SALINNOVA

Axial Piston Pump for High Pressure Application

NOVA Pump

Installation/Operating Manual

engineered by KSB

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Installation/Operating Manual NOVA Pump

Original operating manual

Subject to technical modification without prior notice.

Contents

Glossary

Back pressure

The pressure at the "Low Pressure Out" connection of the energy recovery device.

Certificate of decontamination

A certificate of decontamination is enclosed by the customer when returning the product to the manufacturer to certify that the product has been properly drained to eliminate any environmental and health hazards arising from components in contact with the fluid handled.

Discharge line

The line connected to the pump's "High Pressure Out" connection and the energy recovery device's "High Pressure In" connection.

Drains

No connections on the pump are required provided Boosting is not requested. In case of boosting One additional line is requested.

Drive end

The side of the pump which faces the motor

Inlet line

The line connected to the pump's "Low Pressure In" connection.

Boost pressure

Depending on size and application, boosting of the pump is required.

Outlet line

The line connected to the system to be in high pressure design. High pressure flexible hoses are preferred to connect pump to system.

Pump

Machine without drive, additional components or accessories

Pump end

The side of the pump which faces away from the motor

Pump set

Complete pump set consisting of pump, drive, additional components and accessories

1 General

1.1 Principle

This operating manual is supplied as an integral part of the type series and variants indicated on the front cover. The manual describes the proper and safe use of this equipment in all phases of operation.

The name plate indicates the type series and size, the main operating data, the order number and the order item number. The order number and order item number uniquely identify the pump (set) and serve as identification for all further business processes.

In the event of damage, immediately contact your nearest SALINNOVA service centre to maintain the right to claim under warranty.

Noise characteristics see (⇨Section 4.6 Page 16)

1.2 Target group

This operating manual is aimed at the target group of trained and qualified specialist technical personnel. (⇨Section 2.4 Page 8)

1.3 Other applicable documents

Table 1: Overview of other applicable documents

Document	Contents
Data sheet	Description of the technical data of the pump (set)
Sub-supplier product literature	Operating manuals and other product literature describing accessories and integrated machinery components
Spare parts lists	Description of spare parts

For accessories and/or integrated machinery components, observe the relevant manufacturer's product literature.

1.4 Symbols

Table 2: Symbols used in this manual

Symbol	Description
✓	Conditions which need to be fulfilled before proceeding with the step-by-step instructions
▻	Safety instructions
⇨	Result of an action
⇨	Cross-references
1. 2.	Step-by-step instructions
	Note Recommendations and important information on how to handle the product

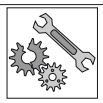
2 Safety

DANGER

All the information contained in this section refers to hazardous situations.

2.1 Key to safety symbols/markings

Table 3: Definition of safety symbols/markings

Symbol	Description
DANGER	DANGER This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.
WARNING	WARNING This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.
CAUTION	CAUTION This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.
	General hazard In conjunction with one of the signal words this symbol indicates a hazard which will or could result in death or serious injury.
	Electrical hazard In conjunction with one of the signal words this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage.
	Machine damage In conjunction with the signal word CAUTION this symbol indicates a hazard for the machine and its functions.

2.2 General

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.

The safety information in all sections of this manual must be complied with.

This manual must be read and completely understood by the specialist personnel/ operators responsible prior to installation and commissioning.

The contents of this manual must be available to the specialist personnel at the site at all times.

Information attached directly to the pump must always be complied with and be kept in a perfectly legible condition at all times. This applies to, for example:

- Arrow indicating the direction of rotation
- Markings for connections
- Name plate

The operator is responsible for ensuring compliance with all local regulations not taken into account in this manual.

2.3 Intended use

- The product must only be operated within the operating limits described in the other applicable documents. (Section 1.3 Page 6)
- Only operate pumps/pump sets which are in perfect technical condition.
- Do not operate the pump (set) in partially assembled condition.
- Only use the pump (set) to handle the fluids described in the data sheet or product literature of the pump model.
- Never operate the pump (set) without the fluid to be handled.
- Observe the minimum speed indicated on the data sheet or in the product literature (prevents overheating, bearing damage, etc.).

- Observe the maximum speed indicated on the data sheet or in the product literature (prevents overheating, mechanical seal damage, cavitation damage, bearing damage, etc.)
- Never operate the pump (set) at a pressure below the specified inlet pressure (prevention of cavitation damage).
- Never operate the pump (set) below the specified back pressure.
- Consult the manufacturer about any use or mode of operation not described in the data sheet or product literature.

Prevention of foreseeable misuse

- The pressure at the pump inlet must never fall below the inlet pressure specified.
  – Risk of cavitation damage
- The energy recovery device must not be operated below the specified back pressure (prevention of cavitation damage).
- Never exceed the permissible operating limits specified in the data sheet or product literature regarding pressure, temperature, etc.
- Never install throttling elements in the outlet pipes of the pump and energy recovery device or in the lubricating flow's drain pipe.
- Observe all safety information and instructions in this manual.

Also see

- Other applicable documents [⇨6]

2.4 Personnel qualification and training

All personnel involved must be fully qualified to transport, 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 operator.

Deficits in knowledge must be rectified by means of training and instruction provided by sufficiently trained specialist personnel. If required, the operator can commission the manufacturer/supplier to train the personnel.

Training on the pump (set) must always be supervised by technical specialist personnel.

2.5 Consequences and risks caused by non-compliance with this manual

- Non-compliance with this operating manual will lead to forfeiture of warranty cover and of any and all rights to claims for damages.
- Non-compliance can, for example, have the following consequences:
  – Hazards to persons due to electrical, thermal, mechanical and chemical effects and explosions
  – Failure of important product functions
  – Failure of prescribed maintenance and servicing practices
  – Hazard to the environment due to leakage of hazardous substances

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

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 shutting down the pump does not increase potential risk, fit an emergency-stop control device in the immediate vicinity of the pump (set) during pump set installation.

2.8 Safety information for maintenance, inspection and installation

- Modifications or alterations of the pump are only permitted with the manufacturer's prior consent.
- Use only original spare parts or parts authorised by the manufacturer. The use of other parts can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that maintenance, inspection and installation is performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.
- Only carry out work on the pump (set) during 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 set out of service always adhere to the procedure described in the manual. (Section 6.3 Page 34)
- 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. (Section 6.1 Page 27)

2.9 Unauthorised 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.

3 Transport/Temporary Storage/Disposal

3.1 Checking the condition upon delivery

1. On transfer of goods, check each packaging unit for damage.
2. In the event of in-transit damage, assess the exact damage, document it and notify Salinnova or the supplying dealer (as applicable) and the insurer about the damage in writing immediately.

3.2 Transport

DANGER

Improper transport
Danger to life from falling parts!

- ▷ Observe the safety regulations for transport work. (Section 2 Page 7) (Section 3 Page 10)
- ▷ Observe the applicable local occupational safety and accident prevention regulations.

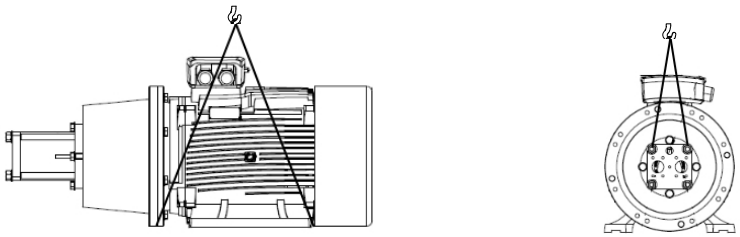
DANGER

The pump (set) could slip out of the suspension arrangement
Danger to life from falling parts!

- ▷ Always transport the pump (set) in the specified position.
- ▷ Never suspend the pump from its free shaft end.
- ▷ Pay attention to the weight data and the centre of gravity.
- ▷ Observe the applicable local health and safety regulations.
- ▷ Use suitable, permitted lifting accessories, e.g. self-tightening lifting tongs.

To transport the pump/pump set suspend it from the lifting tackle as shown.

a)



b)

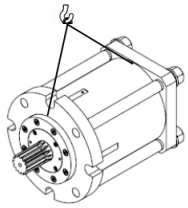


Fig. 1: Transporting the a) pump set b) pump

3.3 Storage/preservation

If commissioning is to take place some time after delivery, we recommend that the following measures be taken for pump (set) storage.

CAUTION

Damage during storage by humidity, dirt, or vermin
Corrosion/contamination of the pump (set)!

▷ For outdoor storage cover the packed or unpacked pump (set) and accessories with waterproof material.

CAUTION

Wet, contaminated or damaged openings and connections
Leakage or damage to the pump!

▷ Clean and cover pump openings and connections as required prior to putting the pump into storage.

Store the pump (set) in a dry, protected room where the atmospheric humidity is as constant as possible.

If properly stored indoors, the pump set is protected for a maximum of 12 months. New pumps/pump sets are supplied by our factory duly prepared for storage.

For storing a pump (set) which has already been operated, observe the instructions in (Section 6.3 Page 34) .

3.4 Return to supplier

1. Drain the pump as per operating instructions. (Section 7.3 Page 39)
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 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 (set).
   Always indicate any safety and decontamination measures taken. (Section 11 Page 51)

NOTE

If required, a blank certificate of decontamination can be downloaded from the web site at: www.salinnova.com/certificate_of_decontamination

3.5 Disposal

⚠ WARNING

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

▷ 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 posing a health hazard.

1. Dismantle the pump (set).
   Collect greases and other lubricants during dismantling.
2. Separate and sort the pump materials, e.g. by:
   - Metals
   - Plastics
   - Electronic waste
   - Greases and other lubricants

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

4 Description of the Pump (Set)

4.1 General description

- Seawater desalination module

For drinking water production and treatment by reverse osmosis in industry, hotels, resorts and ships, as well as for any kind of high pressure application.

