



Flygt 3153



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1 Introduction and Safety

1.1 Introduction

Purpose of the manual

The purpose of this manual is to provide necessary information for working with the unit. Read this manual carefully before starting work.

Read and keep the manual

Save this manual for future reference, and keep it readily available at the location of the unit.

Intended use



WARNING:

Operating, installing, or maintaining the unit in any way that is not covered in this manual could cause death, serious personal injury, or damage to the equipment and the surroundings. This includes any modification to the equipment or use of parts not provided by Xylem. If there is a question regarding the intended use of the equipment, please contact a Xylem representative before proceeding.

Other manuals

See also the safety requirements and information in the original manufacturer's manuals for any other equipment furnished separately for use in this system.

1.2 Safety terminology and symbols

About safety messages

It is extremely important that you read, understand, and follow the safety messages and regulations carefully before handling the product. They are published to help prevent these hazards:

- Personal accidents and health problems
- Damage to the product and its surroundings
- Product malfunction

Hazard levels

Hazard level	Indication
 DANGER:	A hazardous situation which, if not avoided, will result in death or serious injury
 WARNING:	A hazardous situation which, if not avoided, could result in death or serious injury
 CAUTION:	A hazardous situation which, if not avoided, could result in minor or moderate injury
NOTICE:	Notices are used when there is a risk of equipment damage or decreased performance, but not personal injury.

Special symbols

Some hazard categories have specific symbols, as shown in the following table.

Electrical hazard	Magnetic fields hazard
 Electrical Hazard:	 CAUTION:

1.3 User safety

All regulations, codes, and health and safety directives must be observed.

The site

- Observe lockout/tagout procedures before starting work on the product, such as transportation, installation, maintenance, or service.
- Pay attention to the risks presented by gas and vapors in the work area.
- Always be aware of the area surrounding the equipment, and any hazards posed by the site or nearby equipment.

Qualified personnel

This product must be installed, operated, and maintained by qualified personnel only.

Protective equipment and safety devices

- Use personal protective equipment as needed. Examples of personal protective equipment include, but are not limited to, hard hats, safety goggles, protective gloves and shoes, and breathing equipment.
- Make sure that all safety features on the product are functioning and in use at all times when the unit is being operated.

1.4 Ex-approved products

Follow these special handling instructions if you have an Ex-approved unit.

Personnel requirements

These are the personnel requirements for Ex-approved products in potentially explosive atmospheres:

- All work on the product must be carried out by certified electricians and Xylem authorized mechanics. Special rules apply to installations in explosive atmospheres.
- All users must know about the risks of electric current and the chemical and physical characteristics of the gas, the vapor, or both present in hazardous areas.
- Any maintenance for Ex-approved products must conform to international and national standards (for example, IEC/EN 60079-17).

Xylem disclaims all responsibility for work done by untrained and unauthorized personnel.

Product and product handling requirements

These are the product and product handling requirements for Ex-approved products in potentially explosive atmospheres:

- Only use the product in accordance with the approved motor data.
- The Ex-approved product must never run dry during normal operation. Dry running during service and inspection is only permitted outside the classified area.
- Before you start work on the product, make sure that the product and the control panel are isolated from the power supply and the control circuit, so they cannot be energized.
- Do not open the product while it is energized or in an explosive gas atmosphere.
- Make sure that thermal contacts are connected to a protection circuit according to the approval classification of the product, and that they are in use.

- Intrinsically safe circuits are normally required for the automatic level-control system by the level regulator if mounted in zone 0.
- The yield stress of fasteners must be in accordance with the approval drawing and the product specification.
- Do not modify the equipment without approval from an Ex-approved Xylem representative.
- Only use parts that are provided by an Ex-approved Xylem representative.
- The thermal detectors fitted to the stator windings shall be connected into the motor control circuit in such a manner as to disconnect the supply to the motor in order to prevent the Temperature Class T3.
- The width of flameproof joints is more than the values specified in the tables of the IEC 60079-1 standard.
- The gap of flameproof joints is less than the values specified in Table 1 of the IEC 60079-1 standard.
- The equipment must be submerged during normal operation.

Guidelines for compliance

Compliance is fulfilled only when you operate the unit within its intended use. Do not change the conditions of the service without the approval of an Ex-approved Xylem representative. When you install or maintain explosion proof products, always comply with the directive and applicable standards (for example, IEC/EN 60079-14).

Minimum permitted liquid level

See the dimensional drawings of the product for the minimum permitted liquid level according to the approval for explosion proof products. If the information is missing on the dimensional drawing, the product must be fully submerged. Level-sensing equipment must be installed if the product can be operated at less than the minimum submersion depth.

Monitoring equipment

For additional safety, use condition-monitoring devices. Condition-monitoring devices include but are not limited to the following:

- Level indicators
- Temperature detectors

1.5 Special hazards

Biological hazards

The product is designed for use in liquids that can be hazardous to your health. Observe these rules when you work with the product:

- Make sure that all personnel who may come into contact with biological hazards are vaccinated against diseases to which they may be exposed.
- Observe strict personal cleanliness.



WARNING: Biological Hazard

Infection risk. Rinse the unit thoroughly with clean water before working on it.

Wash the skin and eyes

Follow these procedures for chemicals or hazardous fluids that have come into contact with your eyes or your skin:

Condition	Action
Chemicals or hazardous fluids in eyes	1. Hold your eyelids apart forcibly with your fingers. 2. Rinse the eyes with eyewash or running water for at least 15 minutes. 3. Seek medical attention.

Condition	Action
Chemicals or hazardous fluids on skin	1. Remove contaminated clothing. 2. Wash the skin with soap and water for at least 1 minute. 3. Seek medical attention, if necessary.

1.6 Protecting the environment

Emissions and waste disposal

Observe the local regulations and codes regarding:

- Reporting of emissions to the appropriate authorities
- Sorting, recycling and disposal of solid or liquid waste
- Clean-up of spills

Exceptional sites



CAUTION: Radiation Hazard

Do NOT send the product to Xylem if it has been exposed to nuclear radiation, unless Xylem has been informed and appropriate actions have been agreed upon.

1.7 Spare parts



CAUTION:

Only use the manufacturer's original spare parts to replace any worn or faulty components. The use of unsuitable spare parts may cause malfunctions, damage, and injuries as well as void the warranty.

1.8 Warranty

For information about warranty, see the sales contract.

2 Transportation and Storage

2.1 Inspect the delivery

2.1.1 Inspect the package

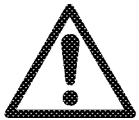
1. Inspect the package for damaged or missing items upon delivery.
2. Note any damaged or missing items on the receipt and freight bill.
3. File a claim with the shipping company if anything is out of order.
If the product has been picked up at a distributor, make a claim directly to the distributor.

2.1.2 Inspect the unit

1. Remove packing materials from the product.
Dispose of all packing materials in accordance with local regulations.
2. Inspect the product to determine if any parts have been damaged or are missing.
3. If applicable, unfasten the product by removing any screws, bolts, or straps.
For your personal safety, be careful when you handle nails and straps.
4. Contact the local sales representative if there is any issue.

2.2 Transportation guidelines

Precautions



DANGER: Crush Hazard

Moving parts can entangle or crush. Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.

Position and fastening

The unit can be transported either horizontally or vertically. Make sure that the unit is securely fastened during transportation, and cannot roll or fall over.

2.2.1 Lifting



WARNING: Crush Hazard

1) Always lift the unit by its designated lifting points. 2) Use suitable lifting equipment and ensure that the product is properly harnessed. 3) Wear personal protective equipment. 4) Stay clear of cables and suspended loads.

NOTICE:

Never lift the unit by its cables or hose.

