Circulating pump / High-efficiency
Drinking Water Pump

Calio-Therm NC

Installation/Operating Manual

KSB

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Installation/Operating Manual Calio-Therm NC

Original operating manual

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Glossary

Discharge line

The pipeline which is connected to the discharge nozzle

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 and size as well as the main operating data. They uniquely identify the pump (set) and serve as identification for 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. (⇨ Section 2.3, Page 9)

1.3 Other applicable documents

Table 1: Overview of other applicable documents

Document	Contents
Sub-supplier product literature	Operating manual

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

1.4 Symbols

Table 2: Symbols used in this manual

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

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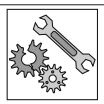
1.5 Key to safety symbols/markings

Table 3: Definition of safety symbols/markings

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

2 Safety

DANGER

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.

2.2.1 Prevention of foreseeable misuse

- Observe all safety information and instructions in this manual.
- Never exceed the permissible application and operating limits specified in the data sheet or product literature regarding pressure, temperature, etc.

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2.3 Personnel qualification and training

All personnel involved must be fully qualified to transport, install, operate, maintain and inspect the equipment this manual refers to.

The responsibilities, competence and supervision of all personnel involved in transport, installation, operation, maintenance and inspection must be clearly defined by the operator.

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

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

This device may be operated by **children** from the age of 8 as well as by persons of limited physical, sensory or mental abilities or lacking experience and knowledge, provided that they are supervised, they have been instructed on how to use this device safely and they understand the hazards it presents. It is impermissible for **children** to play with this device. **Children** must not clean the device or perform any **service work to be carried out by the operator** at the device without supervision.

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 operator/user

- 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.
- Contain leakages (e.g. at the shaft seal) of hazardous fluids handled (e.g. explosive, toxic, hot) so as to avoid any danger to persons and the environment. Adhere to all relevant laws.
- Eliminate all electrical hazards. (In this respect refer to the applicable national safety regulations and/or regulations issued by the local energy supply companies.)
- If shutting down the pump does not increase potential risk, fit an emergency-stop control device in the immediate vicinity of the pump (set) during pump set installation.

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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 26) (⇨ Section 6.3.2, Page 26)
- Decontaminate pumps which handle fluids posing a health hazard.
- 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. (⇨ Section 6.1, Page 22)

2.8 Unauthorised modes of operation

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

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

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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

CAUTION

Improper pump transport

Damage to the pump!

- ▷ Never suspend the pump/pump set from the power cable.
- ▷ Prevent the pump (set) from getting knocked or dropped.

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.

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

For storing a pump (set) which has already been operated, observe the instructions in (⇨ Section 6.3.2, Page 26) .

Table 4: Ambient conditions for storage

Ambient condition	Value
Relative humidity	80 % maximum
Ambient temperature	0 °C to + 40 °C

- Well-ventilated
- Dry
- Dust-free
- Shock-free
- Vibration-free

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3.4 Return to supplier

1. Prior to returning the product to the supplier, flush and clean it, particularly if it has been used in noxious, explosive, hot or other hazardous fluids.
2. If the product has been used in fluids whose residues could lead to corrosion damage in the presence of atmospheric humidity or could ignite upon contact with oxygen, the product must also be neutralised and treated with anhydrous inert gas to ensure drying.
3. Always complete and enclose a certificate of decontamination when returning the product.
   Indicate any safety measures 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 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 0.3 m.

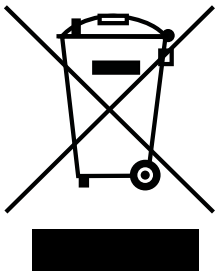
⚠ WARNING

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 fluid residues.
- ▹ Wear safety clothing and a protective mask if required.
- ▹ Observe all legal regulations on the disposal of fluids posing a health hazard.

1. Dismantle the pump (set).
   Collect greases and other lubricants during dismantling.
2. Separate and sort the pump materials, e.g. by:
   - Metals
   - Plastics
   - Electronic waste
   - Greases and other lubricants
3. Dispose of materials in accordance with local regulations or in another controlled manner.