4.2 Designation

Example: NOVA P60

Table 4: Key to the designation

Code	Description	
NOVA	Type series	
P	Design	
	P	Pump
60	Flow rate [l/h (size)	
Fluid	water / waterous solution	
Material of construction	SS 316 L	
	D	Duplex stainless steel

4.3 Name plate

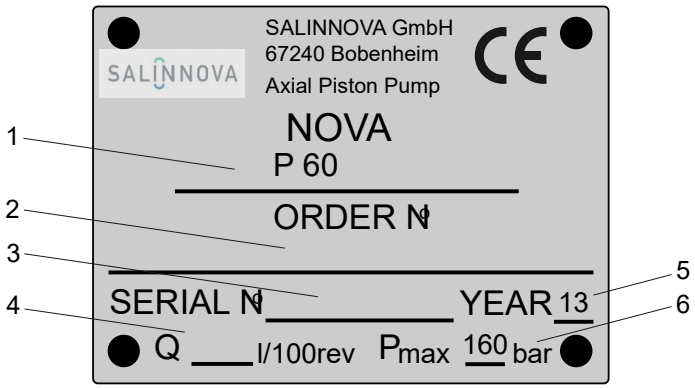


Fig. 2: Name plate (example)

1	Pump type, type series, size, version	2	SALINNOVA order number
3	Serial No.	4	Pump flow rate
5	Year of construction	6	Maximum operating pressure

4.4 Design details

Design

- Hydraulic unit comprising axial piston pump and integrated axial piston motor
- Swash plate design with non-adjustable swash plates
- Number of pistons
  - Axial piston pump: 9
  - option: Axial piston motor: 9
- Horizontal and vertical installation

Shaft seal

- Lip seal or mechanical seal

Static sealing elements

- The elastomer type used for the static seals is NBR.

Bearings

- Product-lubricated plain bearings
- The bearings' service life depends on the operating conditions and the fluid's level of purity.

Automation

- Automation equipment is fitted at the place of use and will be tailored to the individual system requirements by the engineering contractor.

Connections NOVA

- Main connections: BSPP 1“, or 2" / 3“ SAE Flange, 3000 psi depending on size
- Drain G 3/4 / G 1 - 1/2“

4.5 Configuration and function

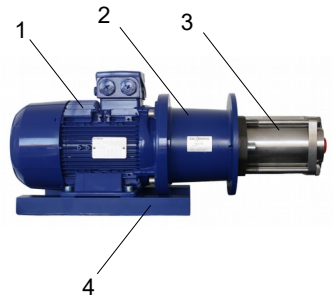


Fig. 3: NOVA

1	Electric motor	2	Bell housing
3	NOVA	4	Mounting frame

Design

The pump with is designed with axial fluid inlets nozzles either BSPP or SAE and outlets. The hydraulic system is connected to the motor by a coupling. The motor is controlled by a frequency inverter. The pump including motor is fitted to a mounting frame.

Function

The axial piston pump transmits the electric motor's mechanical energy to the feed water/seawater which is pumped through the RO membrane, separating the drinking water and leaving the feed water as concentrated brine. The high energy content of this concentrated brine can then re-converted into mechanical energy by use e.g. of any energy recovery device. If NOVA to be in use in high pressure industrial application ATEX or other guidelines are to be taken into account.

Sealing

The pump is sealed by a lip seal or mechanical seal.

Example for PID

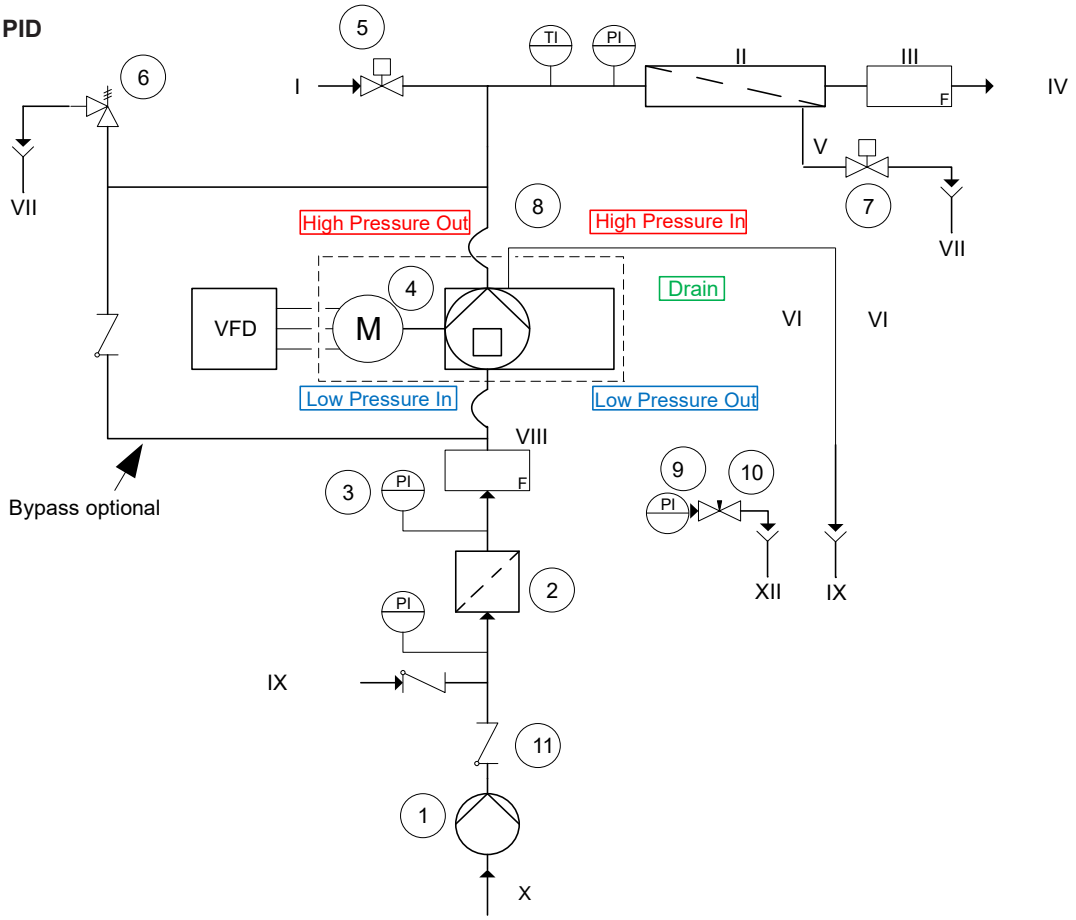


Fig. 4: Example of a flow diagram in case of RO plant

I	Chemical cleaning	II	Membrane
III	Flow meter	IV	Permeate
V	Concentrated salt water / Brine	VI	Lubricant drain
VII	Drain of brine if requested	VIII	Flow meter
IX	Permeate flushing / Drain of lubricant	X	Pretreated and cleaned feed water

Table 5: Explanation of the flow chart

Item	Component	Task
①	Booster pump	Ensures the inlet pressure supply to the pump's "Low Pressure In" connection.
②	Filter	Ensures minimum pump filtration requirements.
③	Suction pressure gauge pump in	Continuous inlet pressure monitoring avoids pump damage.
④	SALINO Pressure Center	Pressure boosting and energy recovery
⑤	Inlet valve for chemical cleaning	Cleaning fluid inlet for the membranes, drainage via bypass valve.
⑥	Pressure relief valve	Serves as a protection device against excess pressure
⑦	Bypass valve / back pressure valve	Relevant for permeate flushing, chemical membrane cleaning, start-up if venting is required, and shut-down procedures.
⑧	Optional: isolation valve	Optional: if SALINO is subject for isolation
⑨	Option:Back pressure gauge	Continuous back pressure monitoring, back pressure must 3 – 5 bar During operation of SALINO
⑩	Option Back pressure valve e.g. self adjusting check valve	Continuous back pressure monitoring at back pressure gauge In order to adjust back pressure to 3 – 5 bar; mandatory for Operation of SALINO
⑪	Check valve	ensures permeate flushing w/o losses caused by feed pump

4.6 Noise characteristics

The noise characteristics depend on both the pressure and the rotational speed. A sound pressure level of > 71 dB (A) can be achieved under normal operating conditions.

4.7 Scope of supply

Depending on the model, the following items are included in the scope of supply:

- High-pressure axial piston pump NOVA
- Drive
  - Electric motor
  - Frequency inverter
- Shaft coupling
- Bell housing
- Mounting frame
  - Welded with V4A stainless steel or steel galvanized

4.8 Dimensions and weights

Dimensions — Refer to the Dimensions/Connections section for information on the dimensions (Section 9.2 Page 48)

Weights — Table 6: Weights [kg] depending on some sizes of NOVA and electrical motor

Motor													
0,55 kW	P1	on request											
0,75 kW	P1, P3, P6	14											
1,1 kW	P3, P6, P15	16											

4.9 Filtration

To ensure that the pump's service life is as long as possible, the fluid handled must be filtered before it flows through the pump. This requires filters with a minimum filtration ratio of β 10 > 1000 which means that 100 of 100,000 particles sized 10 µm will pass through the filter (absolute rating).

5 Installation at Site

5.1 Safety regulations

⚠ DANGER

Installation in potentially explosive atmospheres
Explosion hazard!

- ▷ Never install the pump in potentially explosive atmospheres.
- ▷ Observe the information given in the data sheet and on the name plates of the pump system.

⚠ DANGER

Improper transport
Risk of injury from lifting heavy components!

- ▷ Select lifting accessories which are suitable for the component weight.
- ▷ Always use the attachment points provided for the lifting accessories.
- ▷ Comply with the applicable health and safety regulations.

⚠ DANGER

The pump or individual components could slip out of the suspension arrangement
Danger to life from falling parts!

- ▷ Always transport the pump or components in the specified position.
- ▷ Never attach the suspension arrangement to the free shaft end of the pump.
- ▷ Refer to the weight of the individual components and the centre of gravity.
- ▷ Observe the applicable local accident prevention regulations.
- ▷ Use suitable, permitted lifting accessories, e.g. self-tightening lifting tongs.

5.2 Checks to be carried out prior to installation

Place of installation

⚠ WARNING

Installation on mounting surfaces which are unsecured and cannot support the load
Personal injury and damage to property!

- ▷ Use a concrete of compressive strength class C12/15 which meets the requirements of exposure class XS1 to EN 206-1.
- ▷ The mounting surface must have set and must be completely horizontal and even.
- ▷ Observe the weights indicated.

1. Check the structural requirements.
   All structural work required must have been prepared in accordance with the dimensions. (Section 9.2 Page 48)

CAUTION

Improper installation of the pump set
Damage to property!

- ▷ The pump set must be installed in an enclosed room and protected from adverse environmental conditions.

NOTE

The pump set is most efficiently operated at temperatures of between +5 °C and +40 °C and with an atmospheric humidity of under 50 %.

CAUTION

Use of the pump in adverse ambient conditions
Damage to property!

▷ Never operate the pump set in ambient conditions other than those described.