Lifting equipment

Lifting equipment is always required when handling the unit. It must fulfill the following requirements:

- The minimum height (contact your local sales and service representative for information) between the lifting hook and the floor must be sufficient to lift the unit.
- The lifting equipment must be able to hoist the unit straight up and down, preferably without the need for resetting the lifting hook.
- The lifting equipment must be securely anchored and in good condition.

- The lifting equipment must support the weight of the entire assembly and must only be used by authorized personnel.
- Two sets of lifting equipment must be used to lift the unit for repair work.
- The lifting equipment must be dimensioned to lift the unit with any remaining pumped media in it.
- The lifting equipment must not be oversized.



CAUTION: Crush Hazard

Over-dimensioned lifting equipment can lead to injury. A site-specific risk analysis must be done.

2.3 Temperature ranges for transportation, handling and storage

Handling at freezing temperature

At temperatures below freezing, the product and all installation equipment, including the lifting gear, must be handled with extreme care.

Make sure that the product is warmed up to a temperature above the freezing point before starting up. Avoid rotating the impeller/propeller by hand at temperatures below the freezing point. The recommended method to warm the unit up is to submerge it in the liquid which will be pumped or mixed.

NOTICE:

Never use a naked flame to thaw the unit.

Unit in as-delivered condition

If the unit is still in the condition in which it left the factory - all packing materials are undisturbed - then the acceptable temperature range during transportation, handling and storage is: -50°C (-58°F) to $+60^{\circ}\text{C}$ ($+140^{\circ}\text{F}$).

If the unit has been exposed to freezing temperatures, then allow it to reach the ambient temperature of the sump before operating.

Lifting the unit out of liquid

The unit is normally protected from freezing while operating or immersed in liquid, but the impeller/propeller and the shaft seal may freeze if the unit is lifted out of the liquid into a surrounding temperature below freezing.

Units equipped with an internal cooling system are filled with a mixture of water and 30% glycol. This mixture remains a flowing liquid at temperatures down to -13°C (9°F). Below -13°C (9°F), the viscosity increases such that the glycol mixture will lose its flow properties. However, the glycol-water mixture will not solidify completely and thus cannot harm the product.

Follow these guidelines to avoid freezing damage:

1. Empty all pumped liquid, if applicable.
2. Check all liquids used for lubrication or cooling, both oil and water-glycol mixtures, for the presence of unacceptable amounts of water. Change if needed.

2.4 Storage guidelines

Storage location

The product must be stored in a covered and dry location free from heat, dirt, and vibrations.

NOTICE:

Protect the product against humidity, heat sources, and mechanical damage.

NOTICE:

Do not place heavy weights on the packed product.

Freezing precautions

The unit is frost-proof while operating or immersed in liquid, but the impeller/propeller and the shaft seal may freeze if the unit is lifted out of the liquid into a surrounding temperature below freezing.

Follow these guidelines to avoid freezing damage:

When	Guideline
Before storage	- The unit must be allowed to run for a short time after raising it to discharge remaining pumped liquid. This does not apply to impeller/propeller units. - The discharge opening must be covered in a suitable way, or placed facing down so that any still remaining pumped liquid runs out. - If present, the cooling jacket must be drained manually by opening the air vent screws at the top of the cooling jacket.
After storage	If the impeller/propeller is frozen, it must be thawed by immersing the unit in liquid before operating the unit. NOTICE: Never use a naked flame to thaw the unit.

Long-term storage

If the unit is stored more than six months, then the following apply:

- Before operating the unit after storage, it must be inspected with special attention to the seals and the cable entry.
- The impeller/propeller must be rotated every other month to prevent the seals from sticking together.

Packaging material stacking limit

If the packaging material has an indicated stacking limit, then it is valid for 23°C (73°F) and 50% relative humidity. Depending on the material, other temperature and humidity ranges can reduce the stacking limit.

3 Product Description

3.1 Pump design

The pump is submersible, and driven by an electric motor.
For a list of pump version and corresponding motor type, see *Technical Reference* (page 65).

Intended use

The product is intended for moving wastewater, sludge, raw and clean water. Always follow the limits that are given in *Technical Reference* (page 65). If there is a question regarding the intended use of the equipment, please contact a local sales and service representative before proceeding.



DANGER: Explosion/Fire Hazard

Special rules apply to installations in explosive or flammable atmospheres. Do not install the product or any auxiliary equipment in an explosive zone unless it is rated explosion-proof or intrinsically-safe. If the product is EN/ATEX-, MSHA- or FM-approved, then see the specific EX information in the Safety chapter before taking any further actions.

NOTICE:

Do NOT use the unit in highly corrosive liquids.

Spare parts

- Modifications to the unit or installation should only be carried out after consulting with Xylem.
- Original spare parts and accessories that are authorized by Xylem are essential for compliance. The use of other parts can invalidate any claims for warranty or compensation. For more information contact your Xylem representative.

Pressure class

LT	Low head
MT	Medium head
HT	High head
SH	Super high head

Exterior® product concept

Exterior® is a product concept including N-technology, Premium efficiency motor, and the intelligent control SmartRun®.

Parts

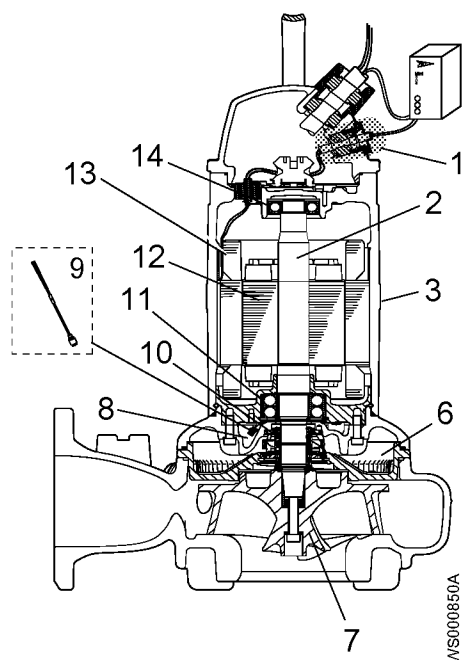


Figure 1: Without cooling jacket

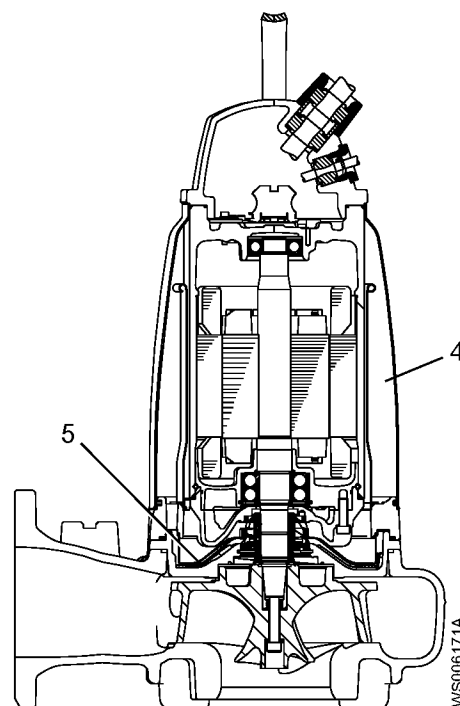


Figure 2: With cooling jacket

Position	Denomination	Description
1	Monitoring sensor	Optional sensor. For information about sensors, see <i>Monitoring equipment</i> (page 12).
2	Shaft	Stainless steel, with an integrated rotor
3	Cooling without jacket	The pump is cooled by the ambient liquid.
4	Cooling with jacket	The motor is cooled by a closed loop system. An integrated coolant pump circulates the coolant whenever the pump is operated.
5	Flow diffuser	Provides heat transfer from the coolant to the pumped fluid.
6	Seal housing	Includes a coolant that lubricates and cools the seals; the housing acts as a buffer between the pumped fluid and the electric motor
7	Impeller	N-impeller, a semi-open, two-vane impeller
8	Inspection chamber	Equipped with an FLS10 leakage sensor to prevent damages to the motor
9	FLS10	For information about FLS10, see <i>Monitoring equipment</i> (page 12).
10	Mechanical seals	Made of one of the following alternatives: - Alternative 1 - Inner seal: corrosion-resistant cemented carbide WCCR/WCCR - Outer seal: corrosion-resistant cemented carbide WCCR/WCCR - Alternative 2 - Inner seal: corrosion-resistant cemented carbide/Aluminum oxide WCCR/Al₂O₃ - Outer seal: silicon carbide RSiC/RSiC
11	Main bearings	Consisting of a two-row angular contact ball bearing
12	Motor	For information about the motor, see <i>Technical Reference</i> (page 65).
13	Thermal contact/ Thermistors	For information about the thermal contact and thermistors, see <i>Monitoring equipment</i> (page 12).

