



EtaLine Pro

Installation/Operating Manual



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Installation/Operating Manual EtaLine Pro

Original operating manual

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Glossary

Back pull-out unit

Pump without pump casing; partly completed machinery

Close-coupled design

Motor directly fitted to the pump via a flange or a drive lantern

Discharge line

The pipeline which is connected to the discharge nozzle

Hydraulic system

The part of the pump in which the kinetic energy is converted into pressure energy

IE5

Efficiency class for rotating electrical machinery to IEC TS 60034-30-2:2021 = Ultra Premium Efficiency (IE = International Efficiency)

In-line design

A pump whose suction and discharge nozzle are arranged opposite each other and have the same nominal diameter.

Pump

Machine without drive, additional components or accessories

Pump set

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

Suction lift line/suction head line

The pipeline which is connected to the suction nozzle

1 General

1.1 Principles

This operating manual is valid for the type series and variants indicated on the front cover.

The operating manual describes the proper and safe use of this equipment in all phases of operation.

The name plate indicates the type series, the main operating data and the serial number. The serial number uniquely describes the product and is used as identification in all further business processes.

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

1.2 Target group

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

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)

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.	Step-by-step instructions
2.	
	Note Recommendations and important information on how to handle the product

1.5 Key to safety symbols/markings

Table 3: Definition of safety symbols/markings

Symbol	Description
	DANGER This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.
	WARNING This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.
	CAUTION This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.

Symbol	Description
	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.
	Warning: Strong magnetic field In conjunction with one of the signal words this symbol indicates a hazard involving magnetic fields and identifies information about protection against magnetic fields.
	Warning for persons with pacemaker In conjunction with one of the signal words this symbol indicates a hazard involving magnetic fields and identifies special information for persons with a pacemaker.



2 Safety

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

In addition to the present general safety information the action-related safety information given in the other sections must be observed.

2.1 General

- This operating manual contains general installation, operating and maintenance instructions that must be observed to ensure safe operation of the system and prevent personal injury and damage to property.
- Comply with all the safety instructions given in the individual sections of this operating manual.
- The operating manual must be read and understood by the responsible specialist personnel/operators prior to installation and commissioning.
- The contents of this operating manual must be available to the specialist personnel at the site at all times.
- Information and markings attached directly to the product must always be complied with and kept in a perfectly legible condition at all times. This applies to, for example:
 - Flow direction arrow
 - Markings for connections
 - Name plate
- The operator is responsible for ensuring compliance with all local regulations not taken into account.

2.2 Intended use

- The pump (set) must only be operated in the fields of application and within the use limits specified in the other applicable documents.
- 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 to handle the fluids described in the data sheet or product literature of the pump model or variant.
- Never operate the pump without the fluid to be handled.
- Observe the minimum flow rate and maximum flow rate indicated in the data sheet or product literature (e.g. to prevent overheating, cavitation damage, bearing damage).
- Do not throttle the flow rate on the suction side of the pump (to prevent cavitation damage).
- Consult the manufacturer about any use or mode of operation not described in the data sheet or product literature.

2.3 Personnel qualification and training

- All personnel involved must be fully qualified to install, operate, maintain and inspect the product 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 product must always be supervised by specialist technical personnel.

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

- Non-compliance with these operating instructions 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

2.5 Safety awareness

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

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

2.6 Safety information for the user/operator

- Fit protective equipment (e.g. contact guards) supplied by the operator for hot, cold or moving parts, and check that the equipment functions properly.
- Do not remove any protective equipment (e.g. 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 stopping 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.

2.7 Safety information for maintenance, inspection and installation

- Modifications or alterations of the pump (set) are only permitted with the manufacturer's prior consent.
- Use only original spare parts or parts/components authorised by the manufacturer. The use of other parts/components can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that maintenance, inspection and installation are 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.
- Only perform work on the pump set when it has been disconnected from the power supply (de-energised).
- The pump (set) 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 45)
- Decontaminate pumps which handle fluids posing a health hazard. (⇒ Section 8.3, Page 74)
- As soon as the work has been completed, re-install and re-activate any safety-relevant devices and protective devices. Before returning the product to service, observe all instructions on commissioning.

2.8 Unauthorised modes of operation

Never operate the pump (set) outside the limits stated in the data sheet and in this operating manual.

The warranty relating to the operating reliability and safety of the pump (set) supplied is only valid if the equipment is used in accordance with its intended use.

3 Transport/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 KSB or the supplying dealer and the insurer about the damage in writing immediately.

3.2 Transport

	⚠ 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. ▷ The lifting accessories must be tight and without slack. ▷ Observe the information on weights, centre of gravity and fastening points. ▷ Observe the applicable local occupational safety regulations and accident prevention regulations. ▷ Use tested and approved lifting accessories.
	⚠ WARNING Insufficient stability Risk of crushing hands and feet! ▷ During assembly/dismantling, secure the pump (set)/pump parts to prevent tilting or tipping over.

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

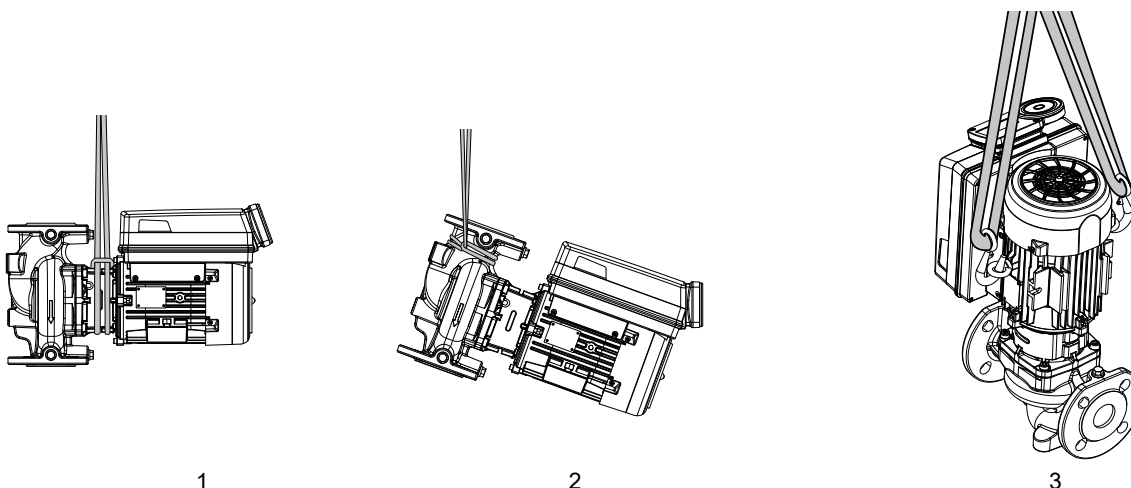


Fig. 1: Transporting the pump set

1	Lifting sling around motor flange
2	Lifting sling around discharge nozzle
3	Lifting strap with eyebolts on the motor (M8 eyebolts not included in the scope of supply)

- ✓ Transport equipment/lifting equipment suitable for the corresponding weight (see type series booklet) has been selected and is available.

1. Pump set: Suspend and transport as illustrated.
2. Carefully place down the pump set at the place of installation. Protect it against damage and secure it against rolling off.

	CAUTION Improper placing down of pump sets Damage to the pump set! ▸ Never place down the pump set with its axis in a vertical position.
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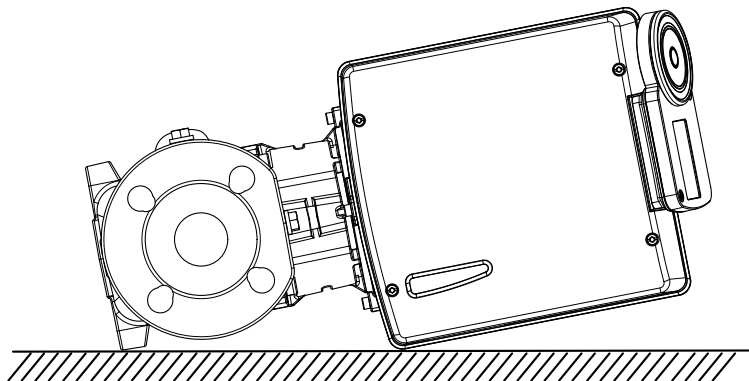


Fig. 2: Placing down the pump set

Ambient conditions for transport (IEC 60721-3-2, EN 50178)

- Climatic conditions for transport: Class 2K3
- Temperature range: -25 °C to +70 °C
- Relative humidity: < 95 %
- Condensation must be prevented.
- Atmospheric pressure: 70 KPa to 106 KPa

3.3 Storage/preservation

	CAUTION Damage during storage due to humidity, dirt or vermin Corrosion/contamination of the pump (set)! ▸ For outdoor storage cover the pump (set) or the packaged 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.

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

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

Storage of new pump sets:

New pump sets are delivered duly prepared for storage. If properly stored indoors, the equipment is protected for a maximum of 12 months.

Storage of pump sets that have previously been operated:

For storing a pump set which has already been operated, observe the instructions in (⇒ Section 6.3.1, Page 45) .

Ambient conditions for storage (IEC 60721-3-1, EN 50178)

- Climatic conditions for storage: Class 1K3
- Temperature range: -25 °C to +55 °C
- Relative humidity: <95 %
- Condensation must be prevented.
- Atmospheric pressure: 70 KPa to 106 KPa
- Well-ventilated
- Dry
- Dust-free
- Shock-free
- Vibration-free

3.4 Return to supplier

1. Drain the pump as per operating instructions. (⇒ Section 8.3, Page 74)
2. Always flush and clean the pump, particularly if it has been used for handling noxious, hot or other hazardous fluids.
3. If the fluids handled by the pump (set) leave residues which might lead to corrosion when coming into contact with atmospheric humidity, or which might ignite when coming into contact with oxygen, the pump set must be neutralised, and anhydrous inert gas must be blown through the pump for drying purposes.
4. Always complete and enclose a certificate of decontamination when returning the pump (set).
Always indicate any safety and decontamination measures taken.

	NOTE If required, a blank certificate of decontamination can be downloaded from the following web site: www.ksb.com/certificate_of_decontamination
---	--

3.5 Disposal

 	 DANGER Strong magnetic field in the pump rotor area Danger of death for persons with pacemaker! Interference with magnetic data carriers, electronic devices, components and instruments! Uncontrolled magnetic attraction forces between magnet-equipped components, tools or similar! ▷ Keep a safety distance of at least 0.5 m. ▷ Also observe the additional instructions.
	 WARNING Fluids handled, 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 protective 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).

2. Collect greases and liquid lubricants during dismantling.
3. Separate and sort the pump materials, e.g. by:
 - ⇒ Metal
 - ⇒ Plastic
 - ⇒ Electronic waste
 - ⇒ Magnets
 - ⇒ Greases and liquid lubricants
4. Dispose of materials in accordance with local regulations or in another controlled manner.

4 Description

4.1 General description

- Fully integrated in-line water pump with continuously variable speed control
- Non-self-priming in-line pump with integrated permanent magnet synchronous motor and electronic variable speed system
- Pump for handling clean, non-aggressive fluids which are not chemically and mechanically aggressive to the pump materials

4.2 Product information

4.2.1 Product information as per Regulation No. 547/2012 (for water pumps with a maximum shaft power of 150 kW) implementing "Ecodesign" Directive 2009/125/EC

- Minimum efficiency index: see name plate, key to the name plate
- The benchmark for the most efficient water pumps is $MEI \geq 0.70$.
- Year of manufacture: see name plate, key to the name plate
- Manufacturer's name or trade mark, commercial registration number and place of manufacture: see data sheet or order documentation
- Product's type and size identifier: see name plate, key to the name plate
- Hydraulic pump efficiency (%) with trimmed impeller: see data sheet¹⁾
- Pump performance curves, including efficiency characteristics: see documented characteristic curve
- The efficiency of a pump with a trimmed impeller is usually lower than that of a pump with the full impeller diameter.¹⁾ Trimming of the impeller will adapt the pump to a fixed duty point, leading to reduced energy consumption. The minimum efficiency index (MEI) is based on the full impeller diameter.
- Operation of this water pump with variable duty points may be more efficient and economic when controlled, for example, by the use of a variable speed drive that matches the pump duty to the system.
- Information on dismantling, recycling and disposal after decommissioning: (⇒ Section 3.5, Page 14)
- Information on benchmark efficiency or benchmark efficiency graph for $MEI = 0.70$ (0.40) for the pump based on the model shown in the Figure are available at: www.europump.org/efficiencycharts

4.2.2 Product information as per Regulation No. 1907/2006 (REACH)

For information as per European chemicals regulation (EC) No. 1907/2006 (REACH) see <https://www.ksb.com/en-global/company/corporate-responsibility/reach>.

4.3 Designation

Table 4: Designation example

Position																					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
E	3	0	B	P	H	0	6	5	G	P	S	V	6	6	3	5	0	7	5	0	0

Table 5: Designation key

Position	Code	Description
1-4	Pump type series/generation	

¹ There is no trimmed impeller for this type series.

Position	Code	Description
1-4	E30B	EtaLine Pro
5	Model	
	-	Standard
	P	Pro
6	Installation position of control panel	
	H	Horizontal
	V	Vertical
7-9	Size [mm], e.g.	
	O65	Nominal diameter of suction and discharge nozzles
10	Pump casing material	
	G	Grey cast iron
11	Impeller material	
	P	PPS-GF40
12	Design	
	S	Standard
13	Shaft seal type	
	V	Single mechanical seal with vented chamber (A-type cover)
14-15	Seal code, single mechanical seal	
	11	BQEGG
	66	QQEGG
16-17	Nominal speed [rpm]	
	35	3500
18-20	Rated output power [W]	
	075	750
21	Field bus module	
	O	None
22	Optional component	
	O	None

4.4 Name plate

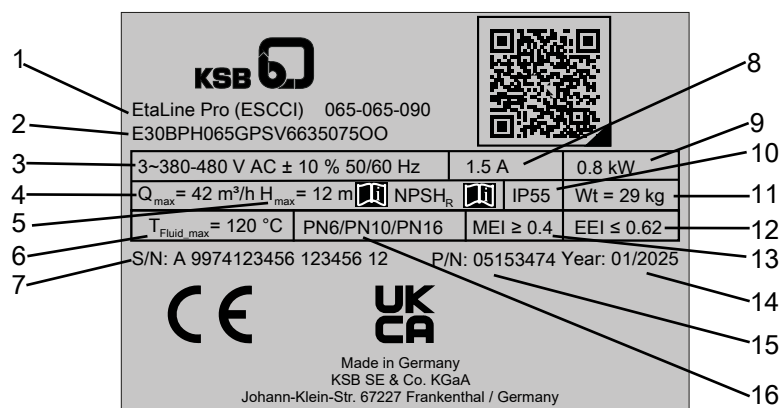


Fig. 3: Name plate (example)

1	Type series name	2	Type series code, size and version
3	Mains voltage and mains frequency	4	Maximum flow rate
5	Maximum head	6	Maximum permissible fluid temperature
7	Serial number	8	Mains input current at 400 V mains voltage
9	Mains power input at 400 V mains voltage	10	Enclosure

11	Weight of pump set	12	Pump set EEI
13	Pump MEI	14	Year of construction
15	Material number	16	Nominal pressure class

4.5 Design details

Design

- Compact pumps consisting of pump and drive unit
- Close-coupled design / in-line design
- Single-stage
- Horizontal installation / vertical installation
- Rigid connection between pump and motor
- Variable speed version

Pump casing

- Radially split volute casing
- In-line design

Drive

- Surface-cooled synchronous motor (TEFC), designed for operation in a compact pump set
- Efficiency class IE5 to IEC 60034-30
- Rated voltage of pump set 3 ~380 - 400 V +/-10 %, 50/60 Hz
- Enclosure IP55
- Duty type: continuous duty S1
- Thermal class F

Shaft seal

- KSB mechanical seal

Impeller type

- Closed radial impeller

Bearings

- Radial ball bearings in the motor housing
- Grease lubrication

4.6 Configuration and function

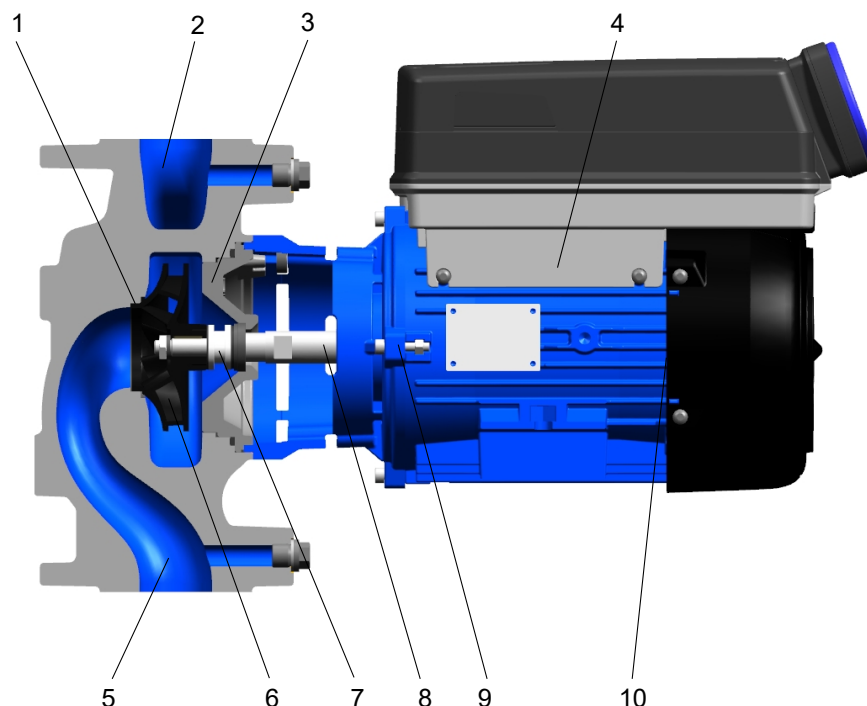


Fig. 4: Sectional drawing

1	Clearance gap	2	Discharge nozzle
3	Casing cover	4	Drive unit
5	Suction nozzle	6	Impeller
7	Shaft seal	8	Shaft
9	Rolling element bearing	10	Rolling element bearing

Design The pump is designed with a radial fluid inlet (suction nozzle) and a radial fluid outlet (discharge nozzle) arranged on the same axis. The hydraulic system is rigidly connected to the motor of the drive unit via a shaft. The shaft is dynamically balanced.