Electrical or electronic equipment marked with the adjacent symbol must not be disposed of in household waste at the end of its service life.

Contact your local waste disposal partner for returns.

If the used electrical or electronic equipment contains personal data, the operator is responsible for deleting it before the equipment is returned.

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4 Description of the Pump (Set)

4.1 General description

- High-efficiency circulator pump for drinking water applications / foodstuff applications
- Non-self-priming in-line pump with integrated permanent magnet motor

Pump for handling clean, non-aggressive fluids which are not chemically and mechanically aggressive to the pump materials.

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

For information as per chemicals Regulation (EC) No. 1907/2006 (REACH), see http://www.ksb.com/reach.

4.3 Designation

Example: Calio-Therm NC 25-40-130

Table 5: Designation key

Code	Description	
Calio-Therm	Type series	
NC	Fixed speed	
25	Connection	
	20	G 1 $^1/_4$
	25	G 1 $^1/_2$
40	Head H [m]	
	40	Head × 10 Example: 4 m × 10 = 40
130	Overall length	
	130	130 mm

4.4 Name plate

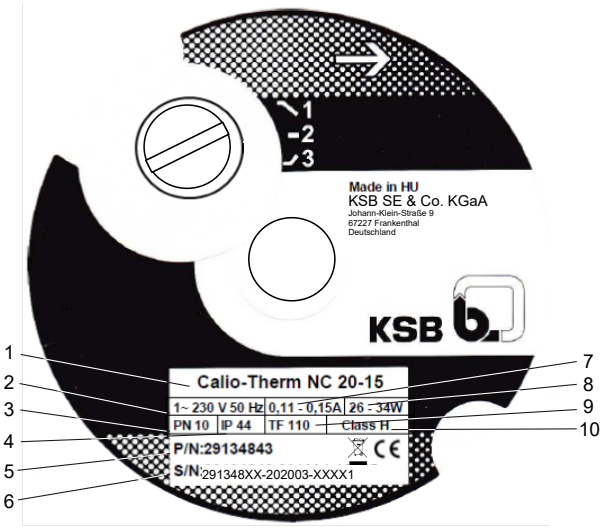

Fig. 1: Name plate (example)

1	Type series, size	6	Production number
2	Mains voltage, frequency	7	Current input
3	Pressure class	8	Electrical power
4	Enclosure	9	Temperature class
5	Material number	10	Thermal class

Key to the production number

Example: 291348XX-202003-XXXX1

Table 6: Key to the production number

Code	Description
291348XX	Material number
2020	Year of production
03	Week of production
XXXX1	Consecutive number

4.5 Design details

Design

- Maintenance-free high-efficiency wet rotor pump (glandless)

Drive

- High-efficiency permanent magnet synchronous motor, brushless, self-cooling
- Integrated motor protection
- 1~230 V AC, 50 Hz
- Enclosure IP44
- Thermal class F
- Temperature class TF 110
- Interference emissions EN 61000-6-3
- Interference immunity EN 61000-6-2

Bearings

- Ceramic bearings

Connections

- Screw-ended

Operating modes

- Fixed speed operation with 3 speed levels

Automatic functions

- Soft start (limitation of starting current)
- Full motor protection with integrated trip electronics

Manual functions

- Vent function
- Deblocking function
- Setting the speed level

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4.6 Configuration and function

