +104°F (+40°C).
  - The unit is located more than 3000 ft. (1000 m) above the sea level. The motor performance may need to be de-rated or replaced with a more powerful motor.

Elevation above sea level, for which the rated motor power is reduced

Table 8:

H (ft)	H (m)	32°F (0°C)	50°F (10°C)	68°F (20°C)	86°F (30°C)	104°F (40°C)	113°F (45°C)	122°F (50°C)	131°F (55°C)	140°F (60°C)
0	0	1.00	1.00	1.00	1.00	1.00	0.95	0.90	0.85	0.80
1640	500	1.00	1.00	1.00	1.00	1.00	0.95	0.90	0.85	0.80
3281	1000	1.00	1.00	1.00	1.00	1.00	0.95	0.90	0.85	0.80
4921	1500	0.97	0.97	0.97	0.97	0.97	0.92	0.87	0.82	0.78
6562	2000	0.95	0.95	0.95	0.95	0.95	0.90	0.85	0.80	0.76

### Pump positions and clearance

Provide adequate light and clearance around the pump. Make sure that it is easily accessible for installation and maintenance operations.

### Installation above liquid source (suction lift)

The theoretical maximum suction height of any pump is 33.9 ft (10.33 m). In practice, the following affect the suction capacity of the pump:

- Temperature of the liquid
- Elevation above the sea level (in an open system)
- System pressure (in a closed system)
- Resistance of the pipes
- Own intrinsic flow resistance of the pump
- Height differences

The following equation is used to calculate the maximum height above the liquid level which the pump can be installed:

$$(p_b \cdot 10,2 - Z) \geq \text{NPSH} + H_f + H_v + 0,5$$

$P_b$  is the barometric pressure in bar (in closed system is system pressure)

NPSH is the value in meter of the pump intrinsic flow resistance

$H_f$  is the total losses in meters caused by passage of liquid in the suction pipe of the pump

$H_v$  is the steam pressure in meters that correspond to the temperature of the liquid T °C

0,5 is the recommended safety margin (m)

Z is the maximum height at which the pump can be installed (m)

$(p_b \cdot 10,2 - Z)$  must always be a positive number.

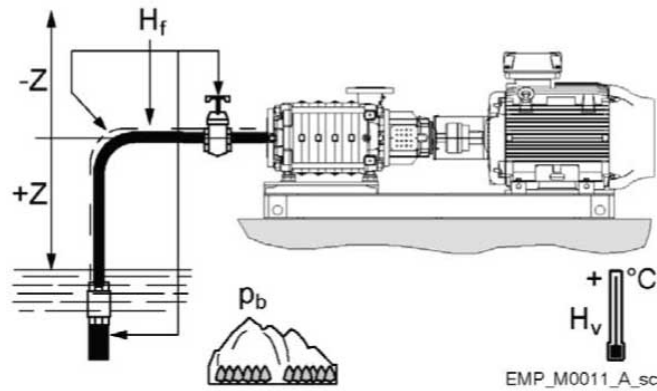


Figure 18

Table 9:

T (°F)	T (°C)	Hv (ft)	Hv (m)
68	20	0.7	0.2
86	30	1.3	0.4
104	40	2.3	0.7
122	50	3.9	1.2
140	60	6.6	2.0
158	70	10.2	3.1
176	80	15.7	4.8
194	90	23.3	7.1
212	100	33.8	10.3
230	110	47.9	14.6
248	120	66.3	20.2
266	130	90.6	27.6
284	140	121.1	36.9

**NOTICE:**

Do not exceed the pumps suction capacity as this could cause cavitation and damage the pump.

## 4.2 Piping requirements

### Precautions



**WARNING:**

- Use pipes suited to the maximum working pressure of the pump. Failure to do so can cause the system to rupture, with the risk of injury.
- Make sure that all connections are performed by qualified installation technicians and in compliance with the regulations in force.

**NOTICE:**

Observe all regulations issued by authorities having jurisdiction and by companies managing the public water supplies if the pump is connected to a public water system. If required, install appropriate backflow-prevention device on the suction side.

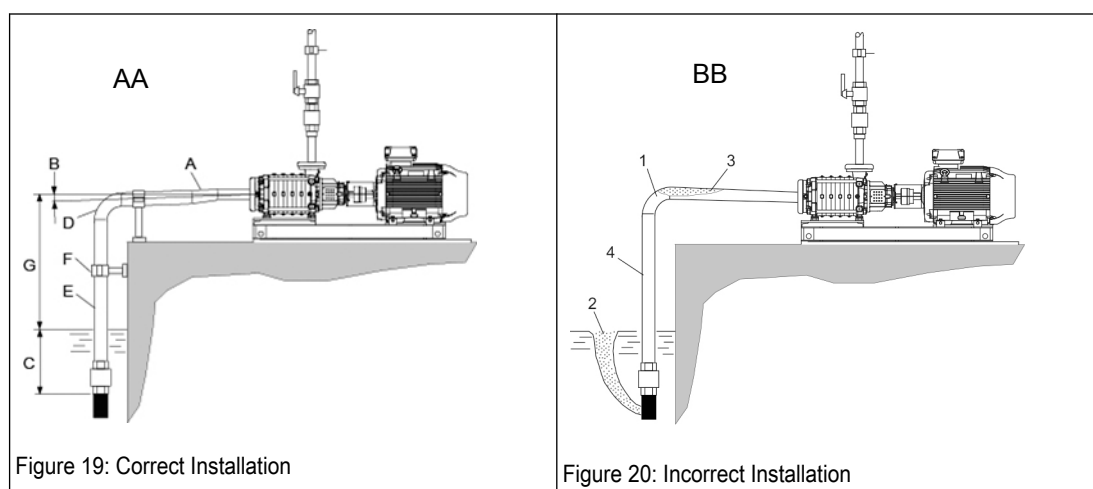
### Piping checklist

Check that the following requirements are met:

- The nominal diameters of the pipes correspond to at least the nominal diameters of the pump flanges.
- The pipes must be free from any impurities.
- If necessary install a filter.
- All piping is independently supported, pump unit must not be used to support the weight of the piping.
- Flexible pipes or unions are used, in order to avoid transmission of pump vibrations to the pipes and vice versa.
- Use wide bends, avoid using elbows which cause excessive flow resistance.
- The suction piping is perfectly sealed and airtight.
- If the pump is used in an open circuit, then the diameter of the suction pipe is suited to the installation conditions. The suction pipe must not be smaller than the diameter of the suction port.
- If the suction piping must be larger than the suction side of the pump, then an eccentric pipe reducer is installed.
- If the pump is placed above liquid level, a foot valve is installed at the end of the suction piping.
- The foot valve is fully immersed into the liquid so that air cannot enter through the suction vortex, when the liquid is at the minimum level and the pump is installed above the liquid source.
- Appropriately sized ON-OFF valves are installed on the suction piping and on the delivery piping (downstream to the check valve) for regulation of the pump capacity, for pump inspection, and for maintenance.
- In order to prevent back flow into the pump when pump is turned off a check valve is installed on the delivery piping.

**WARNING:**

Do not use the ON-OFF valve on the discharge side in the closed position in order to throttle the pump for more than a few seconds. If the pump must operate with the discharge side closed for more than a few seconds, a bypass circuit must be installed to prevent overheating of the liquid inside the pump.



- AA Correct installation  
 A Eccentric reduction  
 B Pipe rising to the pump  
 C Correct submersion depth  
 D Large pipe elbow  
 E Large pipe diameter  
 F Pipe clamp

- G Suction lift depends on the pump and installation.  
Under normale conditions it should not exceed 16.4 ft - 19.7 ft (5m - 6 m).
- BB Incorrect installation
- 1 Narrow arc - high flow resistance
  - 2 Insufficient immersion; sucking air
  - 3 Piping falling - air pocket
  - 4 Pipe diameter < suction nozzle of the pump – high flow resistance

## 4.3 Solids handling




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### CAUTION:

Residues from welding work or other impurities in the pipes may lead to damage in the pump.

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### CAUTION:

A plugged suction strainer can cause severe damage to the pump and would void the warranty

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- A filter with an inserted wire mesh and with wire made of corrosion-resistant material must be used.
- A removable conical shape strainer must be installed on the suction side of the pipe with the cone of the strainer pointing in opposite the direction of the flow.
- A filter where the effective open area of the strainer is not less than three times the cross sectional area of the pipeline.
- It is recommended to flush the system for a minimum of 24 hours using a start-up strainer installed upstream of the pump's suction.
- After the system is flushed, the start-up strainer must be replaced by a permanent strainer.
- Monitor the flow for plugging using pressure gauges installed upstream and downstream of the strainer.
- Remove and clean the filter as needed.

Table 10:

Pump Size	50A/B	65A/B	100A/B	125A/B	150A/B
Recommended start-up filter	60 mesh			40 mesh	
Recommended permanent filter	30 mesh			25 mesh	

## 4.4 Install the pump

### 4.4.1 Foundation requirements

#### Pump foundation

- A substantial foundation and footing should be built to suit local conditions and form a rigid support to maintain alignment.
- The foundation must be able to absorb any type of vibration and form a permanent, rigid support for the pump unit.
- If the foundation is installed over the floor, it must be properly bonded and tied to the floor.

### Foundation recommendations for 300 hp (220 kW) and smaller pumps and motors

- Floor weight can be included in the pump foundation weight calculation within the boundary of the pump foundation if properly attached/bonded to the floor. Base-frame grouting weight can also be included in the pump foundation weight.
- Pump foundation weight required at 2.5 times of the pump unit weight or greater.
- Pump foundations should extend 3 in (76 mm) or more from base-frame edges.
- Pump foundation construction minimum requirements: 3000 psi (200 bar) concrete with steel reinforcement.
- Pump foundations should be a minimum of 1 in (25 mm) above the floor to prevent water collection around the pump base-frame.

### Foundation recommendations for 300 hp (220 kW) and larger pumps and motors

- Floor weight can be included in the pump foundation weight calculation within the boundary of the pump foundation if properly attached/bonded to the floor. Base-frame grouting weight can also be included in the pump foundation weight.
- Pump foundation weight required at 5 times of the pump unit weight or greater.
- Pump foundations should extend 6 in (152 mm) or more from pump base-frame edges.
- Pump foundation construction minimum requirements: 3000 psi (200 bar) concrete with steel reinforcement.
- Multiple larger pumps on a common pump foundation is not a recommended practice due to machine vibration from the operating unit possibly damaging the idle units.
- Pump foundations should be a minimum of 1 in (25 mm) above the floor to prevent water collection around the pump base-frame.

### Anchor bolts

- Foundation bolts or anchor bolts of the proper size and type must be used. Foundation bolts that are cast in place can be of either type. Concrete anchors can also be used. The type selected must be consistent with local codes.
- The size of the foundation bolts or anchor bolts should be 1/8 in (3 mm) smaller diameter than the holes provided in the base-frame. Refer to the pump data sheet for the quantity and size.

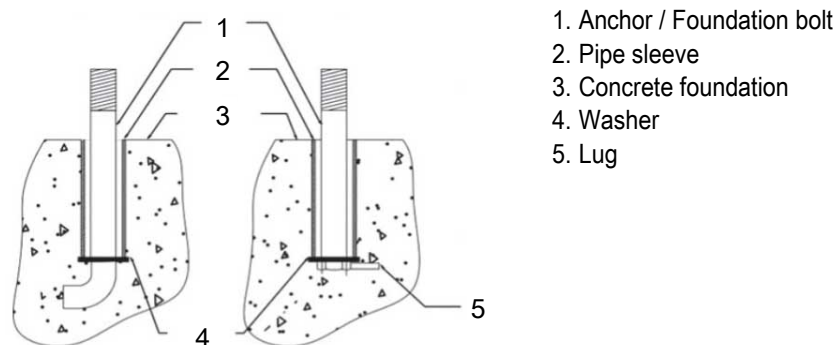


Figure 21

### 4.4.2 Install the pump set

Check the following conditions are before installation:

- The foundation meets the requirements as listed above and according to the dimensions of the data sheet for the pump unit.
- The mounting surface must have set and must be completely horizontal and even.
- Observe the weights indicated.

**DANGER: Static charge**

Ensure that the base-frame is grounded by appropriate measures.

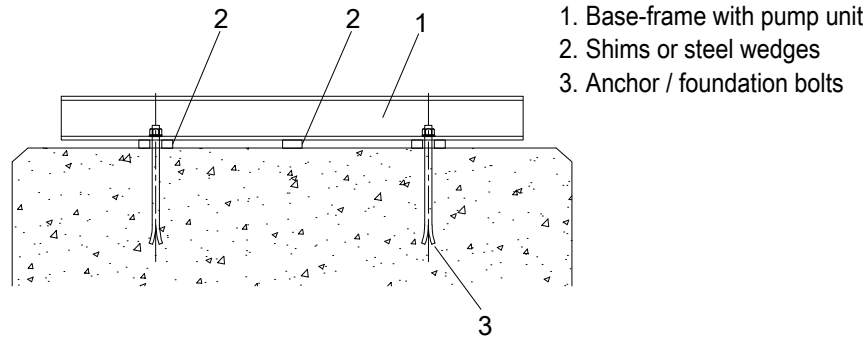


Figure 22: Mount the pump set to a foundation

**NOTICE:**

Sufficient space must be provided for maintenance and repair work, especially for replacing the drive motor or the complete pump unit. The motor fan must be able to take in enough cool air, and the intake grille must be at least 4 in (10 cm) away from any wall.

**Install the pump on a base frame**

Be sure to check that the following are adhered to:

- Solid base frame which does not twist or vibrate during operation (resonance).
- Mounting surfaces of the pump feet and the motor on the base frame must be flat (machining is recommended).
- Safe fastening of pump and motor must be guaranteed.
- Sufficient space between pump and motor shaft must be left depending on the used coupling.
- Between pump and base frame must be a sufficient shimming, so that in case of replacement the same height between bottom and centerline can be adjusted (recommended vertical adjustment 1/8 in - 1/4 in (4 mm - 6 mm)).

**4.4.3 Level the base on a concrete foundation**

1. Install a minimum of 3/4 in (19 mm) thick steel shims or wedges on both sides of each anchor bolt to support the pump.  
This also provides a means of leveling the base.
2. For a bolt to bolt distance, > 31.5 in (800 mm) fit extra shims halfway between the anchor bolts.
3. Make sure that all the shims lie perfectly flush.
4. Insert the anchor bolts into the holes.  
All the holes in base-frame must have anchor bolt.
5. Check the alignment of pump and motor.

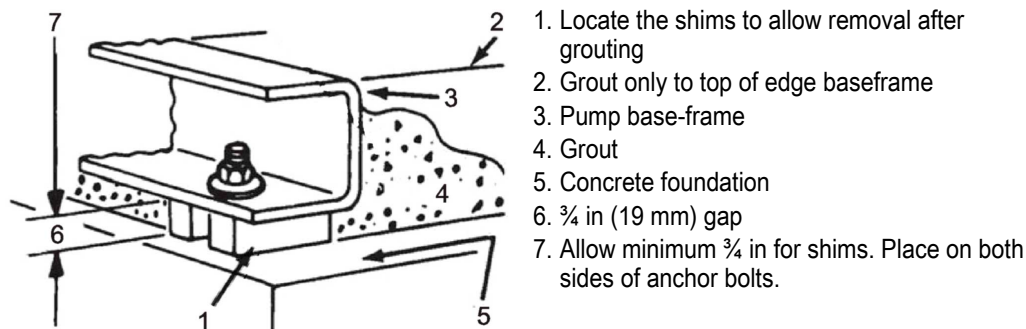


Figure 23

#### 4.4.4 Grouting

##### NOTICE:

- Grout the base-frame with non-shrink grout.
  - If the transmission of vibrations can be disturbing, provide vibration-damping supports between the pump and the foundation.
  - The grouting of the aligned foundation frame with non-shrinking grout is strongly recommended up to the top edge.
- 
- Grout the base-frame after the pump unit has been leveled, securely bolted to the floor, and properly aligned. Use a high precision non-shrinking grout inside the pump base-frame.
  - After the grout has fully set, review the tightening torques for the anchor bolts to base-frame.
  - For the tightening torques of the anchor or foundation bolts, see [Anchor bolts](#) on page 115.
  - Align pipe flanges with the pump flanges.
  - Flange bolts must easily insert through both flanges and the faces of the flanges must be aligned so they are parallel to each other and separated only by the thickness of the gasket.
  - Tighten the flange bolts evenly and in a cross pattern. Check that the gasket is compressed evenly and all bolts are properly tightened.
  - Check the alignment and if it significantly changes, excessive pipe strain exists. Correct piping. Verify coupling alignment.

#### 4.4.5 Requirements for setting the base-frame



**CAUTION:** Use an anchor bolt and a plain, flat, type-W washer at each anchor bolt hole. Otherwise, the pump unit can shift. Failure to follow these instructions can result in serious property damage and/or moderate personal injury.

It is very important that the pump base is set level in order to avoid any mechanical difficulties with the motor or pump. If furnished with a motor, this pump was properly aligned at the factory. However, since all pump base-frames are flexible, they can spring and twist during shipment.

##### Base frame setting

- Place the pump unit on its concrete foundation, supporting it with shims or steel wedges.
- The shims should be machined and be put on both sides of each anchor / foundation bolt to provide a means for leveling the base.
- The shim length should be equal to or greater than the base frame width.
- The width of the shim should be at least four times the diameter of the anchor bolt.
- It is acceptable to place additional shims between the existing anchor bolts.
- Use an anchor bolt for each anchor bolt hole provided in the base-frame.



**CAUTION: Equipment Damage.** Use an anchor bolt and flat washer at each anchor bolt hole. Otherwise, shifting of the pump unit may occur. Failure to follow these instructions could result in serious property damage and/or moderate personal injury.

It is very important that the pump base be set level to avoid any mechanical difficulties with the motor or pump. Do not pipe the pump until it is realigned. After piping is completed and after the pump is installed and bolted down, align it again. It may be necessary to re-adjust the alignment from time to time while the unit and foundation are new.

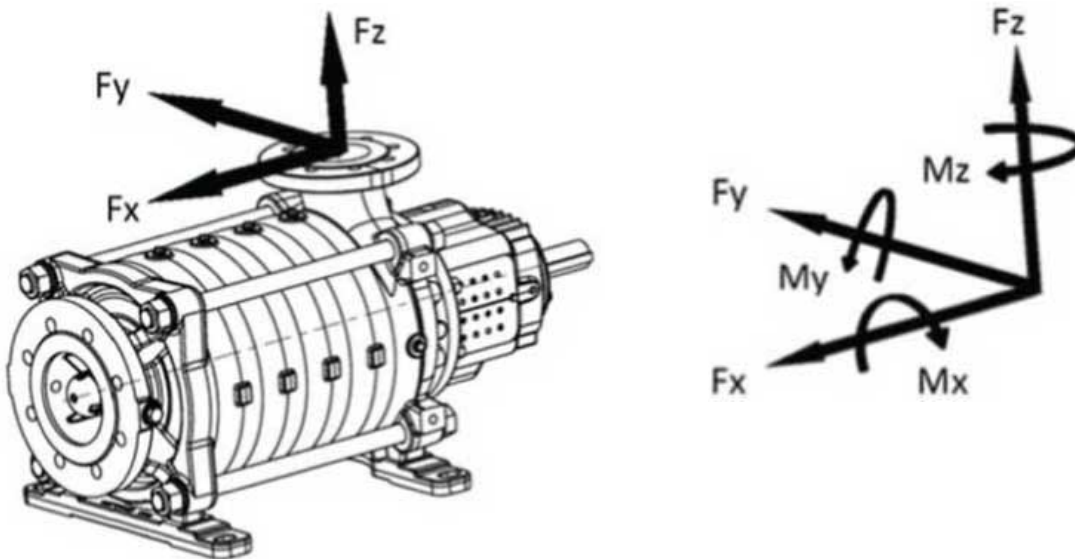
This pump rotates clockwise. An arrow cast into the pump body (discharge casing) shows the direction of rotation.

#### 4.4.6 Permitted nozzle loads and torques at the pump nozzles

Observe the following tables for the permissible nozzle forces and moments on the flanges for the following materials:

- Ductile Iron (D) housing materials
- Stainless Steel (N) Duplex (R) and Super Duplex (T) housing materials

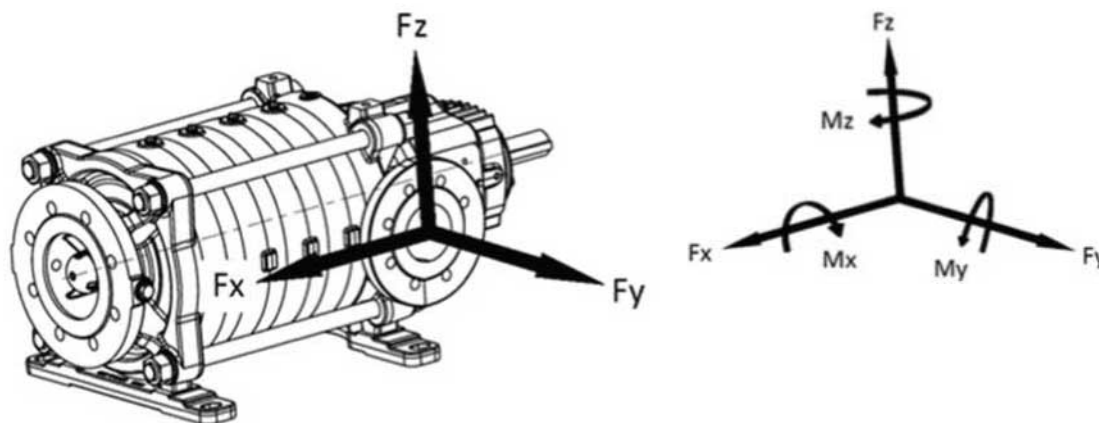
Table 11: Permitted nozzle loads and torques at the pump nozzles- top flange



	Material code: DNC, NNN, RNN, RRR, TTT									Material code: DNC, NNN, RNN, RRR, TTT							
	Fx	Fy	Fz	ΣF	Mx	My	Mz	ΣM		Fx	Fy	Fz	ΣF	Mx	My	Mz	ΣM
DN	[N]	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]	[Nm]		[lbf]	[lbf]	[lbf]	[lbf]	[lb-ft]	[lb-ft]	[lb-ft]	[lb-ft]
50	900	810	990	1564	778	498	603	1104		202	182	223	352	574	367	445	814
65	1110	1020	1260	1965	848	568	638	1204		250	229	283	442	625	419	471	888
80	1350	1230	1500	2363	918	603	708	1307		303	277	337	531	677	445	522	964
100	1800	1620	2010	3147	1023	673	813	1471		405	364	452	707	755	496	600	1085
125	2130	1920	2370	3720	1268	848	1128	1898		479	432	533	836	935	625	832	1400
150	2700	2430	3000	4711	1548	1023	1233	2228		607	546	674	1059	1142	755	909	1643
200	3600	3240	4020	6294	2073	1408	1653	3003		809	728	904	1415	1529	1038	1219	2215

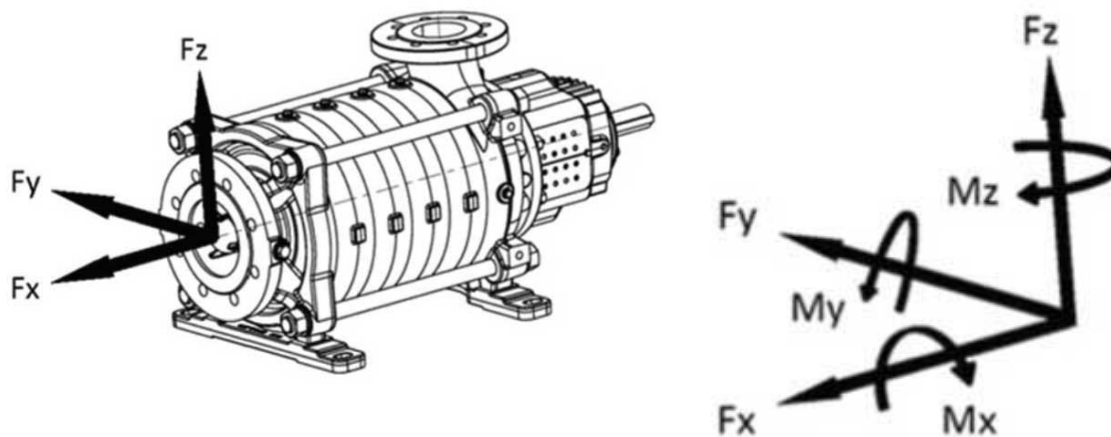


Table 12: Permitted nozzle loads and torques at the pump nozzles -Side flange



	Material code: DNC, NNN, RNN, RRR, TTT								Material code: DNC, NNN, RNN, RRR, TTT							
	Fx	Fy	Fz	ΣF	Mx	My	Mz	ΣM	Fx	Fy	Fz	ΣF	Mx	My	Mz	ΣM
DN	[N]	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]	[Nm]	[lbf]	[lbf]	[lbf]	[lbf]	[lb-ft]	[lb-ft]	[lb-ft]	[lb-ft]
50	900	990	810	1564	778	498	603	1104	202	223	182	352	574	367	445	814
65	1110	1260	1020	1965	848	568	638	1204	250	283	229	442	625	419	471	888
80	1350	1500	1230	2363	918	603	708	1307	303	337	277	531	677	445	522	964
100	1800	2010	1620	3147	1023	673	813	1471	405	452	364	707	755	496	600	1085
125	2130	2370	1920	3720	1268	848	1128	1898	479	533	432	836	935	625	832	1400
150	2700	3000	2430	4711	1548	1023	1233	2228	607	674	546	1059	1142	755	909	1643
200	3600	4020	3240	6294	2073	1408	1653	3003	809	904	728	1415	1529	1038	1219	2215

Table 13: Permitted nozzle loads and torques at the pump nozzles -suction flange horizontal



	Material code: DNC, NNN, RNN, RRR, TTT								Material code: DNC, NNN, RNN, RRR, TTT							
	Fx	Fy	Fz	ΣF	Mx	My	Mz	ΣM	Fx	Fy	Fz	ΣF	Mx	My	Mz	ΣM
DN	[N]	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]	[Nm]	[lbf]	[lbf]	[lbf]	[lbf]	[lb-ft]	[lb-ft]	[lb-ft]	[lb-ft]
100	2010	1800	1620	3147	1023	673	813	1471	452	405	364	707	755	496	600	1085
125	2370	2130	1920	3720	1268	848	1128	1898	533	479	432	836	935	625	832	1400
150	3000	2700	2430	4711	1548	1023	1233	2228	674	607	546	1059	1142	755	909	1643
200	4020	3600	3240	6294	2073	1408	1653	3003	904	809	728	1415	1529	1038	1219	2215
250	5010	4470	4050	7841	2913	2003	2353	4247	1126	1005	910	1763	2149	1477	1735	3132

The forces and torques data apply only to fixed pipelines. The values are only applicable if the pump installed on a base-frame and is bolted to a rigid, flat foundation.

### 4.4.7 Auxiliary connection



**WARNING:**

Non or incorrectly used auxiliary connections (for example, barrier liquid or flushing liquid, etc.) can lead to malfunction of the pump

- Observe the dimensions and position of the additional connections in the installation or piping layout and, if available, the signs on the pump.
- Use existing auxiliary connections.

