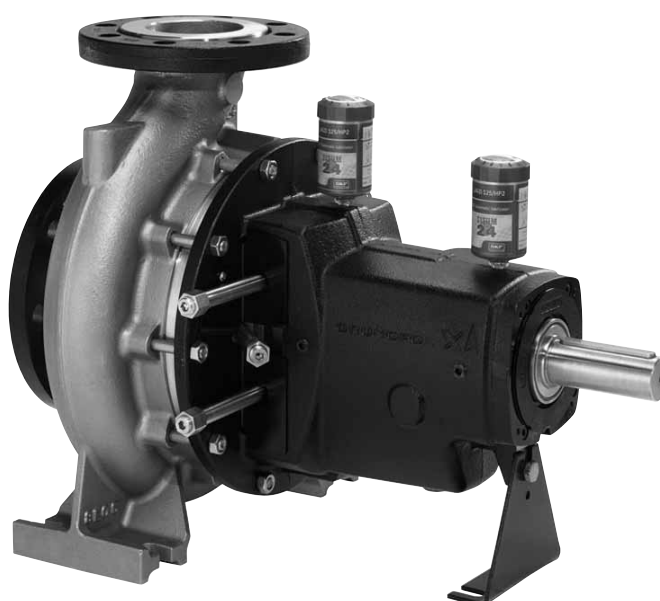


# NKG

## Double seal (back-to-back)

### Installation and operating instructions





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Original installation and operating instructions.

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**Warning**

*Prior to installation, read these installation and operating instructions. Installation and operation must comply with local regulations and accepted codes of good practice.*

**1. Symbols used in this document**



**Warning**

*If these safety instructions are not observed, it may result in personal injury!*



*If these safety instructions are not observed, it may result in malfunction or damage to the equipment!*



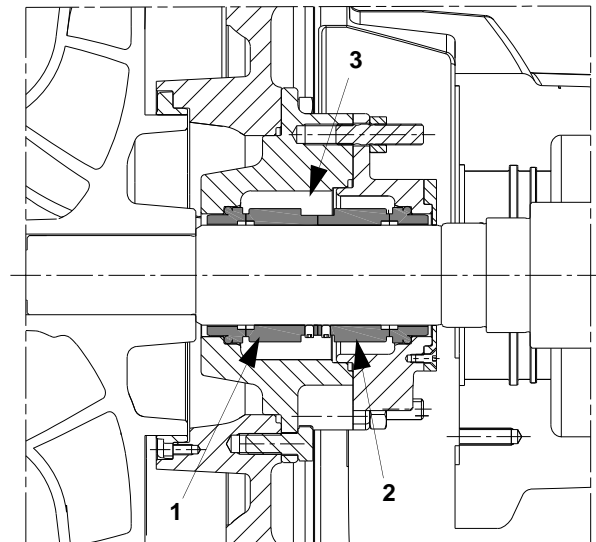
*Notes or instructions that make the job easier and ensure safe operation.*

**2. General information**

These installation and operating instructions are a supplement to installation and operating instructions for NK, NKG pumps.

**3. Product description**

This type of double seal consists of two shaft seals mounted in a back-to-back arrangement in a separate seal chamber or of a cartridge seal.



TM04 6058 4709

**Fig. 1** Back-to-back seal arrangement consisting of two shaft seals

| Pos. | Description                            |
|------|--|
| 1    | Primary shaft seal                     |
| 2    | Secondary shaft seal                   |
| 3    | Seal chamber, containing barrier fluid |

The back-to-back seal arrangement is suitable for applications where leakage of the pumped liquid to the environment is unacceptable. The back-to-back double seal protects the surrounding environment and the people working near the pump. In back-to-back seal arrangements, the pressure in the seal chamber must be higher than the pumped liquid pressure in order to prevent the pumped liquid from leaking through the shaft seal to the environment.

The back-to-back shaft seal arrangement is particularly suitable for liquids with many abrasive particles. The seal arrangement prevents the pumped liquid from entering the seal gap and, consequently, prevents excessive wear. In this case a single-seal arrangement would either wear out or be damaged.

Pumps with a back-to-back shaft seal arrangement require a pressurising system providing the correct pressure to the barrier fluid in the barrier fluid chamber.