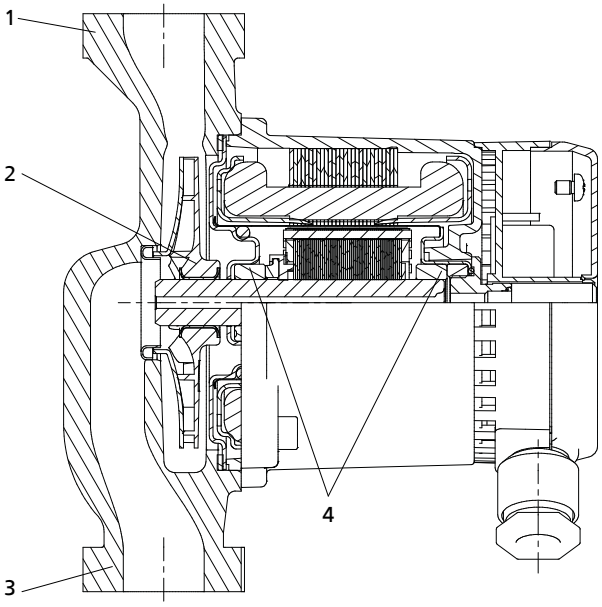

Fig. 2: Illustration of the pump set

1	Discharge nozzle	3	Suction nozzle
2	Impeller	4	Radial plain 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 impeller is rigidly connected to the motor shaft. Mechanical sealing is not required as the rotating assembly is completely isolated from the stator winding. The rotating assembly is lubricated and cooled by the fluid handled. The lubricating system and high-quality ceramic bearings ensure smooth running and a long service life. The combination of an efficient hydraulic system with a high-efficiency electric motor makes sure that the input power is converted into hydraulic energy as efficiently as possible.

Function The fluid enters the pump via the suction nozzle (3) and is accelerated outward in a cylindrical flow by the rotating impeller (2). In the flow passage of the pump casing the kinetic energy of the fluid is converted into pressure. The fluid is pumped to the discharge nozzle (1), where it leaves the pump. The shaft runs in radial plain bearings (4), which are supported by the motor.

4.7 Noise characteristics

Average sound pressure level < 43 dB (A)

4.8 Dimensions and weight

For dimensions and weights please refer to the type series booklet of the pump (set).

4.9 Scope of supply

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

- Pump set
- Sealing elements
- Two-piece thermal insulation shell (only for overall length ≥ 180 mm)
- Installation/operating manual

4.10 Accessories

- Pipe unions

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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.

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

Before beginning with the installation check the following:

- The pump set can be operated on the power supply network according to the data on the name plate.
- The fluid to be handled matches the description of suitable fluids.
  (⇨ Section 6.2.4.1, Page 25)
- All structural work required has been checked and prepared in accordance with the dimensions in the outline drawing.

5.3 Installing the pump set

DANGER

Leakage at the pump

Hot fluids escaping!

- ▷ Fit the sealing elements and make sure they are positioned correctly.

CAUTION

Ingress of fluid into the motor

Damage to the pump set!

- ▷ Install the pump set with the pump shaft in a horizontal position. Connect the piping without transmitting any stresses and strains.
- ▷ Never install the pump set with the motor terminal box pointing downwards.
- ▷ Undo the hexagon socket head cap screws. Then turn the motor housing.

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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 water can drip onto the drive or terminal box.

NOTE

The direction of flow of a vertically installed pump should be upwards.

NOTE

Do not install the pump at the lowest point of the system to prevent any impurities from collecting in the pump.

The control panel can be turned. Positioning must be effected with the pump set removed from the system.

1. Undo and store the 4 hexagon socket head cap screws.
2. Rotate the control panel until it has reached the required position. Compare it against the permissible installation positions. Adjust the position if required.
3. Fit and tighten the 4 hexagon socket head cap screws again.

Permissible installation positions

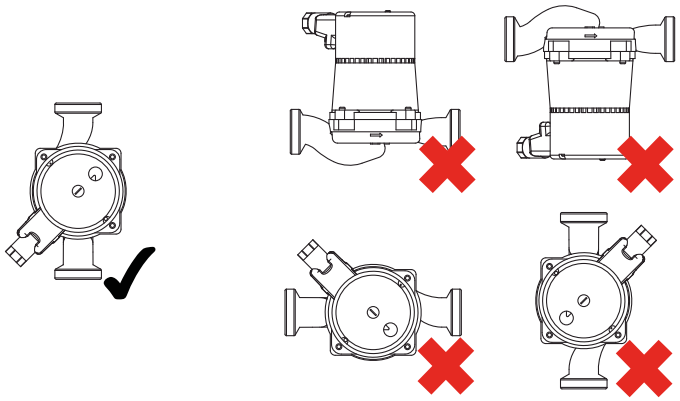

Fig. 3: Permissible installation positions

DANGER

Leakage at the pump

Leakage of hot fluids!