5.3 Installing the pump set

Always install the pump set in a horizontal position.

When installing the pump set, also observe the chapter on Dimensions/Connections. (Section 9.2 Page 48)

⚠ WARNING

Excessive temperatures due to improper installation
Risk of burns!
Damage to the pump!

▷ Install the pump in a horizontal position to ensure self-venting of the pump.

NOTE

When installing the system, ensure that sufficient space is available around the pump set to facilitate servicing and maintenance.

5.3.1 Installation on a foundation

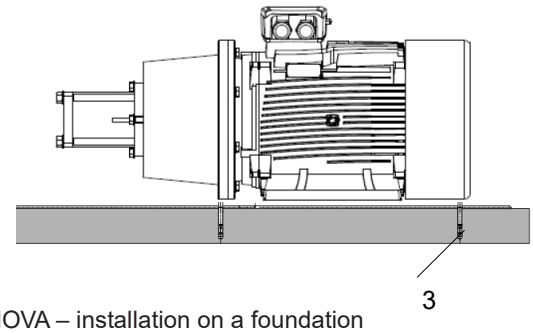


Fig. 5: NOVA – installation on a foundation

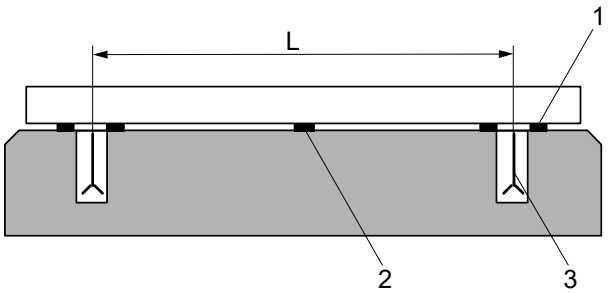


Fig. 6: Shims to compensate imbalance for installation on a foundation

L	Bolt-to-bolt distance		
1	Shims	2	Additional shims
3	Foundation bolt	4	Fastening screw

✓ The foundation has the required strength and characteristics.

✓ The foundation has been prepared in accordance with the dimensions and connections. (⇨Section 9.2 Page 48)

1. Place the pump set including mounting frame on the foundation and align using a spirit level.
2. Use shims (1) and additional shims (2) (if the distance (L) between the foundation bolts is > 800 mm) for height compensation if necessary. Always fit shims immediately to the left and right of the foundation bolts (3) between the mounting frame and the foundation. All shims must lie perfectly flush.
3. Insert the foundation bolts (3) into the holes provided.
4. Use concrete to set the foundation bolts (3) into the foundation.
5. Wait until the concrete has set firmly, then level the mounting frame.
6. Loosen the fastening screw (4) at the pump support without removing it.
7. Tighten the foundation bolts (3) evenly and firmly.
8. Firmly tighten the fastening screw (4) at the pump support.

Table 7: Size of foundation bolts depending on the unit size

Size	Foundation bolt size
14	M12
20	M12
23	M18

NOTE

To install the pump set on a support structure it is also possible to use the holes provided in the mounting frame.

5.4 Pipes/hoses

5.4.1 Properly connecting pipes/hoses

⚠ DANGER

Impermissible loads acting on the mating flanges.
Danger to life from leakage of hot, toxic, corrosive or flammable fluids!

- ▷ Do not use the pump as an anchorage point for the piping.
- ▷ Anchor the pipes in close proximity to the pump and connect without transmitting any stresses or strains using hoses.
- ▷ Take appropriate measures to compensate for thermal expansion of the piping.

CAUTION

Contamination/dirt in the piping
Damage to the pump! Any rust in the pipework will lead to no warranty for NOVA.

- ▷Clean the piping and check for contamination before connecting to the pump.

NOTE

Whenever modifications to the system (e.g. installation of fittings) are performed, always clean the piping avoiding that dirt can enter the pump.

CAUTION

Incorrect earthing during welding work at the piping
Destruction of rolling element bearings (pitting effect)!

- ▷ Never earth the electric welding equipment on the pump or baseplate.
- ▷ Prevent current flowing through the rolling element bearings.

NOTE

Installing check and shut-off elements in the system is recommended, depending on the type of plant and pump. However, such elements must not obstruct proper drainage or hinder disassembly of the pump.

CAUTION

Dry running of the mechanical seal/pump malfunction
Damage to the pump!

- ▷ The connection lines must be laid in such a manner that no air pockets can form.
- ▷ The connection lines must be tightly sealed.
- ▷ In order that the approach flow conditions and thus the NPSH of the system are not impaired, avoid installing narrow elbows and valves directly upstream of the pump.

- ✓ The nominal diameters of the pipes are equal to or greater than the nominal diameters of the pump nozzles.
- ✓ Adapters to larger nominal diameters are designed with a diffuser angle of approx. 8° to avoid excessive pressure losses.
- ✓ The hoses have been connected without transmitting any stresses or strains.
- ✓ The filters have been installed properly.
- ✓ Throttling or shut-off elements have not been installed in the drain lines.

NOTE

The drained liquid from the pump (but not that of the energy recovery device) can be discharged into an unpressurised feed water tank (if fitted).

NOTE

We recommend installing a gate valve or a swing check valve in the inlet or discharge line, either directly upstream or downstream of the pump. This prevents the fluid handled from flowing back if the pump is stopped or removed for servicing and maintenance. During pump operation these gate valves must be fully open and not used for flow control. Operation against a closed gate valve will inevitably lead to damage to the pump/system.

1. Thoroughly clean, flush and blow air through tanks, pipes, hoses and connections.
2. Before installing the pump in the system, remove the flange covers of the inlet and outlet connections.

CAUTION

Welding beads, scale and other impurities in the piping
Damage to the pump!

- ▷ Remove any impurities from the piping.
- ▷ If necessary, install a filter.

3. If required, install a filter in the piping (see drawing: Filter in the piping).

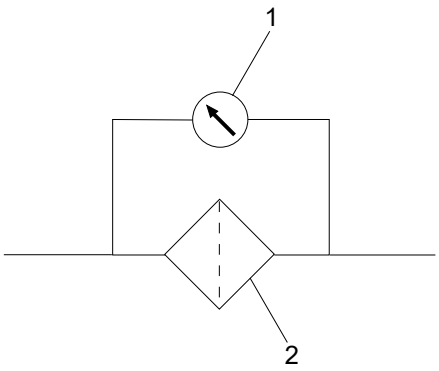


Fig. 7: Filter in the piping

1	Differential pressure gauge	2	Filter

CAUTION

Pressure drop between pressure sensor and pump inlet
Damage to the pump!

- ▷ Never install pressure-reducing components (e.g. filters) between the inlet pressure monitoring sensor and the pump inlet.
- ▷ Position the pressure sensor in close proximity to the pump inlet.

CAUTION

Formation of air bubbles in the pipes during standstill and with the bypass valve open.
Damage to the machinery!
Damage to the pump and membranes!

- ▷ Secure open inlets and outlets to prevent the fluid handled from escaping.

4. Install the bypass valve and drain lines at the highest position in the system. (Section 4.5 Page 14)
5. Connect the pump nozzles to the pipes via hoses. (Section 9.2 Page 48)

CAUTION

Aggressive flushing, cleaning and pickling agents
Damage to the pump!

- ▷ Match the cleaning operation mode and duration of flushing and pickling to the casing and seal materials used.

5.5 Protective equipment

5.5.1 Mounting the coupling guard

⚠ WARNING

Failure to re-install or re-activate protective devices
Risk of injury from moving parts or escaping fluid!

- ▷ As soon as the work is completed, re-install and/or re-activate any safety-relevant and protective devices.

⚠ WARNING

Unprotected rotating coupling
Risk of injury by rotating shafts!

- ▷ Always operate the pump set with a coupling guard.
  If the customer specifically requests not to include a coupling guard in SALINNOVA's delivery, then the operator must supply one!
- ▷ Observe all relevant regulations for selecting a coupling guard.

As standard, the pump set is supplied with a bell housing which serves as a coupling guard. If a different configuration is used, ensure an appropriate coupling guard is fitted.

5.5.2 Fitting the pressure sensors

CAUTION

Pressure drop at the pump inlet and the energy recovery device's outlet
Damage to the pump!

- ▷ Fit the pressure sensor as close as possible to the connections to be monitored.
- ▷ Continuous pressure monitoring and definition as shutdown condition in the system's control unit.
- ▷ Observe the operating limits.

- ✓ The pressure sensors meet the application's requirements.
  (corrosion resistance, atmospheric humidity, measurable pressure range)
- ✓ Pressure-reducing components (e.g. filters) have not been installed between the inlet pressure monitoring sensor and the pump inlet.

1. Fit pressure sensors as close as possible to the connection to be monitored.

5.5.3 Installing the temperature monitoring devices

CAUTION

Exceeding or dropping below the permissible fluid temperatures
Damage to the pump!

- ▷ Continuous temperature monitoring at both inlet connections and definition as shutdown condition in the system's control unit.
- ▷ Observe the operating limits.

- ✓ The temperature sensors meet the application's requirements.
  (corrosion resistance, atmospheric humidity, measurable temperature range)

1. Install the temperature sensors in close proximity to the connection to be monitored.

5.5.4 Installing the pressure relief valve

⚠ WARNING

Incorrect setting of the pressure relief valve

Personal injury and damage to property!
Pump malfunction!

- ▷ The pressure relief valve must be set by the operator to match the respective application as its error-free functioning (correct fluid discharge) depends on the pump's speed/flow rate and the fluid's density and viscosity.

NOTE

The use of a safety valve is always recommended in order to ensure the pump's reliability in the event that an operator's error causes excess pressure peaks.

NOTE

The safety valve ensures the fluid handled is discharged from the high-pressure section of the system thus preventing excess pressure. The valve is spring-loaded. The valve must be set to the maximum system pressure.

1. Properly install the pressure relief valve.
2. Set the pressure relief valve as specified.

5.6 Checking the coupling alignment

CAUTION

Impermissible radial or axial loads at the drive shaft
Damage to the machinery!

▷ Observe the manufacturer's coupling alignment instructions.