Function The fluid enters the pump via the suction nozzle (5) and is accelerated outward by the rotating impeller (6). In the flow passage of the pump casing the kinetic energy of the fluid is converted into pressure energy. The fluid is pumped to the discharge nozzle (2), where it leaves the pump. The clearance gap (1) prevents any fluid from flowing back from the casing into the suction nozzle. At the rear side of the impeller, the shaft (8) enters the hydraulic system through the casing cover (3). The shaft passage through the casing cover is sealed towards the atmosphere with a shaft seal (7). The shaft runs in rolling element bearings (9 and 10), which are supported by the drive unit (4). The drive unit (4) is connected to the pump casing and clamps the casing cover (3).

Sealing The pump is sealed by a standardised mechanical seal.

4.7 Available software/apps

KSB FlowManager 2.0



This app can be used to change the settings for the pump set and carry out a firmware update.



4.8 Noise characteristics

Table 6: Surface sound pressure level L_{pA} ²⁾

Size	Surface sound pressure level L_{pA} [dB(A)]
025-025-090 0,8	62,3
025-025-090 1,6	66,0
032-032-070 0,8	66,7
032-032-070 1,6	69,7
040-040-090 0,8	55,1
040-040-090 1,3	60,0
040-040-090 1,6	63,0
040-040-090 2,6	65,1
050-050-090 0,8	57,5
050-050-090 1,3	57,0
050-050-090 2,3	64,0
065-065-090 0,8	53,4
065-065-090 1,2	55,0
065-065-090 2,0	63,0
065-065-090 2,6	64,4

4.9 Scope of supply

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

- Pump set
- Installation/operating manual

4.10 Dimensions and weight

For dimensions and weights please refer to the type series booklet.

² Surface sound pressure level as per ISO 3744 and DIN EN ISO 20361 ; valid for a pump operating range of Q/ QBEP = 0.8 - 1.1 and non-cavitating operation. If noise levels are to be guaranteed: Add +3 dB for measuring and constructional tolerance.

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 Use for drinking water or foodstuff applications Danger of poisoning! ▷ Never use the pump for drinking water or foodstuff applications.
	CAUTION Improper installation of the pump set Damage to the pump set! ▷ Observe the permissible ambient conditions and the pump set's type of enclosure. ▷ Observe the permissible ambient temperatures. Ambient temperatures < 0 °C are not permitted. ▷ In the event of outdoor installation, fit a protective roof to protect the pump set from the weather (e. g. sun, rain, snow).

5.2 Checks to be carried out prior to installation

Foundation Check the structural requirements.
All structural work required must have been prepared in accordance with the dimensions stated in the outline drawing / general arrangement drawing.

	CAUTION Ingress of leakage into the motor Damage to the pump! ▷ Never install the pump set with the "motor below".
---	--

Protective roof Protective roof / additional roofing

For vertical installation, fit a protective roof or additional roofing on site to prevent foreign objects from falling into the fan hood.

Ventilation Ventilation

	! WARNING Improper installation Drive overheated! ▷ Maintain the specified minimum distances to neighbouring assemblies. ▷ Never restrict the ventilation ducting to/from the drive. ▷ Prevent exhaust air from neighbouring assemblies from being drawn in directly.
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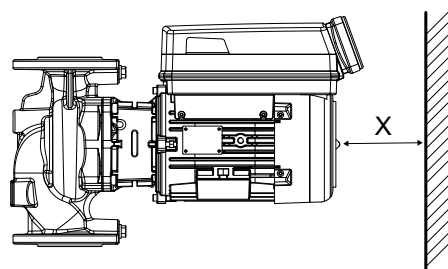


Fig. 5: Minimum distance X

The minimum distance X to neighbouring assemblies must be at least 30 cm.

5.3 Turning the control element

The electronic system housing with integrated control element can be turned. The control element must be easy to read at all times. Positioning must be carried out with the pump set removed from the system.

	⚠ DANGER
	Unintentional start-up Danger to life from electric shock! ▷ Disconnect the pump set from the mains before carrying out any maintenance and installation work. ▷ Prevent the pump set from being re-started unintentionally when carrying out any maintenance and installation work.

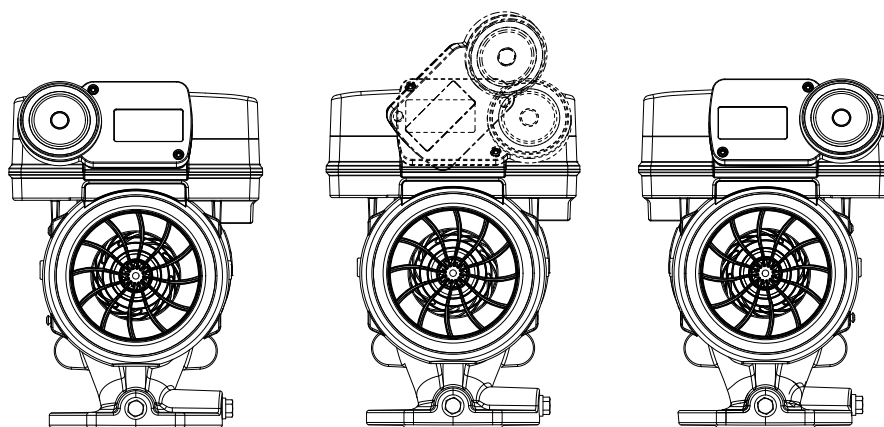


Fig. 6: Turning the control element

1. Undo two screws at the top of the control element and store them.
2. Turn the control element until it has reached the required position. Compare it against the permissible installation positions. Adjust the position if required.
3. Tighten two hexagon socket head cap screws with a suitable tool. Observe the tightening torques. (⇒ Section 8.6, Page 79)

5.4 Installing the pump set

	⚠ DANGER
	Leakage at the pump Leakage of hot fluids! ▷ Fit the sealing elements and make sure they are positioned correctly.

	CAUTION Air entering the pump Damage to vertically installed pump sets whose direction of flow is downwards! ▷ Fit a vent valve at the highest point of the suction line.
	NOTE Installing shut-off valves upstream and downstream of the pump set is recommended. Make sure that no leakage drips onto the pump set.
	NOTE Do not install the pump at the lowest point of the system to prevent any impurities from collecting in the pump.
	CAUTION Ingress of leakage into the motor Damage to the pump! ▷ Never install the pump set with the "motor below".

The pump set may be flanged directly into the piping.

1. Position the pump set in the piping and fasten it.
2. Place a spirit level on the discharge nozzle to align the pump set.

5.4.1 Installation types

Horizontal installation

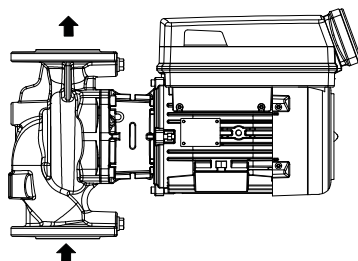


Fig. 7: Horizontal installation of pump set, direction of flow from bottom to top

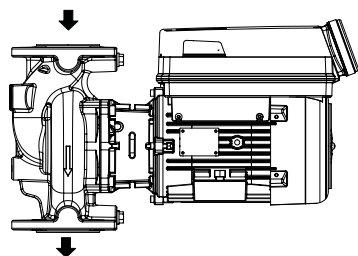


Fig. 8: Horizontal installation, direction of flow from top to bottom

Turn the volute casing and/or pull-out unit by 180° so that the electronic system and the control element remain in their current position on top and are easy to read.

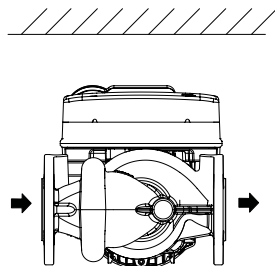


Fig. 9: Horizontal installation (for example under the ceiling)

Turn the volute casing and/or pull-out unit by 90° so that the frequency inverter remains in its current position on top.

Vertical installation

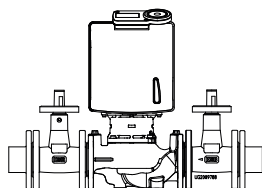


Fig. 10: Vertical installation / mounted without pump foot

In this installation position the mechanical seal must be vented via the vent valve (⇒ Section 8.2.2.3, Page 74) .

5.5 Piping

5.5.1 Connecting the piping

	! DANGER Impermissible loads acting on the pump nozzles 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 pipelines in close proximity to the pump and connect them properly without transmitting any stresses or strains. ▷ Observe the permissible forces and moments at the pump nozzles. ▷ Take appropriate measures to compensate for thermal expansion of the piping.
	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 valves and shut-off elements in the system is recommended, depending on the type of plant and pump. Install the pump without any obstructions to its drainage or removal.

- ✓ Suction lift lines have been laid with a rising slope, suction head lines with a downward slope towards the pump.
- ✓ A flow stabilisation section having a length equivalent to at least twice the diameter of the suction flange has been provided upstream of the suction flange.

- ✓ The nominal diameters of the pipelines are at least equal to the nominal diameters of the pump nozzles.
- ✓ Adapters to larger diameters have a diffuser angle of approximately 8° to prevent excessive pressure losses.
- ✓ The pipelines have been anchored in close proximity to the pump and connected without transmitting any stresses or strains.

	CAUTION
	Weld spatter, scale and other impurities in the piping Damage to the pump! ▷ Remove any impurities from the piping. ▷ If necessary, install a filter. ▷ Observe the instructions in (⇒ Section 8.2.2.1, Page 74) .

1. Thoroughly clean, flush and blow through all vessels, pipelines and connections (especially of new installations).
2. Before installing the pump in the piping, remove the flange covers on the suction and discharge nozzles of the pump.
3. Check that the inside of the pump is free from any foreign objects. Remove any foreign objects.
4. If required, install a filter in the piping (see figure: Filter in the piping).

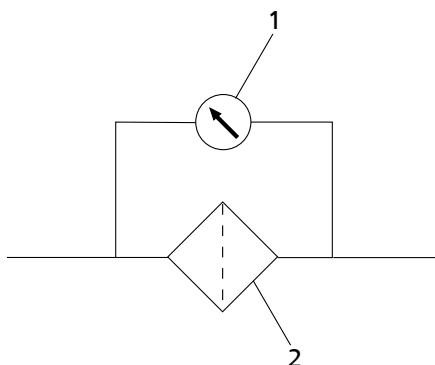


Fig. 11: Filter in the piping

1	Differential pressure gauge	2	Filter
---	-----------------------------	---	--------

	NOTE
	Use a filter with laid-in wire mesh (mesh width 0.5 mm, wire diameter 0.25 mm) of corrosion-resistant material. Use a filter with a filter area three times the cross-section of the piping. Conical filters have proved suitable.

5. Connect the pump nozzles to the piping.

	CAUTION
	Aggressive flushing liquid and pickling agent Damage to the pump! ▷ Match the cleaning operation mode and duration of flushing and pickling to the casing materials and seal materials used.

5.5.2 Permissible forces and moments at the pump nozzles

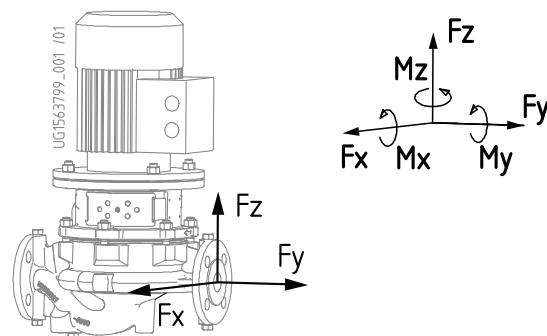


Fig. 12: Forces and moments at the pump nozzles

The data on forces and moments apply to static piping loads only. The values are only applicable if the pump is installed on a baseplate and bolted to a rigid and level foundation.

Table 7: Forces and moments at the pump nozzles

Size	DN	F_x	F_y	F_z	ΣF	M_x	M_y	M_z
		[N]	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]
032-032-070	32	320	370	300	574	390	265	300
040-040-090	40	400	450	350	696	450	320	370
050-050-090	50	530	580	470	916	500	350	400
065-065-090	65	650	740	600	1153	530	390	420

5.5.3 Vacuum balance line



NOTE

Where fluid has to be pumped out of a vessel under vacuum, installing a vacuum balance line is recommended.

The following rules apply to vacuum balance lines:

- Minimum nominal line diameter 25 mm.
- The line extends above the highest permissible fluid level in the vessel.

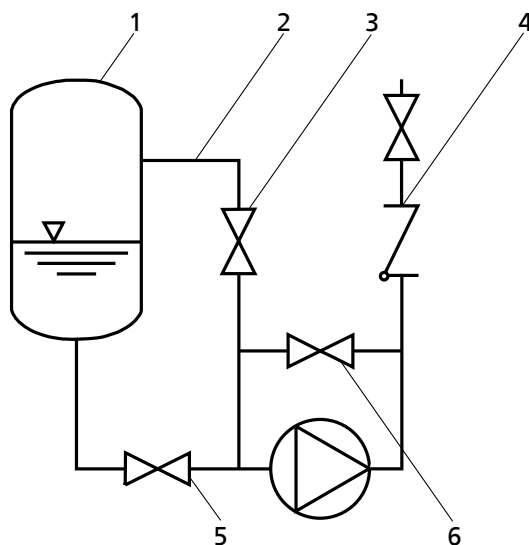


Fig. 13: Vacuum balance system

1	Vessel under vacuum	2	Vacuum balance line
3	Shut-off element	4	Swing check valve
5	Main shut-off element	6	Vacuum-tight shut-off element



NOTE

An additional line fitted with a shut-off valve (from the pump discharge nozzle to the balance line) facilitates venting of the pump before start-up.

5.5.4 Auxiliary connections



WARNING

Failure to use or incorrect use of auxiliary connections (e.g. barrier fluid, flushing liquid, etc.)

Risk of injury from escaping fluid!

Risk of burns!

Malfunction of the pump!

- Refer to the general arrangement drawing, the piping layout and pump markings (if any) for the quantity, dimensions and locations of auxiliary connections.
- Use the auxiliary connections provided.

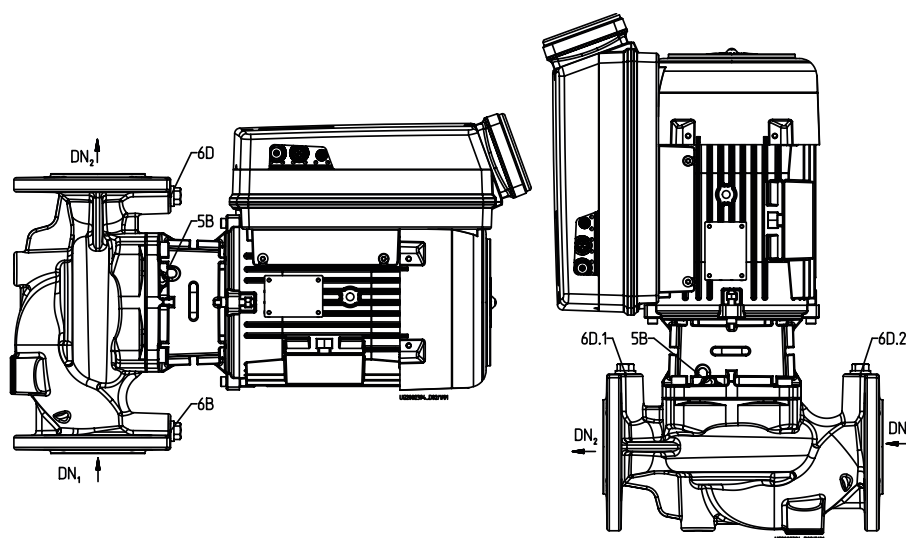


Fig. 14: Connections

Table 8: Connection type

Connection	Description	Configuration	Position
5B	Vent connection for the mechanical seal chamber	Plugged with vent plug	Casing cover
6B	Fluid drain	Drilled and closed	Volute casing
6D, 6D.1, 6D.2 ³⁾	Fluid priming and venting	Drilled and closed	Volute casing

5.6 Enclosure/insulation



WARNING

The volute casing and casing/discharge cover take on the same temperature as the fluid handled

Risk of burns!

- Insulate the volute casing.
- Fit protective equipment.

³ On size DN25 connections 6B, 6D, 6D.1, 6D.2 are not available.

	CAUTION Risk of potentially explosive atmosphere due to insufficient ventilation Explosion hazard! ▷ Make sure the space between the casing cover/discharge cover and the bearing cover is sufficiently vented.
	CAUTION Heat build-up Damage to the bearings! Danger of overheating! ▷ Never insulate the bearing bracket lantern or casing cover. ▷ Never insulate the motor or electronic system.

5.7 Electrical connection

5.7.1 Safety regulations

	⚠ DANGER Incorrect electrical installation Risk of fatal injury due to electric shock! ▷ Always have the electrical connections installed by specialist personnel. ▷ Observe the technical specifications of the local and national energy supply companies.
	⚠ DANGER Unintentional start-up Danger to life from electric shock! ▷ Disconnect the pump set from the mains before carrying out any maintenance and installation work. ▷ Prevent the pump set from being re-started unintentionally when carrying out any maintenance and installation work.
	⚠ DANGER Contact with live components Danger of death from electric shock! ▷ Never remove housing or cover components. ▷ Mind the capacitor discharge time. After switching off the pump set, wait 1 minute until dangerous voltages have discharged. ▷ Never switch on the electronic system of the pump set before it has been fitted on the motor. ▷ No fluid must pass through the pump until the electronic system of the pump set has been fitted on the motor.