▹ Insert the O-ring in the correct position.

Screw-ended pump

1. Position the pump set as indicated in an easily accessible place.
   ⇨ An arrow on the pump casing and thermal insulation shell indicates the direction of flow.
2. Accurately insert the sealing element.
3. Connect the pump and piping with a pipe union.

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4. Tighten the pipe union hand-tight with an assembly tool (e.g. pipe wrench).
5. Accurately insert the sealing element in the opposite pipe union.
6. Tighten the pipe union hand-tight with an assembly tool (e.g. pipe wrench).

5.4 Connecting the piping

⚠ WARNING

Hot surface

Risk of burns

- ▷ Never touch a pump set when it is in operation.

⚠ WARNING

Impermissible loads acting on the pump nozzles

Risk of burns by hot fluids escaping!

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

CAUTION

Contamination/dirt in the piping

Damage to the pump!

- ▷ Flush the piping prior to commissioning or replacing the pump. Remove any foreign matter.

NOTE

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

- ✓ Suction lift lines have been laid with a rising slope, suction head lines with a downward slope towards the pump.
- ✓ The nominal diameters of the pipelines are equal to or greater than the nominal diameters of the pump nozzles.
- ✓ The pipelines have been anchored in close proximity to the pump and connected without transmitting any stresses or strains.

1. Thoroughly clean, flush and blow through all vessels, pipelines and connections (especially of new installations).

5.5 Enclosure/insulation

⚠ WARNING

The pump takes on same temperature as the fluid handled

Risk of burns!

- ▷ Insulate the volute casing.
- ▷ Fit protective equipment.

CAUTION

Heat building up at motor housing and pump casing

Pump overheating!

- ▷ Never insulate the motor and electronic system housings.

NOTE

Two-piece thermal insulation shell supplied for overall length ≥ 180 mm.

5.6 Electrical connection

⚠ DANGER

Electrical connection work by unqualified personnel

Risk of fatal injury due to electric shock!

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

⚠ DANGER

Heat damage to the cable sheath

Danger from electric shock!

- ▷ Make sure the cables are never laid in contact with hot casings/housings or pipelines.

⚠ DANGER

Hazardous electrical voltage when the covers of the terminal wiring compartments are removed

Danger of death from electric shock!

- ▷ For working on the terminals, switch off the power supply at least 5 minutes prior to commencing work and ensure that it cannot be switched on again unintentionally.
- ▷ If applicable, switch off the external power supply to message relays and control cables and make sure it cannot be switched on again unintentionally.
- ▷ Keep the covers of the terminal wiring compartments closed during operation as well as during maintenance work.

⚠ WARNING

Incorrect connection to the mains

Damage to the mains network, short circuit!

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

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NOTE

Connection to power supply must be effected by means of a fixed power cable with a minimum cross-section of 3 × 0.75 mm².

If the power cable of the device is damaged, have it replaced by the manufacturer, a customer service technician or a similarly qualified person. See EN 60335-1.

NOTE

Adjust the overload setting of any motor protection switches to the values indicated on the name plate. When changing the speed level, adjust the setting.

5.6.1 Connecting the cables

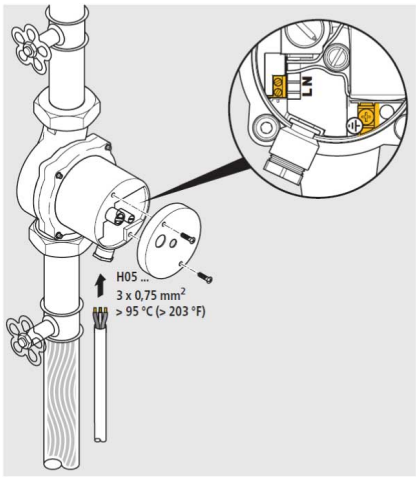

Fig. 4: Connecting the cables

✓ The mains voltage at the site has been verified against the data on the name plate.