Position	Denomination	Description
14	Support bearing	Consisting of a two-row ball bearing

3.2 Monitoring equipment

The following applies to the monitoring equipment of the pump:

- The stator incorporates three thermal contacts connected in series that activate the alarm and stops the pump at overtemperature
- The thermal contacts open at 140°C (285°F).
- Ex-approved pumps must have thermal contacts connected to the control panel.
- The sensors must be connected to either the MiniCAS II monitoring equipment or an equivalent equipment.
- The monitoring equipment must be of a design that makes automatic restart impossible.
- The pump is supplied with an inspection sensor FLS 10 for sensing the presence of any liquid in the inspection chamber.
- Information in the junction box shows if the pump is equipped with optional sensors.

Optional sensors

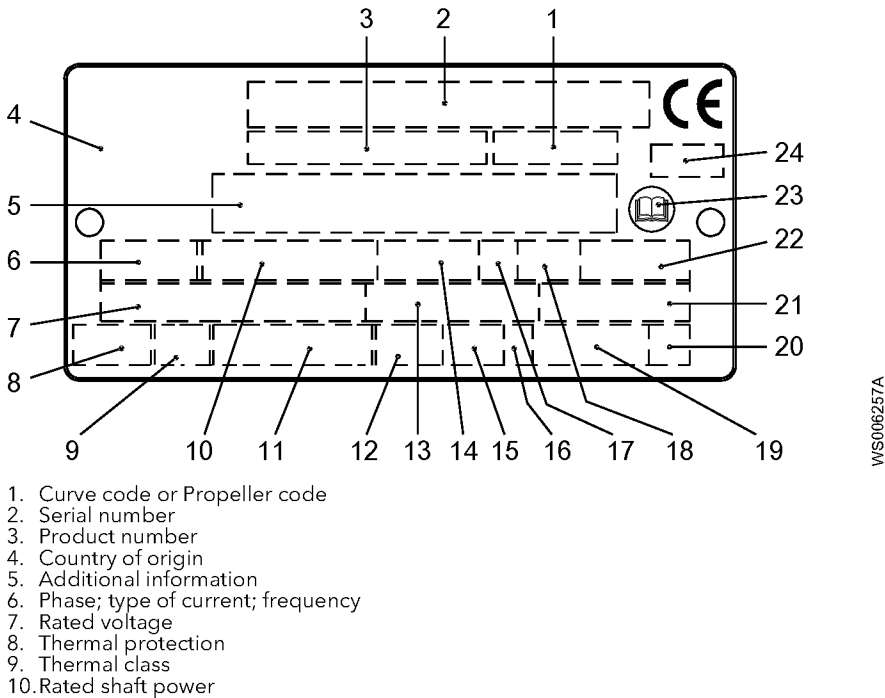
Thermistor Thermistors are optional sensors for measuring the temperature. They are connected in series in the stator and activate the alarm at overtemperature. Thermistors are not applicable to Ex-approved pumps.

NOTICE:

Thermistors must never be exposed to voltages higher than 2.5 V. If the voltage exceeds this value, for example when the control circuit is tested, then the thermistors will be destroyed.

3.3 The data plate

The data plate is a metal label that is located on the main body of the products. The data plate lists key product specifications. Specially approved products also have an approval plate.



11. International standard
12. Degree of protection
13. Rated current
14. Rated speed
15. Maximum submergence
16. Direction of rotation: L=left, R=right
17. Duty class
18. Duty factor
19. Product weight
20. Locked rotor code letter
21. Power factor
22. Maximum ambient temperature
23. Read installation manual
24. Notified body, only for EN-approved Ex products

Figure 3: The data plate

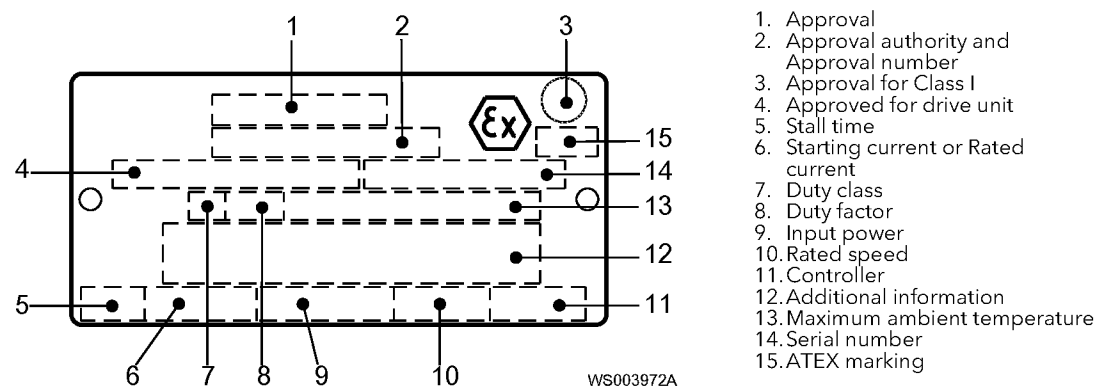
3.4 Approvals

Product approvals for hazardous locations

Pump	Approval
• 3153.091 • 3153.095 • 3153.390 • 3153.670 • 3153.810 • 3153.830 • 3153.850 • 3153.870	European Norm (EN) • ATEX Directive • EN 60079-0:2012/A11:2013, EN 60079-1:2007, EN 13463-1:2009, EN 13463-5:2011 •  I M2 c Ex d I Mb •  II 2 G c Ex d IIB T3 Gb IEC • IECEx scheme • IEC 60079-0, IEC 60079-1 • Ex d I Mb • Ex d IIB T3 Gb FM (FM Approvals) • Explosion proof for use in Class I, Div. 1, Group C and D • Dust ignition proof for use in Class II, Div. 1, Group E, F and G • Suitable for use in Class III, Div. 1, Hazardous Locations CSA Ex • Explosion proof for use in Class I, Div. 1, Group C and D

EN approval plate

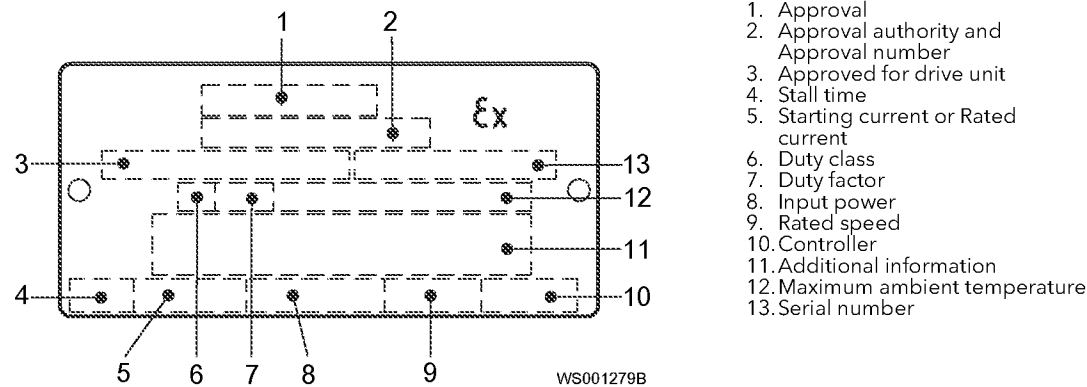
This illustration describes the EN approval plate and the information that is contained in its fields.