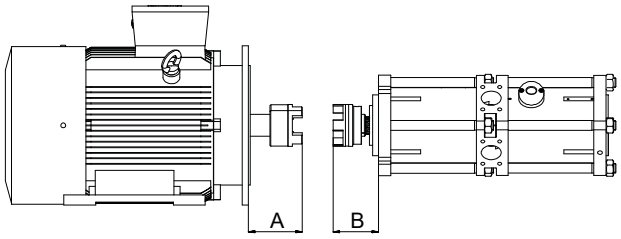


Fig. 8: Checking the coupling alignment

A	Drive-end reference dimension
B	Pump-end reference dimension

Table 8: Reference dimension "A" depending on the motor

Motor	A
	[mm]
22 / 30 kW, 200L, grey cast iron	110
37 / 45 kW, 225S, grey cast iron	140
55 / 75 kW, 280S, grey cast iron	140

Table 9: Reference dimension "B" depending on the pump size

Size	B
	[mm]
14/20	114
23	114
68	114

Drive end

NOTE

The coupling is shrink-fitted and aligned at the factory. If other coupling components are used, ensure that they are aligned properly.

Pump end

CAUTION

Impermissible distance between the coupling halves
Damage to the machinery!

▷ Always observe the specified dimensions for the alignment of the pump's coupling halves.

NOTE

The dimensions refer to the bell housing supplied by Salinnova. The specified fitting dimensions only apply for this bell housing!

5.7 Electrical system

5.7.1 Frequency inverter operation

The pump set can only be operated with a frequency inverter.

Selection

When selecting a frequency inverter, check the following details:

- Data provided by the manufacturer
- Electrical data of the pump set, particularly the rated current

Operation

Observe the following limits during operation on a frequency inverter:

- Only utilise up to 95 % of the motor rating indicated on the data sheet.
- Do not exceed the maximum pump speed (depending on its size).

5.7.2 Electrical connection

⚠ DANGER

Electrical connection work by unqualified personnel
Danger of death from electric shock!

▷ Always have the electrical connections installed by a trained and qualified electrician.

▷ Observe regulations IEC 60364 and, for explosion-proof models, IEC 60079.

▷ Observe the motor and frequency inverter operating manuals.

⚠ WARNING

Unintentional starting of pump set
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

Incorrect connection to the mains
Damage to the mains network, short circuit!

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

1. Check the available mains voltage against the data on the name plate.
2. Select an appropriate start-up method.

NOTE

A motor protection device is recommended.

5.7.2.1 Connecting the motor

NOTE

In compliance with IEC 60034-8, three-phase motors are always wired for clockwise rotation (looking at the motor shaft stub).
The pump's direction of rotation is indicated by an arrow on the pump.

1. Match the motor's direction of rotation to that of the pump.
2. Observe the manufacturer's product literature supplied with the motor.

5.7.2.2 Earthing

⚠ DANGER

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

▷ Connect the PE conductor to the earthing terminal provided.

5.8 Checking the direction of rotation

⚠ DANGER

Rotating shaft during direction of rotation check
Risk of injury!

▷ Maintain a safe distance to the pump set.

▷ Comply with the general health and safety regulations.

⚠ WARNING

Hands inside the pump casing
Risk of injuries, damage to the pump!

▷ Always disconnect the pump set from the power supply and secure it against unintentional start-up before inserting your hands or other objects into the pump.

CAUTION

Drive and pump running in the wrong direction of rotation
Damage to the pump!

▷ Refer to the arrow indicating the direction of rotation on the pump.

▷ Check the direction of rotation. If required, check the electrical connection and correct the direction of rotation.

CAUTION

Dry running
Damage to the pump!

▷ Never check the direction of rotation by starting up the unfilled pump set.

The correct direction of rotation of the motor and pump is counter-clockwise (seen from the drive end, from the fan).

1. Start the motor and stop it again immediately (< 1 second) to determine the motor's direction of rotation via the motor's fan.
   ⇨ The motor's direction of rotation must match the arrow indicating the direction of rotation on the pump.
2. If the motor is running in the wrong direction of rotation, check the electrical connection of the motor and the control system, if applicable.

6 Commissioning/Start-up/Shutdown

6.1 Commissioning/start-up

6.1.1 Prerequisites for commissioning/start-up

Before commissioning/starting up the pump set, make sure that the following conditions are met:

- The pump set has been connected with low-pressure and high-pressure hoses as described.
- The high-pressure and low-pressure hoses have been connected to the mating flanges without transmitting any stresses or strains.
- All screwed connections have been tightened properly.
- The mounting frame has been properly fitted to the base frame or foundation.
- The pump with the integrated energy recovery device and the membranes have been primed with the fluid handled.
- The direction of rotation has been checked.
- The pump set has been installed in the system in compliance with the regulations.
- After prolonged shutdown of the pump (set), the activities required for returning the pump (set) to service have been carried out. (Section 6.4 Page 35)

6.1.2 Priming and venting the pump

⚠ WARNING

Shaft seal failure caused by insufficient lubrication
Leakage of toxic fluid handled!

▷ Before pump start-up, vent the pump and inlet line and prime both with the fluid to be handled.

CAUTION

Increased wear due to dry running
Damage to the pump set!

▷ Never operate the pump set without a liquid fill.

▷ Never close the shut-off element in the inlet line and/or supply line during pump operation.

1. Vent the pump and the inlet lines and prime both with the pretreated fluid.
2. Prime the high-pressure piping system, membranes and integrated energy recovery device of the pump with pretreated fluid handled.

NOTE

For design-inherent reasons some unfilled volume in the hydraulic system cannot be excluded after the pump has been primed for commissioning/start-up. However, once the motor is started up the pumping effect will immediately fill this volume with the fluid handled.

6.1.3 Start-up

⚠ DANGER

Non-compliance with the permissible pressure and temperature limits due to closed inlet, discharge or outlet lines
Personal injury and damage to property!
Leakage of hot or toxic fluids!

- ▷ Never start up or operate the pump with the shut-off elements in the inlet, discharge or outlet lines closed.
- ▷ Only start up the pump set against a fully open inlet-side, discharge-side or outlet-side shut-off element.

⚠ DANGER

Excessive temperatures due to dry-running
Risk of injury!
Damage to the pump set!

- ▷ Never operate the pump set without a liquid fill.
- ▷ Prime the pump as per operating instructions.
- ▷ Always operate the pump within the permissible operating range.

⚠ WARNING

Pump sets with high noise levels
Damage to hearing!

- ▷ Persons must only enter the vicinity of the running pump set if they are wearing protective equipment/ear protection.
- ▷ See noise characteristics.

CAUTION

Abnormal noises, vibrations, temperatures or leakage
Damage to the pump!

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

- ✓ The piping in the system has been cleaned.
- ✓ Pump, inlet pipe system and discharge pipe system (and inlet tank if fitted) have been vented and primed with the fluid to be handled.
- ✓ The priming pipes and vent pipes have been closed.

⚠ WARNING

Start-up and operation of pump against closed discharge line
Personal injury and damage to property!

- ▷ Never operate the pump with the discharge line closed. Pumping against a closed shut-off element will result in overheating and a direct and sudden pressure increase.
- ▷ Install a pressure relief valve upstream of a shut-off element.

1. Fully open the shut-off elements in the inlet pipe.
2. Fully open the shut-off elements in the discharge pipe.
3. Fully open the bypass valve.
4. The required inlet pressure is available at the pump inlet.

CAUTION

Insufficient inlet pressure at the pump inlet
Damage to the pump due to cavitation!

▷ Never operate the pump below the specified inlet pressure required at the pump inlet.

5. Start up the motor and run up to an initial speed of 100 rpm.
   Ensure short start ramps (5 seconds). Increase to 200 rpm, if drainage is visible.

CAUTION

Insufficient back pressure at the energy recovery device's outlet
Damage to the energy recovery device due to cavitation!

▷ For speeds ≥ 600 rpm, never operate the pump below the specified back pressure at the energy recovery device's outlet.

⇨ The required back pressure is available at the energy recovery device's outlet.

6. If required, vent again.
7. Slowly close the bypass valve at 100 rpm
8. Slowly increase the speed up to the rated speed or necessary feed volume flow rate.
   Observe the maximum flow increase per second specified in the membranes' operating manual.

NOTE

Before the motor has run up to the required speed, check for possible faults (pressure overload, cavitation, vibrations, etc.).

6.1.4 SHUTDOWN

⚠ WARNING

Start-up and operation of pump against closed discharge line
Personal injury and damage to property!

- ▷ Never operate the pump with the discharge line closed. Pumping against a closed shut-off element will result in overheating and a direct and sudden pressure increase.
- ▷ Install a pressure relief valve upstream of a shut-off element.

1. Slowly reduce the speed to speed of 600 rpm.
2. Slowly reduce speed to 200, than 100 rpm.
3. Shut down NOVA.
4. Shut down the booster pump. Open bypass valve for 5 sec., then close it again.

CAUTION

Increased corrosion risk due to standing salt water/brine in the pump
Damage to the pump due to corrosion!

- ▷ Sufficiently flush the pump set with permeate before prolonged shutdown periods.

5. Start flushing process using permeate/tap water (start up flushing pump).
6. Have NOVA rotate at a speed of 600 rpm along with the flushing pump.

NOTE

Salinnovas recommends a flushing period of 5 minutes for the pump set only.

7. Shut down NOVA.
8. Stop the flushing process by shutting down the flushing pump.

CAUTION

Risk of freezing during prolonged pump shutdown periods
Damage to the pump!

- ▷ Drain the pump and the cooling/heating chambers (if any) or otherwise protect them against freezing.

6.2 Operating limits

⚠ DANGER

Non-compliance with operating limits
Explosion hazard!
Risk of injury due to leakage of hot or toxic fluids!
Damage to the system!

- ▷ Comply with the operating data indicated on the data sheet.
- ▷ Never operate the pump set against a closed shut-off element.
- ▷ Never operate the pump set at limits exceeding those specified below unless the written consent of the manufacturer has been obtained.

6.2.1 Pressures

6.2.1.1 Inlet / boost pressure

CAUTION

Falling below the permissible inlet pressure at the pump inlet
Damage to the pump set due to cavitation!

- ▷ Never close shut-off elements in the inlet pipe or install throttling elements in the inlet pipe.
- ▷ Continuous inlet pressure monitoring and definition as cut-out condition in the system's control unit.
- ▷ Do not install pressure-reducing components (e.g. filters) between the inlet pressure monitoring sensor and the pump inlet.
- ▷ Position the pressure sensor in close proximity to the pump inlet.

