NK, NKG

ATEX-approved pumps

Installation and operating instructions

Other languages

http://net.grundfos.com/qr/i/96528412

Original installation and operating instructions

These installation and operating instructions describe ATEX-approved Grundfos NK, NKG pumps and NK, NKG bare-shaft pumps.

Sections 1-5 provide important information about the product, information necessary to be able to unpack, install and start up the product in a safe way.

Sections 6-8 provide important information on service, fault finding and disposal of the product.

CONTENTS

Read this document before you install the product. Installation and operation must comply with local regulations and accepted codes of good practice.

1. General information

These supplementary installation and operating instructions apply to ATEX-approved Grundfos NK, NKG pumps and NK, NKG bare-shaft pumps. The pumps comply with ATEX Directive 2014/34/EU.

1.1 Symbols used in this document

DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious personal injury.

WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious personal injury.

CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate personal injury.

The text accompanying the three hazard symbols DANGER, WARNING and CAUTION is structured in the following way:

SIGNAL WORD

Description of hazard

Consequence of ignoring the warning.

- Action to avoid the hazard.

A blue or grey circle with a white graphical symbol indicates that an action must be taken.

A red or grey circle with a diagonal bar, possibly with a black graphical symbol, indicates that an action must not be taken or must be stopped.

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

Tips and advice that make the work easier.

1.2 Related installation and operating instructions

In addition to these instructions, the following installation and operating instructions must be observed:

- NK, NKG
  product number 96646512.

For special versions of the pumps, observe the relevant installation and operating instructions:

- NKG - Double seal (back-to-back)
  product number 97527932
- NKG - Double seal (tandem)
  product number 97527931.

2. Product introduction

2.1 NK, NKG bare-shaft pumps

ATEX-approved NK, NKG bare-shaft pumps are supplied with an ATEX marking similar to that of the ATEX-approved NK, NKG pump. See section *2.5 Identification*.

Installation and operating instructions mentioned in section *1.2* also apply to ATEX-approved NK, NKG bare-shaft pumps.

2.2 Intended use

The pumps are suitable for use in areas or zones classified according to Directive 2014/34/EU. In case of doubt, consult the above-mentioned directives, or contact Grundfos.

The pumps must only be operated within the specification given in the '"key application data sheet".

2.3 Pumped liquids

The pumps are suitable for thin, clean liquids, not containing solid particles or fibres.

2.4 Explosion protection documentation

The combination of an NK, NKG pump and all monitoring equipment must be described in the explosion protection document according to Directive 2014/34/EU. The responsibility rests with the installer or owner.

2.5 Identification

2.5.1 Nameplate

The nameplate on the pump head gives the following details:

- data for the standard pump
- data for the ATEX marking, pos. 1 and 2.

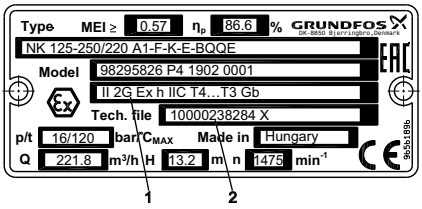


Fig. 1 Nameplate of ATEX-approved NK pump with single seal

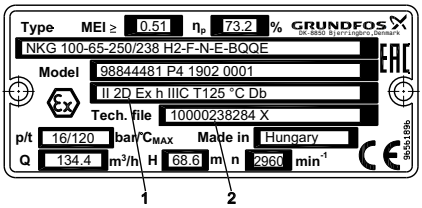


Fig. 2 Nameplate of ATEX-approved NKG pump with single seal

Data for the ATEX marking only refers to the pump part including the coupling. The motor has a separate nameplate.

ATEX-related positions on the pump nameplate:

Pos.	Description	
1	ATEX marking	
	II	Equipment group
	2, 3	Equipment category
	G D	Environment: Gas or vapours Combustible dust
	Ex	Explosion protection
	h	Type of protection
	II C IIIC	Environment group: Gas or vapours Combustible dust
	T4...T3	Maximum surface temperature according to 80079-36. Temperature range or specific temperature.
	T125 °C	
	Gb	EPL (Equipment Protection Level)
	Db	
2	Technical file number	
	100002 38284	Number of technical file stored at DEKRA.
	X	"X" indicates that the equipment is subject to special conditions for safe use. The conditions are mentioned in this document.