IEC approval plate

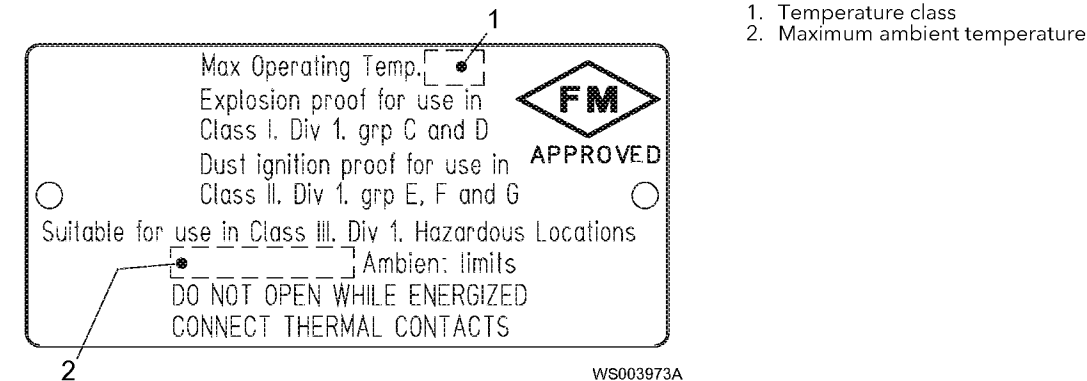
This illustration describes the IEC approval plate and the information that is contained in its fields.

International Norm; not for EU member countries.



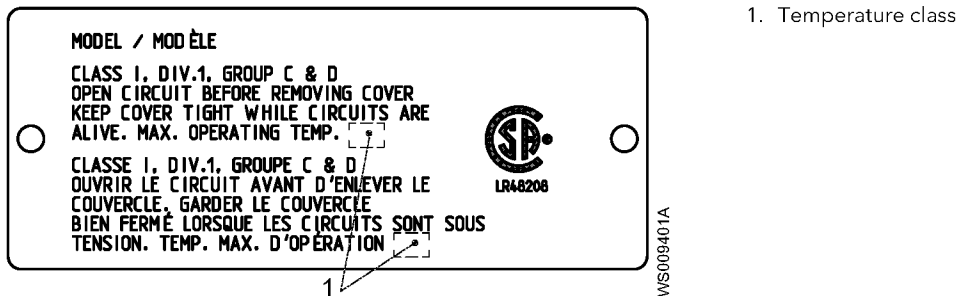
FM approval plate

This illustration describes the FM approval plate and the information that is contained in its fields.



CSA approval plate

This illustration describes the CSA approval plate and the information that is contained in its fields.



3.5 Product denomination

Reading instruction

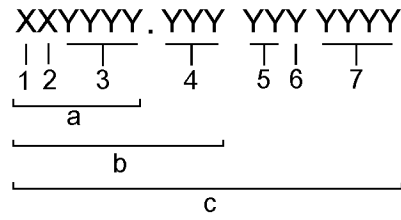
In this section, code characters are illustrated accordingly:

X = letter

Y = digit

The different types of codes are marked up with a, b and c. Code parameters are marked up with numbers.

Codes and parameters



WS006265B

Type of Callout	Number	Indication
Type of code	a	Sales denomination
	b	Product code
	c	Serial number
Parameter	1	Hydraulic end
	2	Type of installation
	3	Sales code
	4	Version
	5	Production year
	6	Production cycle
	7	Running number

4 Installation

4.1 Install the pump

Before starting work, make sure that the safety instructions in the chapter *Introduction and Safety* (page 3) have been read and understood.



DANGER: Electrical Hazard

Before starting work on the unit, make sure that the unit and the control panel are isolated from the power supply and cannot be energized. This applies to the control circuit as well.



DANGER: Inhalation Hazard

Before entering the work area, make sure that the atmosphere contains sufficient oxygen and no toxic gases.



WARNING: Electrical Hazard

The permanent-magnet motor generates voltage when the shaft rotates, even if power sources are disconnected. Never perform any electrical work if the shaft could rotate.

Hazardous atmospheres



DANGER: Explosion/Fire Hazard

Special rules apply to installations in explosive or flammable atmospheres. Do not install the product or any auxiliary equipment in an explosive zone unless it is rated explosion-proof or intrinsically-safe. If the product is EN/ATEX-, MSHA- or FM-approved, then see the specific EX information in the Safety chapter before taking any further actions.



WARNING: Explosion/Fire Hazard

Do not install CSA-approved products in locations that are classified as hazardous in the National Electric Code(TM), ANSI/NFPA 70-2005.

General requirements

These requirements apply:

- Use the pump dimensional drawing in order to ensure proper installation.
- In S-, T-, and Z-installations the pump must be equipped with cooling jacket

Before installing the pump, do the following:

- Provide a suitable barrier around the work area, for example, a guard rail.
- Make sure that equipment is in place so that the unit cannot roll or fall over during the installation process.
- Check the explosion risk before you weld or use electric hand tools.
- Check that the cable and cable entry have not been damaged during transport.
- Always remove all debris and waste material from the sump, inlet piping, and discharge connection, before you install the pump.
- Always check the impeller rotation before lowering the pump into the pumped liquid.
- If the unit has a permanent magnet motor, then ensure that you have read and understood all safety instructions regarding permanent magnet motors.

NOTICE:

Do not run the pump dry.

NOTICE:

Never force piping to make a connection with a pump.

Authority regulation

Vent the tank of a sewage station in accordance with local plumbing codes.

Fasteners

- Only use fasteners of the correct size and material.
- Replace all corroded or damaged fasteners.
- Make sure that all the fasteners are correctly tightened and that there are no missing fasteners.

4.1.1 Install with P-installation

In the P-installation, the pump is installed on a stationary discharge connection, and operates either completely or partially submerged in the pumped liquid. These requirements and instructions only apply when the installation is made according to the dimensional drawing.