	! DANGER Pump starting up unexpectedly If a field bus module or supplementary card for external setpoint input have been installed, the pump set can be started up remotely any time. ▷ Observe the safety information in the operating manual.
	CAUTION Improper dielectric test Damage to the electronic system! ▷ Never carry out dielectric tests on components of the electronic system. ▷ Do not carry out dielectric tests on the power cable or relay connection cables until the connections have been disconnected from the electronic system.
	CAUTION Improper potential equalisation Malfunction of the pump set electronics ▷ The potential equalisation system must have a mesh-type design in accordance with EN 50310 and 50174-2. ▷ The system reference potential plane (SRPP) must be capable of withstanding high currents and have a low impedance.
	NOTE Depending on the combination of settings, the pump set could conceivably restart automatically after acknowledgement/reset or when the cause of failure has been eliminated.

5.7.2 Information for planning the system

5.7.2.1 EMC-compliant installation

An EMC-compliant installation is mandatory in order to ensure trouble-free operation. In addition to product standard EN 61800-3 the corresponding standards for potential equalisation and installation, EN 50310 and EN 50174-2 must be complied with.

The most important points are summarised here:

- Induction loops must be avoided when laying cables.
- Maintain a sufficient distance of signal and bus cables from live cables with rapid current and voltage changes.
- Distributed equipment that is connected by means of signal or bus cables must be connected to the same reference potential.
- Connect all frames, equipment, racks, cabinets and shield connections to one another and to the potential equalisation system at various points (meshed potential equalisation system).
- Fit shield connections of electric cables on both sides.

5.7.2.2 Earth connection

The pump set must be properly earthed and connected to the potential equalisation system. The earth connection is located on the motor. This connection is used to earth the pump, the heat sink of the electronic system and the shield connections inside the electronic system.

As well as ensuring the necessary level of safety, the earth connection is also required for EMC compliance.

5.7.2.3 Electrical protection equipment

Back-up fuses Provide three fast-acting fuses (e.g. SIBA 50 179 06.16) in the mains power supply for the pump set. The fuse size must be suitable for the mains input current supplied to the pump set.

Table 9: Electrical protection equipment

Application category	Rated current	Melting integral	Clearing integral	Rated short-circuit breaking capacity
	[A]	[A ² s]	[A ² s]	[kA (700 V AC)]
gR	16	13	164	200

Motor protection switch A separate motor protection switch is not required because the electronics of the pump set have their own safety devices (e.g. electronic overcurrent tripping). Set any motor protection switches to a minimum of 1.4 times the nominal motor current.

Residual current device If fixed connections and corresponding supplementary earthing are used (see DIN VDE 0160), residual current devices are not mandatory for the pump set electronics.

When using residual current devices, in accordance with DIN VDE 0160 due to the three-phase voltage connection of the electronics, the pump set may only be connected by means of residual current devices that are sensitive to all types of current, since conventional residual current devices either do not trip at all or trip incorrectly as a result of possible DC components.

The residual current device should have a rated current of 150 mA.

If a long shielded cable is used for the mains connection, the residual current device may be triggered by the discharge current that flows to earth (triggered by the carrier frequency).

Measures: Replace the residual current device or increase the response limit.

Power cable Unshielded cables may be used as power cables.

The power cable must meet the following requirements:

- Clamping range for M25 cable gland: 8 to 17 mm
- Maximum core cross-section: 2.5 mm²

Table 10: Technical data of the power cable

Size	Nominal speed	Current input I ₁	Power input P ₁	Weight
		3~ 400 V		
	[rpm]	[A]	[kW]	[kg]
025-025-090 0,8	5900	1,5	0,8	16
025-025-090 1,6	5900	3,8	1,6	16
032-032-070 0,8	6000	1,5	0,8	19
032-032-070 1,6	6000	3,8	1,6	19
040-040-090 0,8	3500	1,4	0,8	21.2
040-040-090 1,3	3500	3,1	1,3	21.2
040-040-090 1,6	4500	3	1,6	21.2
040-040-090 2,6	4500	4,7	2,6	22.6
050-050-090 0,8	3450	1,5	0,8	23.2
050-050-090 1,3	3500	3,1	1,3	23.2
050-050-090 2,3	3900	4,1	2,3	24.6
065-065-090 0,8	2850	1,5	0,8	28.8
065-065-090 1,2	3300	2,9	1,2	28.8
065-065-090 2,0	3300	3,6	2,0	30.2
065-065-090 2,6	3300	4,7	2,6	32.3

5.7.2.4 Mains types

The electronics of the pump set are suitable for connection to TN mains and IT mains.

5.7.3 Connection to power supply

5.7.3.1 Removing the housing cover

	 DANGER
	Contact with live components Danger of death from electric shock! ▷ Never remove housing or cover components. ▷ Mind the capacitor discharge time. After switching off the pump set, wait 1 minute until dangerous voltages have discharged. ▷ Never switch on the electronic system of the pump set before it has been fitted on the motor. ▷ No fluid must pass through the pump until the electronic system of the pump set has been fitted on the motor.

1. De-energise the pump set and wait for the DC link capacitor to discharge for 1 minute.
2. Loosen the four screws in the corners of the cover.
3. Remove the cover.

5.7.3.2 Overview of connections

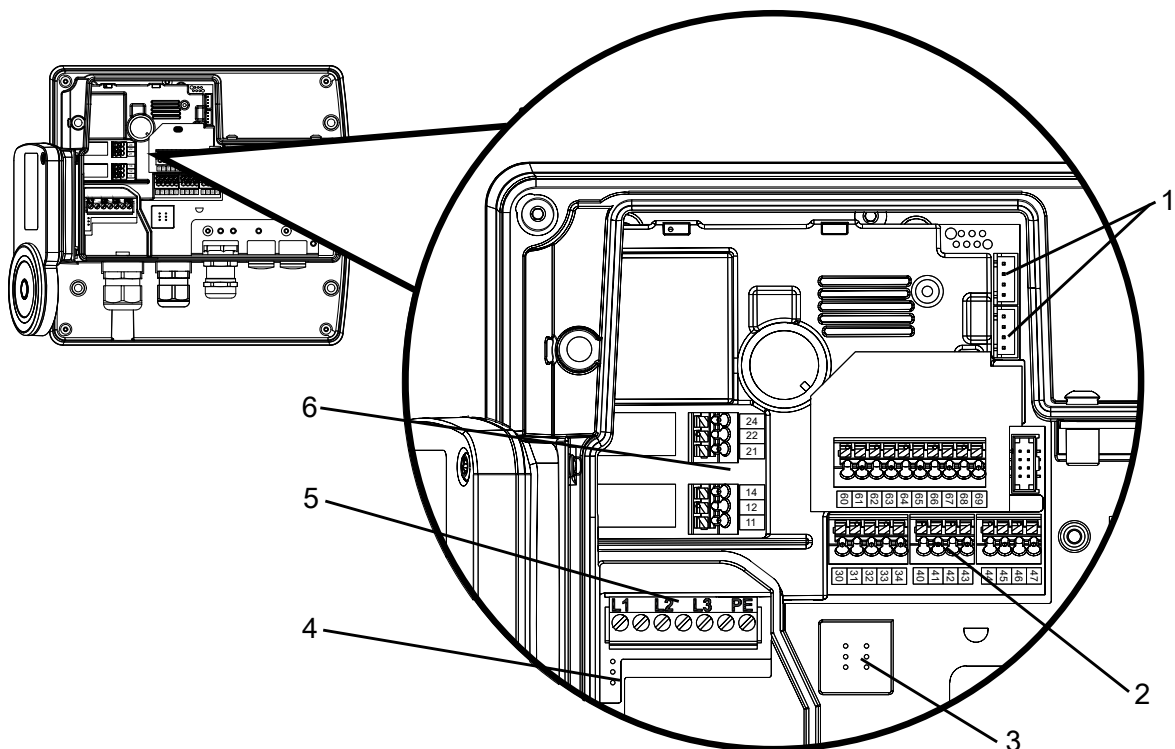


Fig. 15: Overview of connections

1	Slots for M12 accessories set for dual pump configuration	2	I/O connection terminals
3	Jumpers for filter capacitors	4	Jumpers for filter capacitors
5	Power supply	6	Relay connections

5.7.3.3 Signal inputs and signal outputs

Table 11: Technical data for inputs and outputs

Interface type		Value	Unit	Description
RO	Relay output	250	V AC	Maximum voltage AC
		220	V DC	Maximum voltage DC
		1	A AC/DC	Maximum current AC1/DC
DI	Contact	24	V	Auxiliary voltage (internal RC circuit between Uh and DI)
		66	mA	Start-up current
		4.2	mA	Rated current
	Voltage signal	11	V	Switch-on threshold
		5	V	Switch-off threshold
		30	V	Maximum continuous input voltage
		3000	Ω	Input resistance
AI	Auxiliary voltage	24	V	Auxiliary voltage for two-wire sensors (single-ended)
		≥ 30	mA	Maximum output current
		≥ 10	mA	Short-circuit current (downward current characteristic)
	Voltage input	10	V	Measuring range
		11	V	Overload range
		30	V	Maximum input voltage
		100	kΩ	Input load
		± 0,4	%	Measuring range measurement error
	Current input	0 - 20	mA	Measuring range
		22	mA	Overload range
		30	V	Maximum input voltage
		150	Ohm	Input load
		0,4	%	Measuring range measurement error

5.7.3.4 Relay outputs

⚠ DANGER

Insufficient separation from PELV circuits

Danger to life from electric shock!

► When connecting the relay outputs to low voltage or protective extra-low voltage, ensure sufficient separation from the PELV circuits (double or reinforced insulation).

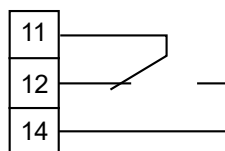


Fig. 16: Relay output 1 (RO1), "in operation" message

Table 12: Relay output 1 (RO1), "in operation" message

Contact	Effect
Volt-free contacts 11 and 12 closed	No operation
Volt-free contacts 11 and 14 closed	Pump set in operation

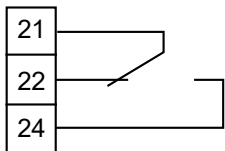


Fig. 17: Relay output 2 (RO2), general fault message

Table 13: Relay output 2 (RO2), general fault message

Contact	Effect
Volt-free contacts 21 and 22 closed	No general fault message
Volt-free contacts 21 and 24 closed	General fault message

The relay outputs can be wired with either low voltage up to 250 VAC/220 VDC or protective extra-low voltage (PELV).

The relay outputs are safely isolated from each other and from the PELV circuits of the digital inputs and analog inputs.

5.7.3.5 Connection to power supply network and motor

⚠ DANGER

Touching or removing terminals
 Danger to life from electric shock!

▸ Never open or touch terminals or plug-type connections until the pump set has been de-energised.

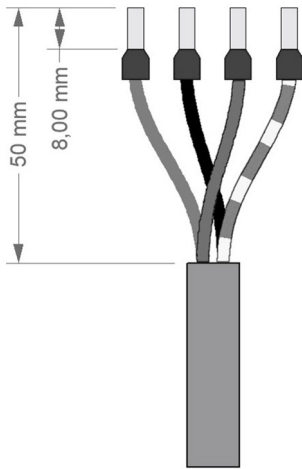


Fig. 18: Preparing the power cable

1. Prepare the power cable for connection. (⇒ Fig. 18)

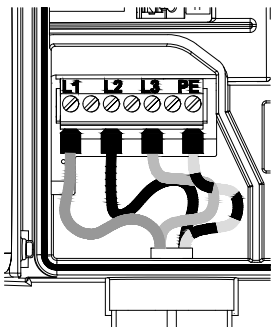


Fig. 19: Connecting the power cable

2. Route the power cable for the power supply network through the cable gland and connect the cable to the specified terminals.
3. **For connection to IT mains only:** Remove jumpers P11 and P12 to disconnect the filter capacitors in the mains input from the earth conductor. Jumper P14 must not be removed.

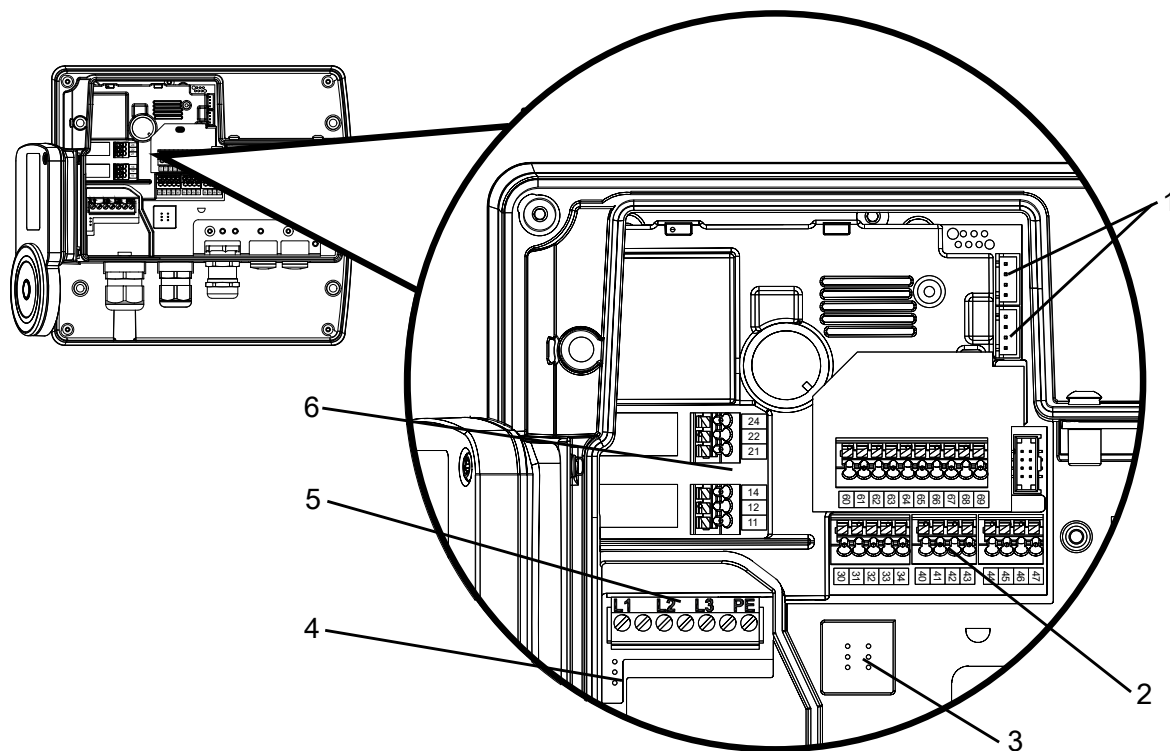


Fig. 20: Overview of connections

1	Slots for M12 accessories set for dual pump configuration	2	I/O connection terminals
3	Jumpers for filter capacitors	4	Jumpers for filter capacitors
5	Power supply	6	Relay connections



NOTE

IP55 enclosure protection as specified in the technical data is only provided if the cover has been fitted properly.

5.7.3.6 Connecting the potential equalisation conductor

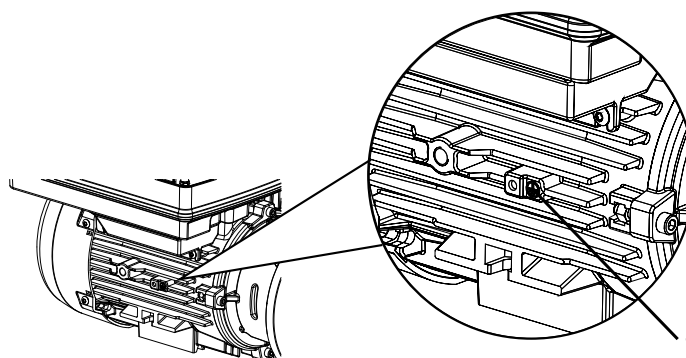


Fig. 21: PE connection

1. Connect the potential equalisation connection to the potential equalisation system.

5.7.3.7 Connecting the analog input and digital input

In order to connect sensors or contacts, the electronics of the pump set supply nominal PELV auxiliary voltages of 24 VDC.

The PELV supply is safely isolated from the power supply network and meets the requirement for protection against electric shock in the case of indirect contact or direct contact with a limited direct contact area. The PELV supply is not earthed in the electronic system of the pump set and must be earthed externally by the installer. If the ground (GND) potentials of several devices are connected to one another, earthing must be provided at a central point.

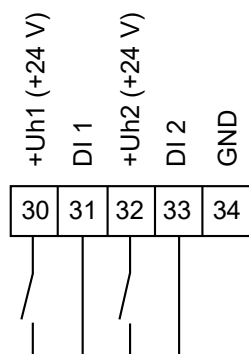


Fig. 22: Digital inputs

Table 14: Terminal assignment: Starting / stopping the pump set

Contact	Effect
Contact closed / terminals 30 and 31 bridged	Pump set starts up.
Contact open / terminals 30 and 31 not bridged	Pump set stops.

Table 15: Terminal assignment: fault acknowledgement

Contact	Effect
Contact closed / terminals 32 and 33 bridged	Active faults are acknowledged.
Contact open / terminals 32 and 33 not bridged	No acknowledgement

The individual auxiliary voltage outputs have separate current limiters and are continuously short-circuit-proof.