Table 12: Inlet / boost pressure [bar] depending on size; NOTE: P1 does not request any boost pressure

Size	Limits		Warning		Shutdown	
	Min.	Max.	Min.	Max.	Min.	Max.
P3, P6	2,5	10,0	2,3	9,0	2,0	10,0
P15, P30	3,0	10,0	2,8	9,0	2,5	10,0
P60, P180	3,5	10,0	3,3	9,0	3,0	10,0

The sum of inlet pressure and differential pressure must not exceed 160 bar.

The 160 bar limit refers to the pump only.
The maximum differential pressure of 160 bar – inlet pressure refers to the pump set.

For higher differential pressures the motor rating must be matched accordingly.

6.2.1.2 Operating pressure

⚠ DANGER

Non-compliance with permissible operating pressure
Damage to the pump set!
Damage to the system!
Risk of injury!

- ▷ Never close the shut-off elements during operation.
- ▷ Check the membranes' condition and clean or replace if required.
- ▷ Set the pressure relief valve to the maximum system pressure.

Table 13: Operating pressure [1)] [bar]

Size	Limits		Warning		Shutdown	
	Min.	Max.	Min.	Max.	Min.	Max.
All	5,0	160,0	4,0	157,5	3,0	165,0

The sum of inlet pressure and differential pressure must not exceed 160 bar.

The 100 bar limit refers to the pump only.
The maximum differential pressure of 160 bar – inlet pressure refers to the pump set.

For higher differential pressures the motor rating must be matched accordingly.

1) All components used in the high-pressure section must be designed to withstand the maximum operating pressure.

6.2.1.3 Back pressure

DANGER

Exceeding the permissible back pressure at the energy recovery device's outlet
Damage to the pump set!
Damage to the system!
Risk of injury!

- ▷ Never close the throttling valve during operation.
- ▷ Continuous back pressure monitoring and definition as shutdown condition in the system's control unit.
- ▷ Position the pressure sensor in close proximity to the energy recovery device's outlet.

CAUTION

Falling below the permissible back pressure at the energy recovery device's outlet
Damage to the pump set due to cavitation!

- ▷ Never fully open the throttling valve.
- ▷ Continuous back pressure monitoring and definition as shutdown condition in the system's control unit.
- ▷ Position the pressure sensor in close proximity to the energy recovery device's outlet.

Table 14: Back pressure [bar] in RO applications; NOTE: For any other application kindly refer to SALINNOVA

Size	Limits		Warning		Shutdown	
	Min.	Max.	Min.	Max.	Min.	Max.
All	2,0	10,0	1,8	4,5	1,5	10,0

6.2.2 Ambient temperature

CAUTION

Operation outside the permissible ambient temperature
Damage to the pump (set)!

- ▷ Observe the specified limits for permissible ambient temperatures.

Observe the following parameters and values during operation:

Table 15: Permissible ambient temperatures

Permissible ambient temperature	Value
Maximum	40 °C
Minimum	2 °C

Observe the supplementary operating manual supplied with the electric motor and frequency inverter.

6.2.3 Frequency of starts

DANGER

Excessive surface temperatures of the motor
Explosion hazard!

- ▷ The limit value for stopping the pump must never exceed the specified surface temperature of the respective temperature class.
- ▷ If the specified surface temperature of the respective temperature class is exceeded, immediately switch off the pump set and determine the cause.

The frequency of starts is usually determined by the maximum temperature increase of the motor. This largely depends on the power reserves of the motor in steady-state operation and on the starting conditions (DOL, star-delta, moments of inertia, etc). If the start-ups are evenly spaced over the period indicated, the pump set can be started up six times per hour (h).

CAUTION

Re-starting while motor is still running down
Damage to the pump (set)!

▷ Do not re-start the pump set before the pump rotor has come to a standstill.

6.2.4 Fluid handled

6.2.4.1 Temperature of fluid handled

CAUTION

Impermissible fluid temperature
Damage to the pump!

▷ Observe the specified limits for permissible fluid temperatures.

▷ Continuous temperature monitoring at both inlet connections and definition as shutdown condition in the system's control unit.

Table 16: Temperature of fluid handled

Measured variable	Limits		Warning		Shutdown	
	Min.	Max.	Min.	Max.	Min.	Max.
Temperature of fluid handled [°C]	2	50	7	45	2	50

6.2.4.2 Abrasive fluids/solids

CAUTION

Impermissibly high solids content in fluid
Damage to the pump!

▷ Observe the filtration instructions.

▷ Observe the limits applicable for the membranes used.

NOTE

The fluid's level of purity has a major influence on servicing/maintenance measures and intervals.

6.3 Shutdown/storage/preservation

6.3.1 Measures to be taken for shutdown

CAUTION

Pretreated salt water or brine in the pump
Damage to the pump due to corrosion!

▷ Properly flush, drain and clean the pump set.

The pump (set) remains installed

✓ Sufficient fluid in the form of either drinking, tap or service water is supplied for the operation check run of the pump.

1. For prolonged shutdown periods, regularly start up the pump set between once a month and once every three months for approximately five minutes at the specified inlet pressure, with the bypass valve open and at a speed of 600 rpm.

⇨ After shutting down NOVA, the booster pump can be switched off.

⇨ This will prevent the formation of deposits within the pump and the pump intake area.

The pump (set) is removed from the piping and stored

✓ The pump has been properly flushed with drinking, tap or service water, and drained. (⇨Section 6.1.4 Page 30) (⇨Section 7.3 Page 39)

✓ The safety instructions for dismantling the pump have been observed. (⇨Section 7.4.1 Page 39)

1. Close the pump set's connections (e.g. with plastic caps or similar).
2. Store the pump in a dry and protected place at room temperature (approx. 20 °C).

6.4 Returning to service

For returning the pump to service, observe the sections on commissioning/start-up (⇨Section 6.1 Page 27) and the operating limits .

In addition, carry out all servicing/maintenance operations before returning the pump (set) to service. (⇨Section 7 Page 36)

⚠ WARNING

Failure to re-install or re-activate protective devices
Risk of personal injury from moving parts or escaping fluid!

▷ As soon as the work is complete, re-install and/or re-activate any safety-relevant and protective devices.

NOTE

If the pump has been out of service for more than one year, replace all elastomer seals.

7 Servicing/Maintenance

7.1 Safety regulations

⚠ DANGER

Insufficient preparation of work on the pump (set)
Risk of injury!

- ▷ Properly shut down the pump set.
- ▷ Close the shut-off elements in inlet, discharge and outlet lines.
- ▷ Drain the pump and release the pump pressure.
- ▷ Shut off any auxiliary feed lines.
- ▷ Allow the pump set to cool down to ambient temperature.
- ▷ Ensure the pump set is secured against tipping over, especially on wet floors.

⚠ 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 shaft seal and coupling.

The operator ensures that maintenance, inspection and installation is performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.

⚠ WARNING

Liquids escaping at high pressure
Risk of injury!

- ▷ Depressurise the pump.

⚠ WARNING

Unintentional starting of pump set
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

Fluids, consumables and supplies which are hot and/or pose a health hazard
Risk of injury!

- ▷ Observe all relevant laws.
- ▷ When draining the fluid take appropriate measures to protect persons and the environment.
- ▷ Decontaminate pumps which handle fluids posing a health hazard.

⚠ WARNING

Insufficient stability
Risk of crushing hands and feet!

- ▷ During assembly/dismantling, secure the pump (set)/pump parts to prevent tipping or falling over.

A regular maintenance schedule will help avoid expensive repairs and contribute to trouble-free, reliable operation of the pump, pump set and pump parts with a minimum of servicing/maintenance expenditure and work.

NOTE

All maintenance, service and installation work can be carried out by SALINNOVA Servicer Or authorised workshops. For contact details please refer to the enclosed "Addresses" booklet or visit "www.salinnova.com" on the Internet.

Never use force when dismantling and reassembling the pump set.

⚠ WARNING

Failure to re-install or re-activate protective devices
Risk of injury from moving parts or escaping fluid!

- ▷ As soon as the work is completed, re-install and/or re-activate any safety-relevant and protective devices.

7.2 Servicing/inspection

7.2.1 Supervision of operation

⚠ DANGER

Non-compliance with permissible operating pressure
Damage to the pump set!
Damage to the system!
Risk of injury!

- ▷ Never close the shut-off elements during operation.
- ▷ Check the membranes' condition and clean or replace if required.
- ▷ Set the pressure relief valve to the maximum system pressure.

⚠ DANGER

Excessive temperatures due to dry-running
Risk of injury!
Damage to the pump set!

- ▷ Never operate the pump set without a liquid fill.
- ▷ Prime the pump as per operating instructions.
- ▷ Always operate the pump within the permissible operating range.

CAUTION

Impermissible fluid temperature
Damage to the pump!

- ▷ Observe the specified limits for permissible fluid temperatures.
- ▷ Continuous temperature monitoring at both inlet connections and definition as shutdown condition in the system's control unit.

CAUTION

Excessively high pressure at the drain connection
Damage to the pump!

- ▷ Never install throttling elements in the drain line.
- ▷ Ensure that the fluid drained is under as little pressure as possible.

CAUTION

Pressure drop at the pump inlet and the energy recovery device's outlet
Damage to the pump due to cavitation!

- ▷ Fit the pressure sensor as close as possible to the connections to be monitored.
- ▷ Continuous temperature monitoring and definition as shutdown condition in the system's control unit.
- ▷ Observe the operating limits.

While the pump is in operation, observe and check the following:

- The pump must run quietly and free from vibrations at all times.
- Check the static seals for leakage.
- Check for running noises. Vibrations, noise and an increase in current input occurring during unchanged operating conditions indicate wear.
- Monitor the correct functioning of any auxiliary connections.
- Monitor the stand-by pump to ensure that it remains ready for operation. Start up the stand-by pumps once a week.
- Warning and shutdown values (Section 6.2 Page 31)

7.2.2 Inspection work

7.2.2.1 Checking the coupling

⚠ DANGER

Excessive temperatures caused by friction, impact or frictional sparks
Fire hazard!
Damage to the pump set!

- ▷ Regularly check the coupling guard, plastic components and other guards of rotating parts for deformation and sufficient distance from rotating parts.

Check the flexible elements of the coupling. Replace the relevant parts in due time if there is any sign of wear and check the alignment.

Observe the manufacturer's product literature supplied with the coupling.

7.2.2.2 Cleaning filters

CAUTION

Insufficient inlet pressure due to clogged filter in the inlet line
Damage to the pump!