✓ The pump set has been de-energised and secured against unintentional start-up.

✓ The wiring diagram is available. (⇨ Section 10.1, Page 32)

1. Unscrew the cable gland.
2. Undo and store the 2 screws of the cover of the terminal wiring compartment.
3. Remove the cover of the terminal wiring compartment.
4. Run the power cable through the cable gland.
5. Strip the cable sheath and cores in accordance with the applicable regulations.
6. Connect the cores in accordance with the wiring diagram.
7. Tighten the cable gland (strain relief).
8. Fit the cover of the terminal wiring compartment.
9. Tighten the two screws of the terminal wiring compartment hand-tight with a suitable tool.

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6 Commissioning/Start-up/Shutdown

6.1 Commissioning/Start-up

6.1.1 Prerequisites for commissioning/start-up

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

- The pump set has been properly connected to the power supply and is equipped with all protection devices.
- The system piping has been cleaned.
- The suction line and inlet tank, if any, have been primed with the fluid to be handled.
- The covers of the terminal wiring compartments have been closed and fastened with screws.

6.1.2 Priming and venting the pump

⚠ WARNING

Hot fluid escaping under pressure when the vent plug is opened

Risk of electric shock!

Risk of scalding!

- ▷ Loosen the vent plug; do not remove it.
- ▷ Protect the electric components against escaping fluid.
- ▷ Wear protective clothing (e.g. gloves).

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.
- ▷ Observe the specified minimum pressure for operating the pump set.
- ▷ Always operate the pump set within the permissible operating range.

1. Completely open the shut-off element in the suction line.
2. During operation at maximum speed loosen the vent plug with a suitable tool until some of the fluid handled escapes.
3. Tighten the vent plug to a maximum tightening torque of 0.5 Nm.
4. Repeat the procedure until all air has escaped.

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6.1.3 Start-up

DANGER

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

Hot 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 against a slightly or completely open discharge-side shut-off element.

DANGER

Excessive temperatures due to insufficient lubrication of the plain bearings

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.

WARNING

Hot surfaces (Pump and piping take on the temperature of the fluid handled.)

Risk of burns!

- Do not touch hot surfaces.

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.

✓ Pump, suction line and inlet tank (if fitted) have been vented and primed with the fluid to be handled.

✓ The priming lines and venting lines 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. Start up the motor.

6.2 Operating limits

DANGER

Non-compliance with operating limits for pressure, temperature, fluid handled and speed

Hot fluids escaping!

- Comply with the operating data indicated in the data sheet.
- Avoid prolonged operation against a closed shut-off element.
- Never operate the pump at product temperatures exceeding those specified in the data sheet or on the name plate.

6.2.1 Ambient temperature

CAUTION

Operation outside the permissible ambient temperature

Damage to the pump (set)!

- Observe the specified limits for permissible ambient temperatures.

Observe the following parameters and values during operation:

Table 7: Permissible ambient temperatures specified for the fluid temperature

Fluid temperature	Permissible ambient temperature
[°C]	[°C]
≤ +110	+40
≥ +2	0

6.2.2 Minimum inlet pressure

The minimum inlet pressure p_{min} at the pump suction nozzle serves to avoid cavitation noises at an ambient temperature of +40 °C and the indicated fluid temperature T_{max}.

The indicated values are applicable up to 300 m above sea level. For installation at altitudes > 300 m, an allowance of 0.01 bar / 100 m must be added.

Table 8: Minimum inlet pressure p_{min} specified for the fluid temperature T_{max}

Fluid temperature	Minimum inlet pressure
[°C]	[bar]
≤ 80	0,05
81 to 95	0,3
96 to 110	1,1

6.2.3 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 is 10 bar.

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6.2.4 Fluid handled

6.2.4.1 Permissible fluids to be handled

CAUTION

Unsuitable fluids

Damage to the pump!