2.6 ATEX approvals

2.6.1 Scope of ATEX categories for NK, NKG pumps

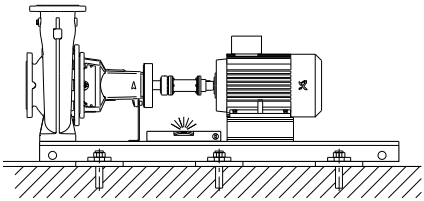
Directive		ATEX-approved NK, NKG pumps							
2014/34/EU	Equipment group	I		II					
	Equipment category	M		1		2		3	
	Environment	1	2	G	D	G	D	G	D
	EPL (Equipment Protection Level)	Ma	Mb	Ga	Da	Gb	Db	Gc	Dc
1999/92/EC	Zone			0	20	1	21	2	22
Pumps		None				NK, NKG			
Motors		None				II 2G Ex eb IIC T3 Gb II 2G Ex db IIC T4 Gb II 2G Ex db eb IIC T4 Gb	II 2D Ex tb IIIC T125 °C Db	II 3G Ex ec IIC T3 Gc	II 3D Ex tc IIIC T125 °C Dc

The link between groups, categories and zones is explained in Directive 2014/34/EU. Please note that this is a minimum directive. Some EU countries might therefore have stricter local rules. The user or installer is always responsible for checking that the group and category of the pump correspond to the zone classification of the installation site.

3. Installation requirements

3.1 Location

3.1.1 Installation position



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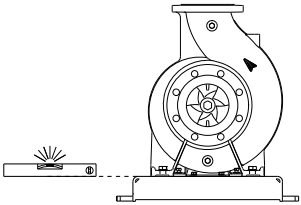

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Fig. 3 Horizontal installation of the products

3.1.2 Pit installation

WARNING

Accumulation of explosive gases from shaft seal leakage

Death or serious personal injury

- Provide adequate ventilation if the pump is installed in a pit. A minimum air exchange of 1.5 times per hour is required.

3.2 Bypass with pressure relief valve

CAUTION

Overheating

Minor or moderate personal injury

- The pump must not run against a closed outlet valve or a closed shut-off element as this may cause overheating. Install a bypass with a pressure relief valve.

Observe the minimum flow rate. See section *1.2 Related installation and operating instructions*.

4. Electrical connection

4.1 Earthing the pump housing

DANGER

Electric shock

Death or serious personal injury

- The pump housing must be earthed.

DANGER

Ignition of explosive environment

Death or serious personal injury

- The pump housing must be earthed.

Remove coating from the earthing point to ensure proper grounding connection.

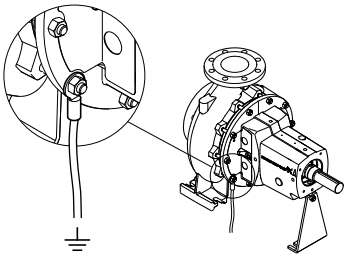

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Fig. 4 Earthing point of the pump housing

Torque: 80 ± 16 Nm.

5. Starting up the product

WARNING

Dry running

Death or serious personal injury

- Make sure that the pump is filled with pumped liquid during operation.

5.1 Before starting an ATEX-approved pump

Strictly observe the following check list.

1. Compare the order with the supplied pump and motor. Check that the EPL (Equipment Protection Level) of the pump and motor corresponds to what is ordered. If the EPL of the motor and pump differs from each other or the temperature class of the motor differs from that of the pump, the following applies:
   – The EPL which defines the lower protection level applies. Example: The EPL of the motor is Gc and the pump's is Gb. Gc applies.
   – The temperature class which defines the higher temperature applies.
   Example 1: Motor temperature class is T4 (135 °C), and pump temperature class is T3 (200 °C). T3 (200 °C) applies.
   Example 2: Motor temperature class is T3 (200 °C), and pump temperature class is T4...T3. T3 (200 °C) applies.
2. Check that the pumped liquid and its operating temperatures are in accordance with what is stated on the "key application data sheet".
3. Check that the shaft seal and rubber parts of the pump are as ordered. See the nameplate.