Standard design of the auxiliary connections

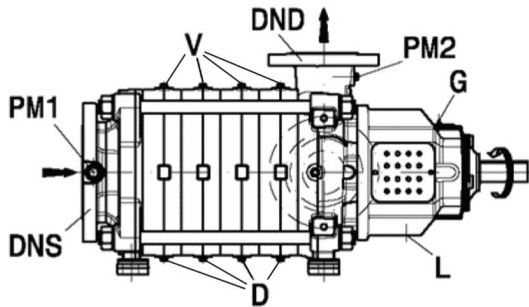


Figure 24: MPA, MPAE

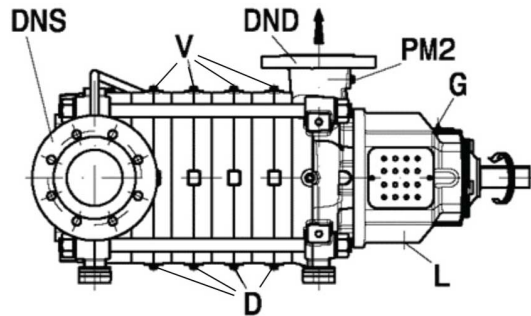


Figure 25: MPR, MPRE

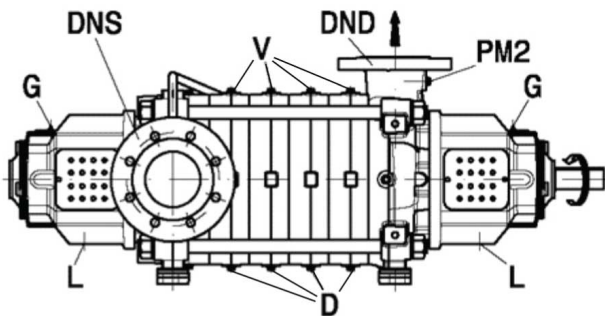


Figure 26: MPD, MPDE

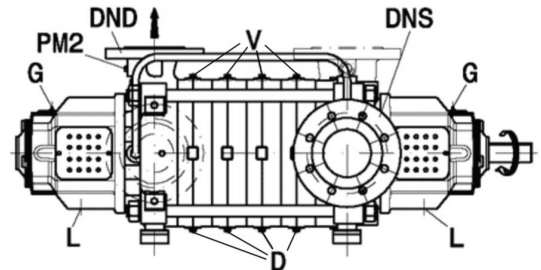


Figure 27: MPD, MPDE with suction side drive

Table 14:

Position	Connection	Size
PM1	Pressure Suction	G ¼
PM2	Pressure Discharge	G ¼
D	Drain	G ¼
G	Grease Nipple	M8
L	Leakage	G ½
V	Vent	G ¼
DND	Discharge	
DNS	Suction	

Optional connection for temperature and vibration sensor

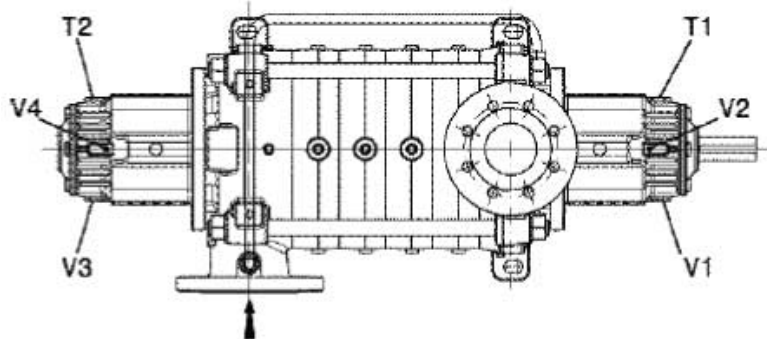


Figure 28

Table 15:

Position	Component
T1, T2	Temperature sensors
V1, V2, V3, V4	Vibration sensors
T2, V3, V4	Only on design MPD, MPDE, MPDP, MPDT

Option bearing bracket with oil lubrication

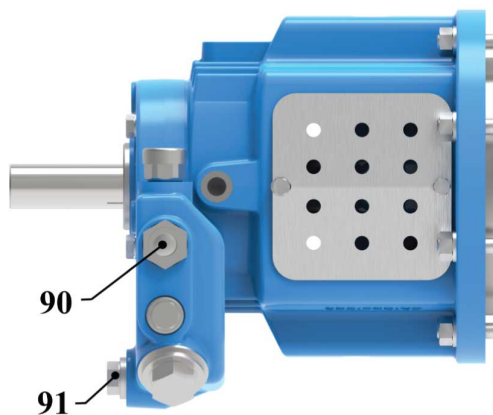


Figure 29

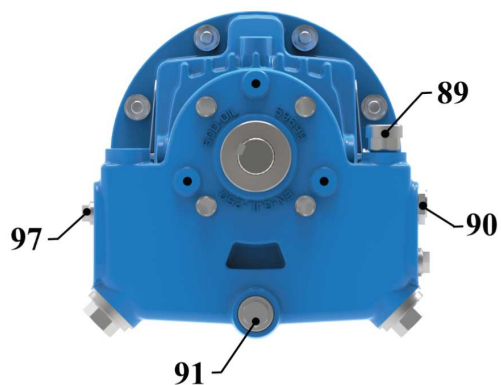


Figure 30

Table 16:

Position	Component
91	Oil drain G1/4 in
89	Oil fill plug

Position	Component
90	Oil sight glass
97	Option constant oiler or Option oil gauge tube

**Option with water-cooled mechanical seal**

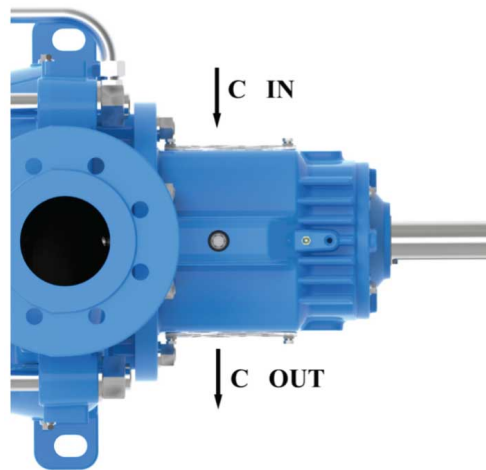


Figure 31

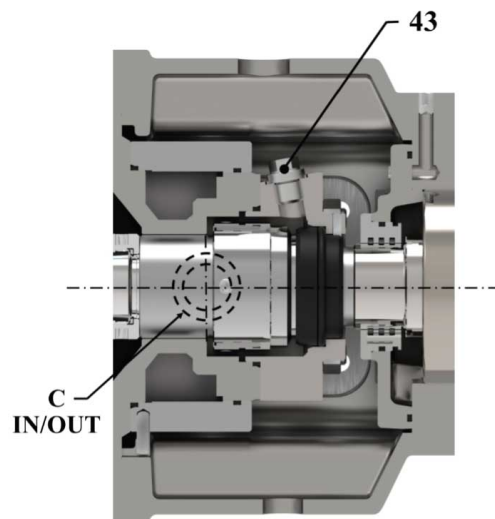


Figure 32

Table 17:

C IN	Cooling IN
C OUT	Cooling OUT
43	Vent

## 4.5 Electrical requirements

- The local regulations in force overrule these specified requirements.
- In the case of fire fighting systems (hydrants and/or sprinklers), check the local regulations in force.



**DANGER:**

A certified electrician must supervise all electrical work. Comply with all local codes and regulations.

**DANGER:**

Make sure that all electrical connections are performed by qualified installation technicians and in compliance with the regulations in force.

- Always have the electrical connections installed by a trained and qualified electrician.
- Observe regulations IEC 60364 and for explosion-proof models EN 60079.

**CAUTION:**

Observe the regulations in NFPA 70 (National Electric Code) or IEC 303645 (DIN VDE 0100) and in the case of explosion protection IEC 60079 (DIN VDE 0165).

- Always use a motor protection switch for explosion-proof motors.

**CAUTION: Short circuit!**

Incorrect connection to the power supply can lead to damage to the electrical network.

- Observe the technical specifications of the local energy supply companies.

**Electrical connection checklist**

Check that the following requirements are met:

- The electrical leads are protected from high temperature, vibrations, and collisions.
- The power supply line is provided with:
  - A short-circuit protection device
  - A mains isolator switch with a contact gap of at least 0.120 in (3 mm).

**The electrical control panel checklist****NOTICE:**

The control panel must match the ratings of the electric pump. Improper combinations could fail to guarantee the protection of the motor.

Check that the following requirements are met:

- The control panel must protect the motor against overload and short-circuit.
- Install the correct overload protection (thermal relay or motor protector).

Pump Type	Protection
Electric standard pump, single-phase supply $\leq$ 2HP (1,5 kW)	<ul style="list-style-type: none"> <li>– Built-in automatic reset thermal-amperometric protection (motor protector)</li> <li>– Short circuit protection (must be supplied by the installer)<sup>1</sup></li> </ul>
Three phase electric pump <sup>2</sup>	<ul style="list-style-type: none"> <li>– Thermal protection (must be supplied by the installer)</li> <li>– Short circuit protection (must be supplied by the installer)<sup>3</sup></li> </ul>

- **NOTICE:**

Qualified electrician to determine motor starting and overloading fuses, switches and relays

- The control panel must be equipped with a dry-running protection system to which a pressure switch, float switch, probes, or other suitable device is connected.

<sup>1</sup> Overload thermal relay with trip class 10A + fuses aM (motor starting) or motor protection magneto-thermal switch with starting class 10A.

<sup>2</sup> fuses aM (motor starting), or magneto-thermal switch with curve C and  $I_{cn} \geq 4,5$  kA or other equivalent device.

<sup>3</sup> Overload thermal relay with trip class 10A + fuses aM (motor starting) or motor protection magneto-thermal switch with starting class 10A.

## The motor checklist



### WARNING:

- Read the operating instructions in order to ensure whether a protection device is provided if another motor other than the standard is used.
- If the motor is equipped with automatic thermal protectors, be aware of the risk of unexpected starts in connection to overload. Do not use such motors for fire-fighting applications.

### NOTICE:

On application in zone 1 and 2 a motor with valid ATEX-certification must be used.

### NOTICE:

- The mains voltage and frequency must agree with the specifications on the data plate.

### NOTICE:

- Only use dynamically balanced motors with a half-sized key in the shaft extension (ANSI/ NEMA MG 1 or IEC 60034-14) and with normal vibration rate (N).
- The electric network voltage and frequency must agree with the specifications on the data plate.
- Only use single-phase or three-phase motors whose size and power comply with the NEMA or European standards.

In general, motors can operate under the following mains voltage tolerances:

Voltage tolerance as listed by the motor manufacturer takes prevalence.

Table 18:

Frequency Hz	Phase ~	UN [V] ± %
50	1	220-240 ±6
	3	230/400 ± 10
		400/690 ± 10
60	1	208-230 ±5
	3	208-230 ±5
		460 ±10

Use cable according to rules with 3 leads (2+ earth/ground) for single phase versions and with 4 leads (3+ earth/ground) for three phase version.

### 4.5.1 Maximum number of starts per hour

This table shows the number of starts allowed per hour for motors supplied by WEG, Baldor, and Lowara (PLM):

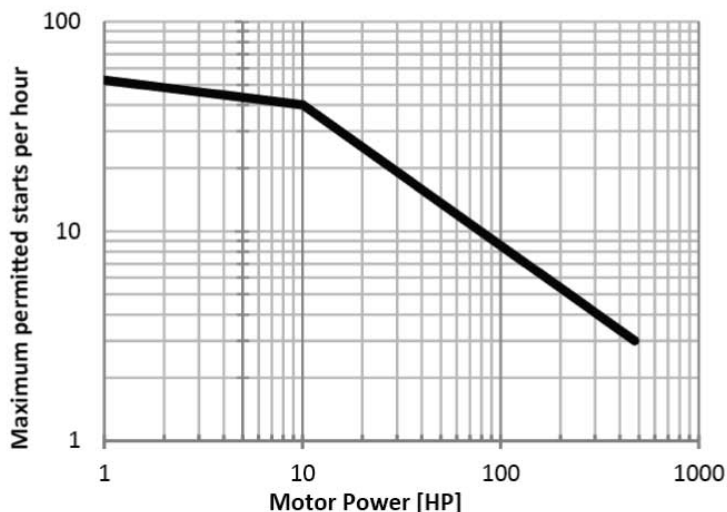


Figure 33

**NOTICE:**

When using third-party motors (for example, ABB, Siemens, etc.), please refer to the operating instructions of that manufacturer for the permissible switching frequency, or inquire at the motor manufacturer's service department!

## 4.6 Coupling

**WARNING:**

Make sure that nobody can start the motor when work is being carried out on the coupling. In accordance with the Accident Prevention Regulations, the pump unit may only be operated when the coupling guard is mounted.

**NOTICE:**

- On operation in zone 1 and 2 a coupling with valid ATEX-certification must be used.
- It should be noted that the coupling guard used is made of spark-free material.

For additional operating manual for the coupling, contact the local sales and service representative.

### 4.6.1 Installation of the coupling

If the pump unit is completed on site and no separate operating instructions have been supplied by the coupling manufacturer, you should proceed according to the following points:

1. Clean the shaft ends and coupling components.
2. Remove the packing between the coupling halves.
3. Before the pulling the coupling, heat the coupling in an oil bath or inductive heater to approximately 212°F (100°C).
4. Pull the coupling onto the shaft end.
5. The coupling must not be hit with the hammer or other tools.
6. The coupling sections must be parallel with the shaft end surfaces.
7. Secure the coupling hubs against the axial sliding by using the setscrew.

### 4.6.2 Alignment of coupling



**DANGER: Risk of burns!**

Inadmissible temperatures at the coupling or bearings due to misalignment of the coupling can lead to Explosion hazard!

- The alignment of the coupling must be carried out with the utmost care and attention, so that the unit will operate without failure.
- If you do not pay attention to this section you will lose your warranty!

**NOTICE:**

After mounting to the foundation and the connection of the piping, the coupling must be adjusted again, even if the unit was delivered completely mounted on the frame.

### 4.6.3 Remove the coupling guard

1. Remove the screws, S1, S2, and S3 from the coupling guard.

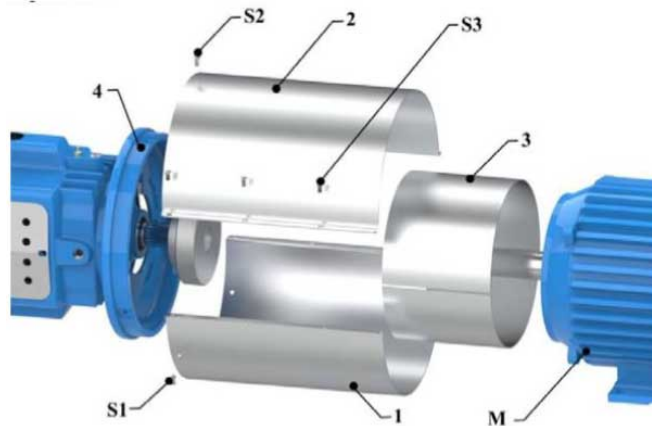


Figure 34

2. Remove the upper half 2 of the coupling guard.
3. Remove the lower half 1 of the coupling guard.
4. Open and lift the supporting/adjusting ring 3.

### 4.6.4 Control the alignment

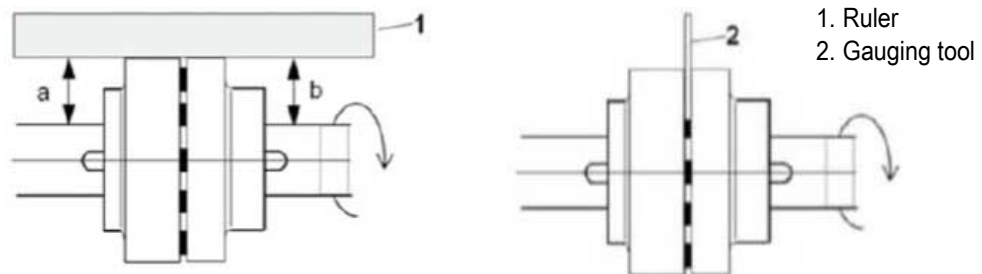


Figure 35: Standard coupling for sizes 50A to 125B



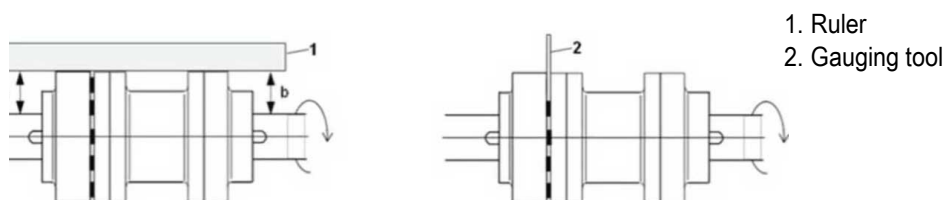


Figure 36: Standard coupling with spacer sleeve for sizes 150A and 150B; option for sizes 50A to 125B

1. Loosen screws of the motor feet.
2. Place the ruler 1 axially on both coupling halves.
3. Leave the ruler 1 in this position and turn the coupling by hand.
  - a) The coupling is aligned correctly if the distances 'a' and 'b' to the respective shafts are the same at all points around the circumference.
4. Check the distance between the two coupling halves around the circumference with a gauge.
  - a) The coupling is properly aligned, when a ruler, which is laid axially over both coupling halves, has the same distance to the particular shaft everywhere on the circumference.
  - b) Use the tracer, gauge or dial gage to check the distance on every point of the circumference.
 

Both the coupling halves must have the same distance to one another on every point of the circumference.
5. Check the distance between the two coupling halves around the circumference with a gauge 2.
 

The coupling is correctly aligned if the distance between the two coupling halves is the same at all points around the circumference.

For more information about the dimensions, see the general arrangement drawing.
6. Tighten the screws of the motor feet.
 

The radial and axial deviation between the two coupling halves must not exceed the permissible misalignment values.

For more information about the permitted tolerances, see [Permitted displacement for flexible couplings](#) on page 48.

For the exact designation of your coupling refer to data sheet and / or order confirmation.

Shaft height differences between pump and drive are compensated with shims under the motor.

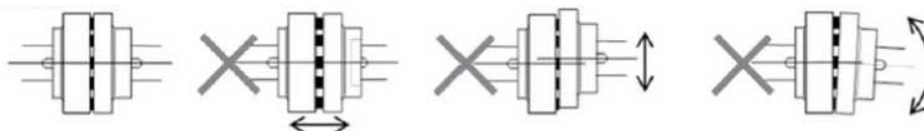


Figure 37

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**NOTICE:**

Install the coupling guard after alignment and before start-up of the pump.

---

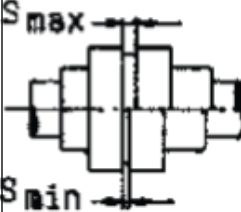
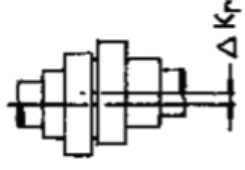
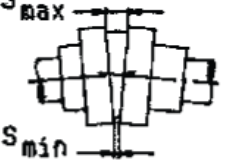
**NOTICE:**

Poor alignment can cause damage to the coupling or to the entire pump unit.

---

### 4.6.5 Permitted displacement for flexible couplings

Table 19:

Coupling size	H80FK	H95FK	H110FK	B125KF H125FK	B140FK H140FK	B160FK H160FK	B180FK H180FK	B200FK H200FK	B225FK H225FK
Coupling-OuterØ (mm)	80	95	110	125	140	160	180	200	225
Axial distance S	5/32 in (4 mm) <sup>4</sup>						¼ in (6 mm)		
	1/16 in (2 mm)								
Max. radial displacement ΔKr	.004 in (0.1 mm)						.008 in (0.2 mm)		
									
Max. angular displacement	0.1				0.2				
	$S_{max}, S_{min}$		$\Delta Kw =$		$S_{max} -$		$S_{min}$		

### 4.6.6 Install the coupling guard



**CAUTION:**

Never operate the pump without the coupling guard correctly installed.

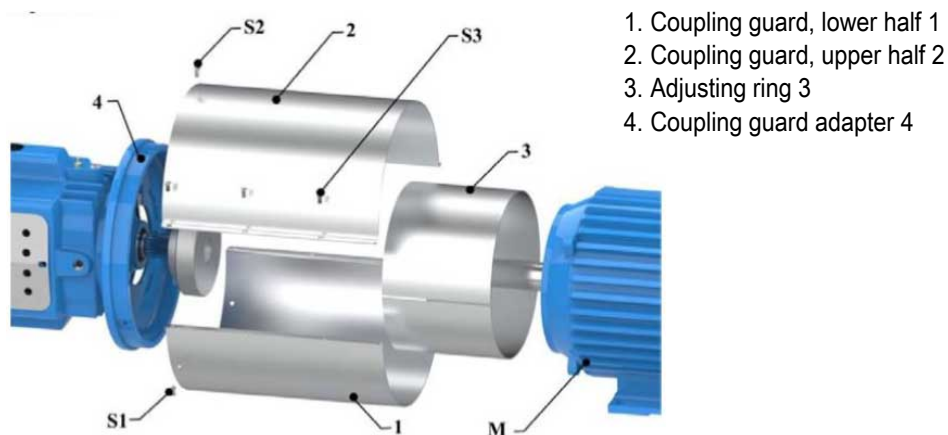


**WARNING: Explosion hazard**

Danger of ignition due to friction sparks

1. Select material for the coupling protection so that there is no sparking during mechanical contact (see ISO 80079-36 or EN 13463-1).

<sup>4</sup> For fluid temperatures above 248°F (120°C) max gap can be 3/16 in (5 mm)



1. Coupling guard, lower half 1
2. Coupling guard, upper half 2
3. Adjusting ring 3
4. Coupling guard adapter 4

2. Install the coupling guard lower half 1 and screws S1 to the bottom of coupling guard adapter 4.
3. Insert the adjusting ring 3 with the slot downward.
4. Press the adjusting ring 3 axially to the motor M.
5. Install the coupling guard upper half 2 with screws S2 to the upper side of the coupling guard adapter 4.
6. Screw parts 1 and 2 together with screws S3, which fixes the adjusting piece.

## 4.7 Final check

### NOTICE:

Repeat the alignment of the coupling at operating temperature and operating pressure, and correct the alignment if necessary.

It must be possible to turn the pump shaft easily by hand at the coupling.

For motor information and instructions, refer to the operating instructions of the respective manufacturer!

# 5 Commissioning, Startup, Operation, and Shutdown

## 5.1 Precautions

Before starting work, make sure that the safety instructions in the chapter *Introduction and Safety* on page 5 have been read and understood.



---

**WARNING:**

- Make sure that the drained liquid does not cause damage or injuries.
  - The motor protectors can cause the motor to restart unexpectedly. This could result in serious injury.
  - Never operate the pump without the coupling guard correctly installed.
- 



---

**DANGER:**

Non-compliance with the permissible pressure and temperature limits can lead to Overheating and explosion hazard!

---

The operating limits of the pump / pump set with respect to pressure, temperature, power and speed are stated in the data sheet and / or the order confirmation and must be strictly followed!

---



---

**DANGER: Explosion hazard**

Shaft seal failure by solids can lead to leakage of hot or toxic fluid

---

Pumping liquids with abrasive components will result in wear on the shaft seal. The inspection intervals must be reduced compared to the usual times.

---



---

**WARNING:**

- Never operate the pump without the coupling guard correctly installed.
  - All protective covers (like fan cover on motor, coupling guard, bearing bracket adapter guard, protection against high temperatures,) must be installed before commissioning / start-up.
  - Start-up the pump only if it is fully assembled.
- 



---

**WARNING: The pump set must run smoothly and with low vibration. Strong vibrations can lead to severe damage to the pump, the foundation frame and the pipeline.**

---



---

**CAUTION: Damage to the pump**

Abnormal noises, vibrations, temperatures or leakage

---



---

**CAUTION:**

- The outer surfaces of the pump and motor can exceed 104°F (40°C) during operation. Do not touch with any part of the body without protective gear.
  - Do not put any combustible material near the pump.
-

**NOTICE:**

- Never operate the pump below the minimum rated flow, when dry, or without prime.
- Never operate the pump with the delivery ON-OFF valve closed for longer than a few seconds.
- Never operate the pump with the suction ON-OFF valve closed.
- Do not expose an idle pump to freezing conditions. Drain all liquid that is inside the pump. Failure to do so can cause liquid to freeze and damage the pump.
- The sum of the pressure on the suction side (mains, gravity tank) and the maximum pressure that is delivered by the pump must not exceed the maximum working pressure that is allowed (nominal pressure PN) for the pump.
- Do not use the pump if cavitation occurs. Cavitation can damage the internal components.
- When operating with a variable frequency drive "VFD" danger exists due to over speed. Follow the operating instructions of the VFD.

## 5.2 Prerequisites for the start-up

Before commissioning or starting the pump set, check that the following requirements are fulfilled:

- The pump must be connected mechanically.
- The pump must be correctly connected to the power supply and is equipped with all the protection devices.  
For more information, see [Electrical requirements](#) on page 42.
- The pump must be filled with the fluid.  
For more information, see [Fill the pump](#) on page 54.
- The pump must be vented.
- The discharge valve behind the pump is closed.
- The direction of rotation must be checked.  
For more information, see [Check the rotation direction of the motor \(three-phase motor\)](#) on page 58.
- All auxiliary connections that are required are connected and operational
- The lubricants must be checked.
- After prolonged shutdown of the pump set, the activities that are required for returning the pump set to service have been carried out.  
For more information, see [Limits of operation](#) on page 59.

## 5.3 Lubrication

### 5.3.1 Grease lubrication (Standard design)

The pump is lubricated with grease from the factory.

### 5.3.2 Oil lubrication of the pump



**CAUTION: Inadequate lubrication oil in the oil bearing bracket cover or in the reservoir of the constant level oiler (option) can lead to bearing damage!**

1. Remove the oil drain plug 91 on the bearing bracket cover.
2. Drain the oil.
3. Examine the oil for contamination.
4. If contamination is present in the oil, disassemble the following components and inspect for damage or corrosion:

- Bearing bracket
  - Bearing bracket cover
  - Bearings
5. Clean and dry all the components.
  6. Close the oil drain plug.

**NOTICE:**

- The pumps are delivered without oil.
  - The bearing bracket cover must be filled with oil before commissioning / start-up.
- 
- Monitor the oil level and keep it at the proper level.
  - Always monitor and fill the constant level oiler (option) to proper level.

Table 20: Oil quality

Designation	Lubricant CLP46 DIN 51517 or HD 20W/20 SAE
Symbol acc. DIN 51502	
Kinematic viscosity at 104°F (40°C)	0.000495 ft <sup>2</sup> /s ±0.00004 ft <sup>2</sup> /s (46 ±4 mm <sup>2</sup> /s)
Flashpoint (according to Cleveland)	+347°F (+175°C)
Pour point	5°F (-15°C)
Working temperature *)	Higher than allowed bearing temperature

\*) For ambient temperatures below +14°F (-10°C) another suitable type of lubricant oil must be used. Consultation required.

Table 21: Oil volume

Size	Oil volume MPA, MPAE, MPAT, MPR, MPRE, MPRT		Oil volume MPD, MPDE, MPDP, MPDT	
	(oz)	(l)	(oz)	(l)
50A, 50B	20.3	0,6	2 x 20.3	2 x 0,6
65A, 65B	32.1	0,95	2 x 32.1	2 x 0,95
100A, 100B	33.8	1,0	2 x 33.8	2 x 1,0
125A, 125B	44.0	1,3	2 x 44.0	2 x 1,3
150A, 150B	60.9	1,8	2 x 60.9	2 x 1,8

### 5.3.3 Fill the oil

1. Remove the oil filler plug 89.
2. Pour the oil into the opening.
3. Fill the oil to the middle of the oil sight glass 90.



4. Keep the filling level.
5. Overfilling leads to the increased bearing temperature and possibly oil leakage.  
Too little oil level can cause bearing damage from the lack of lubrication.

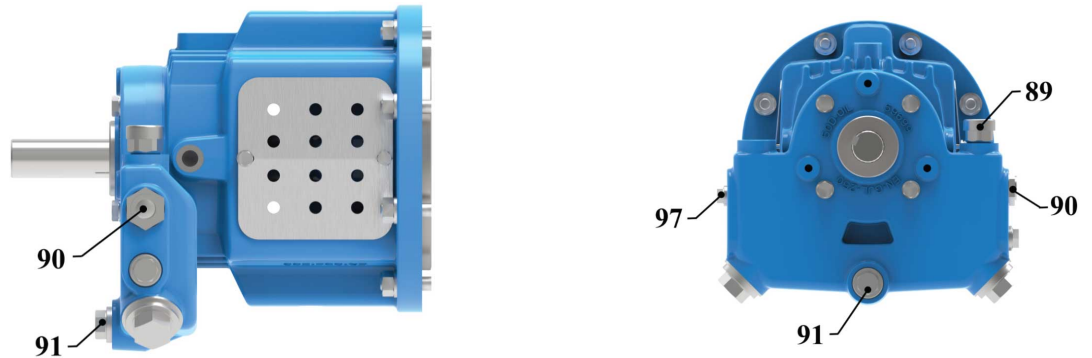


Figure 38

Table 22:

Position	Component
91	Oil drain G1/4 in
89	Oil fill plug
90	Oil sight glass
97	Option constant oiler or Option oil gauge tube

### 5.3.4 Constant level oiler (Optional design)

Shipped unattached from the factory to prevent shipping damage.

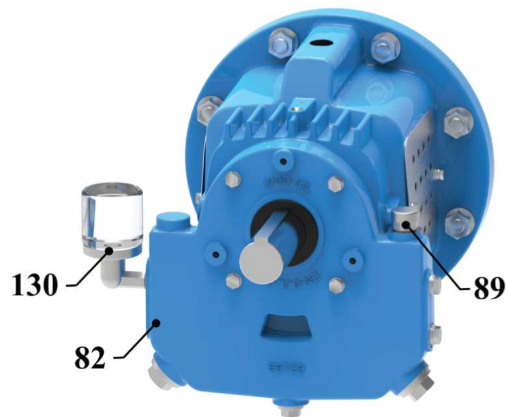


Figure 39: Constant level oiler

Table 23:

Position	Component
130	Constant level oiler
82	Oil bearing bracket cover
89	Oil filling plug

1. Remove the reservoir from the main body.
2. Apply the PTFE sealing tape to the NPT thread.
3. Install the oiler base into the oil bearing bracket cover 82.
4. Tighten the oiler base until the threaded boss is in the vertical position.
5. Remove the oil filling plug 89 on the upper side of bearing cover.
6. Fill the oil through the opening, until the oil level reaches the middle of the oil level sight glass in the bearing cover.