- ▷ Never use the pump to handle corrosive, combustible or explosive fluids.
- ▷ Never use the pump to handle waste water or abrasive fluids.
- ▷ Do not use the pump for foodstuff applications.

- Heating water to VDI 2035
- Higher-viscosity fluids (water/glycol mixture up to a mixing ratio of 1:1)
- Drinking water and water for the food and beverage industry, as per German TrinkwV 2001 drinking water regulations

6.2.4.2 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 will change in proportion to the density of the fluid handled.

6.2.4.3 Fluid temperature

CAUTION

Incorrect fluid temperature

Damage to the pump (set)!

- ▷ Only operate the pump (set) within the temperature limits indicated.

Table 9: Temperature limits of the fluid handled

Permissible fluid temperature	Heating water	Drinking water[1)]
Maximum	+110 °C	+65 °C
Minimum	+2 °C	+2 °C

The fluid temperature has an impact on the minimum inlet pressure.
(⇨ Section 6.2.2, Page 24)

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1) We recommend fluid temperatures no higher than 65 °C to prevent possible consequences caused by lime sedimentation. Higher fluid temperatures are permissible for short periods (e.g. for thermal disinfection cycles).

6.3 Shutdown/storage/preservation

6.3.1 Shutdown

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.

✓ 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 motor and make sure the pump set runs down smoothly to a standstill.

For prolonged shutdown periods

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.

1. Close the shut-off element in the suction line.

6.3.2 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 drained properly (⇨ Section 8.2, Page 29) and the safety instructions for dismantling the pump have been observed.

1. Observe any additional instructions and information provided. (⇨ Section 3, Page 11)

6.4 Returning to service

⚠ 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.

For returning the equipment to service, observe the sections on commissioning/start-up (⇨ Section 6.1, Page 22) and the operating limits (⇨ Section 6.2, Page 24) .

In addition, carry out all servicing/maintenance operations before returning the pump (set) to service. (⇨ Section 8, Page 28)

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7 Operation

7.1 Control panel

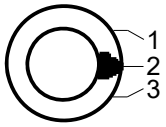

Fig. 5: Control element

1	Speed level 1
2	Speed level 2
3	Speed level 3

7.2 Operating modes

7.2.1 Open-loop control mode

Function

In Open-loop Control operating mode the pump set runs at a set speed. The speed can be set to one of three speed levels using the control element.

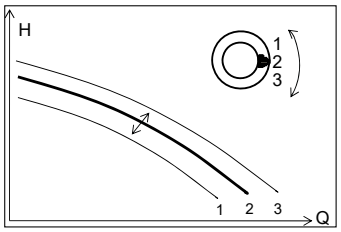

Fig. 6: Open-loop Control settings

8 Servicing/Maintenance

8.1 Servicing/maintenance/inspection

⚠ 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

Any repairs on the pump (set) must only be performed by an authorised service partner. In the event of damage contact the heating system engineer.

The pump set is almost maintenance-free.
If the pump set has not been in operation for a prolonged period of time or if the system severely is contaminated, the pump rotor can become blocked.

Deblocking

1. Close the valves on the suction side and discharge side.
2. Remove the vent plug with a suitable tool.
3. Deblock the pump rotor at the shaft end by turning it with a suitable tool.
4. Tighten the vent plug to a maximum tightening torque of 0.5 Nm. Check that it is tightly sealed.

After maintenance work and inspection have been completed, proceed with the section on Returning to service (⇨ Section 6.4, Page 26) .

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8.2 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 fluid residues.
- ▷ Wear safety clothing and a protective mask if required.
- ▷ Observe all legal regulations on the disposal of fluids posing a health hazard.

1. Always flush and clean the pump before transporting it to the workshop. Provide a certificate of decontamination for the pump.

8.3 Removing the pump set from the piping

⚠ DANGER

Work performed on an energised plug-type connector

Danger of death from electric shock!

- ▷ Switch off the power supply prior to commencing work and ensure that it cannot be switched on again unintentionally.