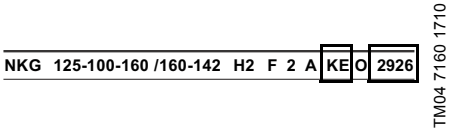

Fig. 5 Example of codes for rubber parts and shaft seal

The key to the nameplate is shown in the installation and operating instructions for the standard pump.

4. Check that the maximum speed on the pump nameplate corresponds to the speed of the motor and that the pump will not be used for operation with a frequency higher than 60 Hz.
5. Check alignment of the pump and motor. Follow the procedure in the standard instructions.
6. For the oil-filled bearing bracket, check that oil is filled to the correct level. Do not use another lubricant than specified. See section *1.2 Related installation and operating instructions*.
7. For bearing brackets with grease nipples, check that grease can be pumped into the bearing. Do not use another lubricant than specified. The re-greasing nipple could be defective, or the re-greasing channel may be blocked.
8. Check that the pump and/or auxiliary units have been filled with liquid and vented.
9. Check that the shaft can rotate freely.
   There must be no mechanical contact between the impeller and the pump housing.
10. Check the direction of rotation. The correct direction of rotation is shown by an arrow on the pump housing.
11. Follow the special startup procedures for pumps with double seal (back-to-back or tandem).
    See the installation and operating instructions for the pump in question.
12. If a pump with double seal (back-to-back) has been chosen, check that the seal chamber is correctly pressurised.
13. Before start and during operation, make sure that the pump does not leak or have any malfunctions.
14. The pump must be re-vented in these cases:
    – The pump has been stopped for a period of time.
    – Air or gas has accumulated in the pump.

5.2 Monitoring, circulating liquid and ventilation

Shaft seal arrangement	Type of unit	Solution		Type of pumped liquid	EPL	Text code[4)]
Single shaft seal	Pump unit			Non-flammable	Gc/Dc	1, 10
					Gb/Db	2, 10
				Flammable	Gc/Dc	2, 11
					Gb/Db	2, 11
Double shaft seal	Pump unit			Non-flammable	Gc/Dc	1, 10
					Gb/Db	2, 10
				Flammable	Gc/Dc	2, 11
					Gb/Db	2, 11
	Auxiliary unit	Dead-end	Pressureless[1)]	Non-flammable	Gc/Dc	3, 10
					Gb/Db	3, 10
				Flammable	Gc/Dc	3, 10
					Gb/Db	4, 11
			Pressurised[2)]	Non-flammable	Gc/Dc	5, 10
					Gb/Db	6, 10
				Flammable	Gc/Dc	5, 11
					Gb/Db	6, 11
		Circulating[3)]	Pressureless[1)]	Non-flammable	Gc/Dc	3, 7, 10
					Gb/Db	3, 7, 10
				Flammable	Gc/Dc	4, 8, 11
					Gb/Db	4, 8, 11
			Pressurised[2)]	Non-flammable	Gc/Dc	5, 7, 10
					Gb/Db	6, 8, 10
				Flammable	Gc/Dc	5, 7, 11
					Gb/Db	6, 8, 11

1) Pressureless: The pumped liquid will continuously leak into the auxiliary system liquid, the maximum leakage is 1.5 ml per hour, and may fill the auxiliary system.

2) Pressurised: The barrier liquid will continuously leak into the pumped liquid, the maximum leakage is 1.5 ml per hour. The liquids must be compatible.

3) Circulating: circulating liquid.

A temperature increase of 7-10 K across the shaft seal chamber and a maximum outlet temperature of 70 °C must be maintained. This ensures correct function of the shaft seals.
If circulation is lost, the temperature of the barrier or flushing liquid will increase.

4) See the table below for text code descriptions.