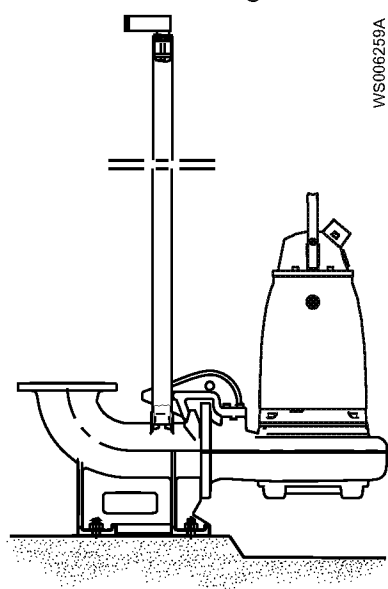


Figure 4: P-installation

These items are required:

- Guide bars
- Guide bar bracket for attaching the guide equipment to the access frame or to the upper part of the sump
- Level regulators or other control equipment for start, stop, and alarm
- Cable holder for holding the cable and regulating the height of the level regulators
- Access frame (with covers) to which the upper guide bar bracket and cable holder can be attached
- Discharge connection for connecting the pump to the discharge line
The discharge connection has a flange which fits the pump housing flange and a bracket for attaching the guide equipment.
- Fasteners for the discharge connection
- Anchor bolts

1. Run a cable between the sump and the stator and monitoring equipment.
Make sure that the cable is not sharply bent or pinched.
2. Install the access frame:

- a) Place the access frame in position and align it horizontally.
- b) Grout the frame in place.
3. Grout the anchor bolts in place.
Be careful when you align and position the discharge connection in relation to the access frame.
4. Place the discharge connection in position, and tighten the nuts.
5. Install the guide bars:
 - a) Secure the guide bars in the bracket.
 - b) Check that the guide bars are placed vertically. Use a level or a plumb line.
6. Connect the discharge pipe to the discharge connection.
7. Prepare for the level regulator:
 - a) Bolt the cable holder to the access frame.
 - b) Attach the level regulator cable to the cable holder and adjust the height of the level regulator.
 - c) Protect bolts and nuts with a corrosion-preventive compound.
8. Lower the pump along the guide bars.
9. Secure the motor cable:
 - a) Fasten the permanent lifting device to the pump and to the access frame. For example, you can use a stainless-steel lifting chain with shackles.
 - b) Fasten the cable to the cable holder.
Make sure that the cable cannot be sucked into the pump inlet or that it is neither sharply bent, or pinched. Support straps are required for deep installations.
 - c) Connect the motor cable and the starter and monitoring equipment according to the separate instructions.
Make sure that the impeller rotation is correct. For more information, see *Check the impeller rotation* (page 33).

Clean all debris from the sump before starting the pump.

4.1.2 Install with S-installation

In the S-installation, the pump is transportable and intended to operate either completely or partially submerged in the pumped liquid. The pump is equipped with a connection for hose or pipe and stands on a base stand.

These requirements and instructions only apply when the installation is made according to the dimensional drawing. For information about the different installation types, see Parts List.

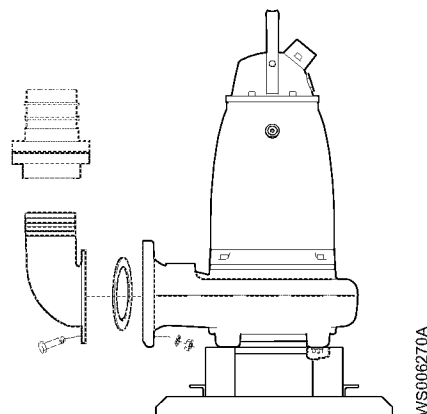


Figure 5: S-installation

1. Run the cable so that it has no sharp bends. Make sure that it is not pinched, and cannot be sucked into the pump inlet.
2. Connect the discharge line.
3. Lower the pump into the sump.
4. Place the pump on the base and make sure it cannot fall over or sink.
Alternatively, the pump can be suspended with a lifting chain just above the sump bottom. Make sure that the pump cannot rotate at start-up or during operation.
5. Connect the motor cable and the starter and monitoring equipment according to the separate instructions.

Make sure that the impeller rotation is correct. For more information, see *Check the impeller rotation* (page 33).

4.1.3 Install with T/Z-installation

In the T-installation, the pump is installed in a vertical position in a dry well next to the wet sump. These requirements and instructions only apply when the installation is made according to the dimensional drawing.

In the Z-installation, the pump is installed in a horizontal position on a support stand in a dry well next to the wet sump, and a bell-mouth is connected to the inlet pipe. These requirements and instructions are for Z-installations that comply to the dimensional drawing.

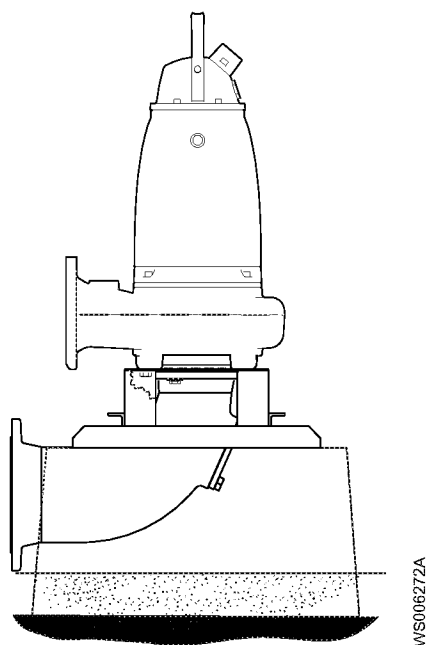


Figure 6: T-installation

These items are required:

- Support stand and anchor bolts for anchoring the pump to a base
- Inlet elbow for connecting the suction line and discharge line
- Shut-off valves that allow you to remove the pump from service

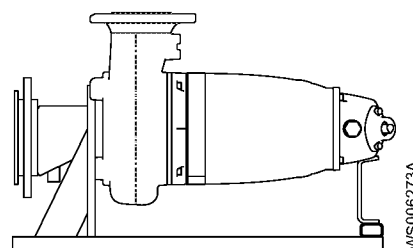
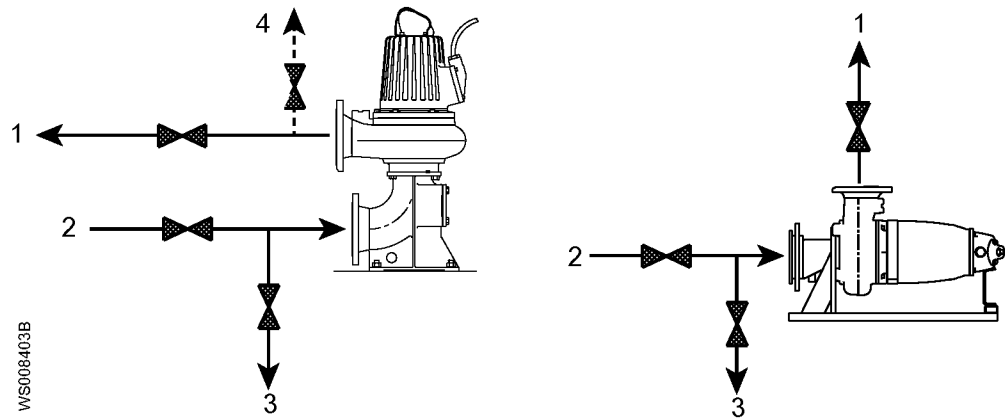


Figure 7: Z-installation



1. Outlet line
2. Inlet line
3. Line to drain
4. Air vent

Figure 8: T-, Z-installation shutoff and air vent valves (generic pumps shown)

- Air vent on the discharge side between the pump and the check valve
- Level regulators or other control equipment for start, stop, and alarm

NOTICE:

The risk of freezing is particularly high in T- or Z-installations.

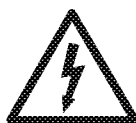
1. Fasten the pump:
 - a) Use the anchor bolts to bolt the support stand to the concrete base.
 - b) Bolt the pump to the support stand and the suction connection.
2. Make sure that the pump is vertical for the T-installation or horizontal for the Z-installation.
3. Connect the suction line and discharge line.
4. Connect the motor cable and the starter and monitoring equipment according to the separate instructions.

Make sure that the impeller rotation is correct. For more information, see *Check the impeller rotation* (page 33).

5. Make sure that the weight of the pump does not put strain on the piping.

4.2 Make the electrical connections

General precautions



DANGER: Electrical Hazard

Before starting work on the unit, make sure that the unit and the control panel are isolated from the power supply and cannot be energized. This applies to the control circuit as well.



WARNING: Electrical Hazard

Risk of electrical shock or burn. A certified electrician must supervise all electrical work. Comply with all local codes and regulations.