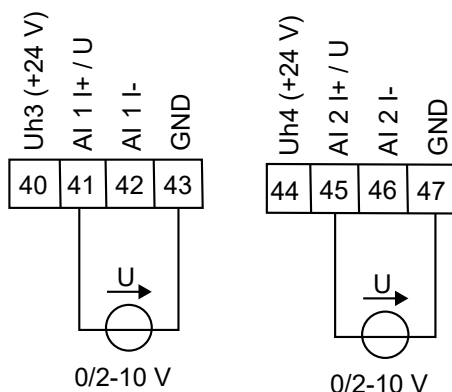


Fig. 23: Analog inputs 0/2-10 V

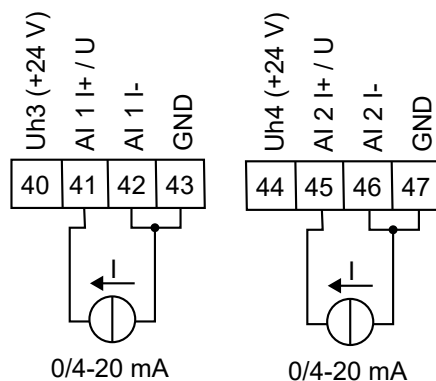


Fig. 24: Analog inputs 0/4-20 mA

Function Analog inputs (⇒ Section 7.3.4.1, Page 61)

5.7.3.8 Installing and connecting the M12 accessories set for dual pump configuration

The M12 accessories set serves to physically connect two pump sets with each other for dual-pump operation. The M12 accessories set can be retrofitted. Each pump set requires its own accessories set.

	⚠ DANGER
	Contact with live components Danger of death from electric shock! ▷ Never remove housing or cover components. ▷ Mind the capacitor discharge time. After switching off the pump set, wait 1 minute until dangerous voltages have discharged. ▷ Never switch on the electronic system of the pump set before it has been fitted on the motor. ▷ No fluid must pass through the pump until the electronic system of the pump set has been fitted on the motor.



Film on installing the M12 accessories set for dual pump configuration

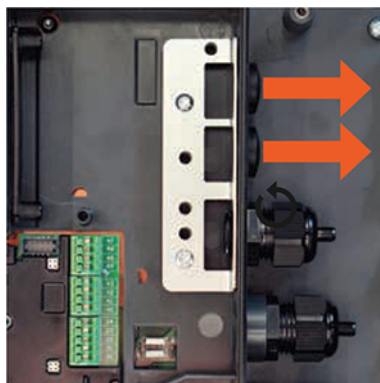


Fig. 25: Removing the screw plugs

1. Remove the two M16 screw plugs.

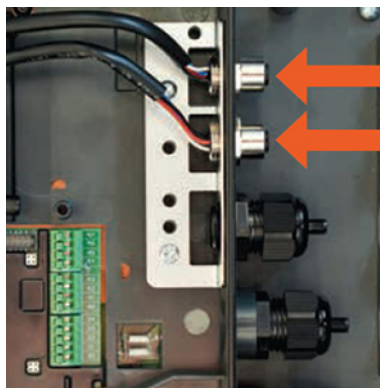


Fig. 26: Inserting the electric cables

2. Insert the electric cables with M12 sockets. Tighten the M12 sockets just hand-tight (max. 1.5 Nm, WAF 17).

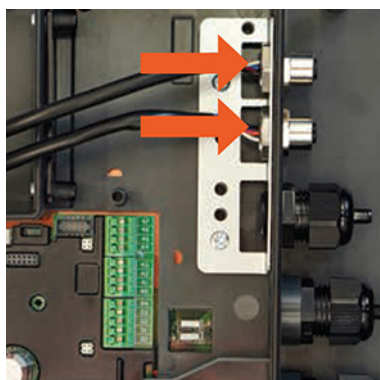


Fig. 27: Screw on locknuts.

3. Thread the locknuts on the electric cables and screw them onto the M12 sockets (WAF 19).

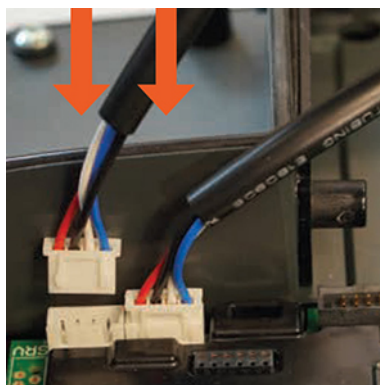


Fig. 28: Connecting the plug-type connectors

4. Plug the plug-type connectors of the two M12 cables into the slots provided. The plug-type connectors are polarised. The plug-type connectors can be plugged into the slots provided on the control PCB in any order.

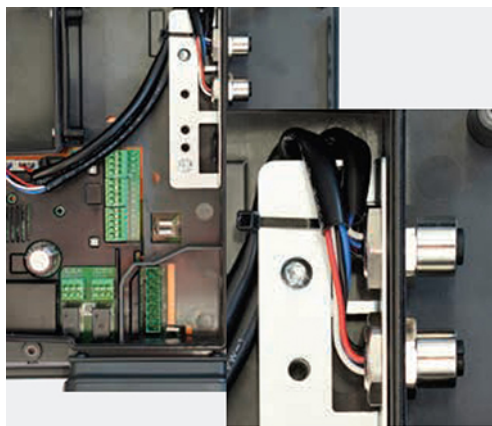


Fig. 29: Laying the M12 cables in the housing

5. Properly lay the M12 cables in the housing and feed them through underneath the connecting plate.

	⚠ WARNING
	Sharp-edged corners of cable ties Risk of injury, scratches! ▶ Shorten cable ties with a suitable tool to prevent sharp-edged corners. ▶ If shortening of the cable ties leads to sharp-edged corners, file the end of the cable ties until round.

6. Hold the M12 cables in position with the cable tie supplied.

5.7.3.9 Connecting the dual pump configuration

Dual pump configuration is effected with a cable pre-configured especially for this connection.

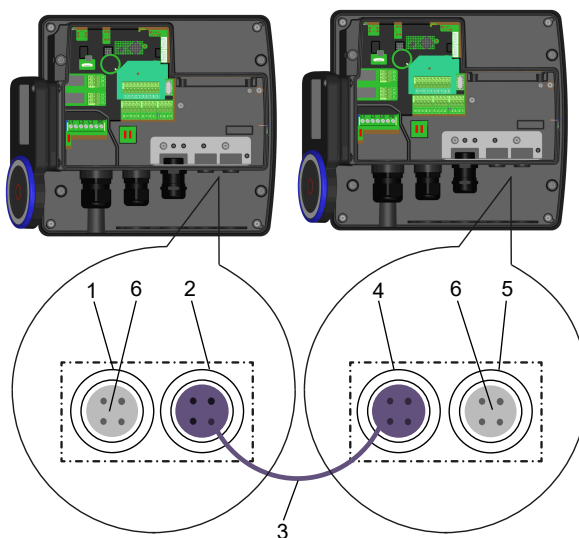


Fig. 30: Connecting the dual pump configuration

1	Connection of terminating resistor, pump set No. 1
2	Connection of bus cable, pump set No. 1
3	Pre-configured bus cable for dual pump configuration ⁴⁾
4	Connection of bus cable, pump set No. 2

⁴ For accessories see the EtaLine Pro type series booklet.

5	Connection of terminating resistor, pump set No. 2
6	Terminating resistor ⁴⁾

	NOTE
	For bus termination, terminating resistors are required ⁴⁾ that must be connected to the free M12 connectors (1 and 5) of the M12 accessories set.

6 Commissioning/Start-up/Shutdown

6.1 Commissioning/start-up/shutdown

	 DANGER
	Hazardous voltage Danger of death from electric shock! ▷ Have all work performed only by qualified specialist personnel and only when the drive is at a standstill and secured against unintentional start-up. This also applies to auxiliary circuits (e.g. standstill heater). ▷ The drive must not be electrically connected at any point in time when work is performed on the open terminal box. ▷ Ensure that the rotor cannot turn or be turned at any point in time when work is performed on the open terminal box.

Before commissioning and whenever returning the product to service, perform the electrical safety checks stipulated by EN 60204-1.

6.1.1 Prerequisites for commissioning

Prior to commissioning, make sure that the following conditions are met:

- The drive has been mounted and aligned correctly.
- The operating conditions have been verified against the name plate data.
- The earth connection and potential equalisation connections have been made correctly.
- All fastening bolts/screws, connecting elements and electrical connections have been tightened to the specified tightening torques.
- Measures have been taken to prevent accidental contact with moving and live parts.
- Components (cables, etc.) that are sensitive to temperature do not come into contact with the motor housing.
- The pump set has been checked for software updates. If necessary, update to the latest version. (⇒ Section 7.3.5, Page 64)
- The pump set has been properly connected to the power supply and is equipped with all protection devices.
- The pump has been primed with the fluid to be handled. The pump has been vented.
- The direction of rotation has been checked.
- All auxiliary connections required are connected and operational.
- After prolonged shutdown of the pump (set), the activities required for returning the equipment to service have been carried out. (⇒ Section 6.4, Page 45)

6.1.2 Checking earth conductor connection

Check that the earth conductor has been correctly connected in accordance with EN 60204.

6.1.3 Checking insulation resistance

Prior to commissioning and following prolonged storage or standstill periods, the insulation resistance will need to be checked and verified.

	NOTE
	Note that the insulation resistance of dry windings that have been reconditioned or cleaned is lower when the winding is warm. The insulation resistance can only be evaluated correctly after converting to the reference temperature of 25°C.

The insulation resistance of the stator winding must equal at least 1.5 megohms for motors with a rated voltage of 220 - 1000 V.

6.1.4 Priming and venting the pump

	⚠ DANGER Formation of a potentially explosive atmosphere inside the pump Explosion hazard! ▶ Before starting up the pump set, vent the pump and suction 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 liquid fill. ▶ Never close the shut-off element in the suction line and/or supply line during pump operation.
1. Vent the pump and suction line and prime both with the fluid to be handled. Connection 6D can be used for venting (see drawing of auxiliary connections). For vertical installation with the motor on top, use connection 5B (if provided) for venting (see drawing of auxiliary connections). 2. Fully open the shut-off element in the suction line. 3. Fully open all auxiliary feed lines (barrier fluid, flushing liquid, etc.), if any. 4. Open the shut-off element, if any, in the vacuum balance line and close the vacuum-tight shut-off element, if any.	
	⚠ WARNING Hot water escaping under pressure when the vent plug is opened Risk of electric shock! Risk of scalding! ▶ Protect the electric components against escaping fluid. ▶ Wear protective clothing (e.g. gloves).
	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.

6.1.5 Start-up

	⚠ DANGER Non-compliance with the permissible pressure limits and temperature limits if the pump is operated with the suction and discharge lines closed Explosion hazard! Hot or toxic fluids escaping! ▶ Never operate the pump with the shut-off elements in the suction line and/or discharge line closed. ▶ Only start up the pump set with the discharge-side gate valve slightly or fully open.
---	---

	⚠ DANGER Excessive temperatures due to dry running or excessive gas content in the fluid handled Damage to the pump set! ▷ Never operate the pump set without liquid fill. ▷ Prime the pump as per operating instructions. ▷ Always operate the pump within the permissible operating range.
---	--

	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 system piping has been cleaned.
- ✓ The pump, suction line and inlet tank (if any) have been vented and primed with the fluid to be handled.
- ✓ The lines for priming and venting have been closed.
 1. Fully open the shut-off element in the suction head line / suction lift line.
 2. Close or slightly open the shut-off element in the discharge line.
 3. Turn on the power supply. / Start up the pump set.
 4. Digital input 1, fit a wire jumper between terminals 30 and 31.
(⇒ Section 5.7.3.7, Page 35)
 5. Slowly open the shut-off element in the discharge line.
 6. Set the operating mode and setpoint. (⇒ Section 7.2.1, Page 50)

	⚠ DANGER Seal leakages at operating temperature Leakage of hot or toxic fluid handled! ▷ Once the operating temperature has been reached, re-tighten the hexagon socket head cap screws between casing and casing cover.
---	--

6.1.6 Checking the shaft seal

Mechanical seal The mechanical seal only leaks slightly or invisibly (as vapour) during operation. Mechanical seals are maintenance-free.

6.1.7 Shutdown

	CAUTION Heat build-up inside the pump Damage to the shaft seal! ▷ Depending on the type of installation, the pump set requires sufficient after-run time – with the heat source switched off – until the fluid handled has cooled down.
---	---

	CAUTION
	Backflow of fluid handled is not permitted Motor or winding damage! Mechanical seal damage! ▸ Close the shut-off elements.

- ✓ The shut-off element in the suction line is and remains open.
1. Close the shut-off element in the discharge line.
 2. Switch off the pump set and make sure it runs down smoothly to a standstill.

	NOTE
	If the discharge line is equipped with a non-return or check valve, the shut-off element may remain open provided that the system conditions and system regulations are considered and observed.

For prolonged shutdown periods:

1. Close the shut-off element in the suction line.
2. Shut off any auxiliary feed lines.
If the fluid handled is fed in under vacuum, also supply the shaft seal with barrier fluid during standstill.

	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 for pressure, temperature and speed Explosion hazard! Leakage of hot or toxic fluid handled! ▸ Comply with the operating data indicated in the data sheet. ▸ Never use the pump to handle fluids it is not designed for. ▸ Avoid prolonged operation against a closed shut-off element. ▸ Never operate the pump at temperatures exceeding those specified in the data sheet or on the name plate unless the written consent of the manufacturer has been obtained.

6.2.1 Ambient conditions

	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 16: Permissible ambient temperatures specified for the fluid temperature

Fluid temperature	Permissible maximum ambient temperature
[°C]	[°C]
≤90	40
>90 to 120	30

Ambient conditions for operation (IEC 60721-3-3, EN 50178)

- Climatic conditions for operation: Class 3K3
- Temperature range: 0° C to +40 °C
- Relative humidity: < 95 %
- Condensation must be prevented.
- Atmospheric pressure: 70 kPa to 106 kPa

6.2.2 Maximum operating pressure

	CAUTION
	Permissible operating pressure exceeded Damage to connections and seals! ▷ Never exceed the operating pressure specified in the data sheet.

The maximum operating pressure depends on the design. See name plate.
 (⇒ Section 4.4, Page 17)

6.2.3 Fluid handled

6.2.3.1 Flow rate

Table 17: Flow rate

Temperature range (t)	Minimum flow rate	Maximum flow rate
0 to +70 °C	≈ 15 % of Q _{BEP} ⁵⁾	See hydraulic characteristic curves
> 70 to +120 °C	≈ 25 % of Q _{BEP} ⁵⁾	

The calculation formula below can be used to check if an additional heat build-up could lead to a dangerous temperature increase at the pump surface.

$$T_O = T_f + \Delta \vartheta$$

$$\Delta \vartheta = \frac{g \times H}{c \times \eta} \times (1 - \eta)$$

Table 18: Key

Symbol	Description	Unit
c	Specific heat capacity	J/kg K
g	Acceleration due to gravity	m/s ²
H	Pump discharge head	m
T _f	Fluid temperature	°C
T _O	Temperature at the casing surface	°C
η	Pump efficiency at duty point	-
Δϑ	Temperature difference	K

5 Best efficiency point

6.2.3.2 Density of the fluid handled

	CAUTION Impermissibly high density of the fluid handled Motor overload! ▸ Observe the information on fluid density in the data sheet.
---	--

The power input of the pump set changes in proportion to the density of the fluid handled.

6.2.3.3 Abrasive fluids

Do not exceed the maximum permissible solids content specified in the data sheet. When the pump handles fluids containing abrasive substances, increased wear of the hydraulic system and shaft seal are to be expected. In this case, reduce the commonly recommended inspection intervals.

6.2.4 Installation altitude

- ≤ 1000 m above MSL, or 1 % power derating per additional 100 m
- Maximum installation altitude 2000 m above MSL

6.3 Shutdown/storage/preservation

6.3.1 Measures to be taken for shutdown

The pump (set) remains installed

- ✓ Sufficient fluid is supplied for the functional check run of the pump.
 1. For prolonged shutdown periods, start up the pump (set) regularly between once a month and once every three months for approximately five minutes.
 - ⇒ This will prevent the formation of deposits within the pump and the pump intake area.

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

- ✓ The pump has been properly drained. (⇒ Section 8.3, Page 74)
- ✓ The safety instructions for dismantling the pump have been observed.
- ✓ The permissible ambient temperature for storing the pump is observed.
 1. Spray-coat the inside wall of the pump casing and, in particular, the impeller clearance areas with a preservative.
 2. Spray the preservative through the suction nozzle and discharge nozzle. It is advisable to then close the pump nozzles (e.g. with plastic caps).
 3. Oil or grease all exposed machined parts and surfaces of the pump (with silicone-free oil and grease, food-approved, if required) to protect them against corrosion. Observe the additional instructions on preservation.

If the pump set is to be stored temporarily, only preserve the wetted components made of low-alloy materials. Commercially available preservatives can be used for this purpose. Observe the manufacturer's instructions for application/removal.

6.4 Returning to service

For returning the equipment to service observe the sections on commissioning/start-up and the operating limits.

In addition, carry out all servicing/maintenance operations before returning the pump (set) to service. (⇒ Section 8, Page 71)

	 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, properly re-install and re-activate any safety-relevant devices and protective devices.
	NOTE If the equipment has been out of service for more than one year, replace all elastomer seals.

7 Operation

7.1 Control panel

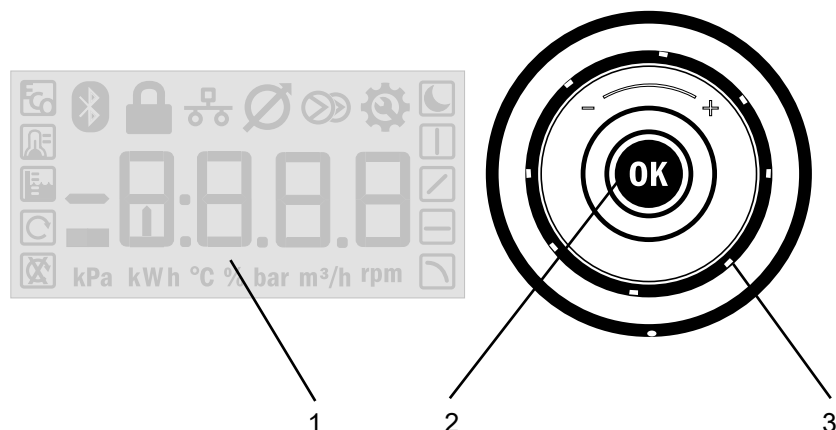


Fig. 31: Control panel

1	Display	3	LED segment display
2	Control element (dial and control button)		

The system is operated and configured by placing a finger on the dial and turning it in the (+) or (-) direction. Pressing the control button serves as a confirmation. Symbols in the display indicate the selected settings.