**4. Applications**

The back-to-back double-seal arrangement is the optimum solution in these cases:

- The pump is pumping toxic and explosive liquids.
- The pump is pumping aggressive and abrasive liquids.
- The pump is pumping hardening liquids, e.g. oil products.
- The pump is pumping sticky liquids, e.g. paint and varnishes.
- The pump is operating with a negative inlet pressure (vacuum) of 0.7 - 0.9 bar compared to the pressure in the barrier fluid chamber.

The back-to-back seal arrangement can handle a pumped liquid temperature up to 140 °C.

## 5. Operating conditions

The operating conditions stated in the installation and operating instructions for NK, NKG pumps also apply for back-to-back shaft seal pumps.

### 5.1 Barrier fluid


The barrier fluid must be clean.

**Caution** *The barrier fluid should be selected according to the application and must not chemically attack the materials of the pump and the shaft seal.*

Examples:

| Application                      | Liquids mixed into the barrier fluid   |
|----------------------------------|--|
| Heat transfer / hot applications | Monoethyleneglycol (without additives) |
| Chemistry / industry             | Customer wish                          |

As the barrier fluid has a higher pressure than the pumped liquid, it serves as lubricating liquid for both primary and secondary seal faces. The barrier fluid will seep through the primary shaft seal and be mixed with the pumped liquid. Consequently, the barrier fluid chosen must always be compatible with the pumped liquid. Barrier fluid seeping through the secondary shaft seal evaporates.

**Warning**  
 *If the shaft seal is used in applications where special safety precautions must be observed due to hazardous liquids, the customer bears full responsibility!*

#### 5.1.1 Prescribed overpressure of barrier fluid

The barrier fluid pressure must be minimum 1.5 bar or 10 % above the pumped liquid pressure close to the seal.

#### 5.1.2 Maximum barrier fluid pressure and temperature

Due to the shaft seal design, the pressure in the seal chamber/cartridge seal must not exceed 25 bar. The maximum permissible temperature of the barrier fluid depends on the rubber material of the shaft seal.

| Shaft seal rubber | Max. permissible temperature of barrier fluid [°C] |
|-------------------|--|
| EPDM              | +120   |
| FFKM              | +140   |
| FKM               | +80  |
| FXM               | +140   |
| HNBR              | +90  |

These values apply to water as barrier fluid. If other barrier fluids are used, contact Grundfos for the max. permissible temperature of the barrier fluid.

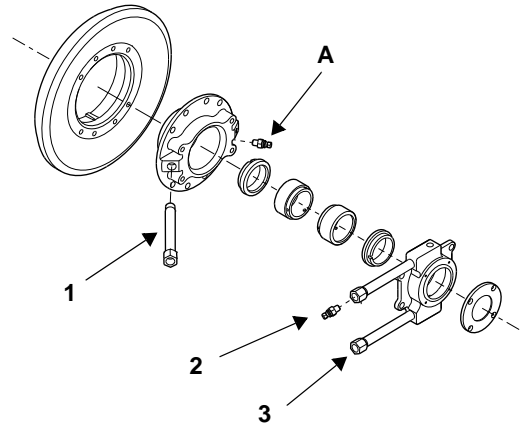
#### 5.1.3 Barrier fluid evaporation point

The back-to-back seal arrangement can handle a pumped liquid temperature up to 140 °C. In order to ensure proper liquid lubrication in the the seal gap, it is very important that the evaporation point of the barrier fluid is at least 10-15 °C higher than the temperature of the pumped liquid.

## 6. Installation

### 6.1 Barrier fluid connection

#### 6.1.1 Back-to-back seal arrangement with two separate shaft seals in a seal chambe

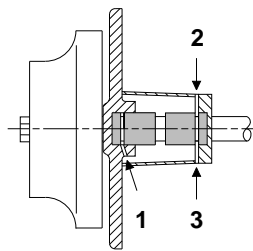


**Fig. 2** Back-to-back seal arrangement with two separate shaft seals in a seal chamber

| Pos. | Description   |
|------|---|
| A    | Vent screw for pumped liquid  |
| 1    | Primary shaft seal pipe connection - 3/8"   |
| 2    | Secondary shaft seal pipe connection with vent screw for venting of seal chamber - 3/8" |
| 3    | Secondary shaft seal pipe connection - 3/8"   |

In this back-to-back shaft seal arrangement the seal chamber has three connections. See fig. 2 and fig. 3. Pos. 1 leads to the pumped liquid side of the shaft seal, and pos. 2 and 3 lead to the seal chamber. All connections are close to the seal faces of the shaft seal.