Text code	Description
Monitoring	
1	No additional monitoring, for example dry-running protection, is required for the pump system.
2	If the operator cannot ensure that the pump is filled with pumped liquid during operation, appropriate monitoring, for instance dry-running protection, is required to stop the pump in case of malfunction.
3	No additional monitoring, for example dry-running protection, is required for the auxiliary unit.
4	If the operator cannot ensure that the auxiliary unit is filled with barrier or flushing liquid during operation, appropriate monitoring, for instance a level switch, is required to give an alarm in case of malfunction.
5	In case of a drop in barrier liquid pressure, a warning must be given. Check the system and remedy.
6	In case of a drop in barrier liquid pressure, an alarm must be given, and the system must shut down if the barrier liquid pressure is not brought back to the correct pressure level.
Circulating liquid	
7	If circulation of the barrier or flushing liquid is lost, a warning must be given. Check the system and remedy.
8	If circulation of the barrier or flushing liquid is lost, an alarm must be given. Check the system and remedy. The system must shut down if the circulation cannot be re-established during operation.
Ventilation	
10	Ventilation around the pump is not required.
11	The leakage rate of a normally working shaft seal is less than 36 ml for each 24 hours of operation. Ventilation around the pump is required. The minimum air exchange is 1.5 times per hour.

CAUTION

Flammable material

Minor or moderate personal injury

- The responsibility for checking the functions of the dry-running protection, such as flow rate, sealing pressure and temperature of the barrier or flushing liquid, rests with the installer or owner.

5.3 Barrier or flushing liquid

Barrier or flushing liquid must have an auto-ignition temperature which is at least 50 K higher than the maximum surface temperature of the pump.

5.4 Liquid connections of dead-end solutions

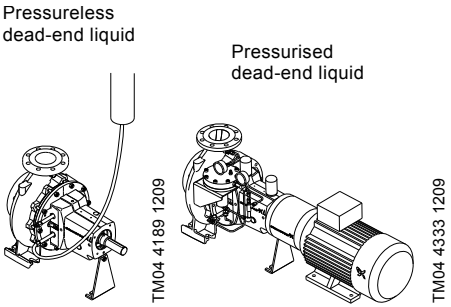

Fig. 6 Examples of double seal arrangements with dead-end solutions

For the examples in fig. 6, the liquid must be connected to pipe connection number 2 in fig. 7. Pipe connections 1 and 3 must be plugged. See fig. 7.

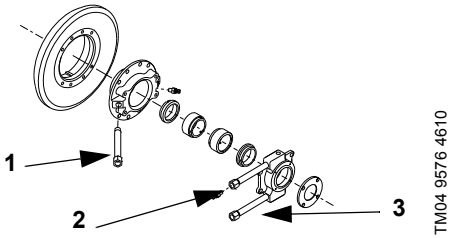

Fig. 7 Pipe connections

5.5 Circulating solution

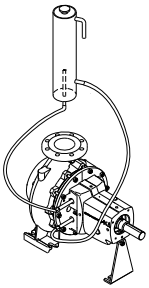

Fig. 8 Example of circulating solution

Important operating parameter for the circulating solution:

At all times, the maximum discharge temperature from the seal chamber must be kept below 70 °C, and optimally maximum 60 °C.

Delta T across the seal chamber is adjusted and set between 7 and maximum 10 K.

5.6 Vacuum operation or suction lift

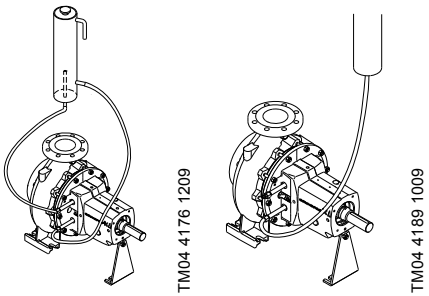

Fig. 9 Pumps with double seal arrangements connected to an elevated vessel

If vacuum operation or suction lift is a continuous or periodic operating condition for the applications shown in fig. 9, use appropriate level monitoring equipment to ensure liquid in the seal chamber. The pump must be stopped if the liquid reaches a specified low level in the supply vessel.

5.7 Checking the direction of rotation

Never check the direction of rotation by starting the pump, not even for a short period, unless the pump and auxiliary unit have been filled with liquid. This is to prevent temperature rises resulting from contact between rotating and stationary components, and to protect the shaft seal against dry running.

5.8 Monitoring of bearing condition

For EPL Gb/Db and Gc/Dc, bearing condition monitoring is basically not needed as failure of the bearings is considered a rare malfunction. However, local regulations may call for stricter measures with continuous monitoring of the bearing condition.

5.8.1 SPM nipples

For bearing brackets with grease nipples or constant-level oiler, SPM nipples are an option for vibration measurement. Through regular shock-pulse measurement, the development of incipient damage can be monitored.

The measuring point is located in the load zone of the bearing.