Press the control button to activate the display from idle mode. The display will show the current operating mode as well as, in alternation, the electrical input power, speed, head and flow rate. If 5 minutes pass without any settings being made or the control button being pressed, the display will revert to idle mode.

7.1.1 Control element

Table 19: Configuration via control element

Menu	Time to open menu	Details
Operating modes / setpoint	Press and hold the control button for 3 seconds.	(⇒ Section 7.2, Page 50)
External interfaces	Press and hold the control button for 6 seconds.	(⇒ Section 7.3, Page 58)
Additional functions ⁶⁾	Press and hold the control button for 9 seconds.	(⇒ Section 7.4, Page 68)
Resetting to factory settings	Press and hold the control button for 30 seconds.	(⇒ Section 7.5, Page 69)

7.1.2 Display

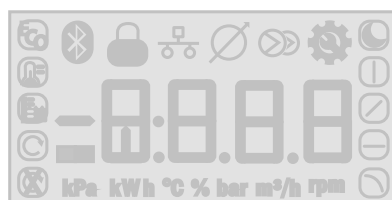


Fig. 32: Display

⁶ Depending on the model / firmware version

Table 20: Symbols key

Symbol	Description
	Bluetooth active/inactive
	Display lock active/inactive
	Analog input 0/2-10 V active/inactive
	Dual-pump operation active/inactive
	Field bus interface active/inactive
Status indicators	
	Status: Pump rotating
	Status: Pump not rotating
	Status LED ▪ Green = no pump fault ▪ Yellow = warning ▪ Red = alert
Units	
	Measured electric input power ▪ Symbol lights up. ▪ Display shows the electric power.
	Head ▪ Symbol lights up. ▪ Display shows the head.
	Flow rate ▪ Symbol lights up. ▪ Display shows the flow rate.
	Speed ▪ Symbol lights up. ▪ Display shows the actual speed.
Operating modes	
	Constant-pressure Control operating mode ▪ Symbol lights up when this operating mode is active.
	Proportional-pressure Control operating mode ▪ Symbol lights up when this operating mode is active.

Symbol	Description
	Constant Speed operating mode Symbol lights up when this operating mode is active.
	Dynamic Control operating mode Symbol lights up when this operating mode is active.
	Constant Flow operating mode Symbol lights up when this operating mode is active.
	Temperature Control operating mode Symbol lights up when this operating mode is active.

7.2 Operating modes

7.2.1 Information on settings

For common applications, such as two-pipe radiator heating systems, Dynamic Control or Proportional-pressure Control ($\Delta p-v$) are the recommended operating modes. These operating modes offer an extended control range with additional potential savings compared to Constant-pressure Control ($\Delta p-c$). Depending on the balancing of branch circuits, undersupply may occur at a consumer installation.

Constant-pressure Control operating mode ($\Delta p-c$) can optionally be selected for underfloor heating systems, for example. If noises are audible at low flow rates, select the Proportional-pressure Control operating mode ($\Delta p-v$).

The setting of the discharge head setpoint depends on the piping curve of the system and on the heat requirements. As standard the pump set is pre-set to Proportional-pressure Control ($\Delta p-v$) operating mode.

7.2.2 Constant-pressure Control

Applications

- Surface heating systems
- Solar pumps

Solar pumps require a high operating pressure to pump sufficient fluid through the heat exchanger. Proportional-pressure Control is not necessary as the thermostatic valves do not impact on the characteristic curve.

Function

In Constant-pressure Control the set head ② is maintained irrespective of the flow rate. The set head setpoint H_s is constant, situated between the maximum curve ① and the permissible flow rate range.

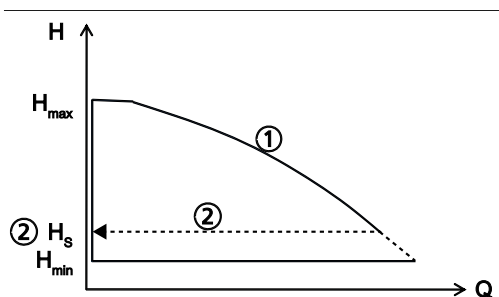


Fig. 33: Constant-pressure Control function

Settings

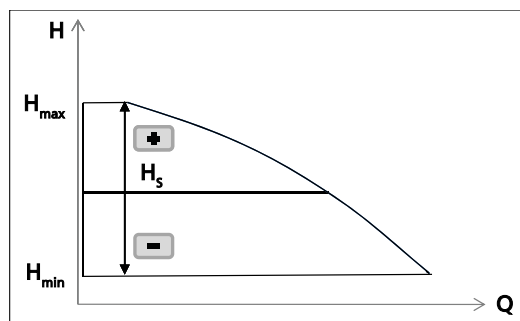
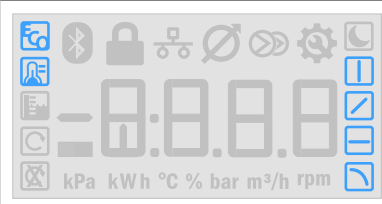
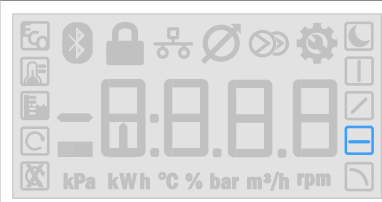
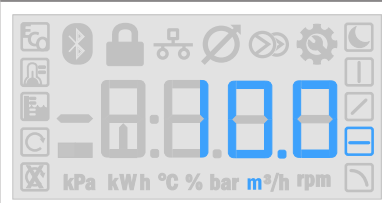


Fig. 34: Constant-pressure Control settings

Table 21: Selecting Constant-pressure Control and setting the setpoint

	Step 1: Activating the setting mode - Press and hold the control button (OK) for 3 seconds. - The flashing symbol indicates the active operating mode.
	Step 2: Selecting the Constant-pressure Control operating mode - Change the control element (+) or (-) until the symbol for <i>Constant-pressure Control operating mode</i> flashes. - Press the control button (OK) to confirm the operating mode.
	Step 3: Confirming the head setpoint - Increase or decrease the flashing head setpoint using the control element (+) or (-). - Press the control button (OK) to confirm the setpoint. - The selected setpoint lights up. It has been saved.

7.2.3 Proportional-pressure Control

Application

- Heating systems with radiators

The higher the flow rate, the higher the system's resistance. This is corrected by the pump set automatically increasing the head setpoint.

When setting the setpoint ensure that the selected controlled-operation curve is suitable for the system characteristic curve:

- If the system characteristic curve is known (e.g. hydraulic balancing), select a controlled-operation curve that is minimally above the characteristic curve. See type series booklet.
 - Controlled-operation curve too low: undersupply
 - Controlled-operation curve too high: increased energy input
- If the system characteristic curve is unknown, *Dynamic Control* is recommended.
 - The pump set automatically recognises the system characteristic curve via the variable speed system and optimises the operating point accordingly.

Function

The Proportional-pressure Control decreases or increases the head setpoint in a linear fashion along an adjustable controlled-operation curve, depending on the flow rate. The controlled-operation curve is defined by two setpoints (H_{ref} and Q_{ref}).

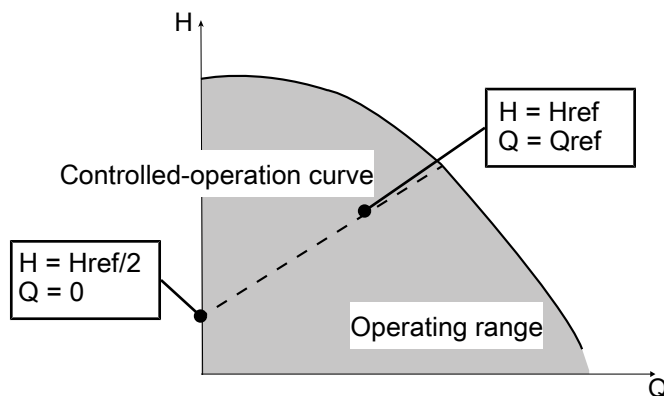


Fig. 35: Proportional-pressure Control function

The controlled-operation curve always runs through the defined reference point (H_{ref} and Q_{ref}) as well as through half the head setpoint ($H_{ref/2}$) at $Q = 0$.

To set the setpoints properly a distinction should be made between hydraulically balanced and hydraulically unbalanced systems.

Hydraulically balanced

In a hydraulically balanced system the maximum duty point (H_{max} , Q_{max}) is known. This should be chosen as the setpoint to make sure the pump always provides sufficient head to supply the building.

Hydraulically unbalanced

In a hydraulically unbalanced system the head setpoint should be chosen to be in the middle of the adjustable range. When the head setpoint has been entered, a flow rate setpoint will be suggested on the control panel. This suggestion represents the intersection between the head setpoint and the operating range of the pump.

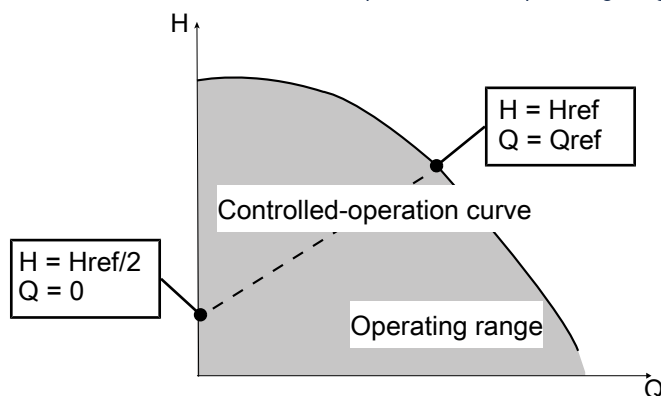


Fig. 36: Flow rate setpoint suggestion function

This suggestion should be accepted by pressing the OK key.

If the entry is made via the analog input, only the head setpoint can be set; the corresponding flow rate is determined by the pump in this case.

Settings

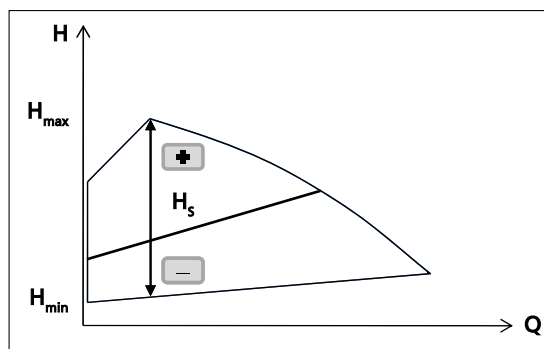
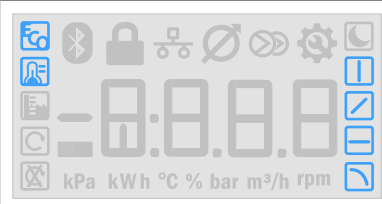
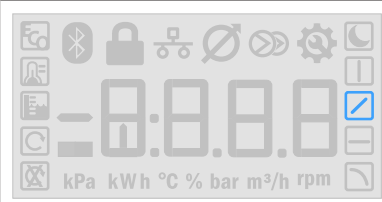
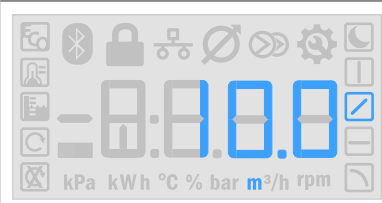
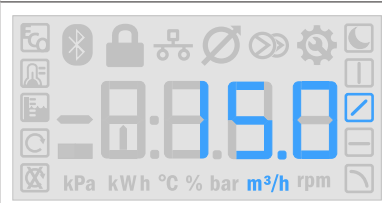


Fig. 37: Proportional-pressure Control settings

Table 22: Selecting Proportional-pressure Control and setting the setpoint

	Step 1: Activating the setting mode - Press and hold the control button (OK) for 3 seconds. - The flashing symbol indicates the active operating mode.
	Step 2: Selecting the Proportional-pressure Control operating mode - Change the control element (+) or (-) until the symbol for <i>Proportional-pressure Control operating mode</i> flashes. - Press the control button (OK) to confirm the operating mode.
	Step 3: Setting the head setpoint - Increase or decrease the flashing setpoint by changing the control element (+) or (-). - Press the control button (OK) to confirm the setpoint. - The selected setpoint lights up. It has been saved.
	Step 4: Changing the flow rate setpoint - Increase or decrease the flashing setpoint by changing the control element (+) or (-). - Press the control button (OK) to confirm the setpoint. - The selected setpoint lights up. It has been saved.

7.2.4 Dynamic Control

Application

- Heating systems with radiators

Dynamic Control is a more energy-efficient alternative to Proportional-pressure Control. The piping losses follow a quadratic system characteristic curve. Dynamic Control makes the pump set follow a quadratic control curve and automatically recognises the averaged degree of opening of the thermostatic valves.

When the thermostatic valves are closed or strongly throttled, the pump set's head reduction exceeds that of the reduction specified by the quadratic control curve. The thermostatic valves open and maintain the required flow rate.

If the thermostatic valves do not respond further to the decreasing head, the pump set automatically switches back to the original control curve. This prevents any undersupply.

Function

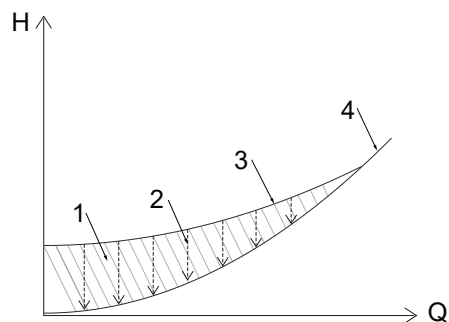


Fig. 38: Dynamic Control function

1	Excess energy input	3	Control curve
2	Dynamic Control	4	Minimum characteristic curve

Dynamic Control (2) detects when the selected control curve (3) is higher than the minimum characteristic curve⁷⁾ (4). The control system shifts the control curve downward, and power input is reduced automatically. To ensure sufficient supply the pump set switches to a higher control curve when the minimum characteristic curve is reached. The energy input is reduced (1) without any negative impact on the supply of the building. The pump set is operated in an optimised way, even if the system characteristic curve is unknown; the noise at the thermostatic valves is reduced.

- If the system characteristic curve is known (e.g. hydraulic balancing):
 - Set the setpoint manually. Select a control curve that is minimally above the characteristic curve.
 - Activating Dynamic Control in addition is recommended. Even if the setpoint has been set to an optimum, excessive throttling of the thermostatic valves may occur in certain climatic conditions. Dynamic Control will further optimise the operating point.
- If the system characteristic curve is unknown:
 - Use the standard settings and activate Dynamic Control. The pump set automatically recognises the system characteristic curve via the variable speed system and optimises the operating point accordingly.

Settings

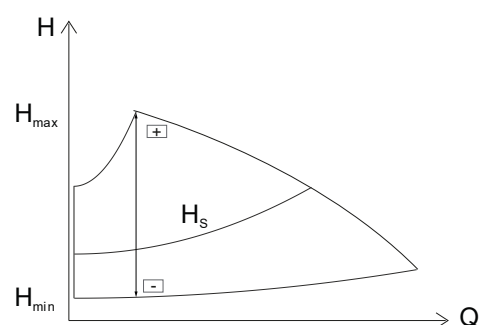


Fig. 39: Dynamic Control settings

Table 23: Activating and deactivating Dynamic Control

	Step 1: Activating the setting mode - Press and hold the control button (OK) for 3 seconds. - The flashing symbol indicates the active operating mode.
	Step 2: Selecting Dynamic Control - Adjust the control element (+) or (-) until the symbol for <i>Dynamic Control operating mode</i> flashes. - Press the control button (OK) to confirm the operating mode.
	Step 3: Setting the head setpoint - Increase or decrease the flashing head setpoint by adjusting the control element (+) or (-). - Press the control button (OK) to confirm the setpoint. - The selected setpoint lights up. It has been saved.
	Step 4: Changing the flow rate setpoint - Increase or decrease the flashing flow rate setpoint by adjusting the control element (+) or (-). - Press the control button (OK) to confirm the setpoint. - The selected setpoint lights up. It has been saved.

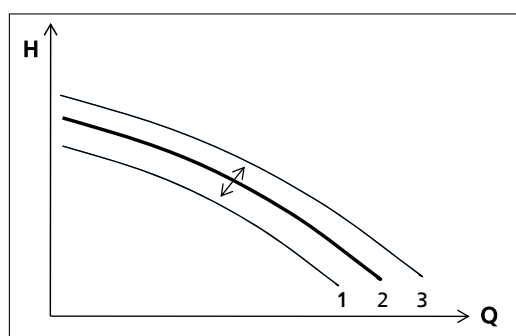
7.2.5 Constant speed (open-loop control)

Application

- Booster pump for supplying a heat distribution system

Function

In Open-loop Control operating mode the pump set runs at a set speed. The speed can be adjusted in 100 rpm increments.