#### Connections



**Fig. 3** Direction of barrier fluid

#### Dead-end solutions (See 6.2 Pressure sources)

Use only connection 1 or 3. Connection 2 must be plugged.

**Note:** Automatic venting of the seal chamber must be considered for the application. Connection 2 can be used for this.

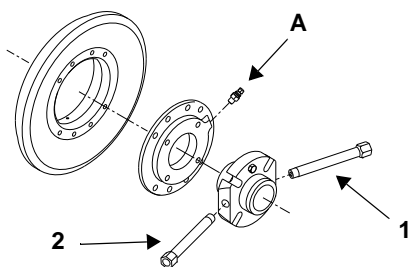
#### Circulating solutions (See 6.2 Pressure sources)

Use two connections. We recommend to use connection 1 as inlet and 2 as outlet. This will create a crossflow, have a cooling effect on the shaft seals, and at the same time provide automatic venting of the seal chamber. Connection 3 must be plugged.

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TM04 6056 4709

6.1.2 Back-to-back seal arrangement with cartridge seal



TM04 4330 3110

Fig. 4 Back-to-back seal arrangement with cartridge seal

| Pos. | Description                                   |
|------|---|
| A    | Vent screw for pumped liquid                  |
| 1    | Cartridge seal inlet pipe connection - 3/8"   |
| 2    | Cartridge seal outlet pipe connections - 3/8" |

6.2 Pressure sources

The overpressure in the barrier fluid in the seal chamber in relation to the pumped liquid pressure can be maintained by various pressure sources:

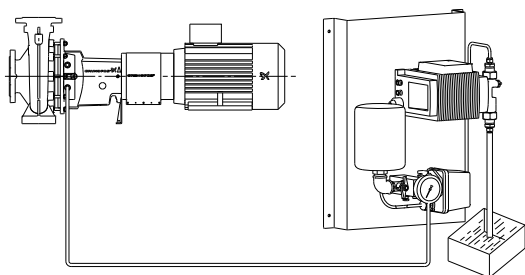
- an existing pressure source (many applications incorporate pressurised systems)
- a separate pressure source (e.g. a dosing pump unit)
- a pressure intensifier.

6.2.1 Existing pressure source

**Standard shaft seals:** The existing system may provide both the barrier fluid and the overpressure. It can be either a dead-end or a circulating solution. In both cases the barrier fluid pressure must be fixed at a prescribed overpressure level, see section 5.1.1.

**Cartridge seal:** The existing system may provide both the barrier fluid and the overpressure. A cartridge seal is **not** for use with a dead-end solution. The barrier fluid pressure must be fixed at a prescribed overpressure level, see section 5.1.1.

6.2.2 Pump with dosing pump unit (dead-end solution)



TM04 4334 1209

Fig. 5 Pump with dosing pump unit

**Standard shaft seals:** The setpoint pressure of the barrier fluid can be set by means of the pressure switch on the dosing pump. When the pressure drops below the setpoint, the dosing pump will start and thus maintain the overpressure in the seal chamber. The dosing pump unit solution is mainly used in dead-end applications where cooling of primary shaft seal is sufficient without the cooling effect of recirculation.

**Note** **One dosing pump unit can supply several pumps with back-to-back seal arrangements.**

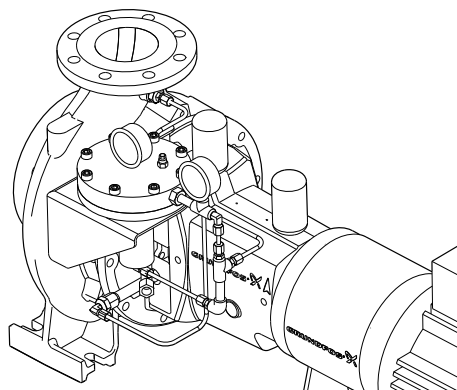
Maximum operating pressure in seal chamber: 16 bar.

Dosing unit outlet: 1 x Rp 1/4.

**Note** **Connecting pipes or hoses are not included.**

**Cartridge seal:** A cartridge seal is not for use with a dead-end connection.

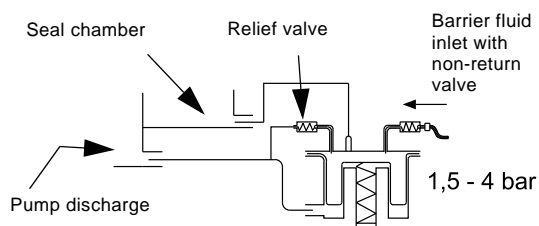
6.2.3 Pump with pressure intensifier (dead-end solution)



TM04 4333 1209

Fig. 6 Pump with pressure intensifier

**Standard shaft seals:** The Grundfos pressure intensifier maintains a pressure that is 1.5 - 4 bar higher than the pumped liquid pressure, independent of the specific pumped liquid pressure.