**WARNING: Electrical Hazard**

There is a risk of electrical shock or explosion if the electrical connections are not correctly carried out, or if there is fault or damage on the product. Visually inspect equipment for damaged cables, cracked casings or other signs of damage. Make sure that electrical connections have been correctly made.

**WARNING: Electrical Hazard**

The permanent-magnet motor generates voltage when the shaft rotates, even if power sources are disconnected. Never perform any electrical work if the shaft could rotate.

**WARNING: Crush Hazard**

Risk of automatic restart.

**CAUTION: Electrical Hazard**

Prevent cables from becoming sharply bent or damaged.

NOTICE:

Leakage into the electrical parts can cause damaged equipment or a blown fuse. Keep the cable ends dry at all times.

Requirements

These general requirements apply for electrical installation:

- The supply authority must be notified before installing the pump if it will be connected to the public mains. When the pump is connected to the public power supply, it may cause flickering of incandescent lamps when started.
- The mains voltage and frequency must agree with the specifications on the data plate. If the pump can be connected to different voltages, then the connected voltage is specified by a yellow sticker close to the cable entry.
- The fuses and circuit breakers must have the proper rating, and the pump overload protection (motor protection breaker) must be connected and set to the rated current according to the data plate and if applicable the cable chart. The starting current in direct-on-line start can be up to six times higher than the rated current.
- The fuse rating and the cables must be in accordance with the local rules and regulations.
- If intermittent operation is prescribed, then the pump must be provided with monitoring equipment supporting such operation.
- If stated on the data plate, then the motor is convertible between different voltages.
- The thermal contacts/thermistors must be in use.
- For FM-approved pumps, a leakage sensor must be connected and in use in order to meet approval requirements.

Cables

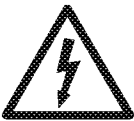
These are the requirements to follow when you install cables:

- The cables must be in good condition, not have any sharp bends, and not be pinched.
- The cables must not be damaged and must not have indentations or be embossed (with markings, etc.) at the cable entry.
- The cable entry seal sleeve and washers must conform to the outside diameter of the cable.
- The minimum bending radius must not be below the accepted value.

- If using a cable which has been used before, a short piece must be peeled off when refitting it so that the cable entry seal sleeve does not close around the cable at the same point again. If the outer sheath of the cable is damaged, then replace the cable. Contact a local sales and service representative.
- The voltage drop in long cables must be taken into account. The drive unit's rated voltage is the voltage measured at the cable connection point in the pump.
- The screened cable must be used according to the European CE and EMC requirements if a Variable Frequency Drive (VFD) is used. For more information, contact your local sales and service representative (VFD-supplier).
- Make sure that the cable is long enough for maintenance work.
- For SUBCAB® cables, the twisted pair copper foil must be trimmed.
- All unused conductors must be insulated.

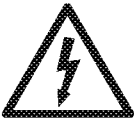
Grounding (earthing)

Grounding (earthing) must be done in compliance with all local codes and regulations.



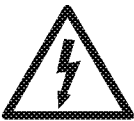
DANGER: Electrical Hazard

All electrical equipment must be grounded (earthed). Test the ground (earth) lead to verify that it is connected correctly and that the path to ground is continuous.



WARNING: Electrical Hazard

If the power cable is jerked loose, then the ground (earth) conductor must be the last conductor to come loose from its terminal. Make sure that the ground (earth) conductor is longer than the phase conductors at both ends of the cable.



WARNING: Electrical Hazard

Risk of electrical shock or burn. You must connect an additional ground- (earth-) fault protection device to the grounded (earthed) connectors if persons are likely to come into contact with liquids that are also in contact with the pump or pumped liquid.

4.2.1 Prepare the SUBCAB® cables

This section applies to SUBCAB® cables with twisted-pair control cores.

The prepared SUBCAB® cable	The prepared screened SUBCAB® cable
1. T1+T2 twisted pairs in control element 2. Drain wire in control element (bare copper wire) 3. Screened copper pt-foil 4. Insulation sheath (jacket) or PT-foil for control element 5. Power cores 6. Ground (earth) core WS004299E	1. T1+T2 and T3+T4 twisted pairs in control element 2. Drain wire in control element (bare copper wire) 3. Screened copper pt-foil 4. Insulation sheath (jacket) for control element 5. Power cores 6. Aluminum foil 7. Ground (earth) core with green/yellow shrink hose 8. Uncovered screen/braided wire WS004298C

1. Peel off the outer sheath at the end of the cable.
2. Prepare the control element:
 - a) Peel the sheath (if applicable) and the copper foil.
The copper foil is a screen and is conductive. Do not peel more than necessary, and remove the peeled foil.

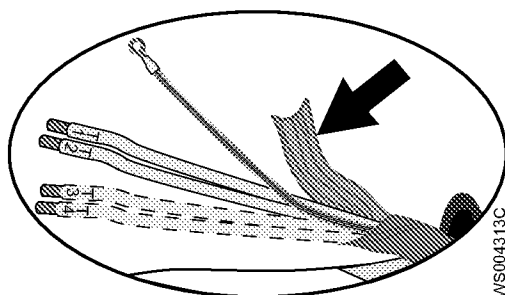


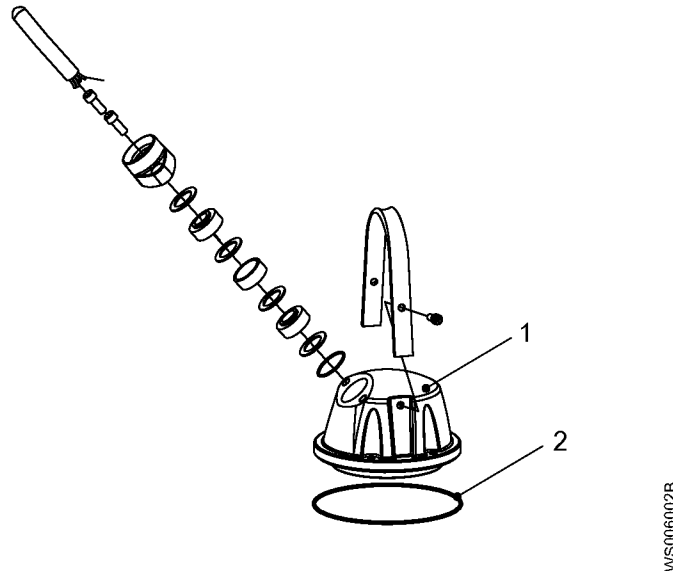
Figure 9: Copper foil on control element.

- b) Put a white shrink hose over the drain wire and the cable terminal.
 - c) Fit a cable lug on the drain wire.
 - d) Twist T1+T2 and T3+T4.
 - e) Put a shrink hose over the control element.
Make sure that the conductive copper foil and drain wire is covered.
3. Prepare the ground (earth) core for SUBCAB™ cable:
 - a) Peel the yellow-green insulation from the ground (earth) core.
 - b) Check that the ground (earth) core is at least 10% longer than the phase cores in the cabinet.
 - c) If applicable, put a cable lug on the ground core.
4. Prepare the ground (earth) core for screened SUBCAB™ cable:
 - a) Untwist the screens around the power cores.
 - b) Put a yellow-green shrink hose over the ground (earth) core.
Leave a short piece uncovered.
 - c) If applicable, put a cable lug on the screened ground core.
 - d) Twist all power core screens together to create a ground (earth) core and fit a cable terminal to the end.
 - e) Check that the ground (earth) core is at least 10% longer than the phase cores in the cabinet.
5. How is the connection to ground (earth) made?
 - Screw: Fit cable terminals to the ground (earth) core and the power cores.
 - Terminal block: Leave the core ends as they are.
6. Prepare the main leads:
 - a) Remove the aluminum foil around each power core.
 - b) Peel the insulation from each power core.