- ▷ Monitor contamination of filter with suitable means (e.g. differential pressure gauge).
- ▷ Clean filters at appropriate intervals.

7.2.3 Lubrication and lubricant change

⚠ DANGER

Excessive temperatures as a result of bearings running hot or defective bearing seals
Fire hazard!
Damage to the pump set!

- ▷ Regularly check the rolling element bearings for running noises.
- ▷ Observe the electric motor's operating manual.

7.3 Drainage/cleaning

⚠ WARNING

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

- ▷ 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 posing a health hazard.

CAUTION

Pretreated salt water or brine in the pump
Damage to the pump due to corrosion!

- ▷ Perform flushing as described.

- ✓ The pump set has been flushed as described.
- ✓ The pump set is not operating.
- ✓ The booster pumps are not operating.
- ✓ The bypass valve has been opened.

1. Secure the pump set against unintentional start-up.
2. Isolate the pump set using shut-off elements.
3. Remove the drain plug.

It is possible to use the pump's "High Pressure Out" of the pump connection to drain it.

7.4 Dismantling the pump set

7.4.1 General information/safety regulations

⚠ DANGER

Insufficient preparation of work on the pump (set)
Risk of injury!

- ▷ Properly shut down the pump set.
- ▷ Close the shut-off elements in inlet, discharge and outlet lines.
- ▷ Drain the pump and release the pump pressure.
- ▷ Shut off any auxiliary feed lines.
- ▷ Allow the pump set to cool down to ambient temperature.
- ▷ Ensure the pump set is secured against tipping over, especially on wet floors.

⚠ WARNING

Unqualified personnel performing work on the pump (set)
Risk of injury!

- ▷ Always have repair and maintenance work performed by specially trained, qualified personnel.

⚠ WARNING

Hot surface
Risk of injury!

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

⚠ WARNING

Improper lifting/moving of heavy assemblies or components
Personal injury and damage to property!

▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.

⚠ WARNING

Unintentional starting of pump set
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.

Observe the general safety instructions and information.

For any work on the motor, observe the instructions of the relevant motor manufacturer.

For dismantling and reassembly refer to the general assembly drawing.

NOTE

All maintenance, service and installation work can be carried out by SALINNOVA or authorised workshops. For contact details please refer to the enclosed "Addresses" booklet or visit "www.salinnova.com" on the Internet.

7.4.2 Preparing the pump set

✓ The pump has been flushed.

✓ The pump has been drained.

1. De-energise the pump set and secure it against unintentional start-up.
2. Dismantle any auxiliary connections.

7.4.3 Removing the pump set from the piping

1. Disconnect the high-pressure and low-pressure hoses from the inlet, discharge and outlet lines.
2. Undo the fastening elements between mounting frame and foundation/base frame.
3. Attach the complete pump set to suitable lifting equipment and remove from the system. (⇨Section 3.2 Page 10)

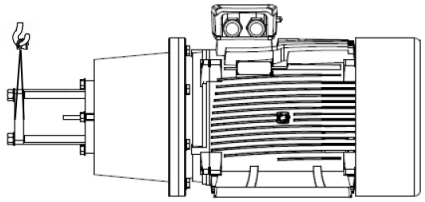
7.4.4 Dismantling the pump

⚠ WARNING

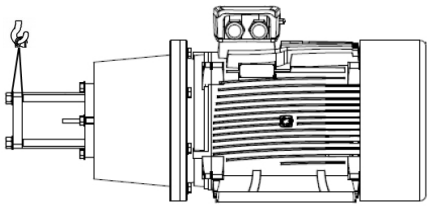
Insufficient stability
Risk of crushing hands and feet!

▷ During assembly/dismantling, secure the pump (set)/pump parts to prevent tipping or falling over.

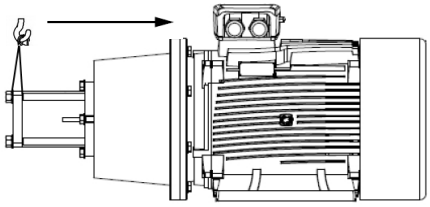
1. Attach the pump to suitable lifting equipment.



2. Loosen and remove the screws between the pump flange and the bell housing.
3. Loosen the screw between the support foot and SALINO, but do not remove.
4. Turn the pump by 45° and ensure that the lifting tackle is slightly tensioned.



5. Remove the screw between the support foot and SALINO.
6. Loosen the screws at the motor feet, but do not remove.
7. Slightly shift the pump set in the axial direction towards the motor fan.



8. Remove the pump to disconnect it from the motor.

	NOTE
	The removal of the pump allows the jaw coupling's insert to be checked for wear. In the event of signs of wear, replace this part. Observe the manufacturer's product literature supplied with the coupling.

7.4.5 Removing the mechanical seal (same proceedure as with SALINO)

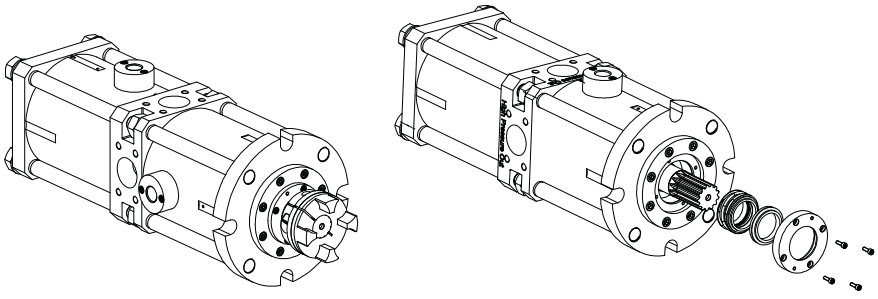


Fig. 11: Dismantling the mechanical seal

✓ The pump is kept in a stable position in a clean and level assembly area.

1. Dismantle the coupling on the pump's drive shaft.
2. Dismantle the seal cover including the mechanical seal's mating ring.
3. Remove the mechanical seal's mating ring from the seal cover.
4. Check the casing cover's static seal.
5. Clean the assembly surfaces and the drive shaft.
6. Pull the complete mechanical seal off the drive shaft.

7.5 Reassembling the pump set

7.5.1 General information/safety regulations

⚠ WARNING

Unqualified personnel performing work on the pump (set)
Risk of injury!

▷ Always have repair and maintenance work performed by specially trained, qualified personnel.

⚠ WARNING

Improper lifting/moving of heavy assemblies or components
Personal injury and damage to property!

▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.

⚠ WARNING

Insufficient stability
Risk of crushing hands and feet!

▷ During assembly/dismantling, secure the pump (set)/pump parts to prevent tipping or falling over.

CAUTION

Improper reassembly
Damage to the pump!

▷ Reassemble the pump (set) in accordance with the general rules of sound engineering practice.

▷ Use original spare parts only.

Sequence	Always reassemble the pump in accordance with the corresponding general assembly drawing.
O-rings	▪ Always use new O-rings. Never use O-rings that have been glued together from material sold by the metre.
Assembly adhesives	▪ Avoid the use of assembly adhesives, if possible. Match the lubricant to the respective fluid handled (e.g. pretreated seawater) and also observe the information given in the membrane operating manual.
Tightening torques	For reassembly, tighten all screws and bolts as specified in this manual. (Section 7.6 Page 44)

7.5.2 Installing the mechanical seal

The following rules must be observed when installing the mechanical seal:

- For installing the mechanical seal, refer to general assembly drawing.
- Work cleanly and accurately.

- Only remove the protective wrapping of the contact faces immediately before installation takes place.
- Prevent any damage to the sealing surfaces or O-rings.
- The surface of the mechanical seal on the drive shaft must be clean and smooth, and the mounting edge chamfered.
- When sliding the rotating assembly onto the drive shaft, take appropriate steps to protect the surface of the drive shaft and the mechanical seal's elastomer bellows from damage.

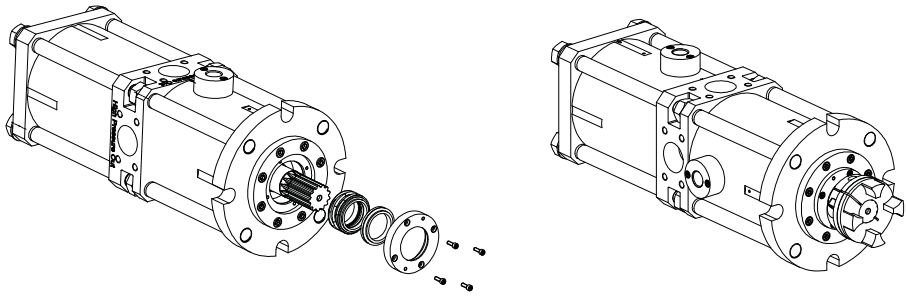


Fig. 12: Installing the mechanical seal

✓ The general information/safety regulations have been observed and implemented. (Section 7.5.1 Page 42)

✓ The pump and the individual parts of the mechanical seal are kept in a clean and level assembly area.

✓ All dismantled parts have been cleaned and checked for wear.

✓ Any damaged or worn parts have been replaced by original spare parts.

✓ The sealing surfaces have been cleaned.

1. Axially slide the rotating assembly of the mechanical seal into position on the drive shaft.
2. Insert the mating ring in the seal cover.
3. Fit the seal cover including inserted O-ring and the mechanical seal's mating ring to the casing using socket head cap screws

7.5.3 Reassembling the pump

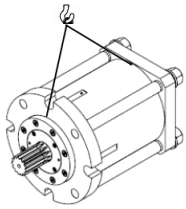


Fig. 13: Reassembling the pump

✓ The axial alignment of the coupling has been checked/adjusted.

✓ The coupling insert has been checked for wear and replaced if necessary.

1. Attach the pump to the lifting equipment as shown.
2. Connect the pump to the motor via the coupling and align to the bell housing.
3. Slide the motor and pump in the direction of the support foot.
4. The distance between the pump and the support foot is defined by means of a spacer sleeve.
5. Fit the support foot to the pump via the spacer sleeve.

6. Position the motor in such a manner that the pump flange lies flush with the bell housing.
7. Turn the pump in such a manner so that the connections are correctly positioned.
8. Fit the pump to the bell housing.
9. Tighten the screwed connection between the pump and the support foot.
10. Fit the motor to the mounting frame.