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Fig. 7 Principle sketch of intensifier connections

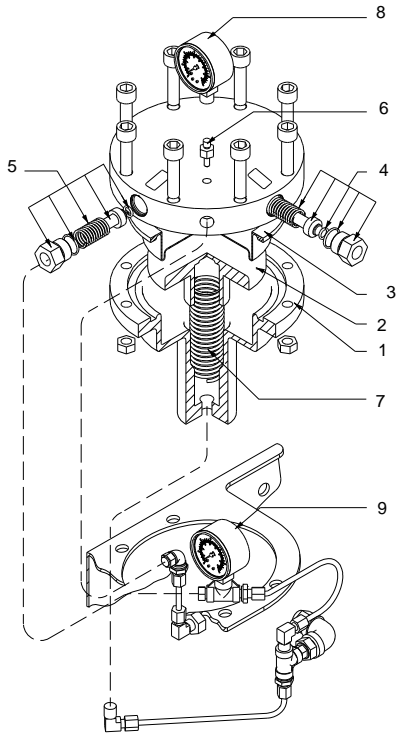
The system maintains the overpressure automatically - from standstill to max. operating pressure. The barrier fluid seeps through the primary shaft seal and evaporates through the secondary shaft seal. In this way the barrier fluid in the intensifier is consumed over time, and the intensifier has to be refilled manually. The barrier fluid inlet must be fitted with a non-return valve to avoid back pressure to the source.

**Note** **One intensifier can only supply one pump. The intensifier is mounted on the pump from factory.**

Maximum operating pressure of the pump discharge pressure at the pressure intensifier: 25 bar.

**Cartridge seal:** A cartridge seal is **not** for use with a dead-end connection.

Components of pressure intensifier

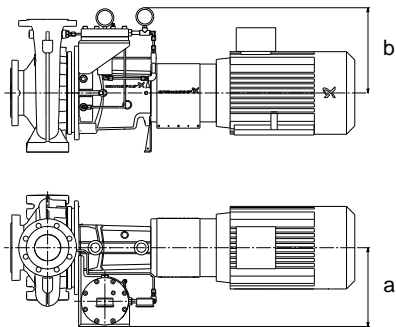


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Fig. 8 Exploded view of pressure intensifier

| Pos. | Designation                           |
|------|---------------------------------------|
| 1    | Pressure intensifier                  |
| 2    | Piston                                |
| 3    | Diaphragm                             |
| 4    | Non-return valve                      |
| 5    | Relief valve, opening pressure 25 bar |
| 6    | Vent screw                            |
| 7    | Spring for piston                     |
| 8    | Pressure gauge (barrier fluid)        |
| 9    | Pressure gauge (pumped liquid)        |

Dimensions of pump with pressure intensifier



TM04 4335 1209

Fig. 9 Pump with pressure intensifier

Dimensions apply to all NKG pump sizes

|        | Shaft seal diameter |    |     |     |     |
|--------|---------------------|----|-----|-----|-----|
|        | 28                  | 38 | 48  | 55  | 60  |
| a [mm] | -                   | -  | 383 | 300 | 300 |
| b [mm] | -                   | -  | 310 | 380 | 380 |



## 7. Start-up

### 7.1 Pump with dosing pump

#### Warning



Pay attention to the orientation of the vent holes, and take care to ensure that the escaping liquid does not cause personal injury or damage to the motor or other components.

When handling hot or hazardous liquids, special attention should be paid to the risk of personal injury.

When pumping flammable liquids, beware of static discharges. The funnel, for instance, should be earthed!

The seal chamber/cartridge seal must always be filled with barrier fluid during operation.