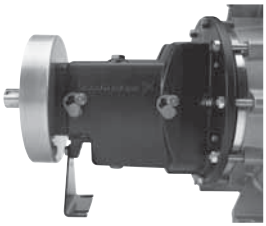

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Fig. 10 SPM fitting in the bearing bracket

To monitor the bearing condition, the initial vibration level, dBi (decibel initial), must be measured. It constitutes the starting point of the condition scale for a particular bearing.

If the vibration level develops faster than it did in the first two to three months of operation, renew the bearings.

If the vibration level develops fast, also observe for other operating conditions which could cause increased vibration levels.

5.8.2 Mounting of sensors or transmitters

Bearing brackets with grease nipples or constant-level oiler are optionally supplied with pre-machined tappings prepared for temperature sensors or transmitters.

Thus, it becomes possible to continuously measure the temperature development of the bearings.

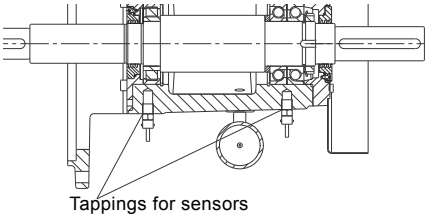

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Fig. 11 Optional tappings prepared for fitting of temperature sensors or transmitters

The alarm level is the maximum surface temperature detected by the bearing temperature sensor. The temperature alarm level is set 65 K above ambient temperature, but must be lower than the temperature classification for the area. Logging interval must be set to every 10th sec.

If the alarm level is reached, the system must be stopped. The protection system must lock the pump till it is manually restarted.

6. Servicing the product

Service on the pump end can be made on site. The pump end does not need to be shipped to an approved ATEX workshop.

Strictly observe the following check list. It may be overruled by stricter local maintenance schedules.

1. Check on a daily basis that the shaft seal and auxiliary units function correctly.
2. Check for oil leakage around the bearing shaft daily. If there is any oil spillage on the shaft packings, it may be due to one of the following reasons:
   – The bearing bracket is overfilled.
   – The breathing hole in the filling plug is blocked.
   – The shaft packing is defective.
3. Check the lubricant and bearing noise each week. If the bearings begin to show signs of wear, they must be replaced. Under optimum operating conditions, the operating life of the bearings can reach its designed life. After that period, we recommend replacing the bearings.
4. Check coupling rubber parts every four weeks. If they begin to show signs of wear, they must be replaced, and alignment of the pump must be checked.
5. Inspect O-rings for cracks, elasticity, and permanent change of shape when doing periodic maintenance or servicing the pump. Replace if necessary.
6. It is the responsibility of the customer to do the following:
   – Decide whether to use the non-sparking tools or to shut down the system for service.
   – Lay down a cleaning scheme for pump surfaces when you install it in a combustible dust environment.
7. When cleaning a pump located in a combustible dust environment, remember to take the shaft guard and coupling guard off, and clean these cavities.
8. Any standby pump installed must be switched on once a week to keep it operational.
9. The pressurising or flushing system must be thoroughly cleaned once a year. Read the manufacturer's instructions for the auxiliary unit. Take the pump out of operation for this purpose.
10. Torques for all fasteners can be found in the service instructions for NK, NKG pumps.

7. Technical data

7.1 Operating conditions

7.1.1 Liquid temperature

The maximum liquid temperature depends on the temperature class specified by the customer and the shaft seal.

Temperature class	Maximum surface temperature [°C]
T1	450
T2	300
T3	200
T4	135
T5	100
T6	85

The illustration below shows the maximum surface temperature of the pump as a result of maximum liquid temperature and temperature rise in the shaft seal.

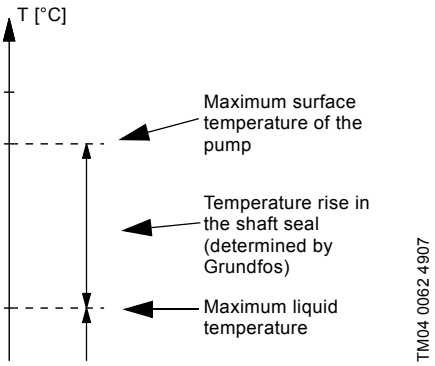

Fig. 12 Calculation of maximum surface temperature

The maximum surface temperature of the pump must be at least 5 °C lower than the maximum surface temperature of the temperature class specified by the customer.