High oil level leads to temperature increase, leak or oil leakage.

7. Fill the reservoir by using a funnel.
8. Check that the O-ring is on reservoir spout.
9. Put the thumb over reservoir spout, invert, and insert the spout into the internal threaded boss on the main body.
10. Tighten the reservoir.
11. Check that the oil is flowing from the reservoir into the bearing chamber.
12. Repeat filling the reservoir so it stays 2/3rd full.
  - Oil must be filled when the oil level falls below 1/3rd.
13. Check the oil level only when pump is out of operation.
 

The oil level is slightly lower during operation than at downtime.

**NOTICE:**

- Check the oil level only when pump is out of operation.
- The oil level is slightly lower during operation than at downtime.
- Too high oil level leads to temperature increase, leak or oil leakage.

## 5.4 Fill the pump



**DANGER: Explosion hazard!**

Risk of potentially explosive atmosphere inside the pump.



**CAUTION: Damage to the pump unit!**

Increased wear due to dry running.

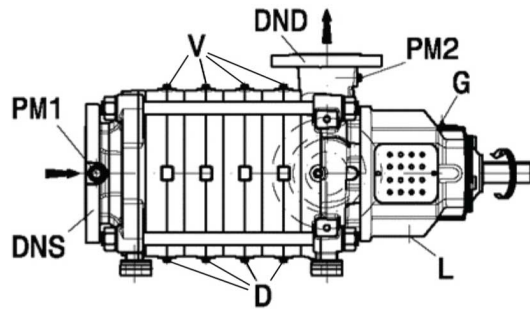


Figure 40: MPA

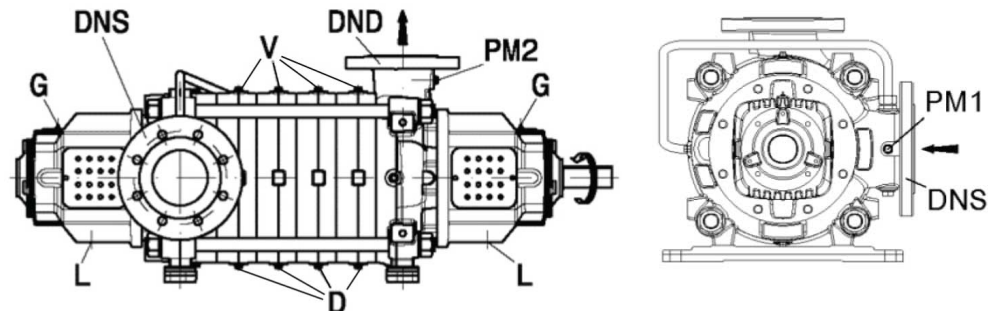


Figure 41: MPD



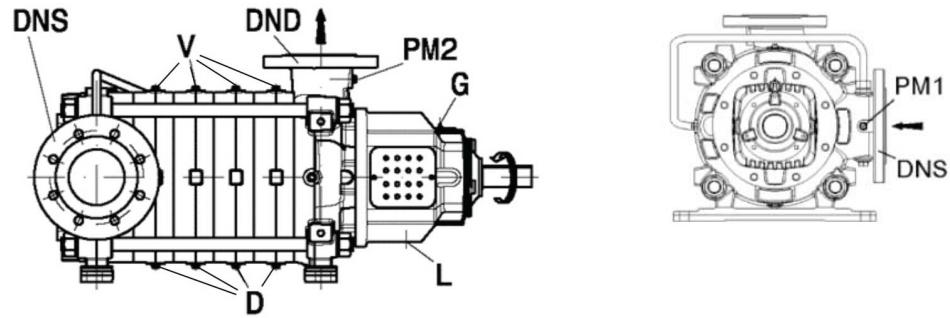


Figure 42: MPR

Table 24:

Position	Connection
PM1	Pressure gauge connection suction side
PM2	Pressure gauge connection discharge side
D	Drain
G	Grease nipple
L	Leakage
V	Vent
DND	Discharge
DNS	Suction

Before starting up the pump, vent the suction line of the pump and prime them with the fluid to be handled.

- Never operate the pump set without liquid fill.
- Never close the shut-off element in the suction line and/or supply line during pump operation.

For design reasons it cannot be excluded that after filling for start-up a residual volume not filled with pumped liquid remains. This volume is filled immediately after start-up of the motor by the pumped fluid.

#### Installation with liquid level above the pump suction head

1. Close the valve upstream the pump.

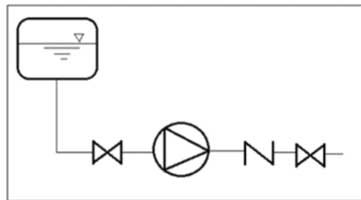


Figure 43

2. Open the pressure gauge connection PM2, the vent plugs V of the pump and the downstream valve until the fluid comes out the vents and PM2 connection.
3. Close the pressure gauge connection PM2 and the vent plugs.

## Installations with liquid level below the pump suction lift

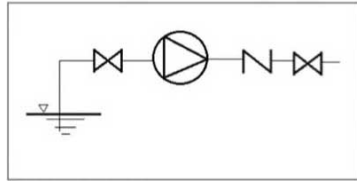


Figure 44

1. Complete piping system empty, valve downstream the pump above the water level:
  - a) Close the valve upstream the pump.
  - b) Open the valve downstream the pump.
  - c) Evacuate the piping system by pressure gauge connection PM2 till fluid comes out.
  - d) Close the pressure gauge connection PM2.
2. Complete piping system empty, valve downstream the pump below water level:
  - a) Close the valve upstream the pump.
  - b) Open the pressure gauge connection PM2 and the vent plugs V.
  - c) Fill the pump by the pressure gauge connection PM2 until fluid comes out.
  - d) Close the vent plugs V and the pressure gauge connection PM2.

## Vacuum compensation

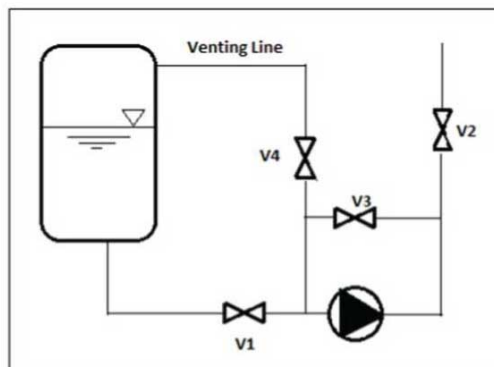


Figure 45

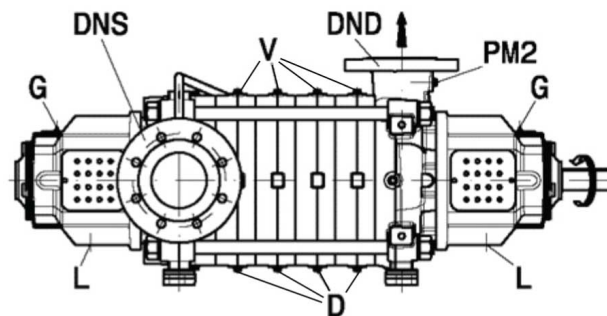


Figure 46

- Pumping from a vessel under vacuum the arrangement of a vacuum equalization pipe is advantageous.
- The pipe must have a minimum nominal diameter of 1 in (25 mm) and must end above the highest level permitted in the tank.
- An additional shut-off pipe and pump pressure equalization pipe makes it easier to vent the pump before start up.

**NOTICE:**

- After filling the pump, vent again the mechanical seal chamber on the vent plugs V.
- When venting under pressurized system, unscrew the vent plug V by a maximum of one full turn.

**Design with the cooling jacket and cooled mechanical seal (MPAT, MPDT, MPDP, and MPRT)****WARNING: Venting of the mechanical seal chamber under hot operating conditions**

Danger of scalding due to blowing out hot steam!

- Vent the sealing chamber only when in cold condition.
1. Open the vent plug 43 for the filling operation.

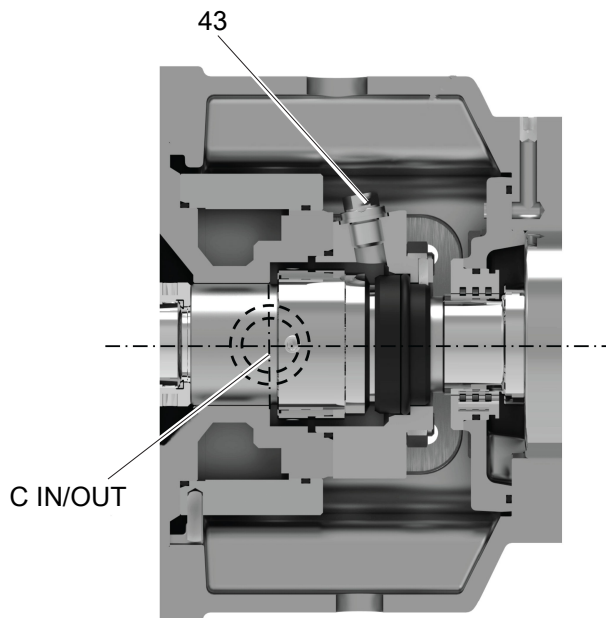


Figure 47

2. Close the vent plug when medium gets out.
3. Before start-up, install the cooling  $C_{IN}$  and  $C_{OUT}$ .

Table 25:

REQUIRED FLUSHING LIQUID FOR COOLING e-MP							
TYPE	MECH. SEAL SIZE	FLOW [US gal/min] per bearing bracket	FLOW [l/min] per bearing bracket	PRESSURE ABS. [PSI] / [bar]	TEMPERATURE FLUSH. LIQUID max INLET [°F] / [°C]	TEMPERATURE FLUSH. LIQUID max OUTLET [°F] / [°C]	CONNECTION
eMP50	38	0.8	3	29 - 87 / 2 - 6	104 / 40	140 / 60	G1/4
eMP65	43	0.8	3	29 - 87 / 2 - 6	104 / 40	140 / 60	G1/4
eMP100	55	1.1	4	29 - 87 / 2 - 6	104 / 40	140 / 60	G1/4
eMP125	65	1.3	5	29 - 87 / 2 - 6	104 / 40	140 / 60	G1/4

## 5.5 Check the rotation direction of the motor (three-phase motor)




---

### **DANGER: Damage to the pump set!**

Temperature increase resulting from contact between rotating and stationary components  
Explosions hazard!

---

- Never check the direction of rotation by starting up the unfilled pump set.
  - Separate the pump from the motor to check the direction of rotation.
- 




---

### **CAUTION: Damage to the pump set!**

Incorrect rotation of pump and motor

---

- Check for the correct rotation of the motor prior to coupling the pump.
  - Refer to the arrow indicating the direction of rotation on the pump body (discharge casing).
  - Check the direction of rotation. If required, check the electrical connection and correct the direction of rotation.
1. Before coupling the pump, check for the correct rotation of the motor.
  2. Locate the arrows on the pump and motor to check the correct rotational direction.
  3. Before the initial startup, turn the pump by using the hand.
  4. Check that the pump moves smoothly and evenly.
  5. Start the motor.
  6. Check the direction of rotation through the coupling guard or through the motor fan guard.
  7. Stop the motor.
  8. If the rotation direction is incorrect, then do as follows:
    - a) Disconnect the power supply.
    - b) In the terminal board of the motor or in the electric control panel, exchange the position of two of the three wires of the supply cable.  
For more information, see the manufacturer manual.
    - c) Check the direction of rotation.

## 5.6 Start up the pump set




---

### **DANGER:**

Non-compliance with the permissible pressure and temperature limits if the pump is operated with the suction and/or discharge line closed.

---




---

### **WARNING: Explosion hazard**

Leakage of hot or toxic fluids.

---

- Never operate the pump with closed shut-off elements in the suction line and/or discharge lines.
- Only start up the pump set with the downstream shut-off element slightly or fully open.

Start-up against open discharge line

- Use speed control
- Make sure the motor has sufficient power reserves.

**CAUTION: Damage to the pump**

Abnormal noises, vibrations, temperatures or leakage

- Switch off the pump set immediately.
- Eliminate the causes before returning the pump set to service.

Before starting the pump, do the following checks:

- The pump is correctly connected to the power supply. For more information, see [Fill the pump](#) on page 54.
  - The pump is filled with fluid
  - The discharge valve behind the pump is closed.
1. Fully open the shut-off element in the suction line.
  2. Slightly open the shut-off element in the discharge line.
  3. Start up the motor.
  4. After the pump has reached full rotational speed, slowly open the shut-off element in the discharge line.
  5. Adjust the shut-off element to comply with the duty point.

If the pump unit is not running smoothly, see [Troubleshooting](#) on page 110.

**NOTICE:**

After the initial start-up, grease-lubricated roller bearings may cause increased temperatures during running-in process. The final bearing temperature does not occur until after a certain operating time (depending on conditions, up to 48 hours).

## 5.7 Limits of operation

**DANGER:**

Explosion hazard by too high pressure and increased temperature

The operating limits of the pump / pump set regarding pressure, temperature, power and speed are shown in the data sheet and / or order confirmation and must be observed under any circumstances!

- Do not exceed the full load or maximum amps given on the motor name plate.
- Avoid sudden changes in temperature (temperature shocks).
- Pump and motor should run smoothly and with minimal vibrations; check at least once a week.

**DANGER:**

Leakage of pumped fluid due to increased wear

**WARNING: Explosion hazard**

Leakage of hot or toxic fluids.

In the case of liquids with abrasive components, increased wear on the hydraulic and shaft seal is to be expected.

- Higher amounts of solids than those given in the data sheet are not permissible.
- The inspection intervals must be reduced compared to the usual times.

**Flow min. / max.**

If no other data is given in the performance curves or data sheet, the following is valid:

$Q_{\min} = 30\% \times Q_{\text{BEP}}$  for continuous operation

$Q_{\max} = 120\% \times Q_{\text{BEP}}$  for continuous operation <sup>5</sup>

$Q_{\text{BEP}}$  = Flow in best efficiency point

## 5.8 Hot water supply (Boiler feed or condensate water applications)



### CAUTION: Damage to the pump set!

Non-compliance with the acceptable water condition and temperature limits for material of construction selection

For boiler feed or condensate water applications the below criteria are to be considered in determining materials of construction:

- Impeller material must be one of the following:
  - Stainless Steel
  - Duplex
  - Super Duplex
- For boiler feed water and condensate please contact the factory to review your configuration and options if your limits exceeds those in the following table:

Table 26:

Criteria	Limits
Temperature	≥200°F (93°C)
Dissolved oxygen	> 0.03 cc/l (0.04 ppm)
pH level	7<pH≤11

## 5.9 Commissioning



### WARNING:

Danger by hot machine parts and suddenly rotating machine parts

- Automatically controlled systems can turn on at any time.
- Install appropriate warning signs on the system side.



### CAUTION: Restart in run down motor

Damage of the pump / pump unit!

- Do not restart when pumps is rotating.
  - Always start with these steps at the first start-up
1. If the motor was disconnected from the pump unit, check the pump rotation prior to start-up.
  2. If the motor or pump was moved, then realignment of the coupler is required for the smooth running of the unit.
  3. Test the motor for insulation resistance, (megger) before starting.
  4. Automatic restarting must only be carried out if it is ensured that the pump remains filled with liquid at standstill.

<sup>5</sup> On condition that  $NPSHA > (NPSHR + 1.6 \text{ ft. } (0,5 \text{ m}))$

## 5.10 Shutdown the system

1. Close the valve in the discharge line immediately (max. 10 seconds) before switching off the motor.  
This is not required if there is a pressure-loaded non-return check valve.
2. Switch off the motor.
3. Ensure a calm run-out.
4. Tag out/lockout the motor.
5. Close the valve on suction side.
6. Close all auxiliary circuits. Do not close the cooling lines before the pump has cooled down.
7. In the case of freezing danger completely drain the pump, the cooling chamber and piping.
8. If the pump remains at shutdown under pressure and temperature, all the existing sealing, flush and cooling systems remain switched on.
9. The barrier system of a mechanical seal must remain switched on if danger exists of air sucking.  
In case of supply from vacuum system or in parallel operation with a common suction line.

## 5.11 Temporary storage, longer periods of non-operation

### Storage of new pumps (max. six months)

If the pump is not going to be installed and used soon after delivery, we recommend the following measures for the storage of the pump:




---

#### **CAUTION: Damage due to moisture, dirt and rodents during storage**

Corrosion / contamination during storage!

---

- For external storage cover the pump / pump set or packaged pump / pump set and accessories to protect them from the elements, rain, snow, heat, dirt. It is best to store the pump indoors.
- If necessary clean and cover the openings and connection points of the pump and motor before storage.
- Store the pump/pump set in a dry, protected place with low humidity.
- Rotate the shaft of the pump and motor by hand once a month.

### Longer storage of new pump/pump set

If longer storage is required (for example longer than three months), the preservation must be specified on an order basis.

### Longer shutdown

Pump remains installed and in ready for operation:

- Test runs of 5 minutes duration must be made in regular intervals.
- The span between the test runs is depending on the plant. However, it should be made at least once a week.

### Longer shutdown of filled pump

- Switch stand-by pumps on and immediately off once a week. Possibly use as main pump.
- If the stand-by pump is at operating pressure and temperature, leave all sealing, flushing and cooling systems switched on.
- Replace oil or grease after 2 years.

---

**NOTICE:**

For pumps of the material versions DNC, (Cast Iron hydraulic components), longer downtimes must be avoided, especially with aggressive water qualities (high oxygen content). In this case the pump should remain filled and at least every second day performed a functional run test.

---

**Longer shutdown of drained pump**

- Turn shaft by hand at least once weekly (do not switch on because of dry running).
- Replace oil or grease after 2 years.

## 5.12 Reshipment

Return to Xylem factory.

1. Drain the pump properly.

For more information, see [Drainage](#) on page 70.

2. Flush and clean the pump, especially for harmful, explosive, hot or other high-risk media.
3. If the pump has been used with fluids that cause corrosion, the pump internal passages must be blown dry with a waterless inert gas or flushed completely with a compatible preservative i.e. a 50-50 mix of inhibited Polypropylene glycol and water.
4. The pump/pump set must be sent back with an approved Return Material Authorization (RMA) prior to shipment to Xylem.



# 6 Maintenance

## 6.1 Precautions

Before starting work, make sure that the safety instructions in the chapter *Introduction and Safety* on page 5 have been read and understood.




---

**DANGER: Sparks produced during servicing work**

Explosion hazard!

- 
- Observe the safety regulations in force at the place of installation.
  - Always perform maintenance work on an explosion-proof pump (set) outside of potentially explosive atmospheres.




---

**DANGER: Improperly serviced pump set**

Explosion hazard! Damage to the pump set!

- 
- Service the pump set regularly.
  - Prepare a maintenance schedule with special emphasis on lubricants, shaft seal and coupling.




---

**DANGER: Unintentional starting of pump set**

Electric shock! Risk of injury by moving parts!

- 
- Ensure that the pump set cannot be started up unintentionally.
  - Always make sure the electrical connections are disconnected before carrying out work on the pump set.




---

**WARNING:**

- Always wear protective gloves when handling the pumps and motor. When pumping hot liquids, the pump and its parts may exceed 40°C (104°F).
- Maintenance and service must be performed by skilled and qualified personnel only.
  - Maintenance and service must be performed by skilled and qualified personnel only.
  - Observe accident prevention regulations in force.
  - Use suitable equipment and protection.
  - Make sure that the drained liquid does not cause damage or injuries.

## 6.2 Service

---

**NOTICE:**

By creating a maintenance plan, costly repairs can be avoided with minimal maintenance and trouble free, reliable operation of the pump unit can be achieved.

---

If the determination of regular maintenance deadlines is desired, then these maintenance intervals depend on the type of pumped medium and the operating conditions of the pump. Contact the local sales and service representative for any requests or information regarding routine maintenance or service.

Extraordinary maintenance may be necessary to clean the liquid end and/or replace worn parts.

## 6.3 Checklist for inspections




---

**DANGER: Overtemperatures due to impact or friction**

Explosion hazard! Fire hazard! Damage to the pump set!

- 
- Regularly check the coupling protection and other covers of rotating parts for deformations and sufficient clearance from the rotating parts.




---

**DANGER: Risk of potentially explosive atmosphere inside the pump**

Explosion hazard!

- 
- The pump internal is in contact with the fluid to be handled, including the seal chamber and auxiliary systems must be filled with the fluid to be handled at all times.
  - Provide sufficient inlet pressure.
  - Provide an appropriate monitoring system.




---

**DANGER: Incorrectly serviced shaft seal**

Explosion hazard! Leakage of hot, toxic fluids! Damage to the pump set! Risk of burns! Fire hazard!

- 
- Regularly service the shaft seal.




---

**DANGER: Excessive temperatures as a result of bearings running hot or defective bearing seals**

Explosion hazard! Fire hazard! Damage to the pump set! Risk of burns!

- 
- Regularly check the lubricant level.
  - Regularly check the rolling element bearings for running noises.




---

**DANGER: Incorrectly serviced barrier fluid system**

Explosion hazard! Fire hazard! Damage to the pump set! Leakage of hot and/or toxic fluids!

- 
- Regularly service the barrier fluid system.
  - Monitor the barrier fluid pressure.




---

**CAUTION: Increased wear due to dry running**

Damage to the pump set!

- 
- Never operate the pump set without liquid fill.
  - Never close the shut-off element in the suction line and/or supply line during pump operation.




---

**CAUTION: Impermissibly high temperature of fluid handled**

Damage to the pump set!

---

- Prolonged operation against a closed shut-off element is not permitted (heating up of the fluid).
- Observe the temperature limits in the data sheet and in the section on operating limits.

**NOTICE:**

Regularly performed monitoring and maintenance work prolongs the service life of your pump or system.

When the pump is in operation, do the following checks:

- The pump must run quietly with no vibrations.
- If oil lubricated, check the oil level once a week and if necessary fill the oil.
- Check the shaft seal.
- Check the static sealing elements for leakage.
- Check the rolling bearings for running noises. Vibrations, noise, and an increase in current input occurring during unchanged operating conditions show wear.
- Monitor the correct functioning of any auxiliary connections and check their function once a week. The cooling water outlet should be no more than hand-hot.
- Pumps which are subjected to chemical attack or abrasive wear because their function must be inspected periodically for chemical or abrasive wear. The initial inspection is to be done after half a year. All other inspection intervals must be determined based on the pump's condition.
- Monitor the standby pump.
- Check that the standby pumps are ready for operation.
- Start the standby pumps once a week.
- Monitor the bearing temperature.

Table 27:

Components	Inspection
Coupling	<ul style="list-style-type: none"> <li>• Flexible elements of the coupling</li> <li>• If there is any sign of wear, replace the coupling.</li> <li>• Check the alignment.</li> </ul>
Mechanical seal, standard	<ul style="list-style-type: none"> <li>• Check the mechanical seal for leakage.</li> <li>• If leak is present, then the mechanical seal is damaged and must be replaced.</li> <li>• Check the bearing to ensure sufficient lubricant is still present if mechanical seal is leaking.</li> </ul>
Packing, optional	Perfect function is given if the medium gets out drop by drop.
Auxiliary connections, optional	Check function and tightness of flush or barrier circuit.

**Checking the vibrations**

**DANGER: Excessive vibrations of pump or motor due to mechanical failure or installation failure**

Risk of explosion! Damage to the pump set!

- Check the vibrations of pump and motor in regular time intervals or install a vibration monitoring system.

### Checking the bearing bracket sealing



**DANGER: Excessive temperatures caused by mechanical contact**

Risk of explosion! Damage to the pump set!

- Check correct seating of axial seal rings mounted on the shaft. Only gentle contact of the lip seal shall be established.

Clean any filters installed in the pipes regularly, replace when needed.

## 6.4 Lubrication of the roller bearings



**DANGER: Excessive temperatures as a result of bearings running hot or defective bearing seals**

Explosion hazard! Fire hazard! Damage to the pump set! Risk of burns!

- Regularly check the condition of the lubricant.
- In potentially explosive atmospheres it is useful to monitor the bearing temperature and the bearing vibrations.

Table 28: Bearing sizes

Pump size	Bearing size	Bearing size
	MPA, MPAE, MPAT MPR, MPRE, MPRT	MPD, MPDE, MPDP, MPDT
50A, 50B	1*3308	1*3308, 1*6308
65A, 65B	1*3310	1*3310, 1*6310
100A, 100B	1*3312	1*3312, 1*6312
125A, 125B	1*3313	1*3313, 1*6313
150A, 150B	1*3315	1*3315, 1*6315

### 6.4.1 Grease lubrication

The roller bearings are lubricated with grease from the factory.

The following grease type must be used to lubricate the roller bearings:

- Polyurea-based high temperature ball and roller bearing grease
  - NLGI GRADE 2
  - Temperature range -22°F to 350°F (-30°C to 177°C)
  - Dropping point 470°F (243°C)
  - Base oil viscosity 0.00013 ft<sup>2</sup>/s (11.8 mm<sup>2</sup>/s) at 212°F (100°C)

### Re-greasing

- Clean the grease nipple 46.
- Re-lubrication minimum once per year.
- Re-lubrication intervals and grease volumes, see below table:

Table 29: The pumps have standard re-greaseable bearings:

Pump size	Lubrication volume				Lubrication interval in operating hours			
	MPA, MPAE, MPR, MPRE		MPD, MPDE, MPDP		1450 rpm	1750 rpm	2950 rpm	3550 rpm
	oz	cm <sup>3</sup>	Discharge / Suction					
50A, 50B	0.5	15	0.5 / 0.3	15 / 10	6500	6000	4300	4000
65A, 65B	0.7	20	0.7 / 0.4	20 / 13	6000	5500	4000	3800

Pump size	Lubrication volume				Lubrication interval in operating hours			
	MPA, MPAE, MPR, MPRE		MPD, MPDE, MPDP Discharge / Suction		1450 rpm	1750 rpm	2950 rpm	3550 rpm
	oz	cm <sup>3</sup>	oz	cm <sup>3</sup>				
100A, 100B	1.0	30	1.0 / 0.7	30 / 20	5500	5000	3800	3500
125A, 125B	1.2	35	1.2 / 0.8	35 / 23	5000	4800	3500	3000
150A, 150B	1.7	50	1.7 / 1.1	50 / 33	4800	4500	3000	-

### 6.4.2 Changing the grease



**CAUTION: Avoid mixing of greases with differing soap bases**

The grease must be replaced completely every two years.

1. Remove the roller bearings.
2. Clean the roller bearings.
3. Refill the roller bearings with the new clean grease.
4. When refilling, hand pack the cavities of the bearings 100% with the grease.

### 6.4.3 Oil lubrication of the roller bearings



**DANGER: Excess temperature due to insufficient oil or too little oil**

Explosion hazard! Damage to the pump set!

- Check frequently the lubricant condition.
  - In case of potentially explosive atmospheres the oil exchange interval must be followed exactly as listed in [Table 30](#) on page 67.
1. After the first 300 hours of operation, drain the oil.
  2. Flush with the fresh oil.
  3. Top up with the oil.
  4. Clean the drain plug.
  5. Close the drain.

If the pump is out of operation for a long time, the oil must be changed after two years.

For more information, see [Oil lubrication of the pump](#) on page 51.

Table 30: Oil change intervals

Temperature on the roller bearing	First oil change after ..... operating hours	All further oil changes after ..... operating hours
Up to 149°F (65°C)	300	8760 *)
149°F - 176°F (65°C - 80°C)	300	4000 *)
176°F - 194°F (80°C - 90°C)	200	3000 *)

\*) minimum 1x per year



**WARNING: Hazardous and / or hot lubricants**

Risk to the environment and people!

- When venting the lubricant, take measures to protect persons and the environment.
- Collect and dispose the lubricant.
- Observe the legal regulations regarding the disposal of hazardous liquids.

### Oil quality

- The rolling bearings must be lubricated with mineral oil.
- Oil lubrication is optional and can be seen if the bearing bracket of the pump has an oil filler plug 89 and an oil drain screw 97.  
For more information, see [Fill the pump](#) on page 54.
- Use oil quality accordingly [Oil lubrication of the pump](#) on page 51.

## 6.5 Mechanical seal

- Before opening the pump, read the safety notes in [Safety](#) on page 6 and [Precautions](#) on page 63.
- If the mechanical seal is leaking, replace the mechanical seal.
- For more information to replace the mechanical seal, see [Replace the shaft seal](#) on page 82.
- Mechanical seals do not need to be maintained, replace if leaking.
- During first start up, dripping from new seals can be observed about three drops for each minute. If more than three drops for each minute or fails to stop after two hours of running, replace the seals.
- Pumps with mechanical seals are only allowed to be operated when filled and vented.
- The mechanical seal chamber must always remain filled with liquid during operation of the pump.
- Pay attention to cleanliness during installation of the mechanical seal. Particular care has to be paid to the surface of the seal rings.
- Lubricate all moving components and sliding areas by means of water or soapy water for easier mounting of the rotating components of the seal onto the shaft respectively for inserting the stationary seat.
- Do not use mineral grease or oil if the O-ring material is not known. The standard O-ring material provided with this pump is EPDM rubber. Mineral oil or grease should not be used with them.
- Do not lubricate the face of the seal rings.
- Do not force elastomeric elements over sharp edges, if necessary use assembling aiding sleeves. Slide the mechanical seal on in a way that the bellow is compressed and not stretched.