7.6 Tightening torques

Table 17: Tightening torques for screws/bolts and/or nuts made of stainless steel, A4-70

Screw/bolt	Thread × pitch	Torque
		[Nm]
Hexagon socket head cap screw, seal cover	M5 × 0,8	4,25
Hexagon head bolt, motor flange	M16 × 2	148
Hexagon socket head cap screw, motor feet	M16 × 2	148
Hexagon socket head cap screw, pump flange	M20 × 2,5	290
Hexagon head bolt, support	M12 × 1,75	59,9

7.7 Spare parts stock

7.7.1 Ordering spare parts

Always quote the following data when ordering replacement or spare parts:

- Order number
- Order item number
- Consecutive number
- Type series
- Size
- Material variant
- Seal code
- Year of construction

Refer to the name plate for all data.

Also specify the following data:

- Part No. and description
- Quantity of spare parts
- Shipping address
- Mode of dispatch (freight, mail, express freight, air freight)

8 Trouble-shooting

⚠ WARNING

Improper work to remedy faults
Risk of injury!

▷ For any work to remedy faults observe the relevant information in this manual or in the relevant accessory manufacturer's product literature.

If problems occur that are not described in the following table, consultation with the KSB customer service is required.

A Pump is running but does not deliver
B Insufficient feed water flow
C Insufficient permeate flow
D Excessive leakage at the shaft seal
E Excessive power input
F Unusual vibrations and/or noises
G Leakage at the pump
H Excessive discharge pressure
I Impermissible temperature increase in the pump
J Pump discharge pressure is too low
K Plain bearing life too short
L Mechanical seal life too short

Table 18: Trouble-shooting

A	B	C	D	E	F	G	H	I	J	K	L	Possible cause	Remedy
-	✘	✘	✘	✘	✘	-	-	✘	-	-	-	Increased leakage due to wear	Perform maintenance and replace worn parts by new ones.
✘	-	-	-	✘	✘	-	-	-	-	-	-	Clogged inlet pipe or valves in piping closed or not fully open	Check inlet pipe, remove any foreign particles and check all valves.
-	-	-	-	✘	-	-	✘	-	-	-	-	Dirt on the membrane (fouling and/or scaling)	Clean membranes or replace if required.
-	-	-	-	✘	-	-	✘	✘	-	-	-	Change of feed water data (higher salt content, temperature)	Check water data, check suitability of selected system.
-	-	-	✘	-	-	✘	-	-	-	-	-	Dynamic and/or static seal failure	Replace mechanical seal, check static seals and replace by new ones if required.
-	-	✘	-	-	-	-	-	-	✘	-	-	Open bypass valve	Close bypass valve.
✘	✘	✘	-	-	-	-	-	-	-	-	-	Incorrect pump rotational speed	Check rotational speed and correct if necessary.
✘	-	-	-	-	✘	-	-	-	-	-	-	Pump and/or piping are not completely vented or primed.	Vent pump and prime.
-	-	-	-	-	✘	-	-	-	-	-	-	Insufficient pump inlet pressure	Check inlet pressure and match if necessary.
-	-	-	-	-	✘	-	-	-	-	-	-	Back pressure too low	Check back pressure and match valve position if necessary.
-	-	-	-	✘	✘	-	-	-	-	-	-	Rolling element bearings of motor are worn.	Replace rolling element bearings.
-	-	-	-	✘	-	-	-	-	-	-	-	Sympathetic vibrations in the piping	Reduce distances between pipe clamps; fasten the pipes using anti-vibration material.
-	-	-	-	-	✘	-	-	-	-	-	-	Insufficiently secured pump and piping system	Check anchoring of pump or pump set. Support and fasten piping sufficiently, use expansion joints if required.
-	-	-	-	-	-	-	-	-	-	✘	✘	Dry running of pump	Monitor pump and system (flow meter, pressure gauge) to prevent dry running.

A	B	C	D	E	F	G	H	I	J	K	L	Possible cause	Remedy
-	-	-	x	-	-	x	-	-	-	x	x	Solids in the fluid handled	Check pretreatment and prefiltration and repair if required.
-	-	-	-	x	-	-	-	-	-	-	-	Speed too high	Reduce speed.

9 Related Documents

9.1 Exploded view and list of components

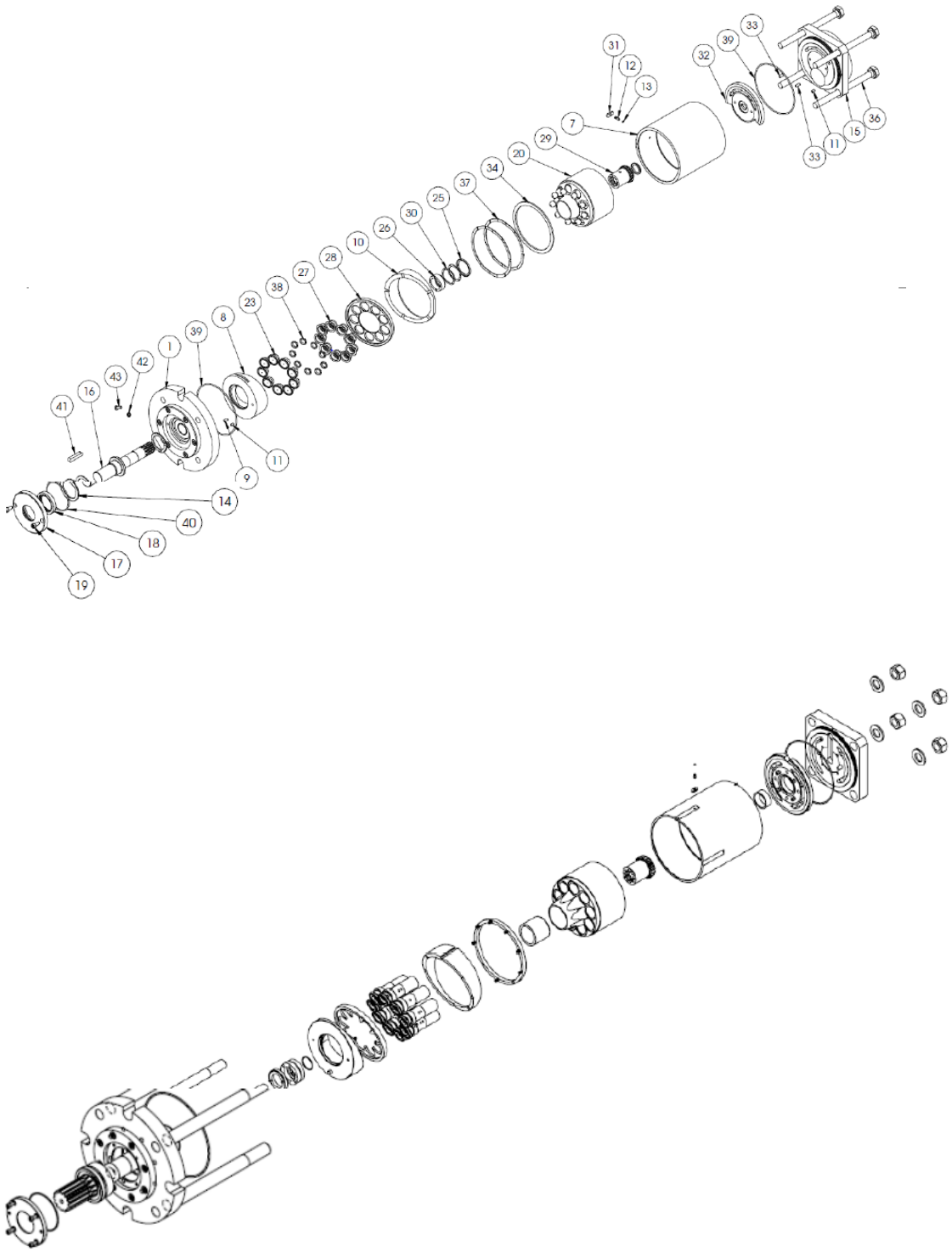


Fig. 14: Exploded view of NOVA P60 and NOVA P180 as shown above

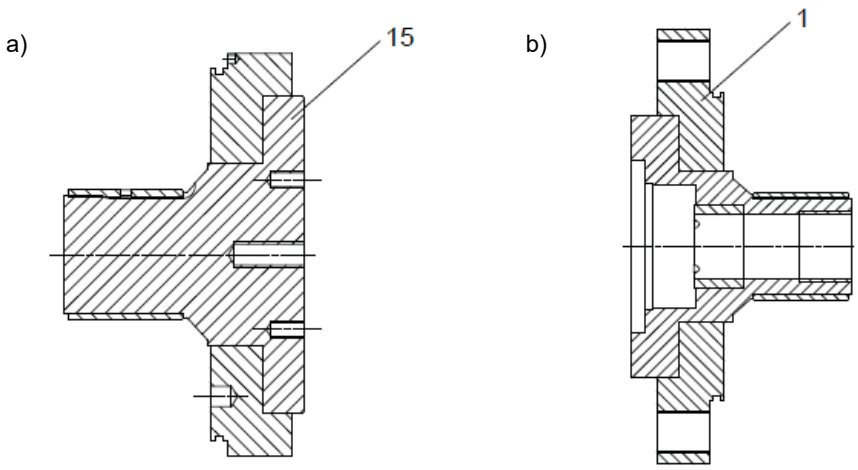


Fig. 15: Detailed view: a) Motor end cover b) Pump flange

Table 19: List of components

Part No.	Description	Part No.	Description
7	Casing	30	Bush
130	Casing part	25	Bearing bush
32	Control cam	10	Guide plate
1	Adapter	34	Disc
15	Casing cover	31	Parallel pin
25	Thrust plate	20	Cylinder
16	Shaft	23/38/27/	Piston slipper and backing ring
29	Drive shaft	14	Thrust washer
26	Thrust bearing plate	36	Tie bolt
39/40	O-rings	19	Hexagon socket head cap screw
17	Mechanical seal	43	Bolt
19	Seal cover	12/33/11	Pin
10	Backing ring	41	Key
37	Ring	37	Spring
28	Retaining ring		