⚠ DANGER

Strong magnetic field in the 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 0.3 m.

⚠ WARNING

Strong magnetic field

Danger of crushing injuries when pulling out the rotor!

Strong magnetic field can suddenly pull the rotor back into its original position!

Danger of magnetic parts near the rotor being attracted!

- ▷ The rotor must only be removed from the motor housing by authorised specialist personnel.
- ▷ Remove any magnetic parts from the vicinity of the rotor.
- ▷ Keep the assembly area clean.
- ▷ Keep a safety distance of at least 0.3 m from electronic components.

⚠ WARNING

Hot surface

Risk of injury!

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

CAUTION

Strong magnetic field in the rotor area

Interference with magnetic data carriers, electronic devices, components and instruments!

Uncontrolled magnetic attraction forces between magnetic components, tools or similar!

- ▷ Remove any magnetic parts from the vicinity of the rotor.
- ▷ Keep the assembly area clean.

CAUTION

Danger by strong magnetic field

Negative impact on or damage to electrical devices!

- ▷ The rotor must generally only be removed from the motor housing by authorised specialist personnel.

- ✓ The pump set has been de-energised and secured against unintentional start-up.
- ✓ The pump has cooled down to ambient temperature.
- ✓ A container for collecting the fluid has been positioned underneath the pump set.

1. Close the shut-off elements.
2. Disconnect the discharge nozzle and suction nozzle from the piping.
3. Depending on the pump size / motor size, remove the supports from the pump set.
4. Remove the complete pump set from the piping.

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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 KSB Service is required.

A Pump is running, but does not deliver

B Pump does not start up or pump running irregularly

C Pump running but not delivering water

D Noises during pump operation

Table 10: Trouble-shooting

A	B	C	D	Possible cause	Remedy[2)]
✘	-	-	-	Pump not connected to power supply	Check the fuses and correct connection to power supply. If required, disconnect the pump from the power supply and re-connect it to the power supply (voltage reset).
-	✘	-	-	Impurities in the pump	
-	✘	-	-	Blockage in the pump	
-	-	✘	-	Shut-off elements closed	Calio-Therm S NC: Open the shut-off elements. Calio-Therm S NCV: Open the integrated shut-off valve.
-	-	-	✘	Pump power output too high	Select a lower speed level.
-	-	-	✘	System pressure too low	Increase the system pressure by filling more water into the boiler.
-	-	✘	✘	Air in the system	Vent the pump (vent plug) and system. (⇨ Section 6.1.2, Page 22) (⇨ Section 6.1.2, Page 22)
-	-	-	✘	Pump running dry	Prime the pump. (⇨ Section 6.1.2, Page 22) (⇨ Section 6.1.2, Page 22)

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2) Release pump set pressure before attempting to remedy faults on parts which are subjected to pressure.

10 Related Documents

10.1 Wiring diagram

1-phase

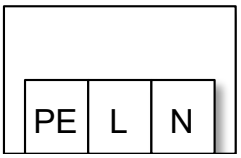

Fig. 7: Wiring diagram for single-phase alternating current

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11 EU Declaration of Conformity

Manufacturer:

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

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

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

Calio-Therm NC

Serial number range: 202001 to 202152

- is in conformity with the provisions of the following Directives as amended from time to time:
  - 2011/65/EU: Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS)
  - 2014/30/EU: Electromagnetic Compatibility (EMC)
  - 2014/35/EU: Electrical Equipment Designed for Use within Specific Voltage Limits (Low Voltage)

The manufacturer also declares that

- the following harmonised international standards have been applied:
  - DIN EN 55014-1, EN 55014-2
  - DIN EN 60335-1, EN 60335-2-51
  - DIN EN 61000-3-2, EN 61000-3-3

The EU Declaration of Conformity was issued in/on:

Frankenthal, 1 January 2020

Jochen Schaab

Head of Product Development Pump Systems and Drives

KSB SE & Co. KGaA
Johann-Klein-Straße 9

67227 Frankenthal

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