## 6.6 Stuffing box



---

**WARNING:**

Packing that runs dry will harden and then destroy the shaft sleeve and/or the shaft.

---

1. Stuffing boxes require constant maintenance.
2. Packing needs leakage for trouble free function (drop wise outlet of pumped medium).
3. Adjust for more leakage at the start.
4. Leave the gland loose initially to provide a continuous trickle of fluid.
5. Slowly adjust the gland over two hours to obtain a leakage of approximate 60–100 drops / minute.
6. If the leakage rate can no longer be set correctly, the packing is worn out and must be replaced.
7. Replace the shaft sleeve of the packing.

For more information, see [Replace the shaft sleeve of the stuffing box](#) on page 95.

8. If a new packing is used, tighten the gland lightly in the start.

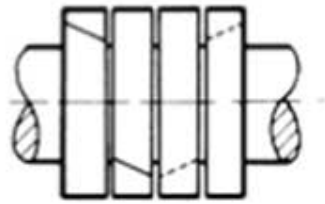


Figure 48: Location of the packing to each other

9. Stagger the ends of packing rings at opposite positions, see [Figure 48](#) on page 69.
10. After a while, tighten smoothly the gland until leakage is decreased to only a few drops. The drops must be 60–100 drops / minute. The leakage must be liquid not vapor. Avoid dry run.

Table 31: Insertion of the packing rings



Figure 49: Correct



Figure 50: Incorrect

## 6.7 Coupling



### **DANGER: Risk of burns!**

High temperatures at the coupling due to misalignment of the coupling can lead to explosion hazard!

If wear is heavy, it must be assumed that the motor is not properly aligned with the pump or that the distance between the coupling parts has changed.

Replace the worn coupling and re-align the coupling. For more information, see [Control the alignment](#) on page 46.

1. Check the coupling components approximately for every 1000 operating hours, but at least once a year for the radial clearance in the coupling parts.
2. For couplings with rubber pads, follow these steps:
  - a) The coupling pads may wear out to approximately  $\frac{1}{4}$  of their usual thickness, before they have to be changed.
  - b) To measure the clearance in the coupling, place a mark on the O.D. of each coupling hub.

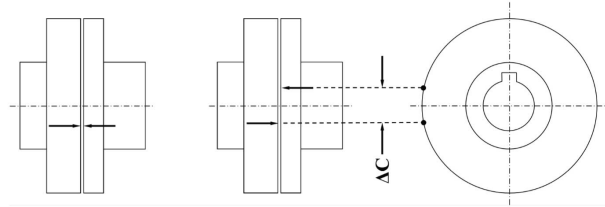


Figure 51

- c) Then fixing one hub, turn the opposite hub as far as possible. Then measure the distance ( $\Delta C$ ) between the marks of the coupling.
- d) If this measure exceeds the value, the coupling unit must be replaced.

Table 32:

Coupling Size	$\Delta C$ , in (mm)
80	0.20 (5.0)
95	0.24 (6.0)
110	0.28 (7.0)
125	0.31 (8.0)
140	0.22 (8.5)
160	0.31 (8.0)
180	0.31 (8.0)
200	0.22 (8.5)
225	0.35 (9.0)

## 6.8 Drainage



### **WARNING: Hazard to persons and the environment!**

Fluids, consumables and supplies which are hot and/or pose a health hazard

- Collect and properly dispose of flushing fluid and any residues of the fluid handled.
- Wear safety clothing and a protective mask, if required.
- Observe all legal regulations on the disposal of fluids.

1. Close isolation valves on both sides of the pump.
2. Allow the temperature to reach a safe level.
3. Before attempting to drain, depressurize the pump.
4. Use all drain plugs 42 to drain the handled fluid.

For more information, see [Auxiliary connection](#) on page 40.

5. If the pump has been used for handling noxious, explosive, hot, or other hazardous fluids, flush the pump.
6. Before transporting the pump to the workshop, flush and clean the pump.

A certificate of decontamination for the pump must be provided.

## 6.9 Cleaning of the pump



### **WARNING:**

The pump need not be cleaned with pressurized water - water will get into the bearings



---

Dirt on the outside of the pump has an adverse effect on transmission of heat. The pump must be cleaned at regular intervals depending on the degree of dirt.

1. Before cleaning, allow the pump to cool down to ambient temperature.
2. Use caution near the pump bearing brackets to avoid contamination of the lubrication.

## 6.10 Maintenance of flood damaged pump



---

**WARNING: Always disconnect and lock out / tag out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.**

Electrical connections must be made by certified electricians in compliance with all international, national, state, and local rules.

---

Perform these maintenance tasks if your pump has been flood damaged

1. Clean the bearing bracket and covers.
2. Replace the bearings.
3. Lubricate the bearings.

To evaluate and repair the motor, contact the local sales and service representative.

For more information, see [Grease lubrication \(Standard design\)](#) on page 51.

# 7 Disassemble and Assemble the Pump

## 7.1 Precautions

Maintenance and service must be performed by skilled and qualified personnel only.

- Repairs to the pump set or system may only be carried out by trained and qualified personnel.
- On request factory service technicians are available for assembly and repairs.



**WARNING: Hot surface**

Risk of injury!

- 
- Allow the pump set to cool down to ambient temperature.



**DANGER: Risk of injury!**

Insufficient preparation of work on the pump / pump set

- 
- Close the shut-off element in the discharge line.
  - Properly shut down the pump set.
  - Close the shut-off element in the suction line.
  - Close any auxiliary connections.
  - Release the pump pressure and then drain the pump.



**DANGER: Risk of injury!**

Tipping of pump, motor or individual components

- 
- Secure dismantled pump, subassemblies or individual parts to prevent them tipping over or rolling away.
  - Attach or support pump, motor and / or individual components.



**DANGER: Health hazardous liquids**

Risk to people and the environment!

- 
- Pumps delivering hazardous liquids must be decontaminate.
  - Collect and properly dispose flush liquid and any residual liquid.
  - If required wear protective clothing and protective mask.
  - Observe legal regulations regarding the disposal of materials.



**WARNING: Risk of injury! Personal damage / property damage**

Improper lifting / moving of heavy assemblies or components

- 
- When moving heavy assemblies or components, use suitable means of transport, hoists and slings.

**DANGER: Fire hazard!**

Explosion hazard! Explosive or hazardous to health atmosphere!

- Use an open flame (soldering lamp, etc.) as help at the disassembly only if this does not result in fire or explosion hazards or in danger of development of dangerous fumes.

**WARNING: Explosive atmosphere**

Explosion hazard!

- Work requiring impact stress must be carried out only outside the explosive atmosphere.
- Do not use spark-forming tools.

**DANGER: Incorrect installation**

Damage to the pump!

- Assemble the pump / pump set in accordance with the rules applicable in mechanical engineering.
- Use only original spare parts. Pay attention to the right material and suitable installation.
- Dismantling and assembly must always be carried out according to the corresponding exploded view (see exploded view in the appendix).
- Before dismantling check whether the required spare parts are ready.
- Disassemble the pump as far as it is necessary to replace the part to be repaired.

**NOTICE:**

After a prolonged period of operation the individual components may be hard to pull off the shaft. If this is the case use one of the well-known rust dissolver or - if possible - use appropriate pull-off device.

## 7.2 Tools and maintenance resources

In normal cases no special tools are required.

The following tools simplify assembly work:

- Warm-up equipment for roller bearings
- Bearing or gear puller
- Sickle spanner for shaft nuts

**WARNING: Contact of elastomers with oil or grease**

Failure of seals, the shaft seal!

- Use water or soapy water as assembly aid.
- Cleaning and degreasing agents (e.g., acetone)
- Lubricant for roller bearings (for selection see operating instructions)
- Lubricant for the assembly (e.g., Molikote)
- Never use oil or grease as assembly aid.

**NOTICE:**

For potable water pumps only lubricants should be used that have potable water approval (NSF-61, ACS or KTW).

## 7.3 Prepare the pump

1. Interrupt the power supply.
2. Secure the pump against the unintentional startup and lockout or tag out.
3. Disconnect all the auxiliary pipe work.
4. Remove all the auxiliary pipe work.
5. Remove the coupling guard.
6. If available, remove the coupling spacer.
7. If applicable, drain the oil out of the oil-lubricated bearing bracket.
8. Allow the pump to cool down.
9. Depressurize the pump.
10. Drain the pump.

Service work must not be done on the pump until it is drained.

## 7.4 Remove the motor

---

### NOTICE:

On pump sets with spacer couplings, the bearings and shaft seal can be removed while the motor remains bolted to the base frame.

---



---

### DANGER: Risk of injury!

Tipping of pump, motor or individual components

---

- Wear proper personal protective footwear and gloves.
  - Suspend or support the motor to prevent it from tipping over.
1. Disconnect the motor from the power supply.
  2. Remove the motor from the base frame.
  3. Shift the motor to separate it from the pump.

## 7.5 Replace the bearings

The drive-end roller bearings are removed without dismantling the opposite slide or roller bearing.

The suction-side roller bearing or plain bearing is removed without disassembly of the opposite roller bearing.

### 7.5.1 Remove the coupling half

The drive side coupling half must be removed.

1. Remove the grub screw (setscrew) in the coupling hub.
2. Use the dismantling tool to pull off the coupling half.
3. Pull out the key 32.

### 7.5.2 Disassemble the grease lubricated roller bearings (all designs)

1. Remove the hexagon bolts 39 and washers 38.

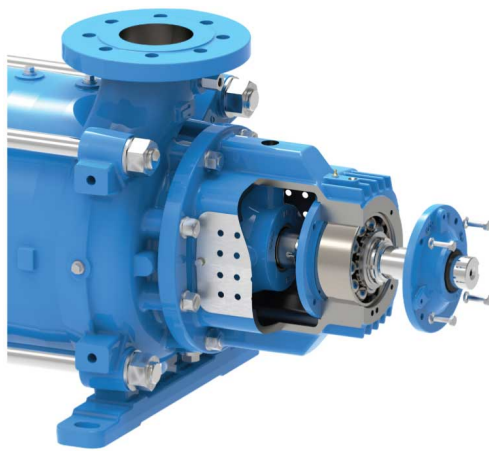


Figure 52: MPA, MPD, and MPR discharge side

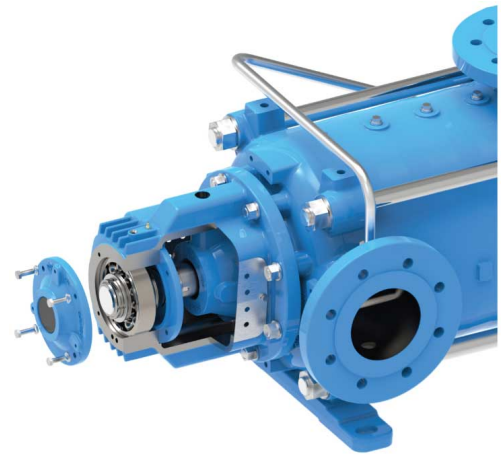


Figure 53: MPD suction side

2. Remove the bearing cover 1 with the seal ring 16 (V-ring) or bearing cover 1 with the bearing cap 64.

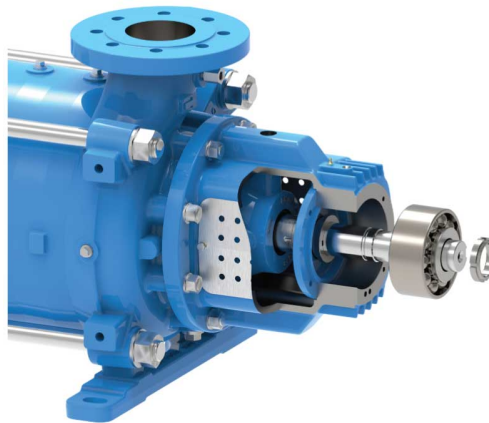


Figure 54: MPA, MPD, and MPR discharge side

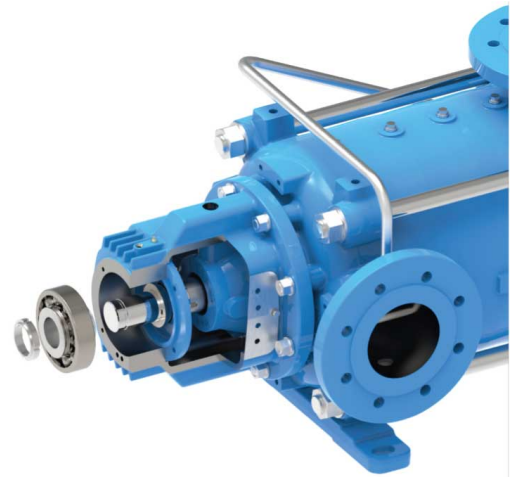


Figure 55: MPD suction side

3. Remove the bearing nut 17.
4. Hold the shaft 28 to keep it from moving.
5. Remove the bearing sleeve 18 with the roller bearing 19 or 63 from the shaft 28.
6. Remove the bearing 19 or 63 from the bearing sleeve 18.

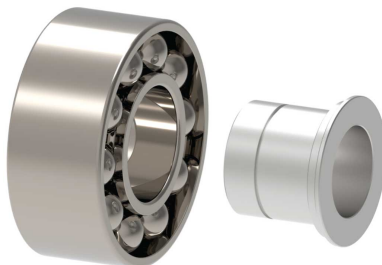


Figure 56: MPA, MPD, and MPR discharge side



Figure 57: MPD suction side

**NOTICE:**

- After removing the discharge-side bearing sleeve 18 with ball bearing 19, the shaft can be axially moved (up to 0.12 in (3 mm)).
- Standard shaft seals absorb this shift without impacting their function.
- For special shaft seals (cartridge mechanical seal), see the mechanical seal manual.

**7.5.3 Assemble the grease lubricated roller bearings (all designs)**

1. Clean the mating surfaces of bearing sleeve 18, bearing bracket 3, and bearing cover 1.
2. Remove the old grease from the bearing bracket 3 and from the opposite bearing cover 2.
3. Preheat the new bearing 19 or 63 for maximum temperature 176°F (80°C).
4. Push the bearing into the bearing sleeve 18.
5. After cooling down the bearing 19 or 63 to room temperature fill 100% of the intermediate space with grease.

Only recommended grease must be used on the bearing.

6. With the flange of the bearing sleeve facing outward or towards the bearing, push the bearing sleeve 18 onto the shaft 28 and push it with bearing into the bearing bracket 3 while slightly lifting the shaft.
7. Use the torque wrench to tighten the bearing nut 17.  
For more information, see [Torque specification](#) on page 113.
8. For the drive side:
  - a) Install bearings cover 1 on bearing bracket 3.
  - b) Install hexagonal bolts (cap screws) 39 and washers 38.
  - c) Tighten the bolts.
  - d) Apply the grease on the counter face of V-ring 16 on bearing cover 1.
  - e) Slide on V-ring 16.
9. For the suction side, model MPD and MPDE:
  - a) Install bearings cover 1 with bearing cap 64 to bearing bracket 3.
  - b) Install the hexagon bolts (cap screw) 39 and washers 38.
10. Turn shaft 28 to check for free movement.



Figure 58: MPA, MPD, and MPR discharge side



Figure 59: MPD suction side

**7.5.4 Disassemble the oil lubricated roller bearings (all designs)****NOTICE:**

Oil is drained.

1. Remove hexagon bolts (cap screws) 39 and washer 38.

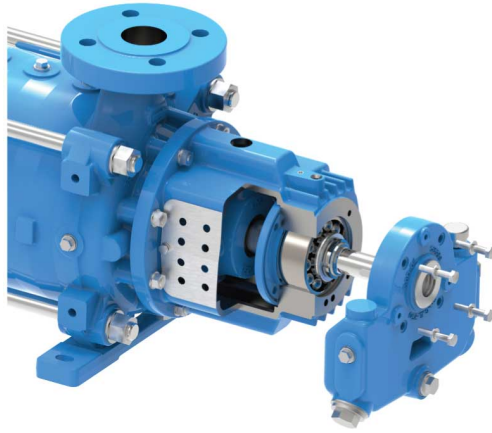


Figure 60: MPA, MPD, and MPR discharge side

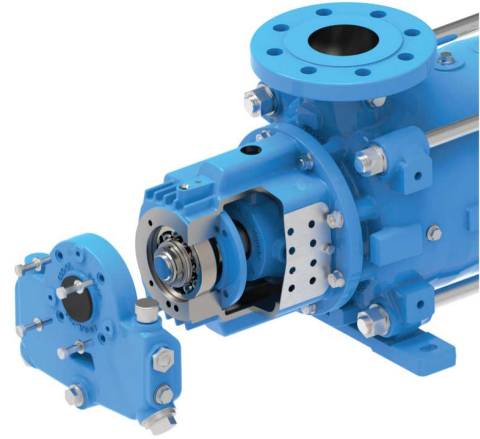


Figure 61: MPD suction side

2. Remove the bearing cover 82 with the labyrinth ring 86 or bearing cover 82 with the bearing cap 64.

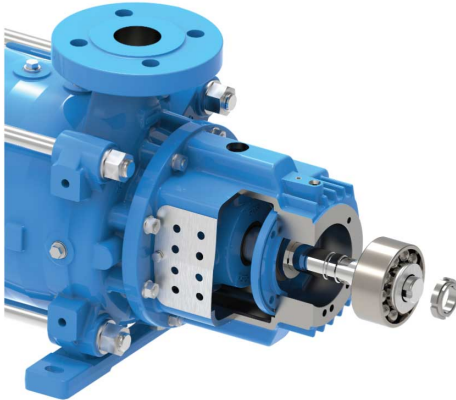


Figure 62: MPA, MPD, and MPR discharge side

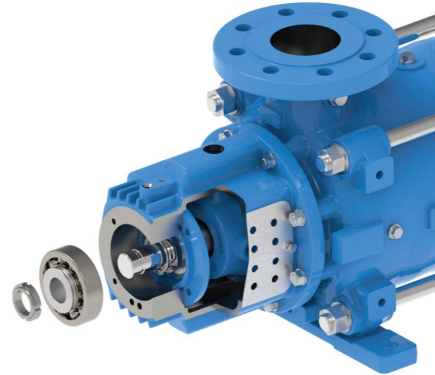


Figure 63: MPD suction side

3. Remove the bearing nut 17.
4. Hold shaft 28 to prevent from moving.
5. Remove bearing sleeve 18 with the roller bearing 19 or 63 from the shaft 28.

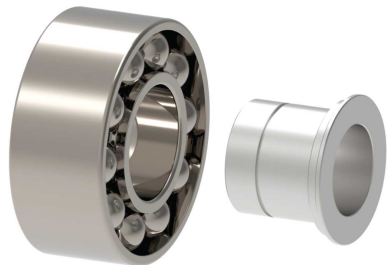


Figure 64: MPA, MPD, and MPR discharge side



Figure 65: MPD suction side

6. Remove the bearing 19 or 63 from the bearing sleeve 18.

**NOTICE:**

- After removing the discharge-side bearing sleeve 18 with bearing 19, the shaft can be axially moved (up to 0.12 in (3 mm) ).
- Standard shaft seals absorb this shift without impacting their function.
- For special shaft seals (for example, cartridge mechanical seal), refer to the mechanical seal manual.

### 7.5.5 Assemble the oil lubricated roller bearings (all designs)

1. Clean the mating surfaces of the bearing sleeve 18, bearing bracket 3, and bearing cover 82.

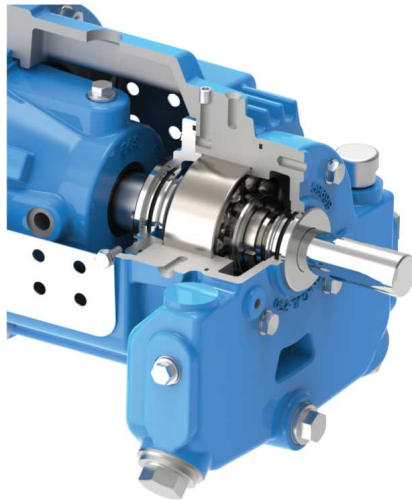


Figure 66: MPA, MPD, and MPR discharge side

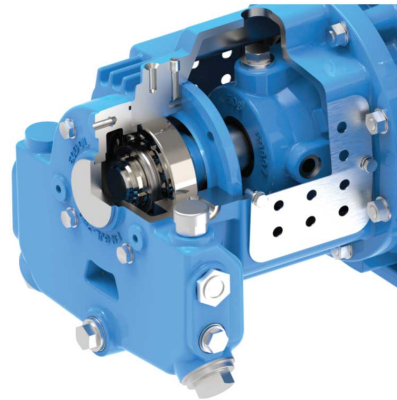


Figure 67: MPD suction side

2. Preheat the new bearing 19 or 63 for maximum temperature 176°F (80°C).
3. Push the bearing into bearing sleeve 18.
4. After cooling down, with the flange of the bearing sleeve facing outward or towards the bearing, push bearing sleeve 18 onto shaft 28.
5. Push the bearing sleeve with the roller bearing into the bearing bracket while slightly lifting the shaft.
6. Use the torque wrench to tighten bearing nut 17.  
For more information, see [Impeller nuts](#) on page 115.
7. For drive side:
  - a) Install the bearings cover 82 on the bearing bracket 3.
  - b) Install the hexagonal bolts 39 and the washers 38.
  - c) Tighten the hexagonal bolts 39.
  - d) Slide on labyrinth ring 86.
8. For suction side, MPD and MPDE:
  - a) Install bearings cover 82 with bearing cap 64 to bearing bracket 3.
  - b) Install hexagon bolts (cap screw) 39 and washers 38.
9. Turn shaft 28 to check for free movement.

### 7.5.6 Disassemble the plain bearing MPA and MPR

The suction-side plain bearing 70 is dismantled without disassembly of the opposite roller bearing.

The hydraulic part of the pump will not get disassembled.



**WARNING: Risk of pinching!**

Tilting the pump

- Wear proper personal protective footwear and gloves.
  - Secure the pump against tilting by fixing the discharge casing on a fixing bracket.
1. Use one of the following methods to prepare the pump:
    - a) Set up the pump horizontally and lift the suction casing by means of wooden wedges so that the feet of the suction casing are free from approximately 0.5 in (10 mm) to 1 in (20 mm).
    - b) Put the pump vertically on the coupling guard adapter.
  2. Remove the balancing pipe 10 from the suction casing 6 and the discharge casing 8.
  3. Remove the tie bolt nuts 35 and the washers 34.

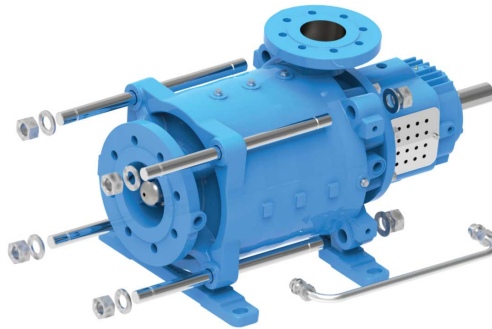


Figure 68: Axial suction nozzle MPA

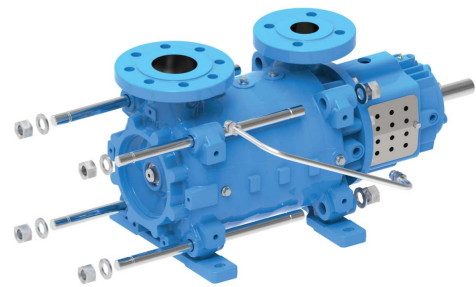


Figure 69: Radial suction nozzle MPR

4. Pull the tie bolts 33 out of the bosses.
5. Loosen the suction casing 6 by light strokes.

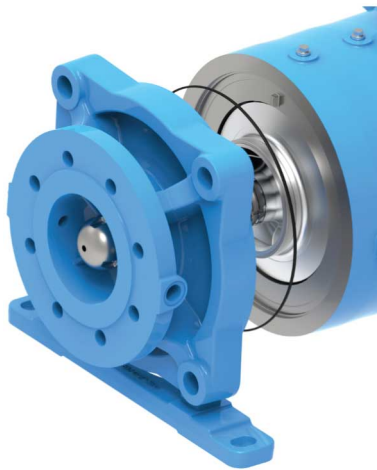


Figure 70: Axial suction nozzle MPA

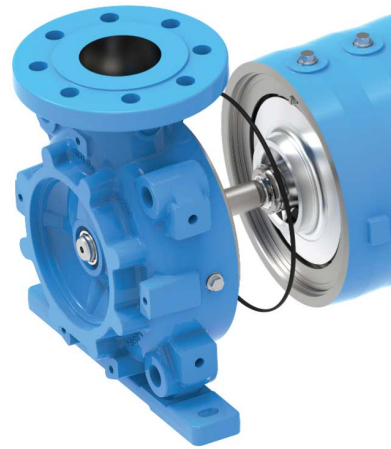


Figure 71: Radial suction nozzle MPR

6. Remove the O-ring 49.

**Disassembly of the plain bearing sleeve 70**

1. Before removing the set screw 69, slightly heat the set screw.

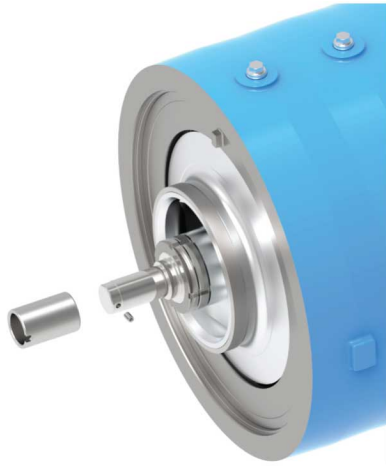


Figure 72: MPA Axial suction nozzle



Figure 73: MPR Radial suction nozzle

2. Remove the set screw 69.
3. Remove the plain bearing sleeve 70.

**Disassembly of the plain bearing bush 71 MPA (axial suction)**

1. Slightly heat the cap 73.



Figure 74: Axial suction

2. Slightly tap the cap to loosen.
3. Remove the cap.
4. Remove the plain bearing bush 71 and the O-rings 67.

**Disassembly of the plain bearing bush 71 MPR (radial suction)**

It is applicable for MPR radial suction.

1. Remove retaining ring 62.



Figure 75: Radial suction

2. Pull plain bearing cover 72 out of suction casing 6.
3. Remove plain bearing bush 71 and O-rings 67.

### 7.5.7 Assemble the plain bearing MPA and MPR

1. Check the shaft 28 for damage to the surface.  
If grooves and scratches cannot be removed, replace the shaft.
2. If possible, polish the grooves.
3. Replace all the O-rings with the new O-rings.  
For more information about the O-ring material, review the documentation of the pump for O-ring material provided.

#### Assemble the plain bearing sleeve 70

1. Slide the new plain bearing sleeve 70 onto the shaft 28.

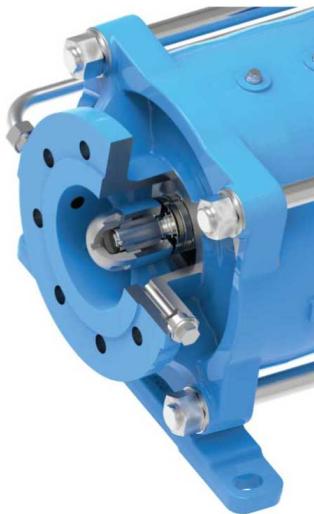


Figure 76: MPA Axial suction nozzle

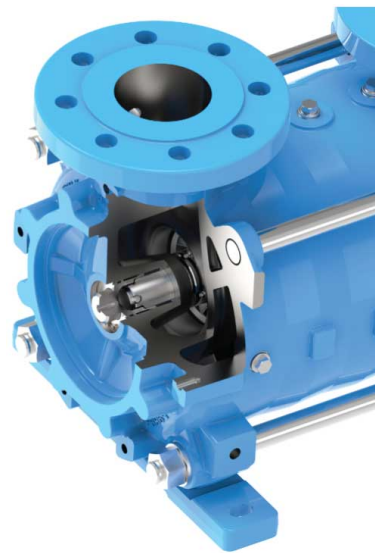


Figure 77: MPR Radial suction nozzle

2. Insert the threaded pin 69 with the adhesive until it is below the outer diameter of the plain bearing sleeve 70.

**Assemble the plain bearing bush MPA (axial suction)**

1. Lubricate the O-rings 67 with the silicone grease.
2. Insert the O-rings 67 into the bore of the suction casing 6.
3. Slide the plain bearing bush 71 into the suction casing 6.
4. Apply the adhesive to the flat surface of the cap 73.
5. Push the cap 73 into the suction casing 6.