9.2 Dimensions and connections

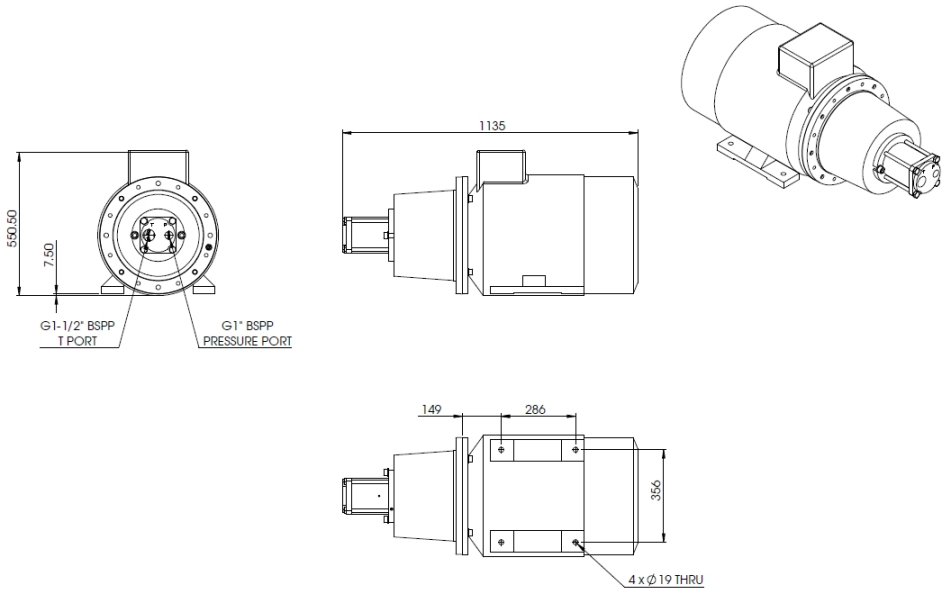


Fig. 16: Dimensions of NOVA P60 with 37 kW motor

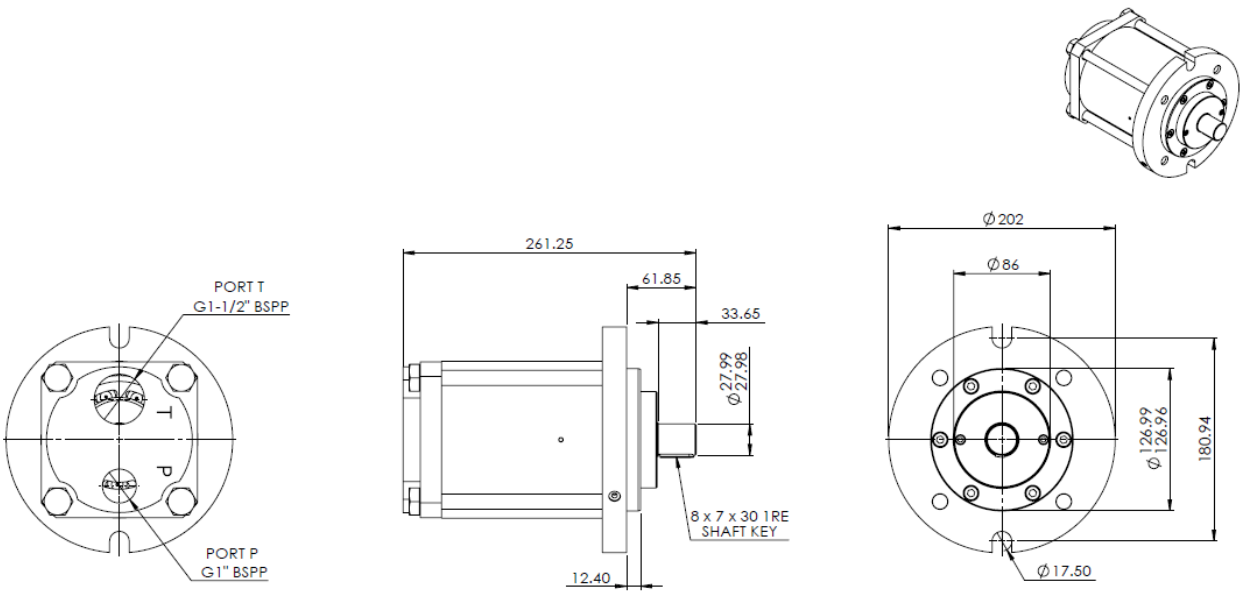


Fig. 17: Dimensions and connections NOVA P60 bare shaft

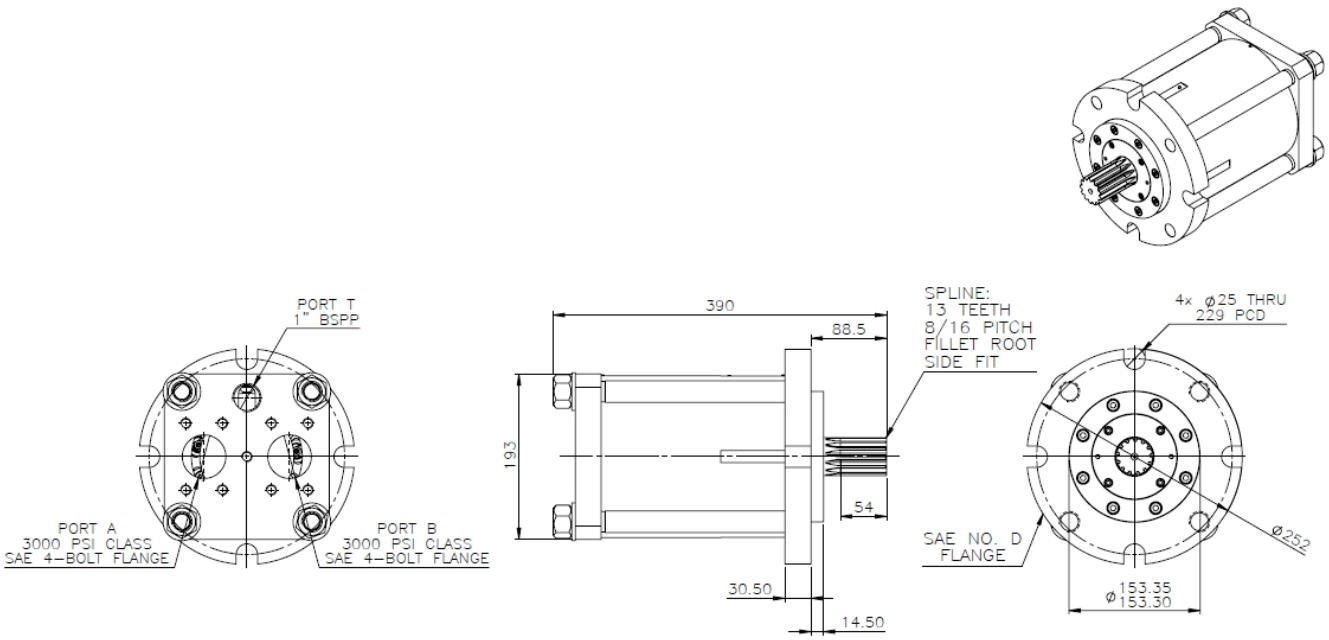


Fig. 18: Dimensions and connections NOVA P180 bare shaft

Fig. 19: Connections

Port T	"Low Pressure in" connection of NOVA P60 1 1/2“ BSPP (fluid inlet)
Port P	"High Pressure Out" connection of NOVA P60 1“ BSPP (fluid out)
Port T	"lubrication flow" connection of NOVA P180 1“ BSPP (fluid out)
Port A	"Low Pressure In" connection of NOVA P180 2“ SAE Flange (fluid inlet)
Port B	"High Pressure Out" connection of NOVA P180 2“ SAE Flange (fluid out)

Dimensions (subject to motor make)

Motor																						
0,55 kW	P1	471																				
0,75 kW	P1, P3, P6	*	*	*																		
1,1 kW	P3, P6, P15		431	431	*																	

* on request

10 EC Declaration of Conformity

Manufacturer: SALINNOVA GmbH
Gutenbergtraße 29
67240 Bobenheim-Roxheim (Germany)

The manufacturer herewith declares that the product:

NOVA Axial Piston Pump

SALINNOVA order number: .....

- is in conformity with the provisions of the following Directives as amended from time to time:
  - Low-voltage Directive 2006/95/EC
  - EC Machinery Directive 2006/42/EC
  - "Ecodesign" Directive 2009/125/EC, Regulation No. 640/2009
  - Electromagnetic Compatibility Directive 2004/108/EC

The manufacturer also declares that:

- the following harmonised international standards have been applied:
  - ISO 12100,
  - EN 809/ A1
  - EN 60034-1:2010, EN 60034-1:2006
  - EN 60204-1:2006
  - EN 61800-3:2004
  - Regulation 640/2009 pertaining to the ecologically compatible design of electric motors

Person authorised to compile the technical file:
Name
Function
Address (company)
Address (Street, No.)
Address (post or ZIP code, city) (country)

The EC Declaration of Conformity was issued in/on:

Place, date

.....[2)].....

Name

Function
Company
Address

2) A signed, legally binding declaration of conformity is supplied with the product.

11 Certificate of Decontamination

Type: .....
Order number/
Order item number [3]: .....

Delivery date: .....

Field of application: .....

Fluid handled [3]: .....

Please tick where applicable [3]:

☐  Radioactive

☐  Explosive

☐  Corrosive

☐  Toxic

☐  Harmful

☐  Bio-hazardous

☐  Highly flammable

☐ 

Safe

Reason for return [3]: .....

Comments: .....

.....

The product/accessories have been carefully drained, cleaned and decontaminated inside and outside prior to dispatch/ placing at your disposal.

We herewith declare that this product is free from hazardous chemicals, biological and radioactive substances.

For mag-drive pumps, the inner rotor unit (impeller, casing cover, bearing ring carrier, plain bearing, inner rotor) has been removed from the pump and cleaned. In cases of containment shroud leakage, the outer rotor, bearing bracket lantern, leakage barrier and bearing bracket or intermediate piece have also been cleaned.

For canned motor pumps, the rotor and plain bearing have been removed from the pump for cleaning. In cases of leakage at the stator can, the stator space has been examined for fluid leakage; if fluid handled has penetrated the stator space, it has been removed.

☐ No special safety precautions are required for further handling.
☐ The following safety precautions are required for flushing fluids, fluid residues and disposal:

.....

.....

We confirm that the above data and information are correct and complete and that dispatch is effected in accordance with the relevant legal provisions.

.....	.....	.....
Place, date and signature	Address	Company stamp

3) Required fields

Index


104 LRS @ 92 bar
Relief set @ 115 bar
102 LRS @ 92 bar
Relief set @ 115 bar

S1859.81/01-EN

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