Dry-running will destroy the shaft seal.

| Illustration | Step | Action  |
|--------------|------|---|
|              | 1    | <p><b>Connecting the barrier fluid supply pipe</b></p> <ul style="list-style-type: none"> <li>Connect one end to the seal chamber (pos. 1, fig. 2) or to the cartridge seal (pos. 1, fig. 4).</li> <li>Connect the other end to the outlet of the dosing pump.</li> </ul>   |
|              | 2    | <p><b>Recommended pressure</b></p> <ul style="list-style-type: none"> <li>Set the start pressure of the dosing pump to a pressure 1.5 to 2 bar above the highest pressure the pump can deliver.<br/>(<math>P_{\text{pump}} + P_{\text{inlet}} + P_{1.5 - 2.0} &lt; P_{\text{dosing max.}}</math>)</li> </ul>  |
|              | 3    | <p><b>Filling with barrier fluid</b></p> <ul style="list-style-type: none"> <li>Start the dosing pump.</li> <li>Fill with barrier fluid.</li> </ul> <p>Seal chamber: Loosen the vent screw at the top of the seal chamber (pos. 2, fig. 2), and fill the seal chamber with barrier fluid through the inlet (pos. 3, fig. 2). When the liquid starts running out of the vent hole, immediately close the vent screw.</p> <p>Cartridge seal: Fill the cartridge seal with barrier fluid through one of the connections (pos. 1 or 3, fig. 4). When the liquid starts running out of the vent hole, immediately close the vent screw.</p> <p>The dosing pump will stop automatically when the pressure set in step 2 has been reached.</p>   |
|              | 4    | <p><b>Operation with positive inlet pressure</b></p> <ul style="list-style-type: none"> <li>Loosen the vent screw (pos. A, fig. 2 or fig. 4) in the cover.</li> <li>Close the isolating valve on the discharge side.</li> <li>Open the isolating valve on the inlet side.</li> <li>Slowly fill the pump with the liquid to be pumped.</li> <li>When the liquid starts running out of the vent hole, immediately close the vent screw.</li> </ul> <p><b>Operation with suction lift</b></p> <ul style="list-style-type: none"> <li>Loosen the vent screw (pos. A, fig. 2 or fig. 4) in the cover.</li> <li>Close the isolating valve on the discharge side.</li> <li>Fill the pump and the inlet pipe with the liquid to be pumped using a funnel.</li> <li>When the liquid starts running out of the vent hole, immediately close the vent screw.</li> </ul> <p><b>Note:</b> A non-return valve must be fitted to the inlet pipe.</p> |
|              | 5    | <p><b>Starting up the pump</b></p> <p>See also installation and operating instructions for NK, NKG pumps.</p> <ul style="list-style-type: none"> <li>Open the isolating valve on the discharge side.</li> <li>Start the pump, and check the direction of rotation.</li> <li>See the correct direction of rotation on the motor fan cover.</li> <li>After a few minutes, vent the pump again by means of the air vent screw (pos. A, fig. 2 or fig. 4).</li> </ul>   |

## 7.2 Pressure intensifier

**Warning**

**Pay attention to the orientation of the vent holes, and take care to ensure that the escaping liquid does not cause personal injury or damage to the motor or other components.**