**Assemble the plain bearing bush MPR (radial suction)**

1. Use the silicone grease to lubricate the O-rings 67.
2. Insert the O-rings 67 into the bore of the suction casing 6.
3. Slide the plain bearing bush 71 into the suction casing 6.
4. Use the silicone grease to lubricate the O-rings 68.
5. Insert the O-rings 68 into the plain bearing cover 72.
6. Slide the plain bearing cover 72 into the suction casing 6.
7. Install the snap ring 62 into the suction casing groove.

**Assemble the suction casing 6**

1. Use the silicone grease to lubricate the suction casing O-ring 49.
2. Push the O-ring 49 onto the suction casing 6.
3. Push the suction casing 6 onto the first stage casing 7.
4. Install the suction casing 6 by light blows on the stage casing 7.
5. Insert tie bolts 33.
6. Install the tie bolts 33, nuts 35, and washers 34.
7. Lightly tighten the bolts.
8. Before tightening the tie bolts and nuts, align the feet of the pump.  
Both feet of the pump must set on a flat surface.
9. Tighten the first tie bolt but not to full torque, go to tie bolt 180° across and tighten and torque.  
Torque must be applied in a 5 point pattern.
10. Move to right then tighten and torque, move 180° tighten and torque, move back to first tie bolt and torque.
11. Use the torque to fasten the tie bolt and nuts 35.  
For more information, see [Torque specification](#) on page 113.
12. Install the balancing pipe.

---

**NOTICE:**

- When installing, make sure the O-ring 49 sits in the groove provided and does not get damaged.
  - Make sure the casing feet are aligned with each other.
  - Using a soft mallet carefully drive the suction casing 6 until seated.
  - Alternatively, press the suction casing 6 into the casing assembly with clamps.
- 

## 7.6 Replace the shaft seal

This procedure is for the replacement of a mechanical seal or the shaft sleeve of the packing box design or the replacement of a cartridge mechanical seal.

### 7.6.1 Requirements

- All removed parts must be cleaned and examine for damage.
- If damaged, the components must be replaced.
- The wear parts such as roller bearings, O-rings, and gaskets must be replaced.

- For more information, see [Precautions](#) on page 63 to [Prepare the pump](#) on page 74.
- If removed components or semi-open pumps are stored for long period of time, must be protected against dirt and corrosion.
- For all types of seal variations, follow these steps:
  - Pump must be drained.
  - Bearing bracket must be removed
  - Bearing must be removedFor more information, see [Disassemble the grease lubricated roller bearings \(all designs\)](#) on page 74 to [Assemble the plain bearing MPA and MPR](#) on page 81.

## 7.6.2 Disassemble the mechanical seal

This procedure is applicable for the suction side MPD and discharge side MPA, MPD, MPR shaft seals.

The shaft sleeves and mechanical seals 22 for the discharge and suction end of the pumps are not interchangeable.

The parts must be marked in a way that the pump can be re-assembled with the same parts and in the same order as they were disassembled.

1. Remove the safety guards 4 from the openings of the bearing bracket 3.

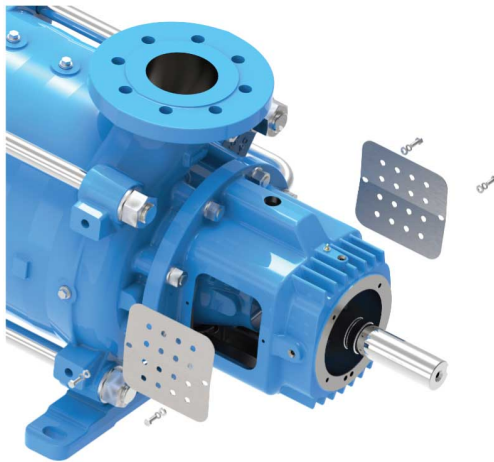


Figure 78

2. Remove the bearing cover nuts 36.

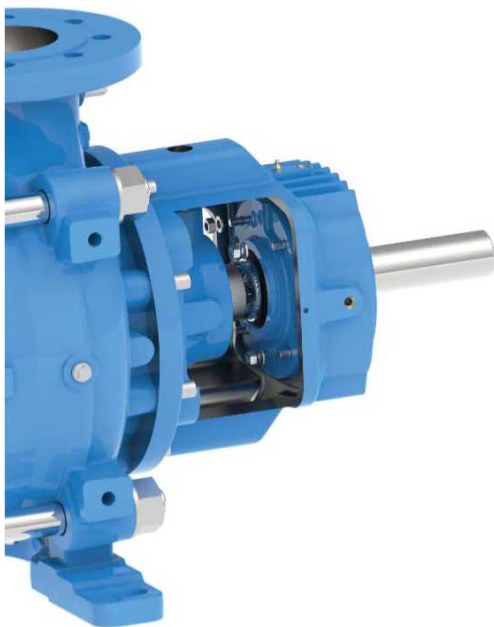


Figure 79

3. Remove the bearing bracket nuts 58.



Figure 80

4. Remove the washers 59.
5. Remove the bearing bracket 3.
6. Pull the spacer sleeve 20 with the bearing cover 2 and V-ring 21 or labyrinth ring 84.

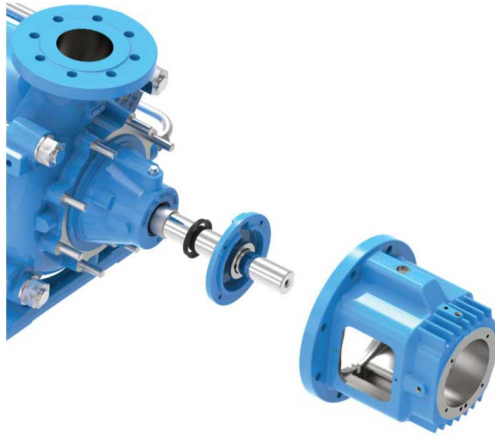


Figure 81

7. Remove the seal cover 5 with the stationary ring of the mechanical seal 22.
8. Remove the key 31.
9. Remove the O-ring 48.
10. Pull the shaft sleeve 23 with the rotating unit of mechanical seal 22.

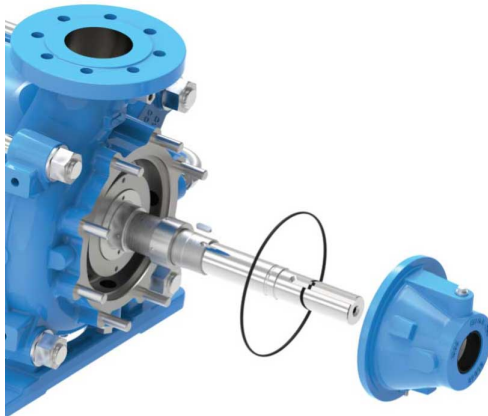


Figure 82

11. Remove the O-ring 47.

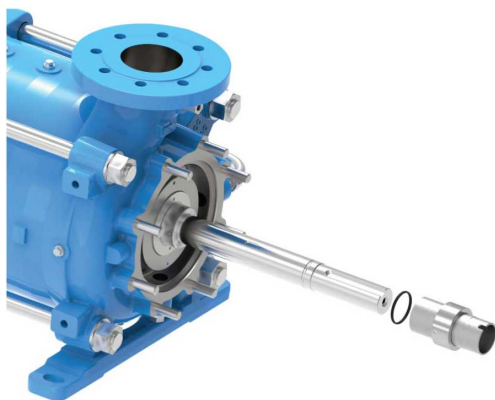


Figure 83

12. Press the stationary ring of the mechanical seal 22.
13. Remove the stationary ring of the mechanical seal out of the seal cover 5.



Figure 84

14. Push the rotating unit of the mechanical seal 22 from the shaft sleeve 23.
15. For the mechanical seals with set screws, loosen the set screws.

### 7.6.3 Assemble the mechanical seal

---

#### NOTICE:

- Always use a lubricant when installing the mechanical seal. We recommend lubricating the O-ring or rubber bellows of the mechanical seal with soapy water shortly before installation. Please do not use mineral grease or oil if the O-ring material is not known.
  - The standard O-ring material provided with this pump is EPDM rubber. Mineral oil or grease should not be used with them. Other optional O-ring materials may be used. Review the pump documentation for the correct materials of construction.
  - Lubricate all pump O-rings using an O-ring manufacturer's approved lubricant compatible with both the O-ring material and the pumped fluid. For potable water services use NSF approved P-80 or other NSF approved lubricant.
  - The selected O-ring lubricant may also be used to lubricate the pump shaft, during assembly.
- 

1. Clean all the parts.

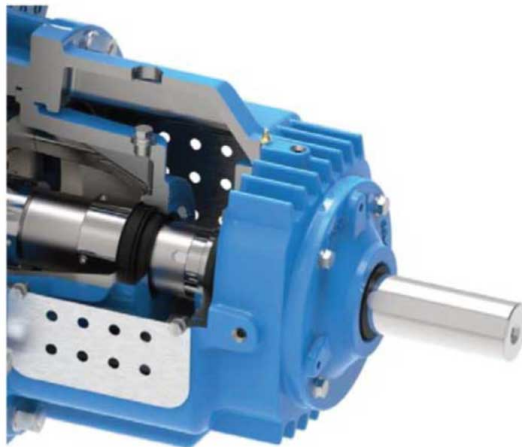


Figure 85: MPA, MPD, and MPR discharge side

2. Check the parts for wear.
3. Replace the mechanical seals.
 

For more information about repair, contact the local sales and service representative.
4. Press the stationary ring of mechanical seal 22 into the seal cover 5.
5. If available, use the screws to hold the stationary ring.
 

It prevents twisting of stationary ring.
6. Push the rotating unit of the mechanical seal 22 onto the shaft sleeve 23 until it touches the shoulder.
7. Use the lubricant to lubricate the O-ring 47.
 

Silicone grease can be used.
8. Slide the O-ring 47.



9. Use the lubricant to lubricate the shaft sleeve 23 in the bore.
10. Check that the recess for the O-ring 47 is clean.
11. Push the shaft sleeve 23 on the shaft 28.
12. Check that the O-ring 47 easily slips into the groove.
13. Apply the silicone grease to the O-ring shoulder of seal cover 5.
14. Install the O-ring 48 on the shoulder and fix it in the silicone grease.
15. Carefully install the seal cover 5.
16. Check the direction of the pin 45 (groove in the bearing bracket) and the vent screw 43 (directed up).

For more information, see [Assemble steps for all shaft seals](#) on page 99.

#### 7.6.4 Disassemble the water-cooled mechanical seal

This procedure is applicable for the suction side MPD and discharge side MPA, MPD, MPR shaft seals.

The parts must be marked in a way that the pump can be reassembled with the same parts and in the same order as they were disassembled.

Table 33: Range of application

Operating temperature design T	284°F – 320°F (140°C – 160°C)
Operating temperature design P	320°F – 356°F (160°C – 180°C)
Sizes	50, 65, 100, 125, and 150

Cooling chamber is empty and the cooling pipes are removed.

1. Remove the vent-adapter 83.
2. Remove the safety guards 4 on the openings of the bearing bracket 3.

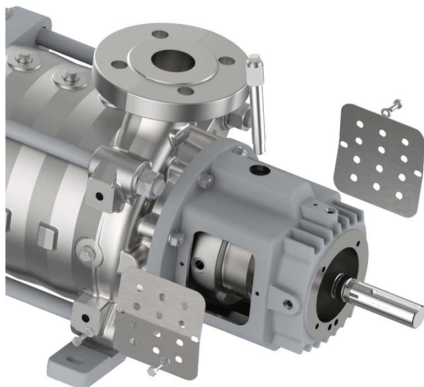


Figure 86: MPAT, MPRT, MPDT, MPDP 50 and 65

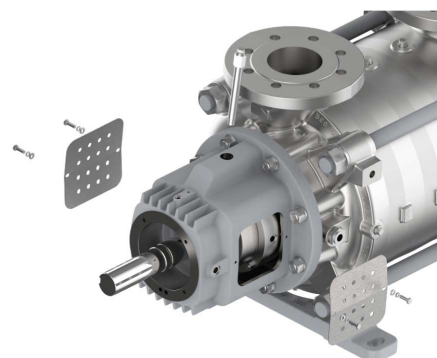


Figure 87: MPAT, MPRT, MPDT, MPDP 100, 125, and 150



Figure 88: MPAT, MPRT, MPDT, MPDP 50 and 65

3. Remove the bearing nuts 36 or hex bolt 111.
4. Remove the bearing bracket nuts 58 and the washers 59.

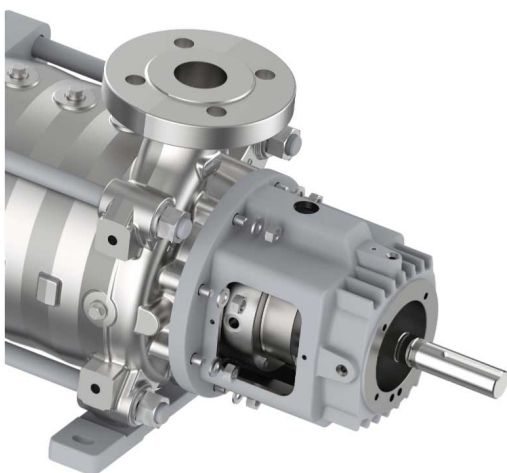


Figure 89

5. Remove the bearing bracket 3.



Figure 90

6. Pull the spacer sleeve 20 with the bearing cover 2 and V-ring 21 or labyrinth ring 84.
7. Remove the seal cover bolting nuts 102.

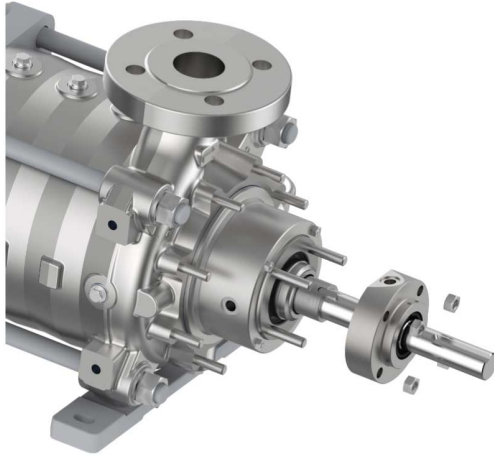


Figure 91

8. Remove the seal cover 106 with the stationary ring of the mechanical seal 22.
9. Remove the key 31.
10. Pull the shaft sleeve 23 with the rotating unit of the mechanical seal 22.

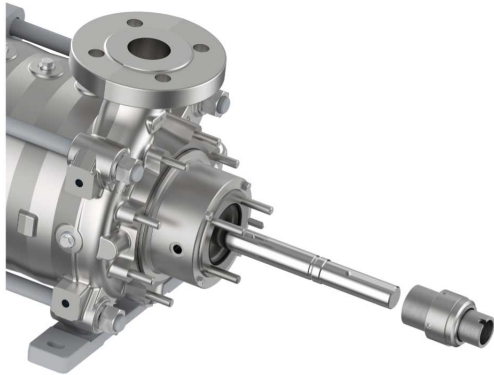


Figure 92

11. Remove the casing cover 99 with the cooling jacket 103.

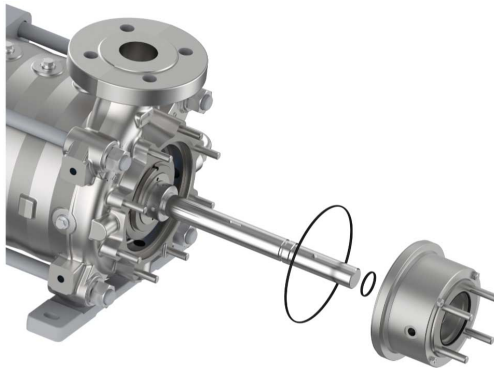


Figure 93

12. Remove the O-rings 100 and 47.
13. Press out evenly the stationary ring of the mechanical seal 22 from the seal cover 106.



Figure 94

14. Push the rotating unit of the mechanical seal 22 from the shaft sleeve 23.
15. For mechanical seals with the screws, loosen the screws.

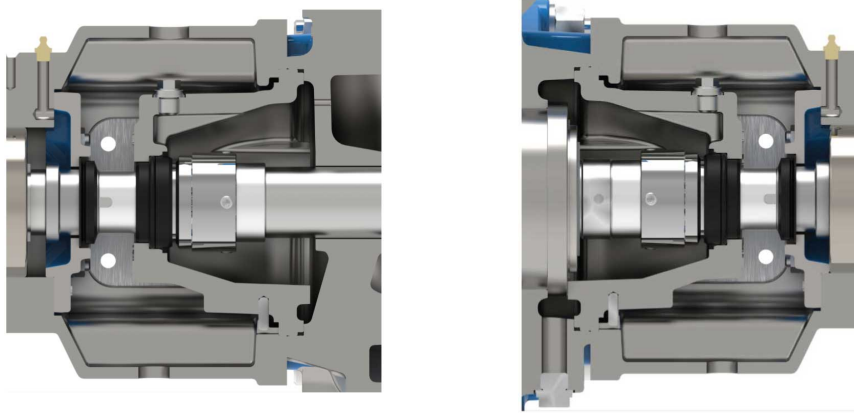


Figure 95: Balanced mechanical seal



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**WARNING: Risk of injury**  
There may be sharp edges

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### 7.6.5 Assemble the water-cooled mechanical seal

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**NOTICE:**

- Always use a lubricant when installing the mechanical seal. We recommend lubricating the O-ring or rubber bellow of the mechanical seal with soapy water shortly before installation. Please do not use mineral grease or oil if the O-ring material is not known.
  - The standard O-ring material provided with this pump is EPDM rubber. Mineral oil or grease should not be used with them. Other optional O-ring materials may be used. Review the pump documentation for the correct materials of construction.
  - Lubricate all pump O-rings using an O-ring manufacturer's approved lubricant compatible with both the O-ring material and the pumped fluid. For potable water services use NSF approved P-80 or other NSF approved lubricant.
  - The selected O-ring lubricant may also be used to lubricate the pump shaft, during assembly.
- 

1. Clean all the parts.

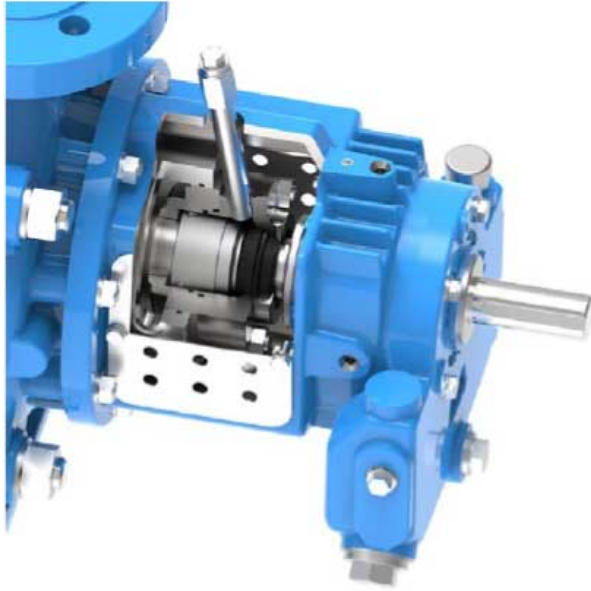


Figure 96: Water-cooled mechanical seal

2. Check the parts for wear.
3. Replace the mechanical seals.  
For more information about the repair of mechanical seal, contact the local sales and service representative.
4. Insert the stationary ring of the mechanical seal 22 in the seal cover 106.
5. If available, use the screws to hold the stationary ring.  
It prevents the rotation of stationary ring.
6. Slide the rotating unit of the balanced mechanical seal 22 onto the shaft sleeve 23 until it touches the shoulder.
7. Slide the O-ring 47.
8. Apply the silicone grease lubricant on the O-ring 47.
9. Use the lubricant to lubricate the shaft sleeve 23 in the bore.
10. Check that the recess for the O-ring 47 is clean.
11. Slide on the shaft sleeve 23.
12. Check that the O-ring 47 can easily slip into the groove.
13. Apply the silicone grease to O-ring shoulder of seal cover 106.
14. Put the O-ring 100 or 48 on this shoulder and fix it in silicone grease.
15. Carefully install the casing cover 99 with the cooling jacket 103.
16. Check the direction of the pin 105 (groove in the bearing bracket).
17. Install the seal cover 106 with the O-ring 107 on the casing cover 99.
18. Tighten the screws 108 and nuts 109.
19. Screw the vent adapter 83 with the vent plug 43 into the seal cover 106.  
For more information, see [Assemble steps for all shaft seals](#) on page 99.

### 7.6.6 Disassemble the cartridge seal

This procedure is applicable for suction side MPD and discharge side MPA, MPD, MPR shaft seals.

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#### **NOTICE:**

When installing and disassembling a cartridge seal always pay attention to the additional operating instructions of the mechanical seal manufacturer.

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1. Remove the safety guards 4 from the openings of the bearing bracket 3.

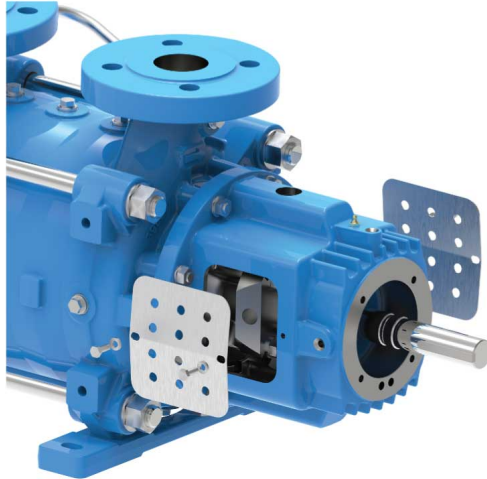


Figure 97: MPA, MPD, and MPR discharge side

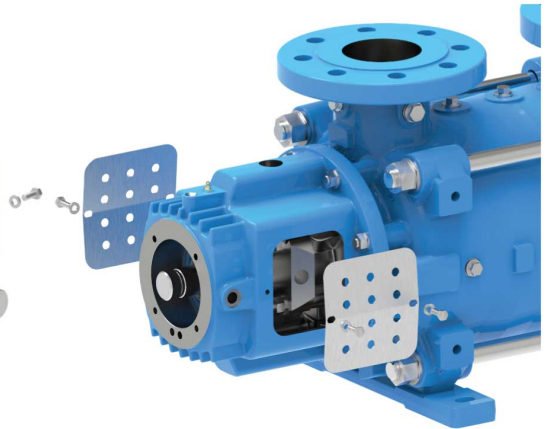


Figure 98: MPD suction side

2. Remove the bearing cover nuts 36.



Figure 99: MPA, MPD, and MPR discharge side



Figure 100: MPD suction side

3. Remove the bearing bracket nuts 58 and washers 59.
4. Remove the bearing bracket 3.

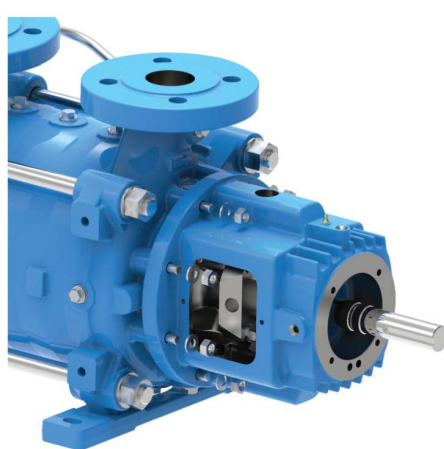


Figure 101: MPA, MPD, and MPR discharge side

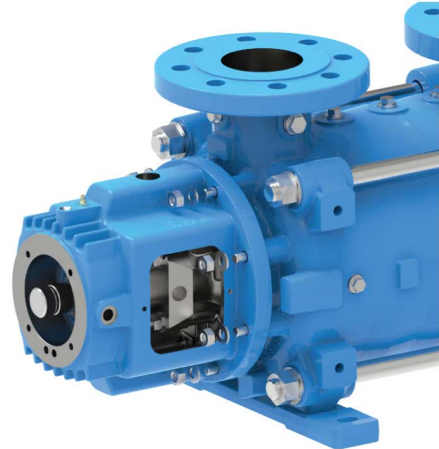


Figure 102: MPD suction side

5. Pull the spacer sleeve 20 with the bearing cover 2 and V-ring 21 or labyrinth ring 84.

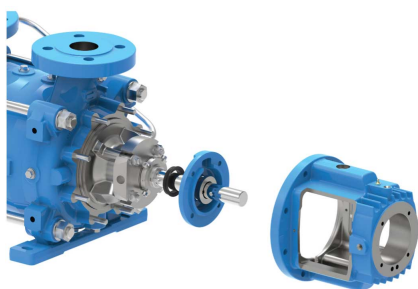


Figure 103: MPA, MPD, and MPR discharge side

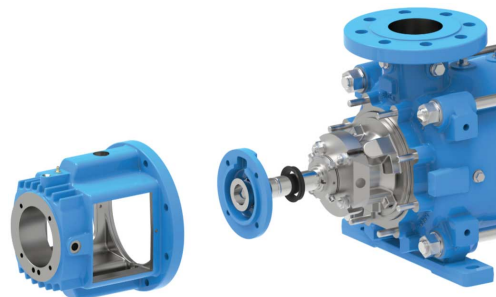
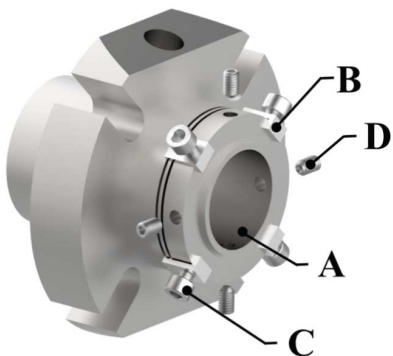


Figure 104: MPD suction side

6. Use the mounting device B and screws C on the cartridge shaft sleeve A to fix the rotating part of the mechanical seal A.



7. Remove the set screws D and nuts 121 to allow the cartridge seal 118 to move freely.

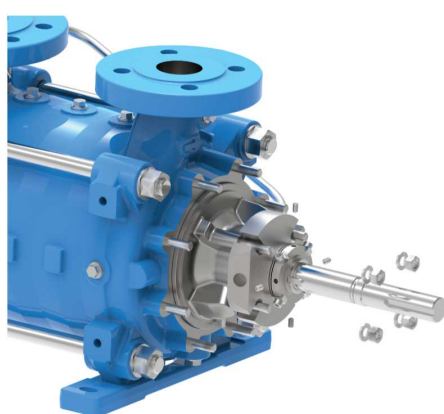


Figure 105: MPA, MPD, and MPR discharge side

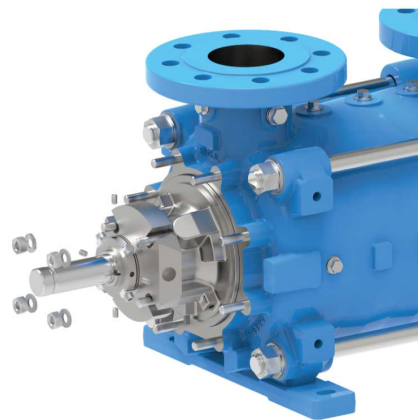


Figure 106: MPD suction side

8. Pull the cartridge seal 118 from the shaft sleeve 23.



Figure 107: MPA, MPD, and MPR discharge side

Figure 108: MPD suction side

9. If removal is not possible, remove the key 31.
10. Remove the nuts 58.
11. Pull the cartridge mechanical seal 118 with the shaft sleeve 23 and seal cover 119 from the shaft 28.

### 7.6.7 Assemble the cartridge seal

This procedure is applicable for suction side MPD and discharge side MPA, MPD, MPR shaft seals.

#### NOTICE:

- When installing and disassembling a cartridge seal always pay attention to the additional operating instructions of the mechanical seal manufacturer.
- Always use a lubricant when installing the mechanical seal. We recommend lubricating the O-ring or rubber bellow of the mechanical seal with soapy water shortly before installation. Please do not use mineral grease or oil if the O-ring material is not known.
- The standard O-ring material provided with this pump is EPDM rubber. Mineral oil or grease should not be used with them. Other optional O-ring materials may be used. Review the pump documentation for the correct materials of construction.
- Lubricate all pump O-rings by using an O-ring manufacturer's approved lubricant compatible with both the O-ring material and the pumped fluid. For potable water services use NSF approved P-80 or other NSF approved lubricant.
- The selected O-ring lubricant may also be used to lubricate the pump shaft, during assembly.

1. Clean all the parts.
2. Check the parts for wear.

The worn parts of the cartridge seal must be replaced or repaired only by the manufacturer.

3. Replace the mechanical seals.

For more information about the repair of mechanical seal, contact the local sales and service representative.