The maximum liquid temperature and the temperature class specified by the customer are stated on the "key application data sheet" supplied with the pump. See the example at the end of this document.

A copy is filed by Grundfos and can be traced by means of the product number and serial numbers on the pump nameplate.

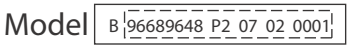

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Fig. 13 Model, product number, production site, year, week, and serial number

Do not exceed the maximum liquid temperature or pump another type of liquid than specified on the "key application data sheet" supplied with the pump. Damage resulting from disregarding this warning will not be covered by the Grundfos warranty.

If the "key application data sheet" is missing, contact Grundfos for information about the maximum liquid temperature.

If the pump is to be operated at a higher liquid temperature or with another liquid than the one stated on the data sheet, contact Grundfos.

7.1.2 Ambient temperature

The ambient temperature range in operation is -20 to +60 °C for the pump-end.

8. Disposing of the product

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.

The crossed-out wheelie bin symbol on a product means that it must be disposed of separately from household waste. When a product marked with this symbol reaches its end of life, take it to a collection point designated by the local waste disposal authorities. The separate collection and recycling of such products will help protect the environment and human health.

Example of key application data sheet

Dear customer, please fill in the following questionnaire in cooperation with a Grundfos representative. This will help to ensure that Grundfos supplies you with a pump solution adapted to meet exactly your needs in terms of pump type, pump materials, shaft seal arrangement, shaft seal type, elastomers and accessories.

Customer information

Company name:	Project title:
Customer number:	Reference number:
Phone number:	Customer contact:
Fax number:	
E-mail address:	

Quotation made by:

Company name:	Prepared by:	
Phone number:	Date:	Page 1 of
Fax number:	Quotation number;	
E-mail address:		

Operating conditions

Pumped liquid

Type of liquid:

_____

Chemical composition (if available):

_____

Distilled or demineralised water? Yes _____ No ____

Conductivity of distilled/demineralised water [µS/cm] _____

Minimum liquid temperature: _____ [°C]

Maximum liquid temperature: _____ [°C]

Vapour pressure of liquid: _____ [bar]

Liquid concentration: _____ %

Liquid pH value: _____

Liquid viscosity: = [mPa·s] Dynamic viscosity: _____ [cP]

Kinematic viscosity: _____ [cSt] = [mm^2/s]

Liquid density: _____

[kg/m^3]
Specific heat capacity of liquid: _____
[kJ/(kg·K)]

Air/gas in liquid? Yes _____ No ____
Solids in liquid? Yes _____ No ____
Contents of solids in liquid (if available): _____ %
of mass

Additives in liquid? Yes _____ No ____

Does the liquid crystallise? Yes _____ No ____
When does crystallisation happen?

_____

_____

Does the liquid get sticky when volatiles evaporate from the pumped liquid?

Yes _____ No ____

Description of 'sticky' circumstances:

_____

_____

Is the liquid hazardous/poisonous? Yes _____ No ____

Special measures to be taken into account when dealing with this hazardous/poisonous liquid:

_____

_____

_____

Special measures for handling this liquid:

_____

CIP liquid (cleaning in place)

Type of liquid:

_____ Chemical composition (if available):

_____ Liquid Temperature during operation:

_____ [°C]

Maximum liquid temperature: _____ [°C]

Vapour pressure of liquid: _____ [bar]

Liquid concentration: _____ %

Liquid pH value: _____

Pump sizing

Main duty point Q:_____ [m^3/h] H:_____ [m]

Max. duty point Q:_____ [m^3/h] H:_____ [m]

Min. duty point Q:_____ [m^3/h] H:_____ [m]

Ambient operating conditions

Ambient temperature: _____ [°C]

Altitude above sea level: _____ [m]

Pressure

Minimum inlet pressure: _____ [bar]

Maximum inlet pressure: _____ [bar]

Discharge pressure (inlet pressure + head): _____ [bar]