Fig. 40: Open-loop Control function

Settings

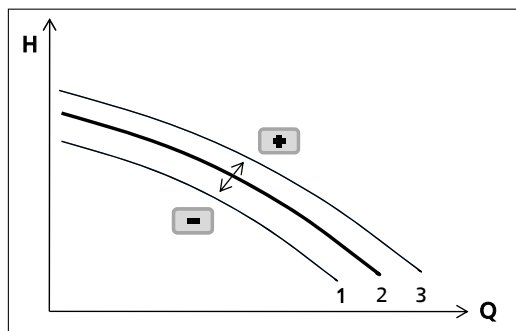


Fig. 41: Open-loop Control settings

Table 24: Selecting Open-loop Control and setting the setpoint

	Step 1: Activating the setting mode - Press and hold the control button (OK) for 3 seconds. - The flashing symbol indicates the active operating mode.
	Step 2: Selecting the Constant Speed (open-loop control) operating mode - Change the control element (+) or (-) until the symbol for <i>Constant Speed operating mode</i> flashes. - Press the control button (OK) to confirm the operating mode.
	Step 3: Setting the speed setpoint - Increase or decrease the flashing setpoint by changing the control element (+) or (-). The speed setpoint is increased or decreased in 100 rpm increments. - Press the control button (OK) to confirm the setpoint. - The selected setpoint lights up. It has been saved.

7.2.6 Constant-flow-rate Control

Application

- Cooling circuit with constant cooling power

Function

In the Constant-flow-rate Control operating mode, the pump maintains the set constant flow rate setpoint. To do so, it increases the speed within the permissible range if the estimated flow rate is below the setpoint, and vice versa. The required flow rate is maintained constant, regardless of the differential pressure.

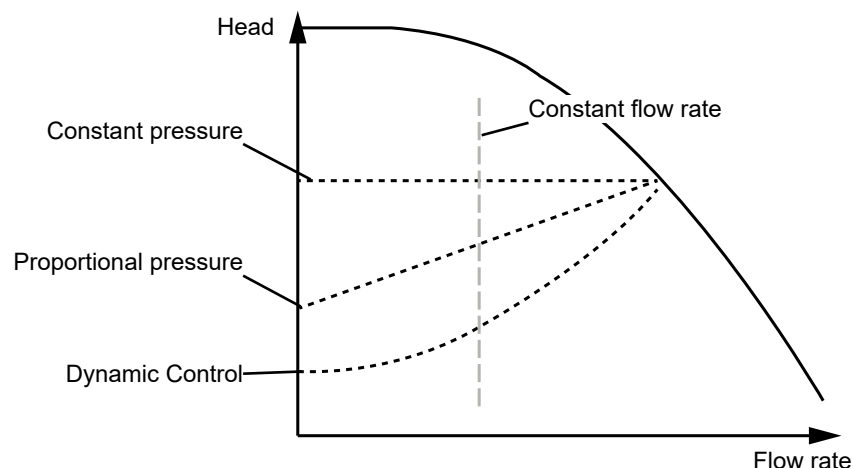


Fig. 42: Constant-flow-rate Control function

Table 25: Selecting Constant-flow-rate Control and setting the setpoint

	Step 1: Activating the setting mode - Press and hold the control button (OK) for 3 seconds. - The flashing symbol indicates the active operating mode.
	Step 2: Selecting the Constant-flow-rate Control operating mode - Change the control element (+) or (-) until the symbol for <i>Constant-flow-rate Control operating mode</i> flashes. - Press the control button (OK) to confirm the operating mode.
	Step 3: Setting the flow rate setpoint - Increase or decrease the flashing setpoint using the control element (+) or (-). - Press the control button (OK) to confirm the setpoint. - The selected setpoint lights up. It has been saved.

7.2.7 Temperature control

The following temperature control types are available:

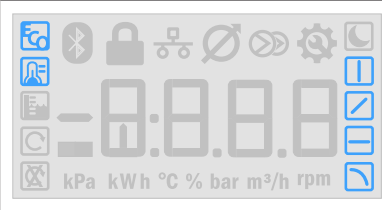
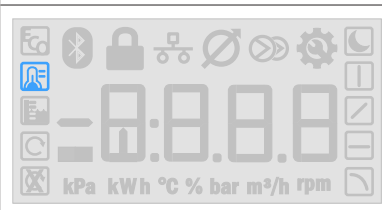
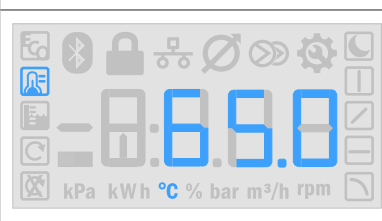
- Constant-temperature Control (T-const)
- Constant-differential-temperature Control (delta T-const)
- Temperature-governed Differential Pressure Control

The default setting is for Constant-temperature Control (T-const).

When the **Temperature Control** operating mode has been selected via the control unit, the temperature setpoint can be entered. The corresponding actual temperature value has to be measured with an external temperature sensor (not included in the scope of supply) and supplied back to the pump set via analog inputs 1 or 2.

When the **T-const** (⇒ Table 26) operating mode has been activated, and the analog input has been parameterised for the actual temperature value, the pump set responds to the measured temperature and increases or decreases the speed according to the actual temperature value.

Table 26: Selecting temperature control and setting the setpoint

	Step 1: Activating the setting mode - Press and hold the control button (OK) for 3 seconds. - The flashing symbol indicates the active operating mode.
	Step 2: Selecting the <i>Temperature Control</i> operating mode - Adjust the control element (+) or (-) until the symbol for <i>Temperature Control</i> operating mode flashes. - Press the control button (OK) to confirm the operating mode.
	Step 3: Setting the temperature setpoint - Increase or decrease the flashing setpoint using the control element (+) or (-). - Press the control button (OK) to confirm the setpoint. - The selected setpoint lights up. It has been saved.

For further setting options and information on scaling the analog input for an external temperature sensor see the application manual.

7.3 Functions

7.3.1 Protective functions

Function

The electronic motor protection automatically reduces the pump power in the event of overloading.

Available protective functions

- Protection against overheating
- Voltage monitoring
- Blocked pump rotor
- Broken wire detection
(For further information see the application manual.)
- Pump service interval and motor bearing service interval
(For further information see the application manual.)
- Characteristic curve control (min. / max. flow)
(For further information see the application manual.)
- Functional check run preventing impeller seizure
(For further information see the application manual.)
- Protection against externally forced flow
(For further information see the application manual.)
- Dry running detection (dry running protection)
(For further information see the application manual.)

Settings

The protective functions and their settings are described in the application manual. All settings are made via the KSB FlowManager app.

7.3.2 Saving data

The operating data of the pump set are saved. Data storage will be maintained also when the pump is switched off or disconnected from the power supply. When the pump set is switched on again, it will be operated with the data that were active before the pump set was last switched off.

7.3.3 Fault messages

Function

The pump set outputs warnings and alerts as a sequence of numbers and LEDs on the display.

Table 27: Warnings

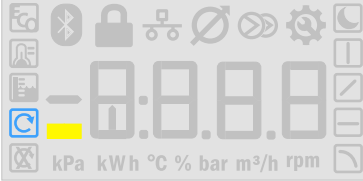
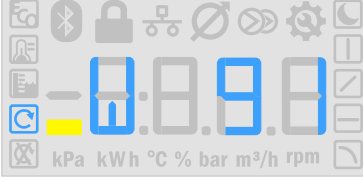
 Pump set status: Warning	- The display shows the error code of the warning. The <i>Pump set status</i> symbol and a yellow LED light up. - The pump set keeps running in the set operating mode, possibly at a lower speed. - The general fault message relay does not emit a message for warnings.
 Warning display (example)	Warning W91 is active. The pump set continues to run. The display alternates between the active warning and the operating mode. When the warning is no longer active, the display will revert to the set operating mode.

Table 28: Alerts

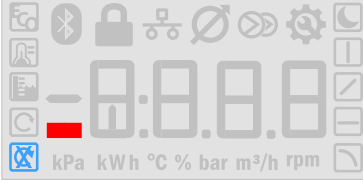
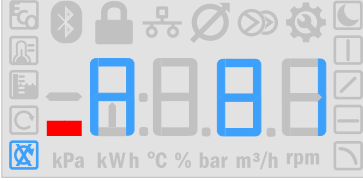
 Pump set status: Alert	- The display shows the error code of the alert. The <i>Pump rotating</i> symbol extinguishes and the <i>Pump not rotating</i> symbol as well as a red LED light up. - The pump set stops / the motor is not rotating. - The general fault message relay emits a message. - If the pump control system cannot re-start the pump set automatically, the pump set continuously remains in fault status.
 Alert display (example)	Alert 81 is active. When the alert is no longer active, the display will revert to the set operating mode. The settings of the pump set can then be changed again.

Table 29: Warnings

Error code	Cause	Response
W10	Pump set service interval reached	Contact KSB Service.
W11	Motor bearing service interval reached	Contact KSB Service.
W36	Motor and electronics not compatible	Contact KSB Service.
W40	Pump unit rotor blocked	Pump unit attempts to deblock automatically.

Error code	Cause	Response
W41	Pump set rotation in the direction of flow is caused by an externally forced flow.	Check the hydraulics of the system (system schematic / piping layout). If an externally forced flow has been detected, the display shows warning W41. The pump set starts up, runs at the set speed and reverts to normal operation. The LED on the display lights up green. If the pump set does not start up due to an excessively high externally forced flow, the pump will switch to alert A41 and stop. The LED on the display lights up red.
W42	Pump set rotation in the reverse direction of flow is caused by an externally forced flow.	Check the hydraulics of the system (system schematic / piping layout). Fit a check valve if required. After an externally forced flow has been detected, the display shows warning W42, the pump set starts up, runs at the set speed and reverts to normal operation. The LED on the display lights up green. If the pump set does not start up due to an excessively high externally forced flow, the pump will switch to alert A42 and stop. The LED on the display lights up red.
W54 W55	The temperature limit inside the pump set has been reached. The pump set is running at reduced speed.	Let the pump set cool down until the warning clears. If the temperature continues to rise, alert 51 is shown on the display and the red LED will light up. Verify the permissible temperature ranges of the fluid temperature and the ambient temperature.
W86	Mains input power P1 too high	Reduce the hydraulic load / check operating limits (selection chart) and ensure that the pump set does not exceed these limits.
W91	Analog inputs 1 or 2; input signal interrupted or below the defined limit.	Check the input signal and reconnect or replace the wire. If applicable, replace defective sensor with new one.
W92	Minimum flow	Minimum flow monitoring is active and indicates that the set value has been undershot.
W93	Maximum flow	Maximum flow monitoring is active and indicates that the set value has been exceeded.

Table 30: Alerts

Error code	Cause	Response
A21 A22 A23	Critical electronics fault	Disconnect the power supply for 1 minute. After 1 minute, re-connect the power supply. Replace the pump set or contact KSB Service.
A24	Overcurrent Possible causes: Overload or externally forced flow of pump set	A externally forced flow can lead to a clear rise in current/ power during the pump set start-up. Disconnect the power supply for 1 minute. After 1 minute, re-connect the power supply. Repeat the start-up procedure for the pump set.
A25	Overload Possible causes: Overload or externally forced flow of pump set	Check the hydraulics of the system (system schematic / piping layout). Fit a check valve if required. Contact KSB Service.
A30 A31 A32 A33 A34 A35 A36	Internal hardware/firmware fault (incorrect parameters)	Disconnect the power supply for 1 minute. After 1 minute, re-connect the power supply. Replace the pump set or contact KSB Service.
A40	Pump unit rotor blocked	Deblock it by cleaning the pump unit and/or system. After the contamination has been removed, re-start the pump unit.

Error code	Cause	Response
A41	Pump set rotation in the direction of flow is caused by an externally forced flow.	Check the hydraulics of the system (system schematic / piping layout).
A42	Pump set rotation in the reverse direction of flow is caused by an externally forced flow.	Check the hydraulics of the system (system schematic / piping layout). Fit a check valve if required.
A46	Dry running detected	Prime the piping with water and vent the piping.
A51 A52 A53 A54 A55	Excessive temperature inside the pump set / Pump set has been stopped.	Interrupt the power supply and let the pump set cool down. Verify the permissible temperature ranges of the fluid temperature and the ambient temperature.
A61	Supply voltage below the permissible limit.	Verify the available supply voltage against the data on the name plate. Measure the supply voltage.
A62	Supply voltage above the permissible limit.	Verify the available supply voltage against the data on the name plate. Measure the supply voltage.
A63	Mains voltage phase failure	Check the power supply and fuse elements.
A64	DC link voltage too high	Check the power supply and fuse elements.
A70	Test alert	Interrupt and re-establish the power supply, or deactivate the test alert.
A71	External message at digital input active	Check the signal or, if necessary, change the setting of the digital inputs.
A81	Synchronisation alert/motor synchronisation lost Possible causes: Externally forced flow of pump set	The rotary field of the rotating motor is not synchronised with the output signal of the frequency inverter power electronics. To detect the rotor position of the motor disconnect the power supply for 1 minute. After 1 minute, re-connect the power supply. Repeat the start-up procedure for the pump set. Check the hydraulics of the system (system schematic / piping layout). Fit a check valve if required. Contact KSB Service.
A82 A83 A84 A85 A86 A87	Motor fault	Disconnect the power supply for 1 minute. After 1 minute, re-connect the power supply. Replace the pump set or contact KSB Service.

7.3.4 Analog inputs

7.3.4.1 Analog input 1

Analog input 1 can be activated via the control element. (⇒ Table 33)

After it has been activated, the analog input is pre-set to voltage signals from 0/2-10 V.
The signal type can be changed to 0/4-20 mA with the KSB FlowManager app
(⇒ Section 4.7, Page 19) .

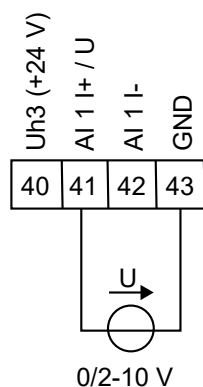


Fig. 43: Analog input 1, voltage input 0/2-10 V

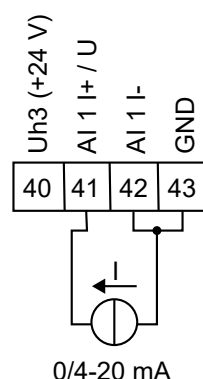


Fig. 44: Analog input 1, current input 0/4-20 mA

Function

An external analog signal serves as setpoint input. The pump set processes this setpoint input as head setpoint, flow rate setpoint, temperature setpoint or speed setpoint, depending on the selected operating mode.

The external analog signal can also be configured as actual value. This is required for all temperature control modes, for example.

Broken wire detection (live zero)

The control system monitors all analog inputs for broken wires.

In addition to the actual value signal, the external signal for defining the setpoint or control value can also be monitored for broken wires.

If the set limit value is undershot, a warning is emitted (⇒ Table 29). The warning is self-acknowledging. The limit value for broken wire and the behaviour in the case of a warning can be set via the KSB FlowManager app (factory setting: Pump stops). For further information see the application manual.

Table 31: Setpoint settings at the pump for signal level 0/2 - 10 V

Signal level	Setpoint input at the pump set
10 V DC	Highest setting of head (or speed)
2 V DC	Lowest setting of head (or speed)
< 1,8 V DC	Pump set stops.
≥ 2 V DC	Pump set starts up (precondition: digital input 1 is bridged).

For voltages between 2 V and 10 V the setpoint is derived by linear interpolation.

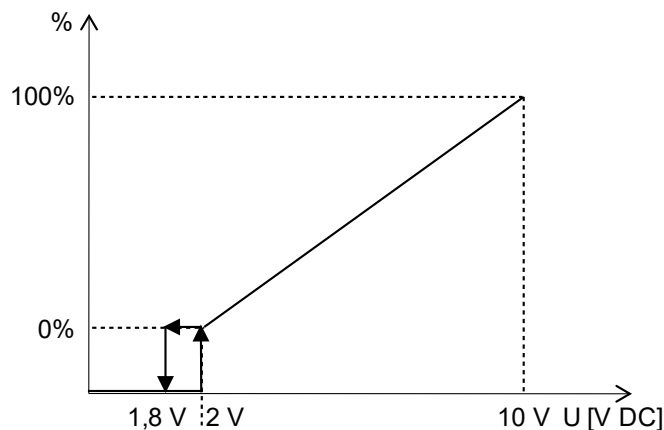


Fig. 45: Analog 0-10 V signal as setpoint input for the pump set

Table 32: Adjustable head setpoints and speed setpoints

Size	Adjustable head		Adjustable speed	
	Minimum	Maximum	Minimum	Maximum
025-025-090 0,8	5,5	41	1000	5900
025-025-090 1,6	5,0	41	1000	5900
032-032-070 0,8	4,0	28	1000	6000
032-032-070 1,6	5,6	28	1000	6000
040-040-090 0,8	1,6	18	1000	3500
040-040-090 1,3	4	18	1000	3500
040-040-090 1,6	3	27	1000	4500
040-040-090 2,6	6	29	1000	4500
050-050-090 0,8	1,9	14	1000	3500
050-050-090 1,3	1,9	16,1	1000	3500
050-050-090 2,3	2	20	1000	3900
065-065-090 0,8	1,8	11	1000	2900
065-065-090 1,2	1,8	15	1000	3300
065-065-090 2,0	2,7	16	1000	3500
065-065-090 2,6	3,8	16	1000	3300

Table 33: Function of analog input 1: Starting and stopping 0/2-10 V

	Step 1: Activating the analog input 1 function (0/2-10 V) - Press and hold the control button (OK) for 6 seconds. - The functions setting mode is active.
	Step 2: Selecting the symbol <i>Analog input 0/2-10 V active / inactive</i> - Set the desired function on the control element. - The symbol flashes.
	Step 3: Activating / deactivating <i>Analog input 0/2-10 V active / inactive</i>. - Press the control button (OK). - The symbol lights up (activated) or the symbol extinguishes (deactivated).



NOTE

If 20 seconds pass without any settings being made or saved, the control unit will revert to the previous settings.



NOTE

To start the pump the digital input 1 terminal pair must be bridged.