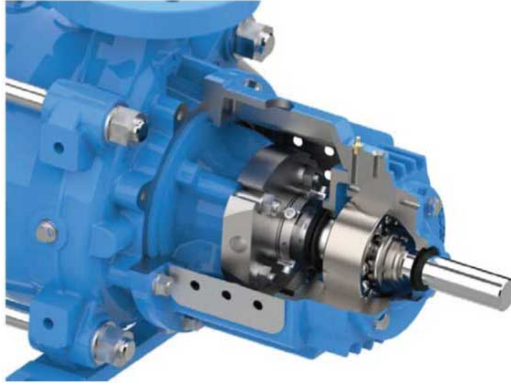


Figure 109

4. Use the lubricant to lubricate the O-ring 47.  
Silicone grease can be used.
5. Slide the O-ring 47 on the shaft 28.
6. Use the lubricant to lubricate the shaft sleeve 23 in the bore.
7. Check that the recess for the O-ring is clean.
8. Push the shaft sleeve 23 on the shaft 28.
9. Check that the O-ring 47 can easily slip into the groove.
10. Install the O-ring 123 to the seal cover 119 and fix it with silicone grease.
11. Carefully install the seal cover 119.
12. Check the direction of the pin 45 (groove in the bearing bracket) and the vent screw (directed up).
13. Push the cartridge seal 119 onto the shaft sleeve 23.
14. Install the stud bolts 60, washers 59, and nuts 58.
15. Tighten the stud bolts 60, washers 59, and nuts 58.
16. Drill a spot-drill into the shaft sleeve 23 by using a drill.  
The drill must be smaller in size than the core hole of the cartridge seal screw D.
17. Use the set screw to attach the cartridge seal 119 onto the shaft sleeve 23.
18. Remove the mounting devices after the bearing is installed and before the startup.  
For more information, see [Assemble steps for all shaft seals](#) on page 99.

### 7.6.8 Replace the shaft sleeve of the stuffing box

The procedure is applicable for the suction side MPD and the discharge side MPA, MPD, MPR stuffing box.

The parts must be marked in a way that the pump can be reassembled with the same parts and in the same order as they were disassembled.

#### 7.6.8.1 Disassemble the shaft sleeve of the stuffing box

1. Remove the safety guards 4 from the openings of the bearing bracket 3.

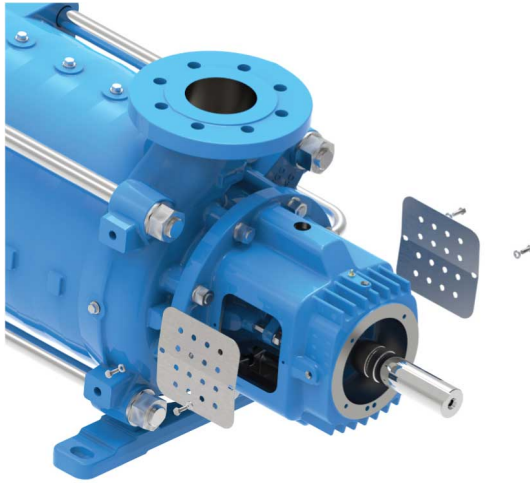


Figure 110

2. Remove the bearing cover nuts 36 and washers 38.



Figure 111

3. Remove the bearing bracket nuts 58 and washers 59.

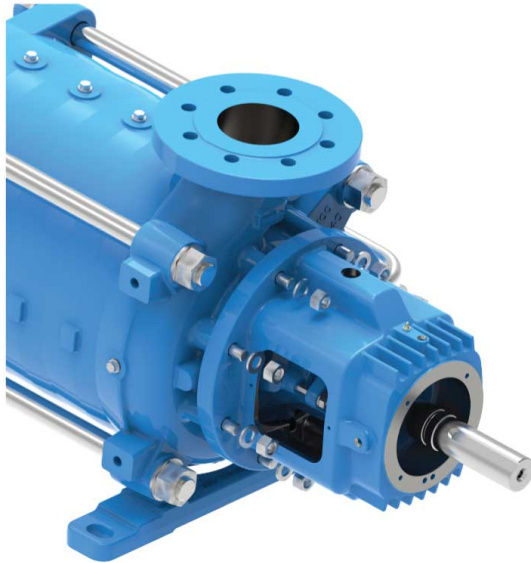


Figure 112

4. Remove the bearing bracket 3.

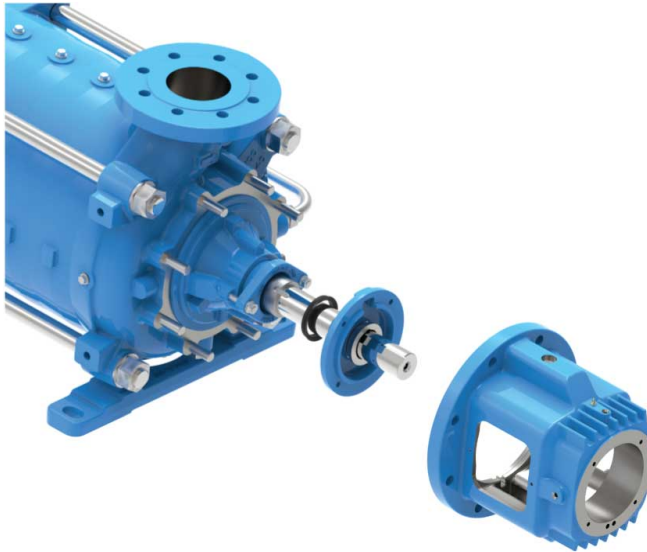


Figure 113

5. Pull the spacer sleeve 23 with the bearing cover 5 and the V-ring 21 or labyrinth ring 84.
6. Remove the nuts 125 of gland screw 124.

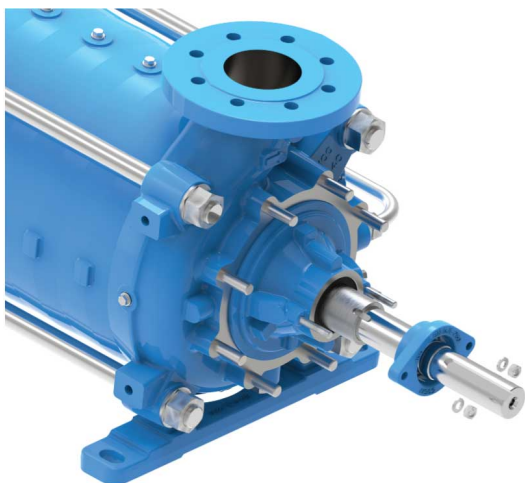


Figure 114

7. Remove the stuffing box gland 116.
8. Remove the stuffing box housing 115 with the stuffing box packing 117.

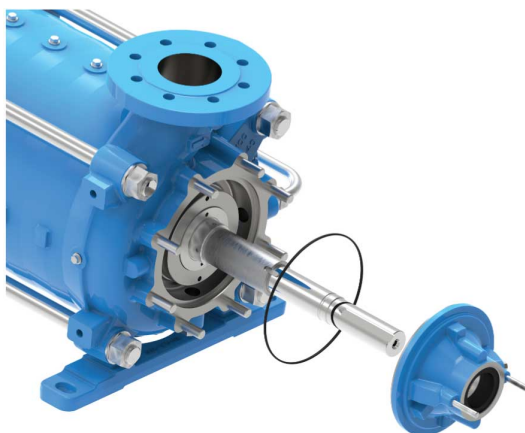


Figure 115

9. Remove the O-ring.
10. Remove the key 31.
11. Pull the shaft sleeve 23.

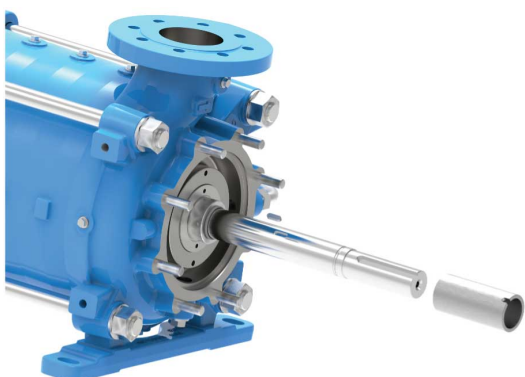


Figure 116

12. Remove the stuffing box packing 117 from the stuffing box housing 115.



Figure 117

### 7.6.8.2 Assemble the shaft sleeve of the stuffing box

1. Clean the housing.
2. Clean all the parts.
3. Check the shaft sleeve for wear.  
If there is wear, replace the shaft sleeve.
4. Slide the new O-ring 47 onto the shaft 28.
5. Apply the lubricant on the O-ring 47.  
Silicone grease can be used.
6. Use a lubricant to lubricate the bore shaft sleeve 23.

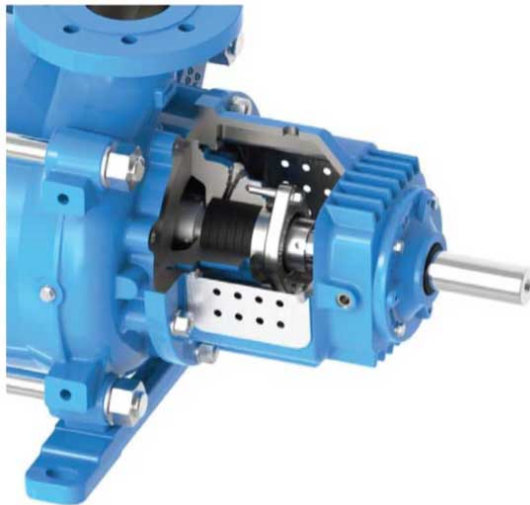


Figure 118

7. Check that the recess for the O-ring is clean.
8. Push the shaft sleeve 23 on the shaft 28.
9. Check that the O-ring 47 can easily slip into the groove.
10. Slide on the stuffing box housing 115 while paying attention to the direction of the pin 45 (groove in the bearing cover).
11. Insert new packing rings 117 and slightly fix the stuffing box gland 116 with the nuts 121.  
For more information about the packing rings, see [Stuffing box](#) on page 68.  
For more information, see [Assemble steps for all shaft seals](#) on page 99.

### 7.6.9 Assemble steps for all shaft seals

1. Insert the shaft sleeve key 31.

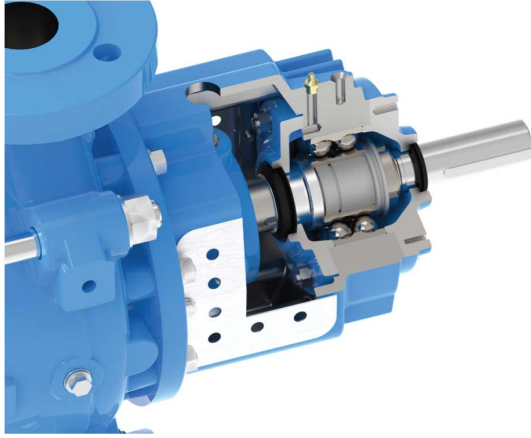


Figure 119

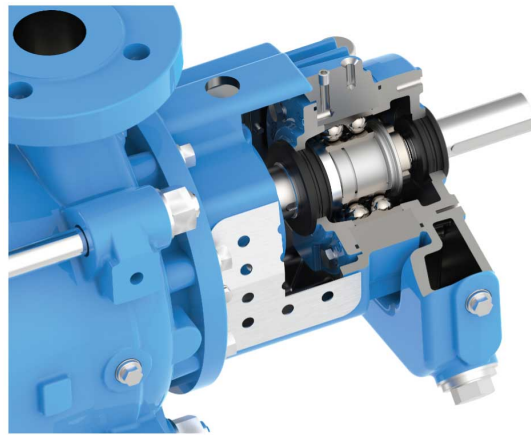


Figure 120

2. Slide the spacer sleeve 20 with the bearing cover 2 and the V-ring 21 or labyrinth ring 84 onto shaft 28.
3. Slide the bearing bracket 3 onto the seal cover 5.
4. Attach the bearing bracket with the nuts 58 and washers 59 to the discharge casing.
5. Tighten the bearing cover 2 with the nuts 36 and washers 38 on the bearing bracket.
6. Push the V-ring 21 on the bearing cover 3 or insert the labyrinth ring 84.
7. Install the roller bearing.

For more information, see [Assemble the grease lubricated roller bearings \(all designs\)](#) on page 76 or [Assemble the oil lubricated roller bearings \(all designs\)](#) on page 78.

8. Turn the shaft 28 to check for free movement.

## 7.7 Replace the balancing drum

- The replacement must be done from the discharge side.
- During the replacement of the balancing drum, the hydraulic part must be assembled.
- The balancing bush can get replaced on the assembled hydraulic part.
- All removed parts must be cleaned and their condition checked. In case of doubt components have to be replaced.
- Wear parts like roller bearings and O-ring seals must always be replaced.
- If components or semi-open pumps are stored for time, must be protected against dirt and corrosion.
- For more information, see [Precautions](#) on page 72 to [Prepare the pump](#) on page 74.

### 7.7.1 Disassemble the balancing drum

1. Remove the bearing bracket.  
For more information, see [Replace the bearings](#) on page 74.
2. Remove the shaft seal.  
For more information, see [Replace the shaft seal](#) on page 82.  
O-ring 47 is already removed.
3. Remove the drum nut 24.

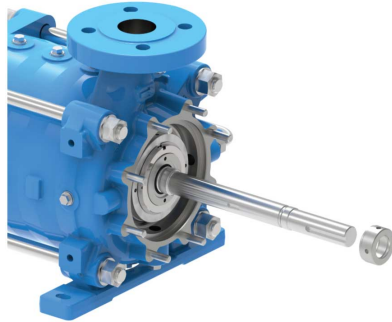


Figure 121: Sizes 50 and 65

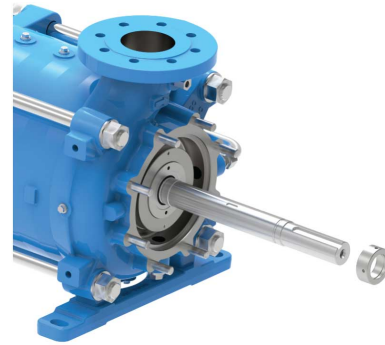


Figure 122: Sizes 100, 125, and 150

4. Remove the O-ring 81.
5. For casing material ductile iron, remove the two set screws from the drum 26.

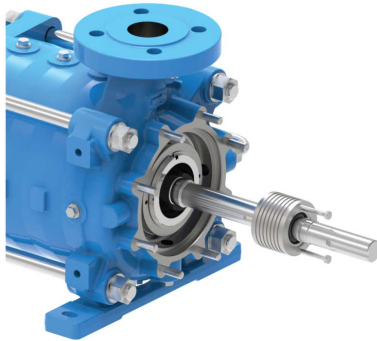


Figure 123

6. Screw in the two puller screws in the threaded holes.
7. Use the puller screws to remove the drum 26.

### 7.7.2 Assemble the balancing drum

1. Clean all the parts.
2. Check for wear and damage in all the parts.  
If there is a wear or damage, replace the parts.
3. Lubricate the drum 26 in the bore.
4. Push the drum onto the shaft 28 to the hub of the impeller 11.
5. Use the lubricant to lubricate the O-ring 81.
6. Push the O-ring 81 into the recess of the drum 26.
7. Use a hook wrench to tighten the drum nut 24.
8. Turn the drum nut back by 30°.
9. Install the shaft seal.  
For more information, see [Replace the shaft seal](#) on page 82.

## 7.8 Replace the hydraulic parts

- If components or semi-open pumps are stored for time, must be protected against dirt and corrosion.
- All removed parts must be cleaned and their condition checked. In case of doubt components have to be replaced.
- Wear parts, roller bearing, and seals must always be replaced.
- All O-rings and gaskets must be replaced.
- If components or semi-open pumps are stored for any period of time, they must be protected against dirt and corrosion.

### 7.8.1 Disassemble the hydraulic part

- If the pump is disassembled for maintenance, it should be placed vertically with the suction casing facing up. In this case a work plate with a hole is very helpful (about 0.5 in (10 mm) larger than the shaft).
- The pump can be placed on the coupling guard adapter.




---

#### **WARNING: Risk of pinching!**

Tilting the pump

---

- Wear proper personal protective footwear and gloves.
  - Secure the pump against tilting by fixing the discharge casing on a fixing bracket.
1. Remove the balancing pipe 10 from the suction casing 6 and discharge casing 8.



Figure 124: MPA

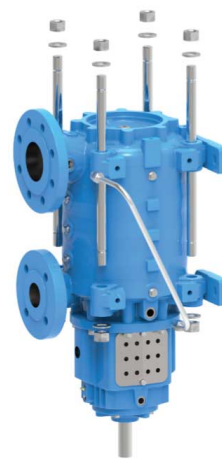


Figure 125: MPR

2. Remove the tie bolt nuts 35 and washers 34.
3. Remove the tie bolt 33.
4. Use a soft mallet and slightly tap on the suction casing 6 to loosen the suction casing 6.





Figure 126: MPA



Figure 127: MPR

5. Remove the suction casing 6 and the O-ring 49.
6. Remove the threaded pin 69.
7. Slightly heat the set screws.
8. Remove the grub screw (setscrew).
9. Pull the slide bearing sleeve 70.



Figure 128

### 7.8.2 Disassemble the hydraulic part MPD

1. Remove the suction side bearing bracket.  
For more information, see [Replace the bearings](#) on page 74.
2. Remove the shaft seal.  
For more information, see [Replace the shaft seal](#) on page 82.
3. Remove the balancing pipe 10 from the suction casing 6 and discharge casing 8.



Figure 129

4. Remove the tie bolt nuts 35 and washers 34.
5. Pull the tie bolts 33 out of the bosses.
6. Use a soft mallet and slightly tap on the suction casing 6 to loosen the suction casing 6.
7. Remove the suction casing 6 and the O-ring 49.

### 7.8.3 Disassemble the hydraulic part MPA, MPD, and MPR

1. Remove the impeller nuts 27.
2. Remove the suction impeller 14.



Figure 130

3. Mark the suction impeller to identify from the other stage impellers.



Figure 131

4. Use a soft mallet and slightly tap on the bosses to remove the stage casing 7.
5. Number the stage casings for reassembly in same order as initial assembly.
6. Remove the stage casing 7, O-ring 49, and diffuser 13.



Figure 132



Figure 133

7. Remove the key 29.
8. Disassemble the impeller 11, stage casing 7, and diffuser 13 in steps to the discharge casing.
9. Number the impellers 11 for reassembly in same order as initial assembly.  
The last key 30 must not be removed from the shaft.

## 7.9 Assemble the hydraulic parts

1. Clean all the parts.
2. Check for wear and damage in all the parts.  
If there is a wear or damage, replace the parts.  
O-rings, rolling bearings, and shaft seals must be replaced during pump maintenance.
3. Put the pump vertically.
4. Use the fixing bracket to hold the discharge casing.  
It prevents the discharge casing from falling.
5. Keep the impellers 11 and stage casings 7 in the same order as the initial assembly.

6. Lubricate the last impeller 11 in the bore.
  7. Push the last impeller 11 onto the shaft 28 to the discharge casing.
  8. Use the silicone grease to lubricate the O-ring 49.
  9. Install the O-ring 49 on the stage casing 7.
  10. Put the stage casing 7 on the discharge casing 8.
  11. Press the stage casing 7 into the discharge casing 8.
  12. Insert the key 29.
  13. Slide on the diffuser 13.
  14. Check that the twist fixing bosses of the stage casing 7 are kept between the two diffuser blades.
  15. Assemble the following parts in the order below until the first suction impeller 14:
    - Next impeller 11
    - Stage casing 7 with O-ring 49
    - Diffuser 13
    - Key 29

The suction impeller 14 must be installed last as it was the first impeller to be removed.
  16. Tighten the first impeller nut 27.
  17. Install the second impeller nut 27 on the first impeller nut.
  18. Use the hook wrench to hold the second impeller nut 27 in its position.
  19. Turn back the first impeller nut 27 to lock the two impeller nuts.
- For more information, see [Impeller nuts](#) on page 115.



Figure 134

**NOTICE:**

- When installing the stage casings 7 make sure that the O-ring 49 slips into the provided recess and that it is not damaged.
- Make sure that the drain plugs are oriented vertically downwards and the mounting bosses are aligned horizontally in the axis.
- Tap the stage casing 7 with a soft mallet until it stops.
- Alternatively press the stage casing 7 into the centering by means of clamps. Use water as assembly lubricant.
- Lubricate all pump O-rings using an O-ring manufacture's approved lubricant compatible with both the O-ring material and the pumped fluid. For potable water services use NSF approved P-80 or other NSF approved lubricant.
- The selected O-ring lubricant may also be used to lubricate the pump shaft, during assembly.

### 7.9.1 Assemble the hydraulic part MPA and MPR

Install the plain bearing.

For more information, see [Assemble the plain bearing MPA and MPR](#) on page 81.

### 7.9.2 Assemble the hydraulic part MPA, MPD, and MPR (mount the suction casing)

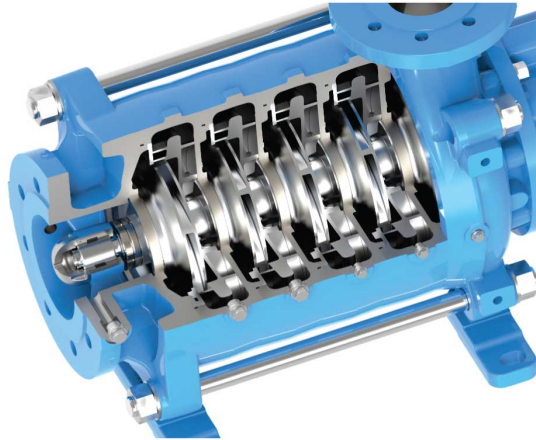


Figure 135

1. Check the O-ring 49 for damages.  
If damaged, replace the O-ring 49.
2. Check that the O-ring 49 is in correct position in the recess.
3. Use the silicone grease to lubricate the O-ring 49.
4. Install the O-ring 49 on the suction casing 6.
5. Put the suction casing 6 on the centering of the first stage casing 7.
6. Assemble the suction casing 6 by light blows on the stage casing 7.
7. Insert the tie bolts 33.
8. Put the pump feet on a flat surface.  
It must be a machined flat surface.
9. Align the pump feet.
10. Install the tie bolt nuts 35 and washers 34.
11. Use a torque wrench to tighten the bolts.  
For more information, see [Torque specification](#) on page 113.
12. Apply the torque in a 5 point pattern.
  - a) Tighten the first tie bolt but not to full torque, go to the tie bolt 180° across and tighten and torque.
  - b) Move to right then tighten and torque, move 180° tighten and torque, move back to first tie bolt and torque.

## 7.10 Replace the wear ring

The wear rings 15 and 12 are standard for the material versions NNN, RNN, and RRR. For the material version DNC wear rings can be installed optionally.

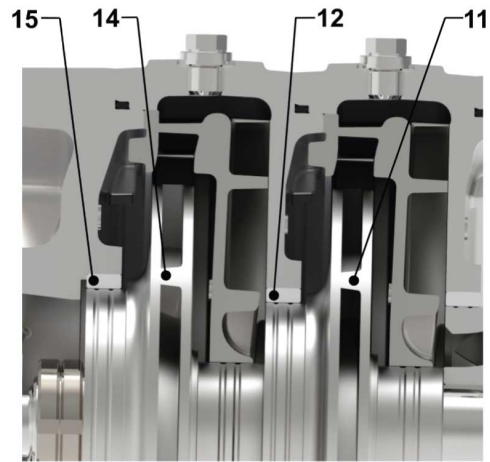


Figure 136

The wear rings 15 and 12 in the suction casing or in the stage casing are:

- Welded for material Stainless Steel (N), Duplex (R) and replaced with the casing.
- Glued in for material Ductile Iron (D) and can be replaced separately.

## 7.11 Assemble the complete disassembled pump

To assemble a completely disassembled pump request the Standard Works Instruction.

# 8 Troubleshooting

## 8.1 The main switch is on, but the electric pump does not start

The troubleshooting instructions in the tables below are for installers only.

Cause	Remedy
The thermal protector incorporated in the pump (if any) has tripped.	Wait until the pump has cooled down. The thermal protector will automatically reset.
The protective device against dry running has tripped.	Check the liquid level in the tank, or the mains pressure.

## 8.2 The electric pump starts, but the thermal protection trips a varying time after

Cause	Remedy
There are foreign objects (solids or fibrous substances) inside the pump which have jammed the impeller.	Contact the Sales and Service Department.
The pump is overloaded because it is pumping liquid that is too dense and viscous.	Check the actual power requirements based on the characteristics of the pumped liquid and then contact the Sales and Service Department.

## 8.3 The pump runs but delivers too little or no liquid

Cause	Remedy
The pump is clogged.	Contact the Sales and Service Department.

## 8.4 The main switch is on, but the electric pump does not start

Cause	Remedy
There is no power supply.	<ul style="list-style-type: none"> <li>Restore the power supply.</li> <li>Make sure all electrical connections to the power supply are intact.</li> </ul>
The thermal protector incorporated in the pump (if any) has tripped.	Wait until the pump has cooled down. The thermal protector will automatically reset.
The thermal relay or motor protector in the electric control panel has tripped.	Reset the thermal protection.
The protective device against dry running has tripped.	Check the: <ul style="list-style-type: none"> <li>liquid level in the tank, or the mains pressure.</li> <li>protective device and its connecting cables.</li> </ul>
The fuses for the pump or auxiliary circuits are blown.	Replace the fuses.

## 8.5 The electric pump starts, but the thermal protector trips or the fuses blow immediately after

Cause	Remedy
The power supply cable is damaged.	Check the cable and replace as necessary.



Cause	Remedy
The thermal protection or fuses are not suited for the motor current.	Check the components and replace as necessary.
The electric motor is short circuit.	Check the components and replace as necessary.
The motor overloads.	Check the operating conditions of the pump and reset the protection.

## 8.6 The electric pump starts, but the thermal protector trips or the fuses blow a short time after

Cause	Remedy
The electrical panel is situated in an excessively heated area or is exposed to direct sunlight.	Protect the electrical panel from heat source and direct sunlight.
The power supply voltage is not within the working limits of the motor.	Check the operating conditions of the motor.
A power phase is missing. Motor is overloaded or voltage / current exceeds allowable unbalance as permitted by the motor manufacture	Check the <ul style="list-style-type: none"> <li>• power supply</li> <li>• electrical connection</li> </ul>

## 8.7 The electric pump starts, but the thermal protector trips a varying time after

Cause	Remedy
There are foreign objects (solids or fibrous substances) inside the pump which have jammed the impeller.	Contact the local sales and service representative.
The pumps delivery rate is higher than the limits specified on the data plate.	Partially close the ON-OFF valve down stream until the delivery rate is equal or less than the limits specified on the data plate.
The pump is overloaded because it is pumping liquid that is too dense and viscous.	Check the actual power requirements based on the characteristics of the pumped liquid and replace the motor accordingly.
The motor bearings are worn.	Contact the local sales and service representative.

## 8.8 The electric pump starts, but the system's general protection is activated

Cause	Remedy
A short circuit in the electrical system.	Check the electrical system.

## 8.9 The electric pump starts, but the system's residual current device (RCD) is activated

Cause	Remedy
There is an ground (earth) leakage.	Check the insulation of the electrical system components.

## 8.10 The pump runs but delivers too little or no liquid

Cause	Remedy
There is air inside the pump or the piping.	<ul style="list-style-type: none"> <li>• Bleed the air</li> </ul>

Cause	Remedy
The pump is not correctly primed.	Stop the pump and repeat the prime procedure. <ul style="list-style-type: none"> <li>• Check that the mechanical seal is not leaking.</li> <li>• Check the suction pipe for perfect tightness.</li> <li>• Replace any valves that are leaking.</li> </ul>
The throttling on the delivery side is too extensive.	Open the valve.
Valves are locked in closed or partially closed position.	Disassemble and clean the valves.
The pump is clogged.	Contact the local sales and service representative.
The piping is clogged.	Check and clean the pipes.
The rotation direction of the impeller is wrong. (three-phase version)	Change the position of two of the phases on the terminal board of the motor or in the electric control panel.
The suction lift is too high or the flow resistance in the suction pipes is too great.	Check the operating conditions of the pump. If necessary, do the following: <ul style="list-style-type: none"> <li>• Decrease the suction lift</li> <li>• Increase the diameter of the suction pipe.</li> </ul>

For any other situation not contemplated in these tables, contact the local sales and service representative.

### 8.11 The electric pump stops, and then rotates in the wrong direction

Cause	Remedy
There is a leakage in one or both of the following components: <ul style="list-style-type: none"> <li>• The suction pipe</li> <li>• The foot valve or the check valve</li> </ul>	Repair or replace the faulty component.
There is air in the suction pipe.	Bleed the air.

### 8.12 The pump starts up too frequently

Cause	Remedy
There is a leakage in one or both of the following components: <ul style="list-style-type: none"> <li>• The suction pipe</li> <li>• The foot valve or the check valve</li> </ul>	Repair or replace the faulty component.
There is a ruptured membrane or no air pre-charge in the pressure tank.	See the relevant instructions in the pressure tank manual.