4.2.2 Connect the motor cable to the pump

NOTICE:

Leakage into the electrical parts can cause damaged equipment or a blown fuse. Keep the end of the motor cable dry at all times.



1. Entrance cover
2. O-ring

For more information about the cable entry, see the Parts list.

1. Remove the entrance cover and the O-ring from the stator housing.
This provides access to the terminal board.
2. Check the data plate to see which connections are required for the power supply.
3. Arrange the connections on the terminal board in accordance with the required power supply.
Links (jumper strips) are not used with the Y/D start.
4. Connect the mains leads (L1, L2, L3, and ground (earth)) according to applicable cable chart.
The ground (earth) lead must be 100 mm (4.0 in.) longer than the phase leads in the junction box of the unit.
5. Make sure that the pump is correctly connected to ground (earth).
6. Connect the control leads to the applicable terminal board.
7. Make sure that any thermal contacts incorporated in the pump are properly connected to the terminal board.
8. Install the entrance cover and the O-ring on the stator housing.
9. Fasten the screws on the entrance flange so that the cable insertion assembly bottoms out.

4.2.3 Connect the motor cable to the starter and monitoring equipment

If there are two power cables, then the cable that is connected to T1 and T2 is labeled. If a separate control cable is used, then the control leads in the power cable are never connected.



DANGER: Explosion/Fire Hazard

Special rules apply to installations in explosive or flammable atmospheres. Do not install the product or any auxiliary equipment in an explosive zone unless it is rated explosion-proof or intrinsically-safe. If the product is EN/ATEX-, MSHA- or FM-approved, then see the specific EX information in the Safety chapter before taking any further actions.

NOTICE:

Either thermal contacts or thermistors are incorporated in the pump.

NOTICE:

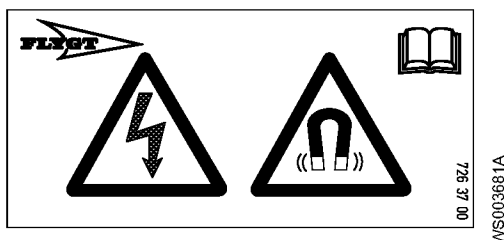
Thermal contacts must never be exposed to voltages higher than 250 V, breaking current maximum 5 A. It is recommended that they are connected to 24 V over separate fuses to protect other automatic equipment.

1. If thermal contacts are included in the pump installation, then connect the T1 and T2 control conductors to the MiniCAS II monitoring equipment.

NOTICE:

The thermal contacts are incorporated in the stator. Connect them to 24 V over separate fuses to protect other automatic equipment.

2. If thermistors are included in the pump installation, and screened or auxiliary cable is used, then connect T1(1) and T2(2) to the thermistor relay or MAS 711, and T3(3) and T4 (4) to MiniCAS II or MAS 711.
3. Connect the mains leads (L1, L2, L3, and ground (earth)) to the starter equipment.
For information about the phase sequence and the color codes of the leads, see Cable charts.
4. Applicable for permanent magnet motor; ensure that the warning label is attached to the cable end. In case the label is missing, attach the spare label to the cable end.
The label is delivered with the pump.



5. Check the functionality of the monitoring equipment:
 - a) Check that the signals and the tripping function work properly.
 - b) Check that the relays, lamps, fuses, and connections are intact.
 Replace any defective equipment.

4.2.4 Cable charts

Description

This topic contains general connection information. It also provides cable charts that show connection alternatives for use with different cables and power supply.

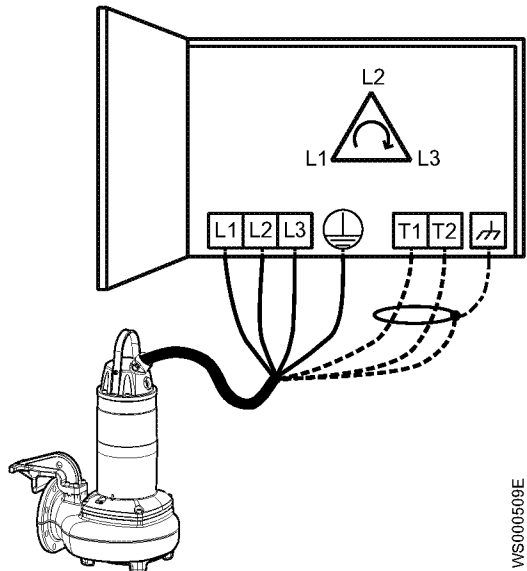
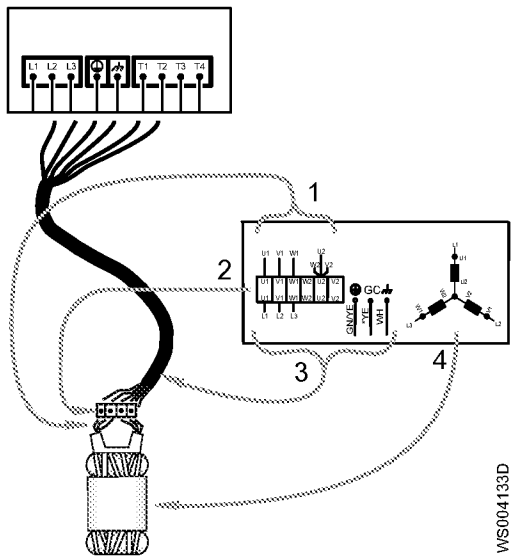


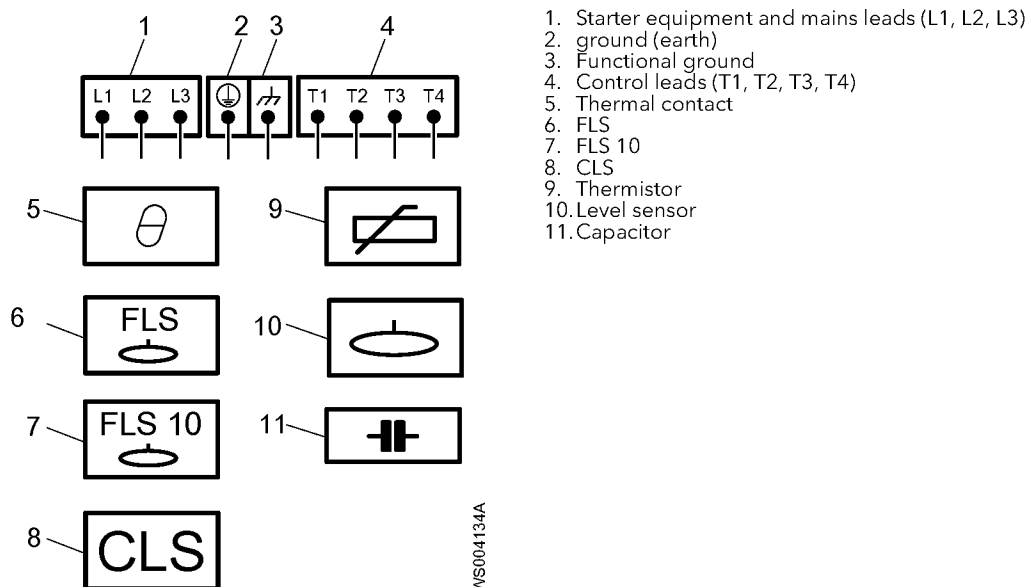
Figure 10: Phase sequence

Connection locations

The figures in this section illustrate how to interpret the connection strip symbols.