7.3.4.2 Analog input 2

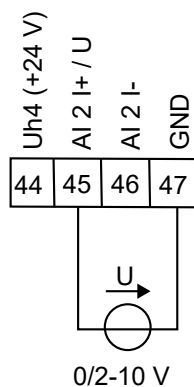


Fig. 46: Analog input 2, voltage input 0/2-10 V

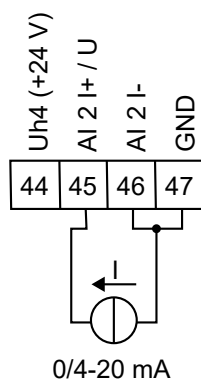


Fig. 47: Analog input 2, current input 0/4-20 mA

Analog input 2 behaves like analog input 1 and offers the same functionality.

However, analog input 2 cannot be activated via the control element but only via the KSB FlowManager app. (⇒ Section 4.7, Page 19)

7.3.5 Bluetooth

Activating the Bluetooth function enables a connection to be established between the pump set and the KSB Flow Manager app (⇒ Section 4.7, Page 19) .



Table 34: Bluetooth

	Step 1: Activating the Bluetooth functions - Press and hold the control button (OK) for 6 seconds. - The function setting mode is active.
	Step 2: Selecting Bluetooth Change the control element until the <i>Bluetooth active / inactive</i> symbol flashes.
	Step 3: Activating/deactivating Bluetooth - Press the control button (OK). - The <i>Bluetooth active / inactive</i> symbol flashes in a different frequency (long ON, brief OFF). The <i>Bluetooth active / inactive</i> symbol flashes for 2 minutes, during which a connection with the smartphone and the KSB FlowManager app can be established. If no connection to the pump set is established within these 2 minutes, Bluetooth is switched off automatically. - Connect the pump set to the smartphone while the symbol is flashing. Once successfully connected, the <i>Bluetooth active / inactive</i> symbol lights up for as long as a connection is present. If a connection has not been established, the <i>Bluetooth active / inactive</i> symbol extinguishes.

Table 35: Overview of the Bluetooth display

Bluetooth display	Description
Bluetooth symbol flashing	Bluetooth pairing - Pairing is activated by pressing the button for 6 seconds. - Approximately 60 seconds are available for pairing.
Bluetooth symbol lit continuously	Bluetooth connection active

7.3.6 Digital inputs

7.3.6.1 Digital input 1 (start/stop)

	CAUTION
	External voltage applied to the digital inputs Damage to the printed circuit board! ▷ Always use a volt-free contact for the digital inputs.

The pump set is started or stopped by a signal at digital input 1.

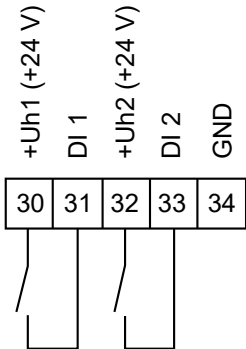


Fig. 48: Digital inputs

Table 36: Terminal assignment: Starting / stopping the pump set

Contact	Effect
Contact closed / terminals 30 and 31 bridged	Pump set starts up.
Contact open / terminals 30 and 31 not bridged	Pump set stops.

7.3.6.2 Digital input 2 (external fault acknowledgement)

CAUTION

External voltage applied to the digital inputs

Damage to the printed circuit board!

▷ Always use a volt-free contact for the digital inputs.

A signal at digital input 2 acknowledges active errors at the pump set.

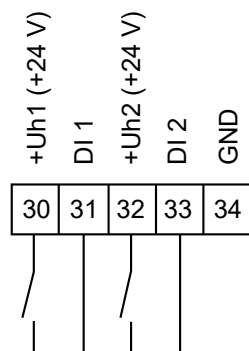

Fig. 49: Digital inputs

Table 37: Terminal assignment: fault acknowledgement

Contact	Effect
Contact closed / terminals 32 and 33 bridged	Active faults are acknowledged.
Contact open / terminals 32 and 33 not bridged	No acknowledgement

7.3.7 Dual pump configuration



When dual pump configuration is activated, up to two pump sets can be operated redundantly or in peak load operation. The pump sets have to be physically connected to each other with the M12 accessories set.

	Step 1: Activating / deactivating the Dual pump configuration function - Press and hold the control button (OK) for 6 seconds. - The function setting mode is active.
	Step 2: Selecting Dual pump configuration Keep adjusting the control element until the Dual pump configuration symbol flashes.
	Step 3: Activating / de-activating Dual pump configuration - Press the control button (OK). - The symbol lights up: Dual pump configuration is activated. - The symbol extinguishes: Dual pump configuration is deactivated.

After Dual pump configuration has been activated, peak load operation is active per default.

Table 38: Dual pump configuration functions

Function	Description
Peak load operation	Peak load operation, unlike redundant operation, enables both pump sets to run in parallel when required.
Redundant operation	Both pump sets run in alternation for 24 hours each. In the event of a pump set failure the other available pump set is started up.
Intelligent pump changeover	If a pump set in dual pump configuration has been replaced, the operating hours per pump set can be balanced out with the intelligent pump changeover function.
Speed equaliser	The Speed equaliser function can be used to partly compensate hydraulic asymmetries in the system.
Learning hysteresis	Pumps starting and stopping Learning hysteresis can prevent continuous starting and stopping (excessive on/off cycling) depending on the duty point. An excessive hysteresis increases the energy input. A hysteresis that is too low does not protect the system sufficiently from excessive on/off cycling. The control system integrates a learning procedure that is leveraged to automatically optimise hysteresis.

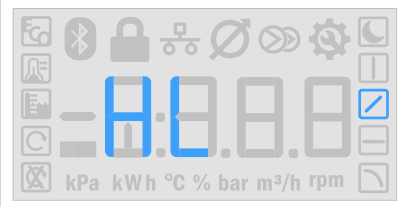
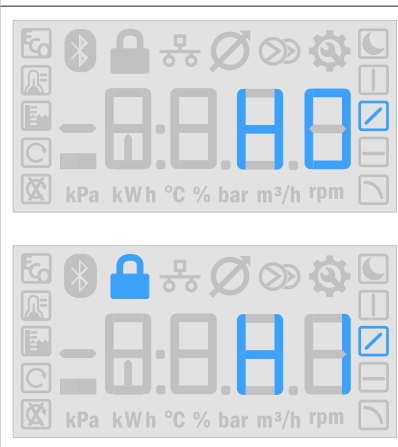
All Dual pump configuration functions and their settings are described in detail in the application manual. All settings are made via the KSB FlowManager app.

7.4 Additional functions

7.4.1 Locking / unlocking the control panel

Operating modes and functions can only be selected when the control panel is unlocked.

Table 39: Locking / unlocking the control panel

	Step 1: Activating the additional functions setting mode - Press and hold the control button (OK) for 10 seconds. - The additional functions setting mode is active. - The symbol flashes.
-	Step 2: Activating the setting mode - Press the control button (OK). - The current status of the control panel is shown.
	Step 3: Locking / unlocking the control panel - Select the desired status by adjusting the control element (+) or (-). - H0 = control panel unlocked - H1 = control panel locked - Press the control button (OK) to confirm the status.

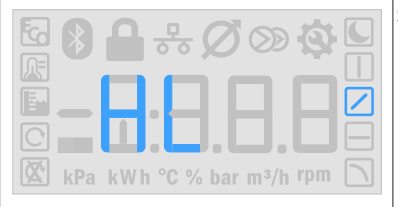
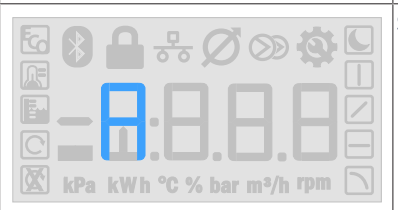
7.4.2 Test alert

Function

The test alert can be used to check the connection of the general fault message. The test alert is indicated by alert 70 on the display, and the pump stops.

The test alert can be disabled by either disconnecting and re-connecting the power supply or via the control element.

Table 40: Activating / deactivating the test alert

	Step 1: Activating the additional functions setting mode - Press and hold the control button (OK) for 10 seconds. - The additional functions setting mode is active. - The symbol flashes.
	Step 2: Selecting <i>test alert</i> Adjust the control element (+) or (-) until A is shown on the display.

-	Step 3: Activating the setting mode Press the control button (OK) to confirm the function.
	Step 4: Activating/deactivating <i>test alert</i> - Select the desired status by adjusting the control element (+) or (-). - A-0 = test alert deactivated - A-1 = test alert activated - Press the control button (OK) to confirm the status.

7.4.3 Information

Table 41: Displaying information

	Step 1: Activating the additional functions setting mode - Press and hold the control button (OK) for 10 seconds. - The additional functions setting mode is active. - The symbol flashes.
	Step 2: Selecting <i>Information</i> Adjust the control element (+) or (-) until In is shown on the display.
-	Step 3: Confirming the setting - Press the control button (OK) to confirm the function. - The pump size and the current firmware version are briefly shown on the display. - The display then changes automatically to its normal operating display.

7.5 Resetting to factory settings

Resetting to factory settings comprises the following settings:

Table 42: Factory-set functions

Function	Description
Operating mode	Proportional-pressure Control
Functions	Deactivates the Bluetooth and analog input functions
Setpoints	50 % of the maximum adjustable head setpoint.

Table 43: Resetting to factory settings

-	Step 1: Activating resetting - Press and hold the control button (OK) for 30 seconds. - The display of the head setpoint extinguishes. - The pump set has now been reset to factory settings.
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7.6 Carrying out a firmware update

- ✓ The current version of the KSB FlowManager app is installed on the smartphone.
 1. Disconnect the pump set from the power supply.
 2. Remove the housing cover. (⇒ Section 5.7.3.1, Page 31)
 3. Remove the wire jumper at digital input 1 between terminals 30 and 31.
 4. Fit the housing cover.
 5. Re-connect the pump set to the power supply.
 6. Activate Bluetooth. (⇒ Section 7.3.5, Page 64)
 7. Connect the pump set with the KSB FlowManager app.
 8. Carry out the firmware update using the KSB FlowManager app.

After it has been connected with the pump set, the app automatically detects if the firmware on the pump set requires updating. This is then shown in the corresponding dialogue in the app.
 9. Disconnect the pump set from the power supply.
 10. Remove the housing cover. (⇒ Section 5.7.3.1, Page 31)
 11. Fit a wire jumper at digital input 1 between terminals 30 and 31.
 12. Fit the housing cover.
 13. Re-connect the pump set to the power supply.

For further information on the firmware update see the description of the KSB FlowManager app in the application manual.

8 Servicing/Maintenance

8.1 Safety regulations

	 DANGER Sparks produced during servicing work Explosion hazard! ▷ Observe the safety regulations in force at the place of installation! ▷ Never open an energised pump set. ▷ Always perform maintenance work on pump sets outside potentially explosive atmospheres only.
	 DANGER Improperly serviced pump set Damage to the pump set! ▷ Service the pump set regularly. ▷ Prepare a maintenance schedule with special emphasis on power cable, bearing assembly and shaft seal.
The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.	
	 WARNING Unintentional starting of the pump set Risk of injury by moving components and shock currents! ▷ Ensure that the pump set cannot be started unintentionally. ▷ Always make sure the electrical connections are disconnected before carrying out work on the pump set.
	 WARNING Fluids handled, 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 tilting or tipping 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 work, service work and installation work can be carried out by KSB Service or authorised workshops. Find your contact in the attached Addresses booklet or visit https://www.ksb.com/en-global/contact.
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Never use force when dismantling and reassembling the pump set.

Assembly and disassembly must be carried out on a slip-proof surface.

8.2 Servicing/inspection

8.2.1 Supervision of operation

	⚠ DANGER Rotating or live parts Death, serious injury or damage to property! ▷ If covers have to be removed, de-energise the motor beforehand. ▷ Avoid touching live or rotating parts.
	⚠ DANGER Pump starting up unexpectedly If a field bus module or supplementary card for external setpoint input have been installed, the pump set can be started up remotely any time. ▷ Observe the safety information in the corresponding operating manual. ▷ Prevent the pump from starting up due to externally forced flow.
	⚠ DANGER Incorrectly serviced shaft seal Fire hazard! Hot fluids escaping! Damage to the pump set! ▷ Regularly service the shaft seal.
	⚠ DANGER Excessive temperatures as a result of bearings running hot or defective bearing seals Explosion hazard! Fire hazard! Damage to the pump set! ▷ Regularly check the rolling element bearings for running noises.
	⚠ DANGER Hot surface Risk of burns! ▷ Never touch a motor when it is in operation. ▷ Let the motor cool down. ▷ Only remove covers if indicated.

	! WARNING Condensing air humidity inside the motor if the motor and/or ambient temperatures frequently change Risk of corrosion by condensation! ▸ Always observe the information provided on ambient conditions.
	CAUTION Impermissibly high temperature of fluid handled Damage to the pump! ▸ Prolonged operation against a closed shut-off element is not permitted (heating up of the fluid). ▸ Observe the temperature limits in the data sheet and in the section on operating limits.
	CAUTION Increased wear due to dry running Damage to the pump set! ▸ Never operate the pump set without liquid fill. ▸ Never close the shut-off element in the suction line and/or supply line during pump operation.

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 shaft seal.
- Check the static sealing elements for leakage.
- Check the rolling element bearings 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 make sure that stand-by pumps are ready for operation, start them up once a week.
- Monitor the bearing temperature.
The bearing temperature must not exceed 90 °C (measured on the motor housing).
- Deviations from normal operation such as increased power consumption, temperatures or vibrations, unusual noises or odours, tripping of monitoring devices, etc.

	CAUTION Operation outside the permissible bearing temperature Damage to the pump! ▸ The bearing temperature of the pump (set) must never exceed 90 °C (measured on the outside of the motor housing).
	NOTE After commissioning, increased temperatures may occur at grease-lubricated rolling element bearings due to the running-in process. The final bearing temperature is only reached after a certain period of operation (up to 48 hours depending on the conditions).

8.2.2 Inspection work

	! DANGER Excessive temperatures caused by friction, impact or frictional sparks Fire hazard! Damage to the pump set! ▷ Regularly check the cover plates, plastic components and other guards of rotating parts for deformation and sufficient distance from rotating parts.
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8.2.2.1 Cleaning filters

	CAUTION Insufficient inlet pressure due to clogged filter in the suction line Damage to the pump! ▷ Monitor contamination of filter with suitable means (e.g. differential pressure gauge). ▷ Clean filter at appropriate intervals.
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8.2.2.2 Checking the drive

Carry out the following measures:

- Check that the electrical connections are firmly seated.
- Verify that ventilation paths are unobstructed and clean.
- Check that the electronic system housing is securely closed.

8.2.2.3 Venting the mechanical seal

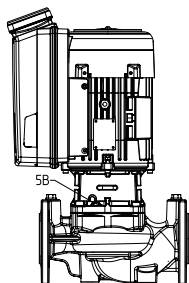


Fig. 50: Vent valve 5B

- ✓ A suitable container for collecting the fluid handled is on hand.
1. Hold the container for collecting the fluid handled beneath vent valve 5B.
 2. Open vent valve 5B.
 3. Allow all of the air to discharge. As soon as fluid escapes, close vent valve 5B immediately.

8.3 Drainage/cleaning

	! WARNING Fluids handled, 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 protective clothing and a protective mask if required. ▷ Observe all legal regulations on the disposal of fluids posing a health hazard.
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1. Use connection 6B to drain the fluid handled (see drawing of auxiliary connections).
2. Always flush the system if it has been used for handling noxious, explosive, hot or other hazardous fluids.
Always flush and clean the pump before transporting it to the workshop. Provide a certificate of decontamination for the pump.

8.4 Dismantling the pump set

8.4.1 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 the suction line and discharge line. ▷ Drain the pump and release the pump pressure. (⇒ Section 8.3, Page 74) ▷ Shut off any auxiliary feed lines. ▷ Allow the pump set to cool down to ambient temperature.
	 WARNING Unqualified personnel performing work on the pump (set) Risk of injury! ▷ Always have repair work and maintenance work performed by specially trained, qualified personnel.
	 DANGER Hot surface Risk of burns! ▷ Never touch a motor when it is in operation. ▷ Let the motor cool down. ▷ Only remove covers if indicated.
	 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.

Always observe the safety instructions and information.

For dismantling and reassembly observe the exploded views and the general assembly drawing.

In case of damage you can always contact our service staff.

Prior to dismantling, label the respective assignment of fastening elements as well as the arrangement of internal connections for future reassembly.

Drive

- Replace any corroded bolts/screws.
- Never damage the insulation of live parts.
- Document position of any rating and additional plates or labels to be removed.
- Avoid damaging the centring spigots.

Protect rolling element bearings against the ingress of contamination and moisture.

	NOTE All maintenance work, service work and installation work can be carried out by KSB Service or authorised workshops.
	NOTE After a prolonged period of operation the individual components may be hard to pull off the shaft. If this is the case, use a brand name penetrating agent and/or - if possible - an appropriate puller.

8.4.2 Preparing the pump set

1. De-energise the pump set and secure it against unintentional start-up.
2. Reduce pressure in the piping by opening a consumer installation.
3. Disconnect and remove all auxiliary pipework.

8.4.3 Removing the complete pump set from the piping

	NOTE The pump casing can remain installed in the piping for further dismantling.
---	---

- ✓ The notes and steps stated in (⇒ Section 8.4.1, Page 75) to (⇒ Section 8.4.2, Page 76) have been observed/carried out.
- 1. Disconnect the discharge nozzle and suction nozzle from the piping. For screw-ended pumps, undo the union nut.
- 2. Depending on the pump/motor size, remove the supports from the pump set.
- 3. Remove the complete pump set from the piping.