### 8.13 The pump vibrates and generates too much noise

Cause	Remedy
Pump cavitation	Reduce the required flow rate by partially closing the ON-OFF valve downstream from the pump. If the problem persists check the operating conditions of the pump (for example height difference, flow resistance, liquid temperature).
The motor bearings are worn.	Contact the local sales and service representative.
There are foreign objects inside the pump.	Contact the local sales and service representative.

For any other situation, contact the local sales and service representative.

# 9 Technical Specification

## 9.1 Torque specification

### 9.1.1 Tightening torques of the pump screws

Pump					Tie bolt nut				Bearing bracket			
Size	Design	Material code	Maximum operating pressure		Pos.	# x Size	Tightening torque		Pos.	# x Size	Tightening torque	
			psi	bar			lb-ft	Nm			lb-ft	Nm
50A	MPA	NNN, RRR	0 .. 580.2	0 .. 40	33	4	143.8	195	58	8	31	42
50B	MPR	DNC	913.7	63	35	M20x1.5	225	305	60	M10		
	MPD	RNN, RRR	913.7	63								
		TTT	913.7	63								
65A	MPA	NNN, RRR	0 .. 580.2	0 .. 40	33	4	265.5	360	58	8	51.6	70
65B	MPR	DNC	913.7	63	35	M24x2	416.7	565	60	M12		
	MPD	RNN, RRR	913.7	63								
		TTT	913.7	63								
	MPA	DNC	1450.4	100	33	8	265.5	360	58	8	62.7	85
	MPR	RNN, RRR	1450.4	100	35							
	MPD	TTT	1450.4	100								
100A	MPA	NNN, RRR	0 .. 580.2	0 .. 40	33	4	453.6	615	58	8	88.5	120
100B	MPR	DNC	913.7	63	35	M30x2	715.4	970	60	M16		
	MPD	RNN, RRR	913.7	63								
		TTT	913.7	63								
	MPA	DNC	1450.4	100	33	8	442.5	600	58	8	132.	180
	MPR	RNN, RRR	1450.4	100	35							
	MPD	TTT	1450.4	100								
125A	MPA	NNN, RRR	0 .. 580.2	0 .. 40	33	4	774.9	1010	58	8	103.	140
125B	MPR	DNC	913.7	63	35	M33x2	1172.7	1590	60	M16	3	
	MPD	RNN, RRR	913.7	63								
		TTT	913.7	63								
	MPA	DNC	1450.4	100	33	8	818.7	1110	58	8	132.	180
	MPR	RNN, RRR	1450.4	100	35							
	MPD	TTT	1450.4	100								
150A	MPA	DNC	0 .. 580.2	0 .. 40	33	8	516.3	700	58	8	177	240
150B	MPR	RNN, RRR	0 .. 580.2	0 .. 40	35	M33x2	811.3	1100	60	M20		
	MPD	DNC	913.7	63								
		RNN, RRR	913.7	63								
	MPA	DNC	1450.4	100	33	8	1224.4	1660	58	8	265.	360
	MPR	RNN, RRR	1450.4	100	35							
	MPD	TTT	1450.4	100								

Pump					Bearing cover				Support foot			
Size	Design	Material code	Maximum operating pressure		Pos.	# x Size	Tightening torque		Pos.	# x Size	Tightening torque	
			psi	bar			lb-ft	Nm			lb-ft	Nm
50A 50B	MPA	NNN, RRR	0 .. 580.2	0 .. 40	36	4 M8	11.1	15	50	2 x 2 M12 5 M12	44.3	60
	MPR	DNC	913.7	63	37							
	MPD	RNN, RRR	913.7	63	39							
		TTT	913.7	63	111 <sup>6</sup>							
65A 65B	MPA	NNN, RRR	0 .. 580.2	0 .. 40	36	4 M8	11.1	15	50	2 x 2 M12 5 M12	44.3	60
	MPR	DNC	913.7	63	37							
	MPD	RNN, RRR	913.7	63	39							
		TTT	913.7	63	111							
	MPA	DNC	1450.4	100	36	4 M8	11.1	15	50	2 x 2 M12	44.3	60
	MPR	RNN, RRR	1450.4	100	37							
	MPD				39							
		TTT	1450.4	100	111							
100A 100B	MPA	NNN, RRR	0 .. 580.2	0 .. 40	36	4 M8	11.1	15	50	2 x 2 M12 5 M12	81.1	110
	MPR	DNC	913.7	63	37							
	MPD	RNN, RRR	913.7	63	39							
		TTT	913.7	63	111							
	MPA	DNC	1450.4	100	36	4 M8	11.1	15	50	2 x 2 M12	81.1	110
	MPR	RNN, RRR	1450.4	100	37							
	MPD				39							
		TTT	1450.4	100	111							
125A 125B	MPA	NNN, RRR	0 .. 580.2	0 .. 40	36	4 M10	18.4	25	50	2 x 2 M20 4 x 2 M16	147.5	200
	MPR	DNC	913.7	63	37							
	MPD	RNN, RRR	913.7	63	39							
		TTT	913.7	63	111							
	MPA	DNC	1450.4	100	36	4 M10	18.4	25	50	2 x 2 M20	147.5	200
	MPR	RNN, RRR	1450.4	100	37							
	MPD				39							
		TTT	1450.4	100	111							

<sup>6</sup> only for eMPD oil lubricated & eMPDP in place of 36, 37

Pump					Bearing cover				Support foot			
Size	Design	Material code	Maximum operating pressure		Pos.	# x Size	Tightening torque		Pos.	# x Size	Tightening torque	
			psi	bar			lb-ft	Nm			lb-ft	Nm
150A	MPA	DNC	0 .. 580.2	0 .. 40	36	4 M10	18.4	25	50	2 x 2 M20 4 x 2 M16	147.5	200
150B	MPR	RNN, RRR	0 .. 580.2	0 .. 40	37							
	MPD	DNC	913.7	63	39							
		RNN, RRR	913.7	63	111							
		TTT	913.7	63								
	MPA	DNC	1450.4	100	36	4 M10	18.4	25	50	2 x 2 M20	147.5	200
	MPR	RNN, RRR	1450.4	100	37							
	MPD				39							
		TTT	1450.4	100	111							

### 9.1.2 Anchor bolts

Thread size (mm)	Tightening torque	
	(lb-ft)	(Nm)
M12	44.3	60
M16	81.1	110
M20	147.5	200
M24	258.1	350
M27	390.9	530

### 9.1.3 Impeller nuts

Pump	1st inner Impeller nut				2nd outer Impeller nut			Self-locking Bearing nut			
Size	Pos	Size	Tightening torque M1		Pos	Size	Tightening torque M2	Pos	Size	Tightening torque	
			lbf.ft	Nm						lbf.ft	Nm
50A 50B	27	M35 x1,5	by hand / 73.8	by hand /100	27	M35 x1,5	by hand / fixed when tightening the 1st impeller nut	17	M35 x1,5	59	80
65A 65B	27	M40 x1,5	by hand / 103.3	by hand /140	27	M40 x1,5		17	M38 x1,5	95.9	130
100A 100B	27	M50 x1,5	by hand / 132.8	by hand /180	27	M50 x1,5		17	M48 x1,5	118	160
125A 125B	27	M60 x2	by hand /17 7	by hand /240	27	M60 x2		17	M55 x2	147.5	200
150A 150B	27	M70 x2	by hand / 221.3	by hand /300	27	M70 x2		17	M65 x2	184.4	250

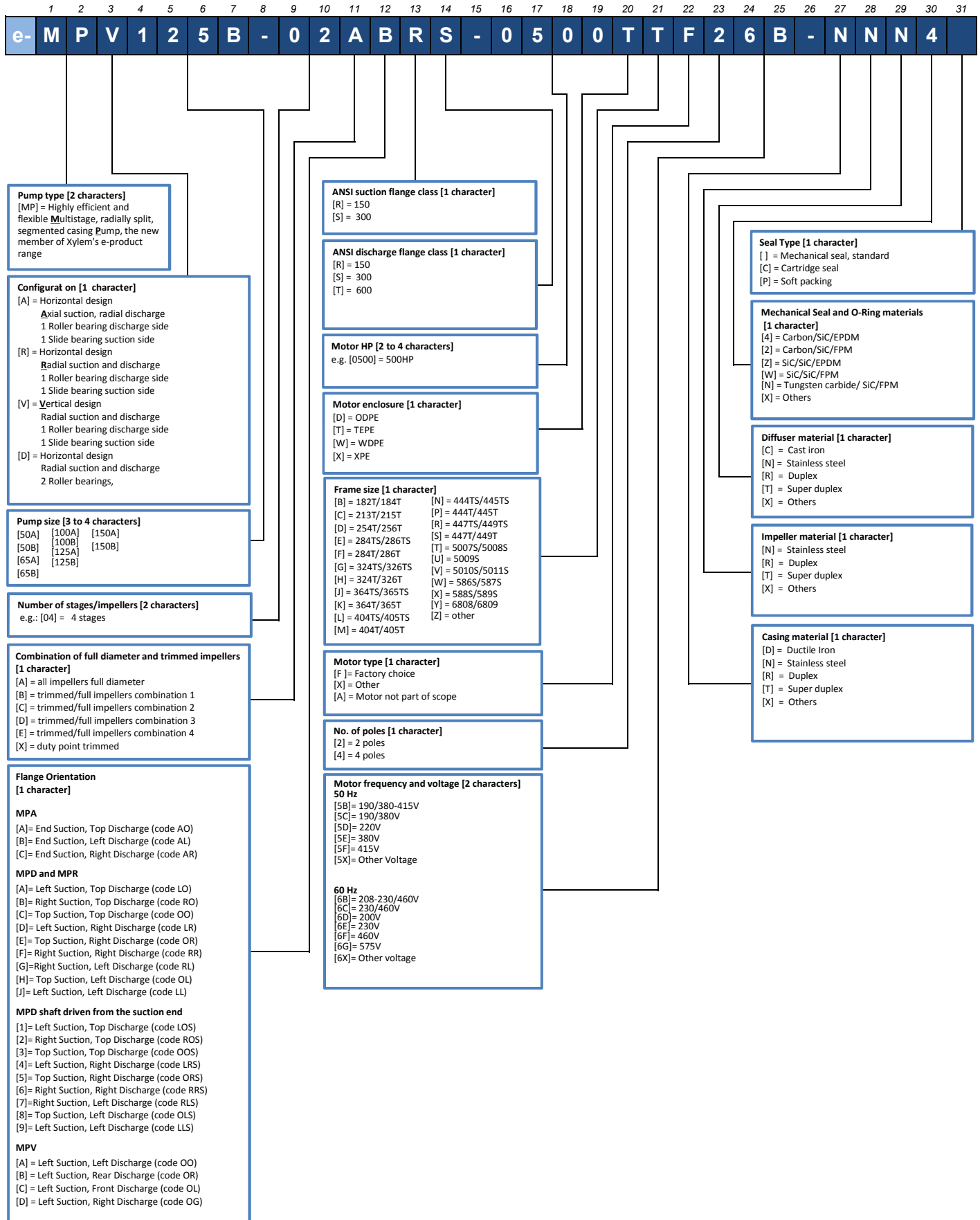
## 9.1.4 Plugs

Position	Size	Tightening torque	
		(lb-ft)	(Nm)
42, 43, 89, 91, 93, 95, 97	G 1/4"	11.1	15
	G 3/8"	22.1	30
	G 1/2"	36.9	50
	G 3/4"	88.5	120
	G 1"	147.5	200

## 9.2 Pump data Mechanical Seals and Coupling sizes

Size	Mechanical seal Dm, mm	Coupling Dc, mm
50A, 50B	38	28 j6
65A, 65B	43	35 k6
100A, 100B	55	45 k6
125A, 125B	65	52 k6
150A, 150B	75	60 m6

# 9.3 Product name



**EXAMPLES:****Pump coupled with motor**

MPV125B-02ABRS-0500TTF26B-NNN4

Series eMP, vertical configuration, radial suction and discharge, size DN125, hydraulic B, 2 stages/impellers, all impellers with full diameter, flange orientation: left suction and rear discharge, ANSI suction flange class 150, ANSI discharge flange class 300, 500HP factory choice motor with TEPE enclosure, 5009SD frame size, 2 poles, 60Hz at 208-230/460V, stainless steel casings, stainless steel impeller, stainless steel diffusers, mechanical seal Carbon/SiC/EPDM.

**Pump mounted on frame, with coupling, motor not part of scope**

MPV125B-02ABRS-0500TT A26B-NNN4

Series eMP, vertical configuration, radial suction and discharge, size DN125, hydraulic B, 2 stages/impellers, all impellers with full diameter, flange orientation: left suction and rear discharge, ANSI suction flange class 150, ANSI discharge flange class 300, to be used with motor frame size 5009SD, 2 poles (motor not part of scope), stainless steel casings, stainless steel impeller, stainless steel diffusers, mechanical seal Carbon/SiC/EPDM.

**Bareshaft pump (only for horizontal configurations)**

MPA125B-02AARS-NNN4

Series eMP, horizontal configuration, radial suction and discharge, size DN125, hydraulic B, 2 stages/impellers, all impellers with full diameter, flange orientation: end suction and top discharge, ANSI suction flange class 150, ANSI discharge flange class 300, motor and coupling not part of scope, stainless steel casings, stainless steel impeller, stainless steel diffusers, mechanical seal Carbon/SiC/EPDM.

**NOTE:**

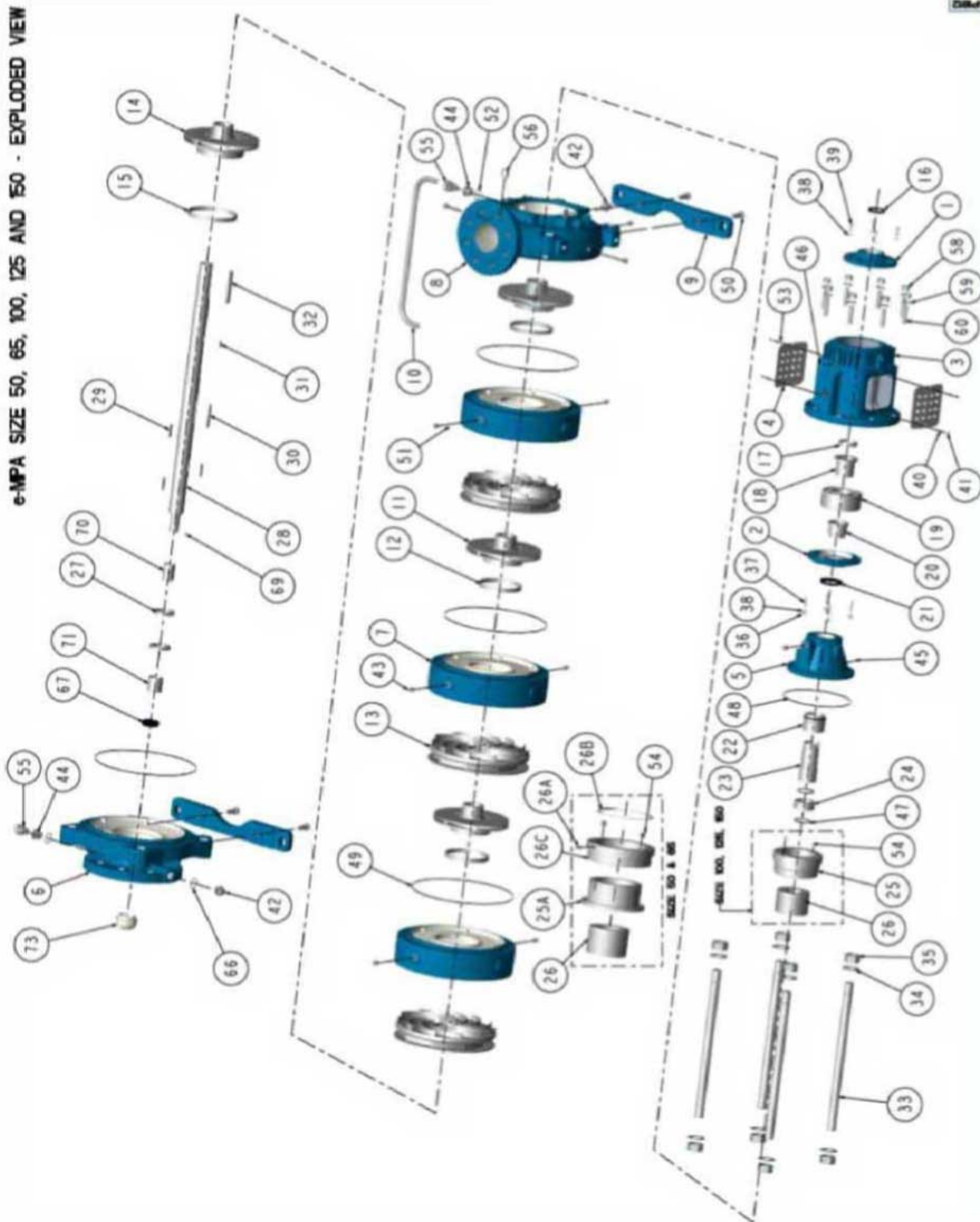
1. "e-" in front of MP is used for all marketing materials and in the selection tools
2. "e-" in front of MP is NOT used on the name plate and NOT in denomination of pumps
3. Not used nomenclature characters, e.g. if the digit description is [ ] are skipped and the next used digit is shifted to the left



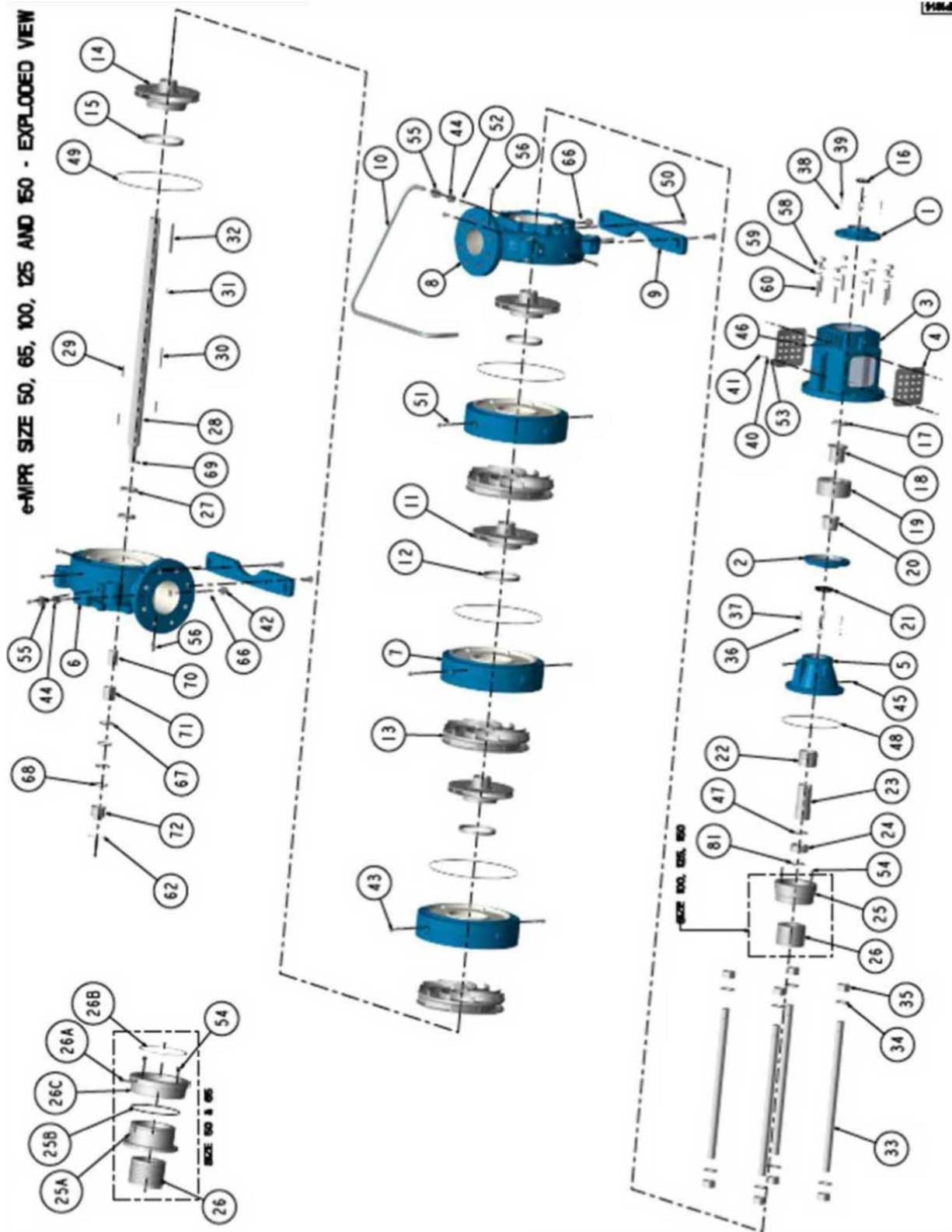
# 10 Exploded View

## 10.1 Exploded view

MPA - Sizes 50, 65, 100, 125, and 150

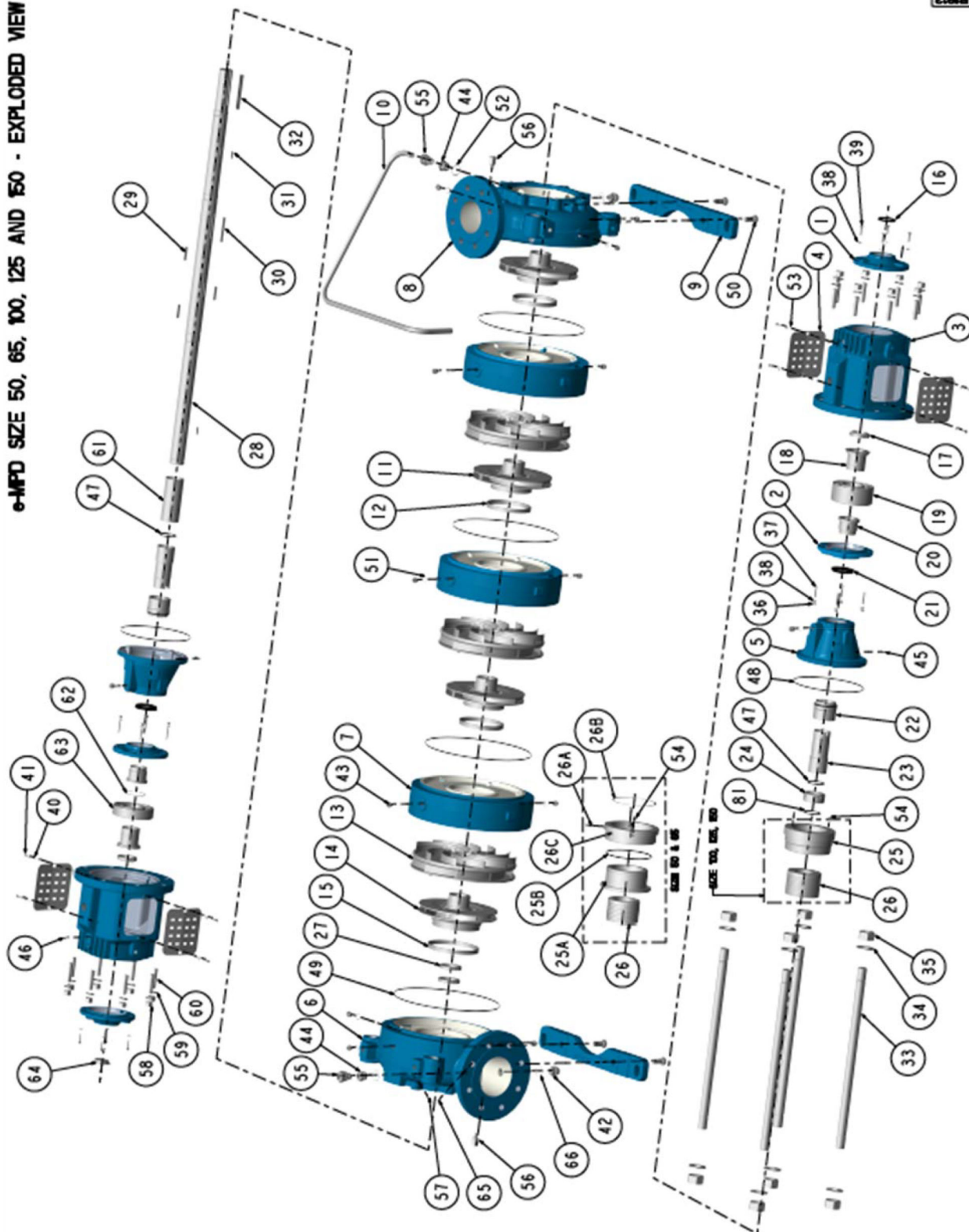


MPR - Sizes 50, 65, 100, 125, and 150

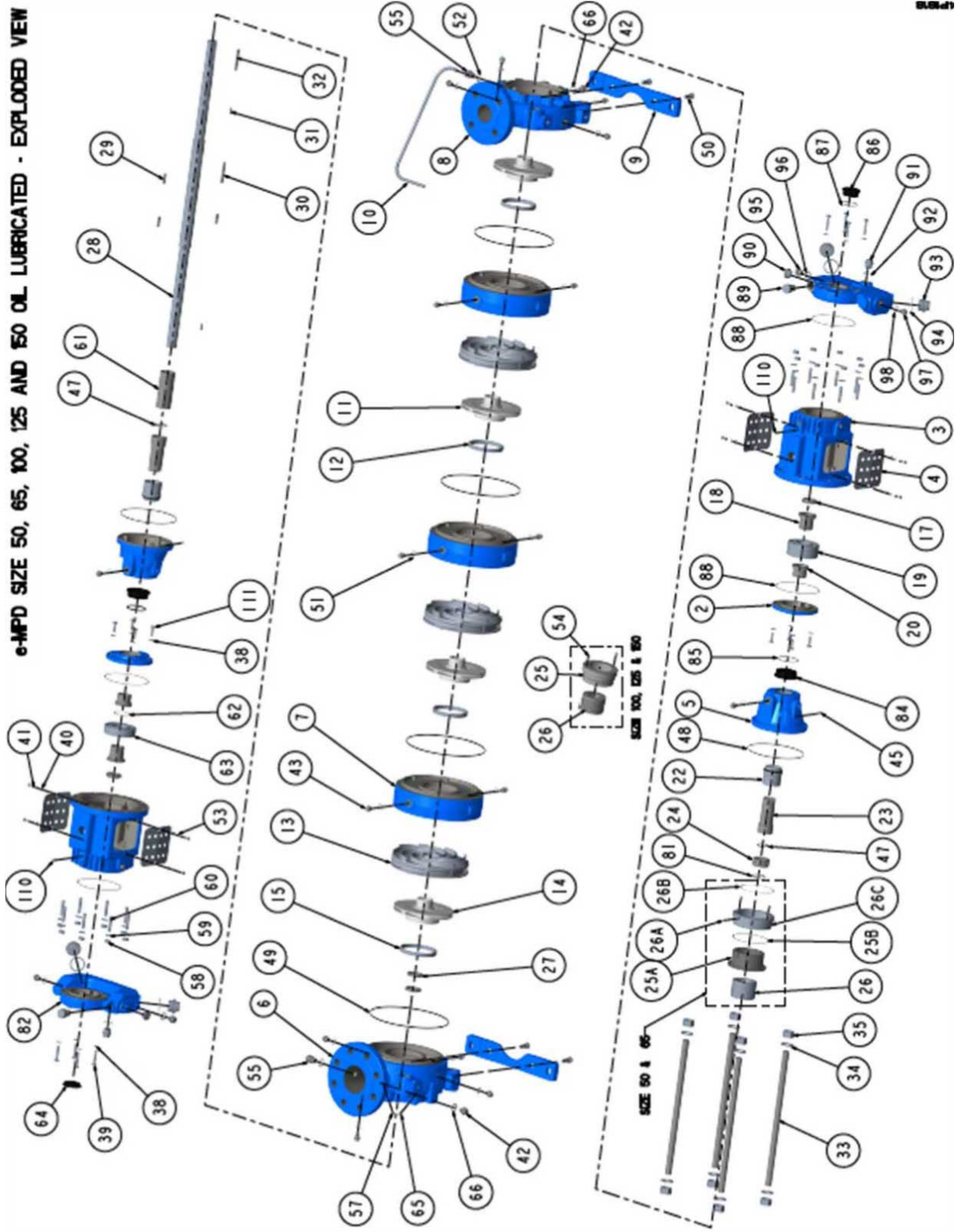


MPD - Sizes 50, 65, 100, 125, and 150

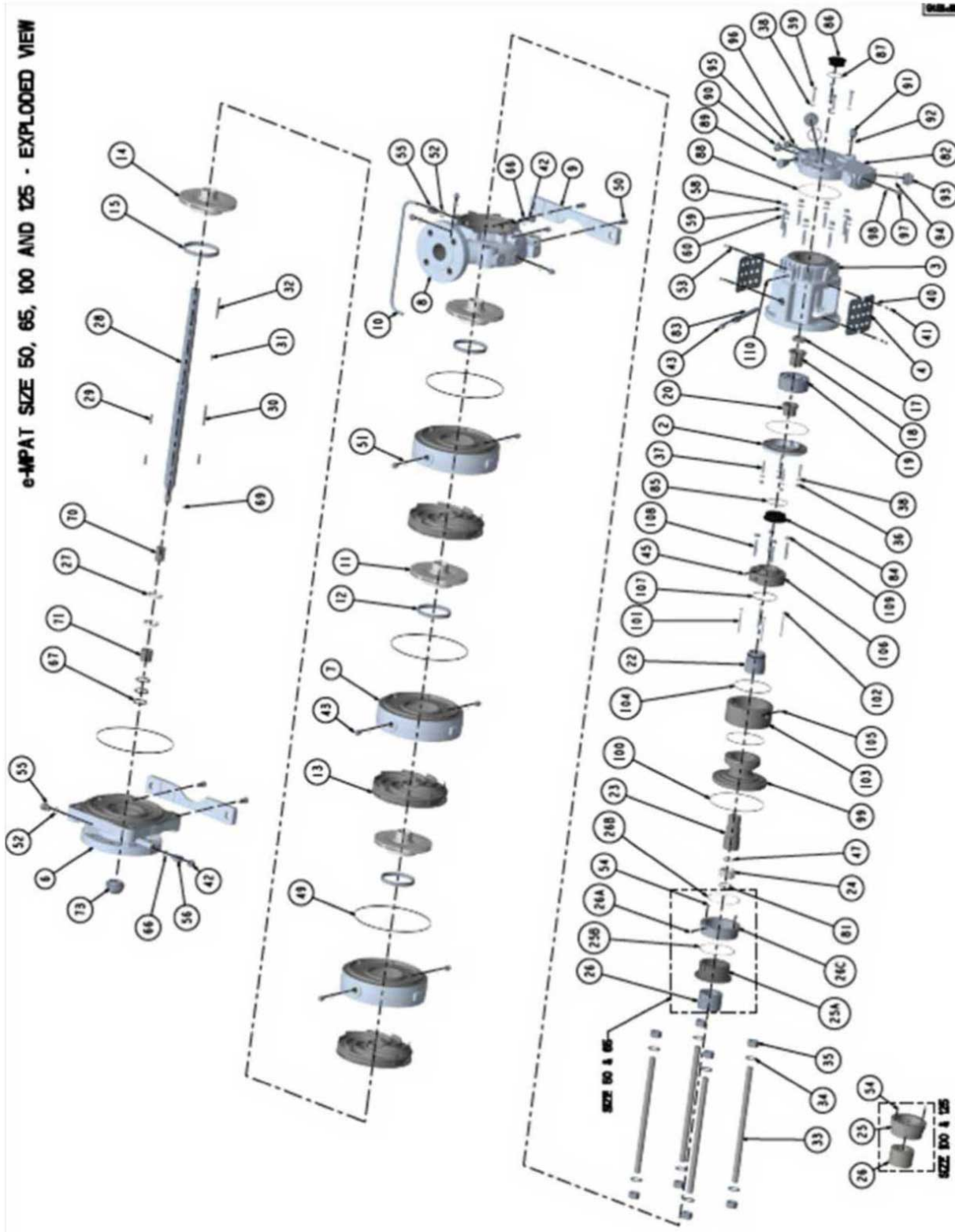
e-MPD SIZE 50, 65, 100, 125 AND 150 - EXPLODED VIEW