**When handling hot or hazardous liquids, special attention should be paid to the risk of personal injury.**

**When pumping flammable liquids, beware of static discharges. The funnel, for instance, should be earthed!**

**The seal chamber/cartridge seal must always be filled with barrier fluid during operation.**

**Dry-running will destroy the shaft seal.**

| Illustration | Step | Action  |
|--------------|------|---|
|              | 1    | <p><b>Operation with positive inlet pressure</b></p> <ul style="list-style-type: none"> <li>Loosen the vent screw (pos. A, fig. 2 or fig. 4) in the cover.</li> <li>Close the isolating valve on the discharge side.</li> <li>Open the isolating valve on the inlet side.</li> <li>Slowly fill the pump with the liquid to be pumped. When the liquid starts running out of the vent hole, immediately close the vent screw.</li> </ul>   |
|              | 2    | <p><b>Operation with suction lift</b></p> <ul style="list-style-type: none"> <li>Loosen the vent screw (pos. A, fig. 2 or fig. 4) in the cover.</li> <li>Close the isolating valve on the discharge side.</li> <li>Fill the pump and the suction pipe with the liquid to be pumped using a funnel.</li> <li>When the liquid starts running out of the vent hole, immediately close the vent screw.</li> </ul> <p><b>Note:</b> A non-return valve must be fitted to the suction pipe.</p>  |
|              | 2    | <p><b>Filling with barrier fluid</b></p> <ul style="list-style-type: none"> <li>Fill the intensifier and the seal chamber/cartridge seal with barrier fluid, and connect the barrier fluid supply pipe to the unused inlet of the intensifier (pos. 4, fig. 8). The pressure in the seal chamber/cartridge seal must always be 1.5 to 4 bar higher than the pump pressure when the pump is not operating.</li> </ul> $p_f = p_s + 1.5 \text{ to } 4 \text{ bar.}$ <p><math>p_f</math> = To be read on the pressure gauge on the intensifier (pos. 8, fig. 8).<br/> <math>p_s</math> = Inlet pressure when the pump is not operating; it must always be 0.1 to 5 bar higher than the atmospheric pressure.<br/> To be read on the pressure gauge in the connection pipe (pos. 9, fig. 8) between intensifier and pump.</p> |
|              | 3    | <p><b>Venting</b></p> <p>During filling, the seal chamber/cartridge seal and the intensifier must be vented:</p> <ul style="list-style-type: none"> <li>Seal chamber: Vent the seal chamber by means of the vent screw at the top of the seal chamber (pos. 2, fig. 2).</li> <li>Cartridge seal: The cartridge seal is self venting.</li> <li>Intensifier: Vent the intensifier by means of the vent screw at the top of the intensifier (pos. 6, fig. 8).</li> </ul>   |
|              | 4    | <p><b>Disconnecting the barrier fluid supply pipe</b></p> <ul style="list-style-type: none"> <li>Disconnect the barrier fluid supply pipe from the intensifier.</li> </ul>  |
|              | 5    | <p><b>Starting up the pump</b></p> <p>See also installation and operating instructions for NK, NKG pumps.</p> <ul style="list-style-type: none"> <li>Start the pump, and check the direction of rotation. See the correct direction of rotation on the motor fan cover.</li> <li>After a few minutes, vent the pump again by means of the vent screw (pos. A, fig. 2 or fig. 4).</li> </ul>   |

## 8. Maintenance

See installation and operating instructions for NK, NKG pumps.

### Dosing pump

See the installation and operating instructions for the dosing pump.

### Pressure intensifier

The pressure intensifier is maintenance-free.

## 9. Operation

A very small quantity of the barrier liquid (less than 1.5 ml per operating hour) will flow into the pumped liquid.

The flow will increase with:

- increasing start/stop frequency
- discharge pressure fluctuations
- poor shaft seal assembly
- worn shaft seal faces.

### Dosing pump

The pressure of the barrier fluid must always be at least 1.5 bar or 10 % higher than the pressure of the pumped liquid. This is automatically checked by the pressure switch/transmitter fitted together with the dosing pump.

### Pressure intensifier

To ensure optimum function and performance, check that the barrier fluid pressure (read pressure gauge pos. 8 in fig. 8) is always at least 1.5 bar or 10 % higher than the pressure of the pumped liquid (read pressure gauge pos. 9 in fig. 8). As the barrier fluid is consumed over time, the pressure intensifier has to be refilled.

### 9.1 Periods of inactivity and frost protection

#### Warning

***Pay attention to the directions of the vent holes, and take care to ensure that the escaping liquid does not cause injury to persons or damage to the motor or other components.***

***When handling hot or hazardous liquids, special attention should be paid to the risk of injury caused by scalding hot liquid or hazardous liquid.***  
***Local safety regulations must be observed.***



### Pump

For general guidelines, see installation and operating instructions for NK, NKG pumps.

### Seal chamber

Unscrew the two connections (pos. 2 and 3, fig. 2).

The lower barrier fluid connection functions as drain.

### Cartridge seal

1. Unscrew the connections (pos. 1 and 3, fig. 4).
2. Empty the cartridge seal. This can be done in two ways:
  - Blow out remaining liquid by means of an air gun or a similar device. The pressure must not exceed the pressure rating of the cartridge seal.
  - Flush the cartridge seal by means of a glycol-water solution, if applicable for the application. The pressure must not exceed the pressure rating of the cartridge seal.

### Dosing pump

For frost protection, see installation and operating instructions for the dosing pump.

## 10. Service

When ordering spare parts, always state the pump nameplate data to ensure that the correct parts are delivered.

If Grundfos is requested to service the pump, Grundfos must be contacted with details about the pumped liquid, etc. before the pump is returned for service. Otherwise Grundfos can refuse to accept the pump for service.

### 10.1 Service kits and service instructions

See [www.grundfos.com](http://www.grundfos.com) (WebCAPS), WinCAPS or Service Kit Catalogue.

## 11. Disposal

This product or parts of it must be disposed of in an environmentally sound way:

1. Use the public or private waste collection service.
2. If this is not possible, contact the nearest Grundfos company or service workshop.



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