8.4.4 Removing the back pull-out unit

	WARNING Back pull-out unit tilting Risk of squashing hands and feet! ▷ Suspend or support the back pull-out unit at the pump end.
---	--

- ✓ The notes and steps stated in the sections (⇒ Section 8.4.1, Page 75) to (⇒ Section 8.4.3, Page 76) have been observed/carried out.
- 1. If required, suspend or support the back pull-out unit to prevent it from tipping over.
- 2. Loosen hexagon socket head cap screws 914 at the bearing bracket lantern.
- 3. Pull the back pull-out unit out of the volute casing.
- 4. Remove and dispose of O-ring 412.
- 5. Place the back pull-out unit on a clean and level surface.

8.4.5 Removing the impeller

- ✓ The notes and steps stated in the sections (⇒ Section 8.4.1, Page 75) to (⇒ Section 8.4.4, Page 76) have been observed/carried out.
- ✓ The back pull-out unit has been placed in a clean and level assembly area.
- 1. Undo nuts 920. Remove lockwasher 930 from the shaft.
- 2. Remove impeller 230 by hand or with an impeller removal tool.

3. Place impeller 230 on a clean and level surface.
4. Remove key 940 from the shaft.

8.4.6 Removing the mechanical seal

- ✓ The notes and steps stated in the sections (⇒ Section 8.4.1, Page 75) to (⇒ Section 8.4.5, Page 76) have been observed/carried out.
- ✓ The back pull-out unit has been placed in a clean and level assembly area.
 1. Remove the rotating assembly of mechanical seal 433 (primary ring) from the shaft.
 2. Lever the stationary assembly of mechanical seal 433 (mating ring with profiled gasket) out of casing cover 161 using a screwdriver. When doing so, take care not to damage the mating ring seat.

8.5 Reassembling the pump set

8.5.1 General information/Safety regulations

	⚠ 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.
	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 re-assemble the pump in accordance with the corresponding general assembly drawing or exploded view. (⇒ Section 10.2, Page 84)

Sealing elements Check O-rings for any damage and replace by new O-rings if required.

Always use new gaskets. Make sure that new gaskets have the same thickness as the old ones.

Always fit gaskets of asbestos-free materials or graphite without using lubricants (e.g. copper grease, graphite paste).

Assembly adhesives Avoid the use of assembly adhesives if possible.

Should an assembly adhesive be required after all, use a commercially available contact adhesive (e.g. Pattex) or sealant (e.g. HYLOMAR or Eppl 33).

Only apply adhesive at selected points and in thin layers.

Never use quick-setting adhesives (cyanoacrylate adhesives).

Coat the locating surfaces of the individual components with graphite or similar before reassembly.

Tightening torques For reassembly, tighten all screws and bolts as indicated.

8.5.2 Installing the mechanical seal

Installing the mechanical seal

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

- Work cleanly and accurately.
 - Only remove the protective wrapping of the seal faces immediately before installation takes place.
 - Prevent any damage to the sealing surfaces or profiled gasket.
 - ✓ The notes and steps stated in (⇒ Section 8.5.1, Page 77) have been observed/carried out.
 - ✓ Motor 801 with fitted casing cover 161 as well as individual parts have been placed in a clean and level assembly area.
 - ✓ All dismantled components have been cleaned and checked for wear.
 - ✓ Any damaged or worn components have been replaced with original spare parts.
 - ✓ The sealing surfaces have been cleaned.
1. Clean the mating ring seat in casing cover 161.

	CAUTION
	Elastomers in contact with oil/grease Shaft seal failure! ▸ Use water as assembly lubricant. ▸ Never use oil or grease as assembly lubricant.

2. Carefully insert the mating ring with profiled gasket. Make sure to apply pressure evenly.
3. Fit the rotating assembly of mechanical seal 433 (primary ring) on the shaft of motor 801.

8.5.3 Fitting the impeller

- ✓ The notes and steps stated in (⇒ Section 8.5.1, Page 77) to (⇒ Section 8.5.2, Page 78) have been observed/carried out.
 - ✓ The pre-assembled unit (motor, cap, drive lantern, casing cover) as well as the individual parts have been placed in a clean and level assembly area.
 - ✓ All dismantled components have been cleaned and checked for wear.
 - ✓ Any damaged or worn components have been replaced with original spare parts.
 - ✓ The sealing surfaces have been cleaned.
1. Insert key 940 and slide impeller 230 onto the shaft of motor 801.
 2. Fit nut 920 and lock washer 930. Observe the tightening torques. (⇒ Section 8.6, Page 79)

	CAUTION
	Improper reassembly Damage to the impeller and pump set! ▸ Lock washer 930 must not be used more than once.

8.5.4 Installing the back pull-out unit

	! WARNING
	Back pull-out unit tilting Risk of squashing hands and feet! ▸ Suspend or support the back pull-out unit at the pump end.

- ✓ The notes and steps stated in (⇒ Section 8.5.1, Page 77) to (⇒ Section 8.5.3, Page 78) have been observed/carried out.
- ✓ Any damaged or worn components have been replaced with original spare parts.
- ✓ The sealing surfaces have been cleaned.
 1. Suspend or support the back pull-out unit to prevent it from tipping over.
 2. Fit new O-ring 412 on casing cover 161.
 3. Insert the back pull-out unit into volute casing 102.
 4. Tighten hexagon socket head cap screws 914 with connection discs 81-43 on motor flange 801. Observe the tightening torques. (⇒ Section 8.6, Page 79)

8.6 Tightening torques

Table 44: Tightening torques for bolted/screwed connections at the pump

Part No.	Quantity	Thread	Tightening torque [Nm]
741	1	G1/4 A	35,0
900.01	4	M4	2,6
900.02	4	M4	1,0
900.03	4	M4	2,6
900.04	2	4	1,0
900.05	2	4	1,0
903.01/.02	2	G1/4 A	55
914	4	M8	25,0
920	1	M8	29

8.7 Spare parts stock

8.7.1 Ordering spare parts

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

- Type series
- Size
- Material variant
- Seal code
- Material number
- Series code

Refer to the name plate for all data.

Also specify the following data:

- Part number and description
- Quantity of spare parts
- Shipping address
- Mode of dispatch (freight, mail, express freight, air freight)

8.7.2 Recommended spare parts stock for 2 years' operation to DIN 24296

Table 45: Quantity of spare parts for recommended spare parts stock

Part No.	Description	Number of pumps (including stand-by pumps)						
		2	3	4	5	6 and 7	8 and 9	10 and more
230	Impeller	1	1	1	2	2	2	20 %
412	O-ring	4	6	8	8	9	10	100 %
433	Mechanical seal	1	1	2	2	2	3	25 %
914	Hexagon socket head cap screw	1	1	1	2	2	2	20 %
930	Safety device	1	1	1	2	2	2	20 %

9 Trouble-shooting

	 WARNING
	Improper work to remedy faults Risk of injury! ► For any work performed to remedy faults, observe the relevant information given in this operating manual and/or in the product literature provided by the accessories manufacturer.

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

- A** Pump delivers insufficient flow rate
- B** Motor overload
- C** Tripping due to excessive motor temperature
- D** Increased bearing temperature
- E** Leakage at the pump
- F** Excessive leakage at the shaft seal
- G** Vibrations during pump operation
- H** Impermissible temperature increase in the pump
- I** Pump set does not start up.

Table 46: Trouble-shooting

A	B	C	D	E	F	G	H	I	Possible cause	Remedy ⁸⁾
X	-	-	-	-	-	-	-	-	Pump delivers against an excessively high pressure.	- Re-adjust to duty point. - Check system for impurities. - Fit a larger impeller. Increase the speed (frequency inverter).
X	-	-	-	-	-	X	X	-	Pump and/or piping are not completely vented or primed.	Vent or prime.
X	-	-	-	-	-	-	-	-	Supply line or impeller clogged	Remove deposits in the pump and/or piping.
X	-	-	-	-	-	-	-	-	Formation of air pockets in the piping	- Alter piping layout. - Fit a vent valve.
X	-	-	-	-	-	X	X	-	Suction lift is too high/NPSH _{available} (positive suction head) is too low.	- Check/alter liquid level (open system). - Increase system pressure (closed system). - Install pump set at a lower level. - Fully open the shut-off element in the inlet line. - Change suction/inlet line, if the friction losses in the suction/inlet line are too high. Check any strainers installed/suction opening. Observe permissible speed of pressure fall.
X	-	-	-	-	-	-	-	-	Speed too low (operation on a frequency inverter)	Increase voltage/frequency at the frequency inverter in the permissible range.
X	-	-	-	-	-	X	-	-	Wear of internal components	Replace worn parts by new ones.

8 Release pump pressure before attempting to remedy faults on parts which are subjected to pressure.

A	B	C	D	E	F	G	H	I	Possible cause	Remedy ⁸⁾
-	X	-	-	-	-	X	-	-	Pump back pressure is lower than specified in the purchase order.	Re-adjust to duty point.
-	X	-	-	-	-	-	-	-	Density or viscosity of fluid handled higher than stated in purchase order	Consult the manufacturer.
-	-	-	-	-	X	-	-	-	Use of unsuitable shaft seal materials	Change the material combination.
-	X	X	-	-	-	-	-	-	Speed is too high.	Reduce speed.
-	-	-	-	X	-	-	-	-	Tie bolts/sealing element defective	- Fit new sealing element between volute casing and casing cover. - Re-tighten the bolts.
-	-	-	-	-	X	-	-	-	Worn shaft seal	Fit new shaft seal.
-	-	-	-	-	X	-	-	-	Dismantle to find out.	- Remedy. - Fit new shaft seal if required.
-	-	-	-	-	X	-	-	-	Vibrations during pump operation	- Correct the suction conditions. - Increase the pressure at the pump suction nozzle.
-	-	-	X	-	X	X	-	-	Pump is warped or sympathetic vibrations in the piping.	- Check pipeline connections and secure fixing of pump; if required, reduce the distances between the pipe clamps. - Fix the pipelines using anti-vibration material.
-	-	-	-	-	-	X	-	-	Rotor out of balance	Clean the impeller.
-	-	-	X	-	-	X	X	-	Flow rate is too low.	Increase the minimum flow rate.
-	-	-	-	-	-	-	-	X	No voltage	Check mains fuses, mains voltage and operating status of the frequency inverter.
-	-	-	-	-	-	-	-	X	- Power cables connected incorrectly / - Power cable fault	Check wiring.

10 Related Documents

10.1 Installation types

Horizontal installation

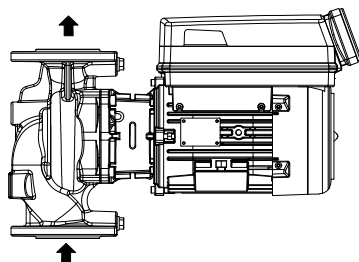


Fig. 51: Horizontal installation of pump set, direction of flow from bottom to top

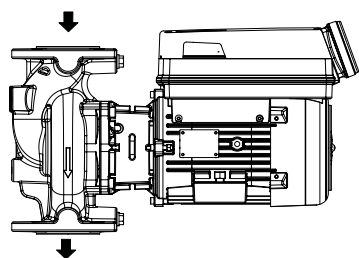


Fig. 52: Horizontal installation, direction of flow from top to bottom

Turn the volute casing and/or pull-out unit by 180° so that the electronic system and the control element remain in their current position on top and are easy to read.

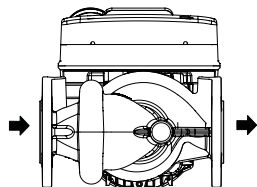


Fig. 53: Horizontal installation (for example under the ceiling)

Turn the volute casing and/or pull-out unit by 90° so that the frequency inverter remains in its current position on top.

Vertical installation

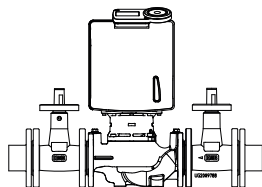


Fig. 54: Vertical installation / mounted without pump foot

In this installation position the mechanical seal must be vented via the vent valve (⇒ Section 8.2.2.3, Page 74) .

10.2 Exploded view and list of components

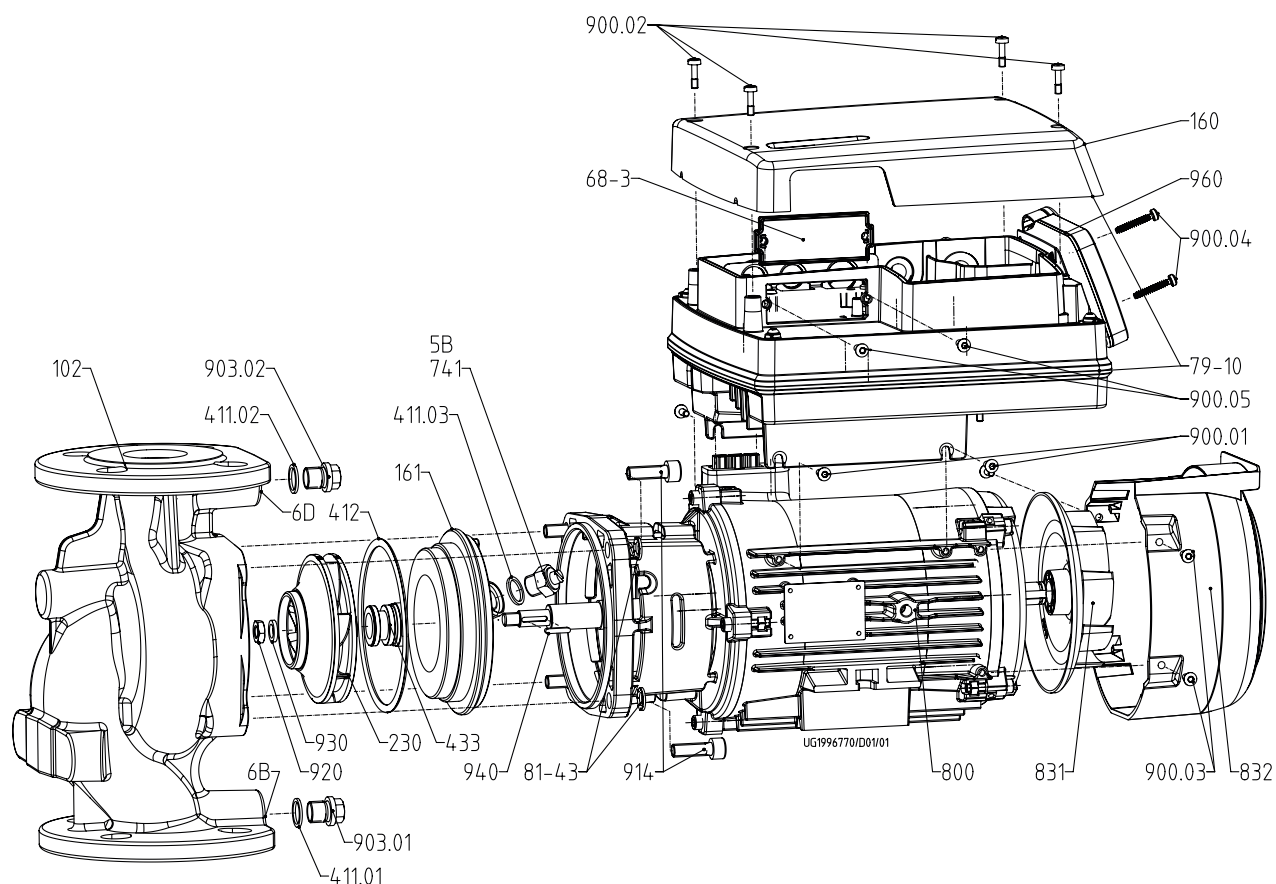


Fig. 55: Exploded view

Table 47: List of components

Part No.	Description	Part No.	Description
102	Volute casing	914	Hexagon socket head cap screw
161	Casing cover	920	Hexagon nut
160	Cover	930	Safety device
210	Shaft	940	Key
230	Impeller	960	Operating element
411.01/.02/.03	Joint ring	59-2	Fan impeller
412	O-ring	68-3	Cover plate
433	Mechanical seal	79-10	Frequency inverter
741	Vent valve	81-43	Connection disc
800	KSB motor		
831	Fan impeller		Auxiliary connections
832	Fan hood	6B	Fluid drain
900.01/.02/.03/.04/.05	Bolt/screw	6D	Fluid priming and venting
903.01/02	Screw plug	5B	Fluid venting (vertical installation)

11 UK Declaration of Conformity

Manufacturer:

KSB SE & Co. KGaA
Johann-Klein-Straße 9
67227 Frankenthal (Germany)

This UK Declaration of Conformity is issued under the sole responsibility of the manufacturer.

The manufacturer herewith declares that **the product**:

EtaLine Pro

Serial number range: A xxxxxxxxxxxxxxxx (e.g. A 9974125784 123545 10)

- is in conformity with the provisions of the following harmonisation legislation as amended from time to time:
 - Supply of Machinery (Safety) Regulations 2008
(The safety objectives set out in the Electrical Equipment (Safety) Regulations 2016 are observed.)
 - Ecodesign for Energy-Related Products Regulations 2010
 - Radio Equipment Regulations 2017
(The safety objectives set out in the Electromagnetic Compatibility Regulations 2016 are observed.)

The manufacturer also declares that

- the following *designated standards* have been applied:
 - EN ISO 12100:2010 (8 April 2011⁹⁾)
 - EN 809:1998+A1:2009/AC:2010 (18 December 2009⁹⁾)
 - EN 60034-1:2010/AC:2010 (8 June 2016⁹⁾), EN 60034-5:2001/A1:2007 (8 June 2016⁹⁾)
 - EN 300 328 v2.2.2 (6 February 2020⁹⁾)
- the following international standards have been applied:
 - EN 17038-1:2022-08, EN 17038-2:2022-08
 - EN/IEC 61800-3:2018

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The UK Declaration of Conformity was issued in/on:

Frankenthal, 5 July 2023



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⁹ Date of publication in the Official Journal of the European Union

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Simply scan
the QR code
and find your
regional contact.
ksb.com/en-global/contact