ATEX marking

Required marking of the pump

Customer's equipment group (e.g.: II): _____

Customer's equipment category (e.g.: 2, 3) _____

Gas (G) and/or dust (D) Gas (G)____Dust (D)____ Gas and dust (G/D)____

Required marking of the motor

Protection type (e.g.: d, de, e, nA) _____

Maximum experimental safe gap (e.g.: B, C) _____

Temperature class - gas (e.g.: T3, T4, T5) _____
- dust (e.g.: 125 °C) _____ [°C]

Description/sketch

Detailed description of ATEX application
_____(attach a drawing if possible)
_____

_____

ATEX certificate required Yes _____ No ____

Frequency converter

Frequency converter option wanted? Yes _____ No ____
Control parameter: Pressure ___ Temperature ___
Flow ___ Other ___
Detailed description of requirements:
_____
(attach a drawing if possible)
_____

_____

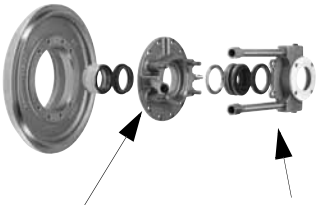
System information

Please provide us with some information about your system and maybe a simple sketch. This will give us hints as to whether you need accessories or monitoring equipment, or whether you already have a suitable system which makes it unnecessary to attach any further equipment.

Double shaft seal solutions

If you chose a tandem or a back-to-back shaft seal solution, you must connect either a flushing system or pressurizing system for barrier liquid to the connection pipes.

Tandem shaft seals

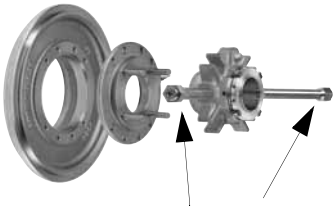


Pipe connection to primary shaft seal. The liquid is directed to the seal faces of the shaft seal. The primary seal is placed on the pumped liquid side.

Pipe connections to secondary shaft seal. The liquid is directed to the seal faces of the secondary shaft seal. The secondary seal is placed in the seal chamber.

GrA8480

Fig. 1 Flushing connections of tandem shaft seal arrangement with standard seals



Pipe connections to the cartridge seal. The direction of the flushing flow depends on the direction of rotation of the shaft

GrA8610

Fig. 2 Flushing connections of tandem shaft seal arrangement with a cartridge seal

Is a flushing liquid available in the application? Yes ____ No ____

Description of the flushing liquid: _____

Chemical composition (if available): _____

Pressure of the flushing liquid: _____ ___ [bar]

Does the application require flushing/cooling of the primary shaft seal?

Yes ____ No ____

Comments on flushing/cooling for the primary shaft seal:

_____

_____

More comments/info about your system:

_____

_____

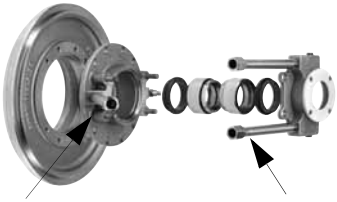
_____

_____

_____

_____

Back-to-back shaft seals



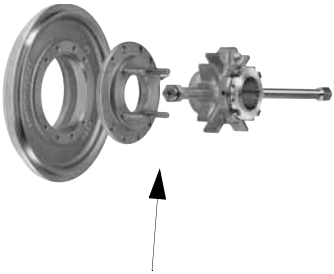
Pipe connection to primary shaft seal.

Pipe connections to secondary shaft seal.

The barrier liquid is directed to the seal faces of the shaft seals. Both primary and secondary seals are placed in the seal chamber

GrA8479

Fig. 3 Connections for barrier liquid of back-to-back arrangement with standard seals



Pipe connections to the cartridge seal. The direction of the barrier liquid depends on the direction of rotation of the shaft.

GrA8610

Fig. 4 Connections for barrier liquid of back-to-back arrangement with a cartridge seal

Is a barrier liquid available in the application? Yes ____ No ____

Description of the barrier liquid:

_____

Chemical composition (if available):

_____

Pressure of the barrier liquid: _____ ___ [bar]

System requirements for the barrier liquid:

_____

_____

Does the application require circulation of the barrier liquid?

Yes ____ No ____ (dead-end arrangement)

Comments on circulation for the primary shaft seal:

_____

_____

Comments on dead-end arrangement

_____

_____

_____

More comments/info about your system:

_____

_____

_____

_____

Date: Date:

_____ _____

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