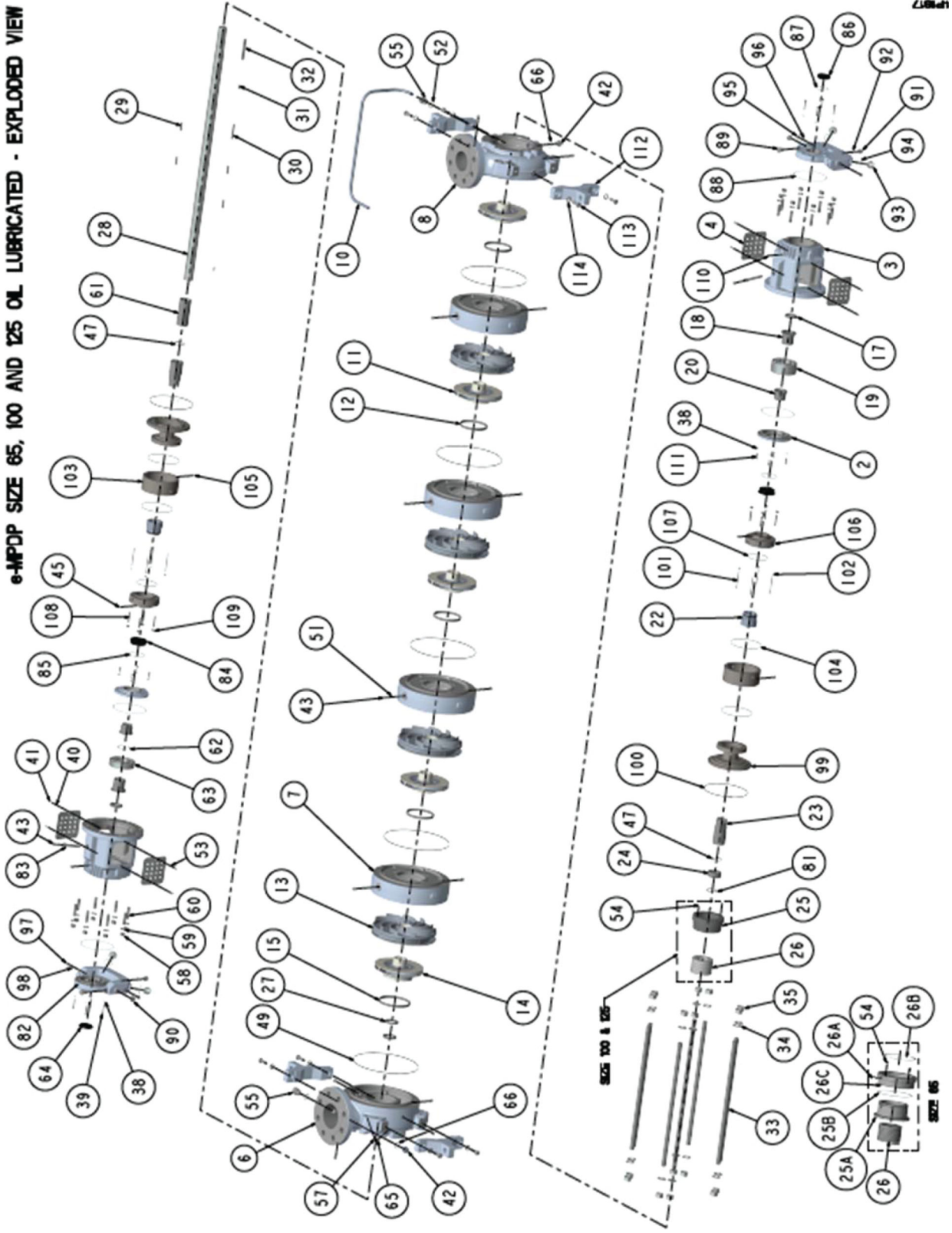
MPD - Sizes 50, 65, 100, 125, and 150



MPAT - Sizes 50, 65, 100, and 125



MPDP - Sizes 65, 100, and 125 oil lubricated



No.	PART	eMPA	eMPR	eMPD	eMPD Oil Lub.	eMPDP	eMPAT	Note	Cool	Oil
1	BEARING COVER-MOTOR	x	x	x				Coupling side		
2	BEARING COVER-PUMP	x	x	x	x	x	x	Pump side		
3	BEARING BRACKET	x	x	x	x	x	x			
4	SHAFT SAFETY GUARD	x	x	x	x	x	x			
5	SEAL COVER	x	x	x	x					
6	SUCTION CASING	x	x	x	x	x	x			
7	STAGE CASING	x	x	x	x	x	x			
8	DISCHARGE CASING	x	x	x	x	x	x			
9	PUMP FOOT	x	x	x	x		x	Pump foot horizontal		
10	BALANCING PIPE	x	x	x	x	x	x			
11	IMPELLER	x	x	x	x	x	x			
12	WEAR RING - STAGE CASING	x	x	x	x	x	x	Impeller		
13	DIFFUSER	x	x	x	x	x	x			
14	IMPELLER-SUCTION	x	x	x	x	x	x			
15	WEAR RING-SUCTION	x	x	x	x	x	x	Suction impeller		
16	V-RING - COUPLER SIDE	x	x	x				Coupling side		
17	BEARING NUT, SELF-LOCK	x	x	x	x	x	x			
18	BEARING SLEEVE	x	x	x	x	x	x			
19	BALL BEARING - DISCHARGE END	x	x	x	x	x	x	Discharge side		
20	SPACER SLEEVE-BEARING	x	x	x	x	x	x	Drive side		
21	V-RING - PUMP SIDE	x	x	x				Pump side		
22	MECHANICAL SEAL	x	x	x	x	x	x	Mechanical seal - balanced		
23	SHAFT SLEEVE	x	x	x	x	x	x	Mechanical seal - balanced, cartridge seal, stuffing box, cooled mechanical seal	x	
24	DRUM NUT	x	x	x	x	x	x			
25	DRUM BUSHING	x	x	x	x	x	x			

No.	PART	eMPA	eMPR	eMPD	eMPD Oil Lub.	eMPDP	eMPAT	Note	Cool	Oil
26	DRUM	x	x	x	x	x	x			
25A	DRUM BUSHING	x	x	x	x	x	x	Balancing bush- size 50 & 65		
25B	O-RING, DRUM BUSHING	x	x	x	x	x	x	Balancing bush- size 50 & 65		
26A	SET SCREW, DRUM	x	x	x	x	x	x	Size 50 & 65		
26B	RETAINING RING, DRUM	x	x	x	x	x	x	Size 50 & 65		
26C	DRUM BODY	x	x	x	x	x	x	Size 50 & 65		
27	IMPELLER NUT	x	x	x	x	x	x			
28	SHAFT	x	x	x	x	x	x			
29	KEY, STAGE	x	x	x	x	x	x	Impeller		
30	KEY, LAST STAGE	x	x	x	x	x	x	Impeller & Balancing drum		
31	KEY, SHAFT SLEEVE	x	x	x	x	x	x	Shaft sleeve		
32	KEY, COUPLING	x	x	x	x	x	x	Coupling		
33	TIE BOLT	x	x	x	x	x	x			
34	WASHER	x	x	x	x	x	x	Tie bolt		
35	HEXNUT	x	x	x	x	x	x	Tie bolt		
36	HEXNUT, BEARING COVER	x	x	x			x	Bearing cover - pump side		
37	STUD, BEARING COVER	x	x	x			x	Bearing cover - pump side		
38	WASHER, BEARING COVER	x	x	x	x	x	x	Bearing cover - pump, coupling side		
39	HEXSCREW, BEARING COVER	x	x	x	x	x	x	Bearing cover - coupling side		
40	WASHER, SAFETY GUARD	x	x	x	x	x	x			
41	HEX SCREW, SAFETY GUARD	x	x	x	x	x	x			
42	THREAD PLUG, DRAIN	x	x	x	x	x	x	Suction & discharge casing - drain & flush		
43	THREAD PLUG, VENT	x	x	x	x	x	x	Stage casing, Seal cover - vent		



No.	PART	eMPA	eMPR	eMPD	eMPD Oil Lub.	eMPDP	eMPAT	Note	Cool	Oil
44	BALANCING PIPE FITTING_1	x	x	x						
45	GROOVED PIN, SEAL COVER	x	x	x	x	x	x	Seal cover, Stuffing box cover		
46	GREASE NIPPLE	x	x	x						
47	O-RING, SHAFT SLEEVE	x	x	x	x	x	x	Shaft sleeve		
48	O-RING, SEAL COVER	x	x	x	x			Seal cover		
49	O-RING, STAGE	x	x	x	x	x	x	Stages		
50	HEX SCREW, PUMP FOOT	x	x	x	x		x	Pump foot horizontal		
51	GASKET, VENT	x	x	x	x	x	x	Stage casing, Seal cover - vent & drain		
52	GASKET, BALANCING PIPE	x	x	x	x	x	x	Suction & discharge casing - balancing pipe		
53	LOCK WASHER, SHAFT SAFETY GUARD	x	x	x	x	x	x			
54	GRUB SCREW	x	x	x	x	x	x	Ductile iron pump		
55	BALANCING PIPE FITTING_2	x	x	x	x	x	x			
56	ADAPTER, PM ADAPTER	x	x	x			x	Suction & discharge PM		
57	GRUB SCREW, SUCTION CASING			x	x	x		For suction casing		
58	HEXNUT, BEARING BRACKET	x	x	x	x	x	x	Bearing bracket		
59	WASHER, BEARING BRACKET	x	x	x	x	x	x	Bearing bracket		
60	STUD, BEARING BRACKET	x	x	x	x	x	x	Bearing bracket		
61	SPACER SLEEVE			x	x	x		Pump side		
62	CIRCLIP, BEARING SUCTION		x	x	x	x				
63	BALL BEARING-SUCTION END			x	x	x		Suction side		
64	BEARING COVER PLUG			x	x	x		Non-drive side		
65	THROTTLE, SUCTION CASING			x	x	x		Suction casing		

No.	PART	eMPA	eMPR	eMPD	eMPD Oil Lub.	eMPDP	eMPAT	Note	Cool	Oil
66	GASKET, DRAIN	x	x	x	x	x	x	Suction & discharge casing - drain, flush, PM adapter		
67	O-RING, SLIDE BEARING BUSH	x	x				x	Plain bearing		
68	O-RING, SLIDE BEARING COVER		x					Plain bearing cover		
69	SET SCREW	x	x				x	Shaft - plain bearing sleeve		
70	SLIDE BEARING SLEEVE	x	x				x			
71	SLIDE BEARING BUSH	x	x				x			
72	SLIDE BEARING COVER		x							
73	CAP SUCTION	x					x			
81	O-RING, DRUM	x	x	x	x	x	x	Drum		
82	BEARING COVER_OIL				x	x	x	Coupling side		x
83	ADAPTER					x	x		x	
84	LABYRINTHRING_1				x	x	x	Labyrinth ring pump side	x	x
85	O-RING, LABYRINTHRING_1				x	x	x	Labyrinth ring pump side	x	x
86	LABYRINTHRING_2				x	x	x	Labyrinth ring drive side	x	x
87	O-RING, LABYRINTHRING_2				x	x	x	Labyrinth ring drive side	x	x
88	O-RING, BEARING COVER				x	x	x	Bearing cover	x	x
89	OIL FILLING PLUG				x	x	x			x
90	OIL LEVEL SIGHT GLASS				x	x	x			x
91	PLUG_1, BEARING COVER_OIL				x	x	x	Oil bearing cover – drain		x
92	GASKET_1, PLUG_1				x	x	x	Oil bearing cover – drain		x
93	PLUG_2, BEARING COVER_OIL				x	x	x	Oil bearing cover - oil chamber		x

No.	PART	eMPA	eMPR	eMPD	eMPD Oil Lub.	eMPDP	eMPAT	Note	Cool	Oil
94	GASKET_2, PLUG_2				x	x	x	Oil bearing cover - oil chamber		x
95	PLUG_3, BEARING COVER_OIL				x	x	x	Oil bearing cover		x
96	GASKET_3, PLUG_3				x	x	x	Oil bearing cover		x
97	PLUG_4, BEARING COVER_OIL				x	x	x	Oil bearing cover - oil level		x
98	GASKET_4, PLUG_4				x	x	x	Oil bearing cover - oil level		x
99	CASING COVER					x	x	Oil bearing cover - oil level	x	
100	O-RING, CASING COVER					x	x	Cooled casing cover	x	
101	STUD, CASING COVER					x	x	Cooled casing cover	x	
102	HEXNUT, CASING COVER					x	x	Cooled casing cover	x	
103	COOLING JACKET					x	x		x	
104	O-RING, COOLING JACKET					x	x	Cooling jacket	x	
105	GROOVED PIN, COOLING JACKET					x	x	Cooling jacket	x	
106	SEAL COVER_COOL					x	x	Seal cover – cool	x	
107	O-RING, SEAL COVER_COOL					x	x	Seal cover – cool	x	
108	STUD, SEAL COVER_COOL					x	x	Seal cover – cool	x	
109	HEXNUT, SEAL COVER_COOL					x	x	Seal cover – cool	x	
110	SET SCREW, BEARING BRACKET				x	x	x	Bearing bracket oil nipple screw	x	x
111	HEX SCREW, BEARING COVER INSIDE				x	x		Oil bearing cover inside	x	x
112	PUMP FOOT LATERAL					x		Pump foot lateral (process type)		
113	HEX SCREW, PUMP FOOT LATERAL					x		Pump foot lateral (process type) - Hexagonal socket head		

No.	PART	eMPA	eMPR	eMPD	eMPD Oil Lub.	eMPDP	eMPAT	Note	Cool	Oil
114	WASHER, PUMP FOOT LATERAL					x		Pump foot lateral (process type)		
115	STUFFING BOX HOUSING	x	x	x	x	x	x			
116	STUFFING BOX GLAND	x	x	x	x	x	x			
117	GLAND PACKING	x	x	x	x	x	x			
118	CARTRIDGE MECHANICAL SEAL	x	x	x	x	x	x			
119	SEAL COVER, CARTRIDGE SEAL	x	x	x	x	x	x	Cartridge seal		
120	STUD, CARTRIDGE SEAL	x	x	x	x	x	x	Cartridge seal		
121	HEXNUT, CARTRIDGE SEAL	x	x	x	x	x	x	Cartridge seal		
122	WASHER, CARTRIDGE SEAL	x	x	x	x	x	x	Cartridge seal		
123	O-RING, SEAL COVER_CARTRIDGE	x	x	x	x	x	x	For seal cover, Cartridge seal		
124	STUD, STUFFING BOX	x	x	x	x	x	x	Stuffing box		
125	HEXNUT, STUFFING BOX	x	x	x	x	x	x	Stuffing box		
126	WASHER, STUFFING BOX	x	x	x	x	x	x	Stuffing box		
127	O-RING, STUFFING BOX	x	x	x	x	x	x	Stuffing box		
128	LANTERN RING	x	x	x	x	x	x	Optional		
129	THROWER	x	x	x	x	x	x	Pump & coupling side		
130	CONSTANT LEVEL OILER				x	x	x	Optional		x

- For mechanical seal, cartridge and packing seals are options.
- Wear rings are standard only with stainless steel, duplex and super duplex.
- For ductile casings, wear rings are optional.
- For drum, pump size 50 and 65 drum components include drum, drum bushing, drum body, retaining ring, O-ring and set screw.
- Quantity depends on pump configuration.
- #54 only for ductile iron pumps.

# 11 Recommended spare parts and stand-by pumps

## 11.1 Ordering of spare parts

When ordering spare parts, refer to the nameplate and supply the following information:

- Config #: \_\_\_\_\_
- Production date: \_\_\_\_\_
- Type: \_\_\_\_\_

All information is given in the data sheet and / or order confirmation and the relevant sectional drawing.

The spare parts are to be selected for the conditions of a two-year continuous operation. If no other guidelines are applicable, we recommend stocking the quantity of parts listed below (in accordance with DIN 24296).

Spare parts	Pos. No.	Quantity of spare parts						
		Number of pumps (including spare pumps)						
		2	3	4	5	6 / 7	8 / 9	10 /+
Impeller	11	i	i	i	2i	2i	3i	30%
Diffuser	13	i/2	i/2	i/2	i	i	3i/2	15%
Casing/Wear ring	i/2	2i	2i	2i	4i	4i	6i	30%
Shaft with keys and nuts	28	1	1	1	2	2	2	20%
Roller bearings, Sets	19, 63	1	1	2	2	2	3	30%
Plain bearing, Sleeve + Bush	70 + 71	1	1	2	2	2	3	30%
Shaft sleeve	23	2	2	2	3	3	4	50%
O-rings for pump casings, Sets	49	4	6	8	8	9	10	100%
Other gaskets, Sets	51, 52, 66	4	6	8	8	9	10	100%
Mechanical seal	22	2	3	4	5	6	7	90%

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### NOTICE:

To ensure optimum availability, we recommend that suitable quantities of spare parts are held in stock, especially if these are made from special materials and in the case of mechanical seals, because of the longer delivery times.

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### NOTICE:

Keep spare parts in dry rooms and protected from dirt!

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## 11.2 Stand-by pumps




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### WARNING: Stand-by pump not available!

Risk of breakdown of the system.

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It is essential that a sufficient number of stand-by pumps are kept ready for use in plants where failure of a pump could endanger human life or cause damage to property or high costs. Regular checks should be carried out to ensure that such pumps are always ready for use.

For more informations, see [Temporary storage, longer periods of non-operation](#) on page 61.

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**NOTICE:**

Store spare pumps according to [Temporary storage, longer periods of non-operation](#) on page 61.

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# 12 Product Warranty

## Commercial warranty

**Warranty.** For goods sold to commercial buyers, Seller warrants the goods sold to Buyer hereunder (with the exception of membranes, seals, gaskets, elastomer materials, coatings and other "wear parts" or consumables all of which are not warranted except as otherwise provided in the quotation or sales form) will be (i) be built in accordance with the specifications referred to in the quotation or sales form, if such specifications are expressly made a part of this Agreement, and (ii) free from defects in material and workmanship for a period of twelve (12) months from the date of installation or eighteen (18) months from the date of shipment (which date of shipment shall not be greater than thirty (30) days after receipt of notice that the goods are ready to ship), whichever shall occur first, unless a longer period is specified in the product documentation (the "Warranty").

Except as otherwise required by law, Seller shall, at its option and at no cost to Buyer, either repair or replace any product which fails to conform with the Warranty provided Buyer gives written notice to Seller of any defects in material or workmanship within ten (10) days of the date when any defects or non-conformance are first manifest. Under either repair or replacement option, Seller shall not be obligated to remove or pay for the removal of the defective product or install or pay for the installation of the replaced or repaired product and Buyer shall be responsible for all other costs, including, but not limited to, service costs, shipping fees and expenses. Seller shall have sole discretion as to the method or means of repair or replacement. Buyer's failure to comply with Seller's repair or replacement directions shall terminate Seller's obligations under this Warranty and render the Warranty void. Any parts repaired or replaced under the Warranty are warranted only for the balance of the warranty period on the parts that were repaired or replaced. Seller shall have no warranty obligations to Buyer with respect to any product or parts of a product that have been: (a) repaired by third parties other than Seller or without Seller's written approval; (b) subject to misuse, misapplication, neglect, alteration, accident, or physical damage; (c) used in a manner contrary to Seller's instructions for installation, operation and maintenance; (d) damaged from ordinary wear and tear, corrosion, or chemical attack; (e) damaged due to abnormal conditions, vibration, failure to properly prime, or operation without flow; (f) damaged due to a defective power supply or improper electrical protection; or (g) damaged resulting from the use of accessory equipment not sold or approved by Seller. In any case of products not manufactured by Seller, there is no warranty from Seller; however, Seller will extend to Buyer any warranty received from Seller's supplier of such products.

**THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ANY AND ALL OTHER EXPRESS OR IMPLIED WARRANTIES, GUARANTEES, CONDITIONS OR TERMS OF WHATEVER NATURE RELATING TO THE GOODS PROVIDED HEREUNDER, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHICH ARE HEREBY EXPRESSLY DISCLAIMED AND EXCLUDED. EXCEPT AS OTHERWISE REQUIRED BY LAW, BUYER'S EXCLUSIVE REMEDY AND SELLER'S AGGREGATE LIABILITY FOR BREACH OF ANY OF THE FOREGOING WARRANTIES ARE LIMITED TO REPAIRING OR REPLACING THE PRODUCT AND SHALL IN ALL CASES BE LIMITED TO THE AMOUNT PAID BY THE BUYER FOR THE DEFECTIVE PRODUCT. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY OTHER FORM OF DAMAGES, WHETHER DIRECT, INDIRECT, LIQUIDATED, INCIDENTAL, CONSEQUENTIAL, PUNITIVE, EXEMPLARY OR SPECIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS OF PROFIT, LOSS OF ANTICIPATED SAVINGS OR REVENUE, LOSS OF INCOME, LOSS OF BUSINESS, LOSS OF PRODUCTION, LOSS OF OPPORTUNITY OR LOSS OF REPUTATION.**

## Limited consumer warranty

**Warranty.** For goods sold for personal, family or household purposes, Seller warrants the goods purchased hereunder (with the exception of membranes, seals, gaskets, elastomer

materials, coatings and other "wear parts" or consumables all of which are not warranted except as otherwise provided in the quotation or sales form) will be free from defects in material and workmanship for a period of twelve (12) months from the date of installation or eighteen (18) months from the product date code, whichever shall occur first, unless a longer period is provided by law or is specified in the product documentation (the "Warranty").

Except as otherwise required by law, Seller shall, at its option and at no cost to Buyer, either repair or replace any product which fails to conform with the Warranty provided Buyer gives written notice to Seller of any defects in material or workmanship within ten (10) days of the date when any defects or non-conformance are first manifest. Under either repair or replacement option, Seller shall not be obligated to remove or pay for the removal of the defective product or install or pay for the installation of the replaced or repaired product and Buyer shall be responsible for all other costs, including, but not limited to, service costs, shipping fees and expenses. Seller shall have sole discretion as to the method or means of repair or replacement. Buyer's failure to comply with Seller's repair or replacement directions shall terminate Seller's obligations under this Warranty and render this Warranty void. Any parts repaired or replaced under the Warranty are warranted only for the balance of the warranty period on the parts that were repaired or replaced. The Warranty is conditioned on Buyer giving written notice to Seller of any defects in material or workmanship of warranted goods within ten (10) days of the date when any defects are first manifest.

Seller shall have no warranty obligations to Buyer with respect to any product or parts of a product that have been: (a) repaired by third parties other than Seller or without Seller's written approval; (b) subject to misuse, misapplication, neglect, alteration, accident, or physical damage; (c) used in a manner contrary to Seller's instructions for installation, operation and maintenance; (d) damaged from ordinary wear and tear, corrosion, or chemical attack; (e) damaged due to abnormal conditions, vibration, failure to properly prime, or operation without flow; (f) damaged due to a defective power supply or improper electrical protection; or (g) damaged resulting from the use of accessory equipment not sold or approved by Seller. In any case of products not manufactured by Seller, there is no warranty from Seller; however, Seller will extend to Buyer any warranty received from Seller's supplier of such products.

**THE FOREGOING WARRANTY IS PROVIDED IN PLACE OF ALL OTHER EXPRESS WARRANTIES. ALL IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED TO TWELVE (12) MONTHS FROM THE DATE OF INSTALLATION OR EIGHTEEN (18) MONTHS FROM THE PRODUCT DATE CODE , WHICHEVER SHALL OCCUR FIRST. EXCEPT AS OTHERWISE REQUIRED BY LAW, BUYER'S EXCLUSIVE REMEDY AND SELLER'S AGGREGATE LIABILITY FOR BREACH OF ANY OF THE FOREGOING WARRANTIES ARE LIMITED TO REPAIRING OR REPLACING THE PRODUCT AND SHALL IN ALL CASES BE LIMITED TO THE AMOUNT PAID BY THE BUYER FOR THE DEFECTIVE PRODUCT. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY OTHER FORM OF DAMAGES, WHETHER DIRECT, INDIRECT, LIQUIDATED, INCIDENTAL, CONSEQUENTIAL, PUNITIVE, EXEMPLARY OR SPECIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS OF PROFIT, LOSS OF ANTICIPATED SAVINGS OR REVENUE, LOSS OF INCOME, LOSS OF BUSINESS, LOSS OF PRODUCTION, LOSS OF OPPORTUNITY OR LOSS OF REPUTATION.**

Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusions may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which may vary from state to state.

To make a warranty claim, check first with the dealer from whom you purchased the product or visit [www.xyleminc.com](http://www.xyleminc.com) for the name and location of the nearest dealer providing warranty service.

The product warranty can be extended to twenty-four (24) months from the date of installation or thirty (30) months from the product date code, whichever shall occur first, if



registered through the ecocirc mobile application. All other aspects of the product warranty will remain the same as stated above.





# Xylem |'zīləm|

- 1) The tissue in plants that brings water upward from the roots;
- 2) a leading global water technology company.

We're a global team unified in a common purpose: creating advanced technology solutions to the world's water challenges. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. Our products and services move, treat, analyze, monitor and return water to the environment, in public utility, industrial, residential and commercial building services settings. Xylem also provides a leading portfolio of smart metering, network technologies and advanced analytics solutions for water, electric and gas utilities. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise with a strong focus on developing comprehensive, sustainable solutions.

**For more information on how Xylem can help you, go to [www.xylem.com](http://www.xylem.com)**



[www.xylem.com/industrial](http://www.xylem.com/industrial)

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