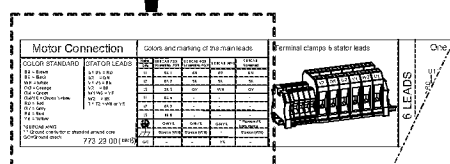
- 1. Stator leads
- 2. Terminal board
- 3. Power cable leads
- 4. Stator (internal connection illustrated)



4.2.4.1 Colors and markings of leads

Motor Connection		Colors and marking of the main leads				
COLOR STANDARD	STATOR LEADS	Mains	SUBCAB 7GX Screenflex 7GX	SUBCAB 4GX Screenflex 4GX	SUBCAB AWG	SUBCAB Screened
BN = Brown BK = Black WH = White OG = Orange GN = Green GN/YE = Green-Yellow RD = Red GY = Grey BU = Blue YE = Yellow	U1, U5 = RD U2 = GN V1, V5 = BN V2 = BU W1, W5 = YE W2 = BK T1, T2 = WH or YE	3				
		L1	BK 1	BN	RD	BN
		L2	BK 2	BK	BK	BK
		L3	BK 3	GY	WH	GY
		L1	BK 4	-	-	-
		L2	BK 5	-	-	-
		L3	BK 6	-	-	-
		Ground	GN/YE	GN/YE	GN/YE	**Screen/PE from cores
		Screen	Screen (WH)	Screen (WH)	-	Screen (WH)
		GC	-	-	YE	-

773 29 00 (REV 6)



Color code standard

Code	Description
BN	Brown
BK	Black
WH	White
OG	Orange
GN	Green
GNYE	Green-Yellow
RD	Red
GY	Grey
BU	Blue

Code	Description
YE	Yellow

4.2.4.2 Motor connection

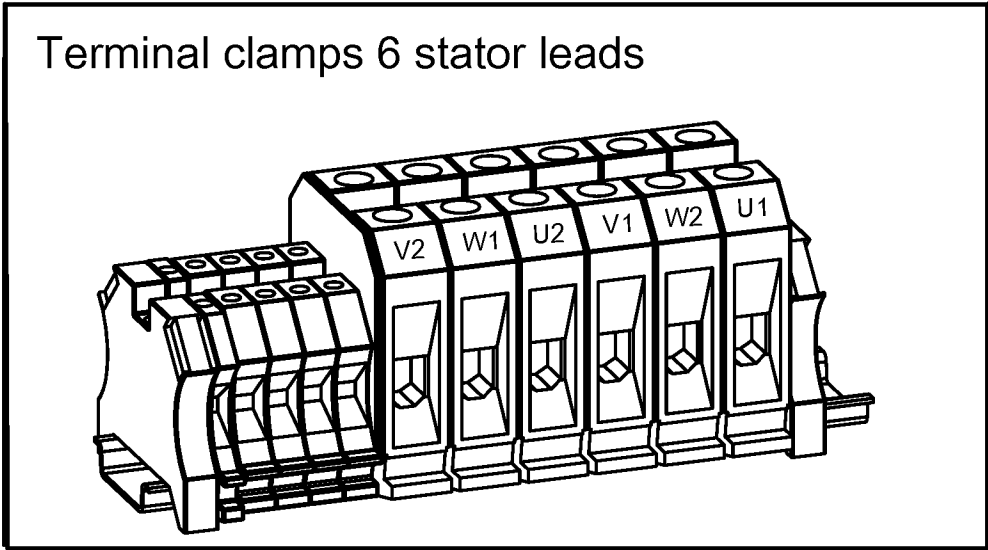


Figure 11: Terminal clamps, 6 stator leads

4.2.4.3 Connections included

- 6-leads connection (page 28)
- 9-leads connection (page 30)
- Screened cable connection (page 30)

6-leads connection

One cable (left) and two cables (right) Y-connection. For 3153, only the one-cable diagram applies.

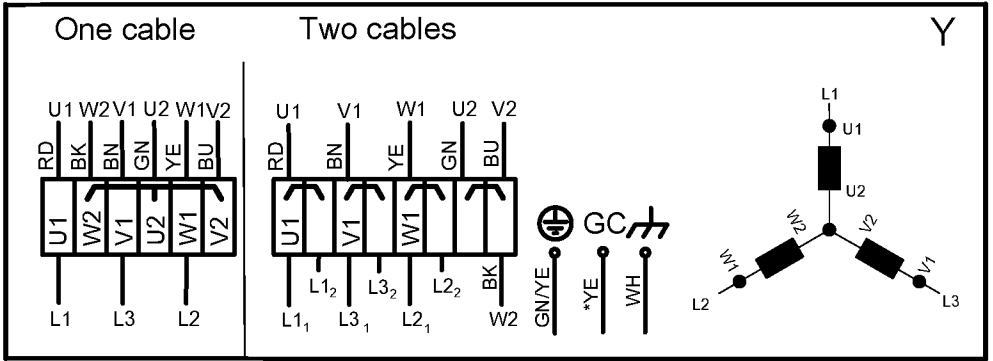


Figure 12: Y-connection

One cable (left) and two cables (right) D-connection. For 3153, only the one-cable diagram applies.

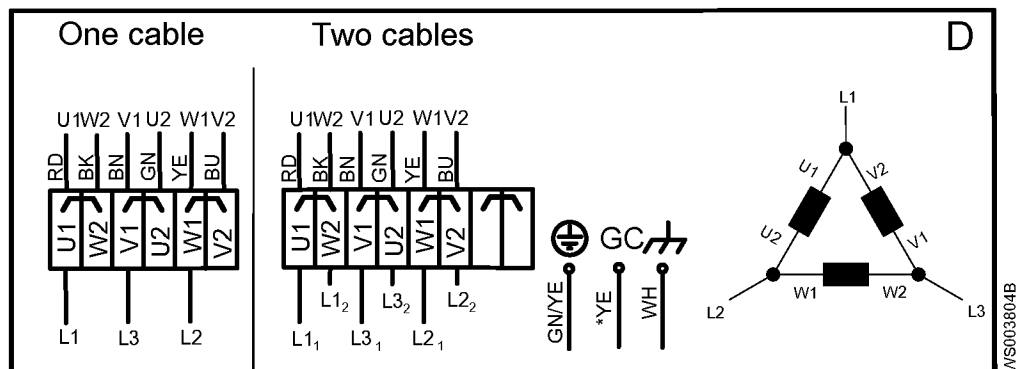


Figure 13: D-connection

One cable (left) and two cables (right) Y/ D-connection. For 3153, only the one-cable diagram applies.

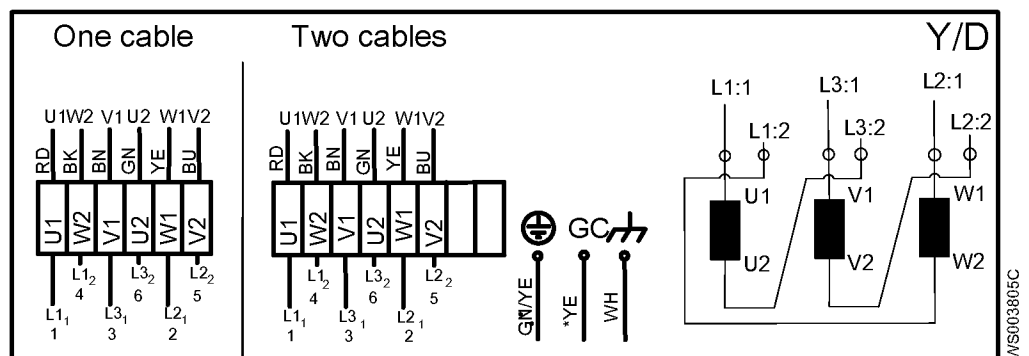


Figure 14: Y/D-connection

Y and D-connection, only applicable to 70 mm² terminal clamp.

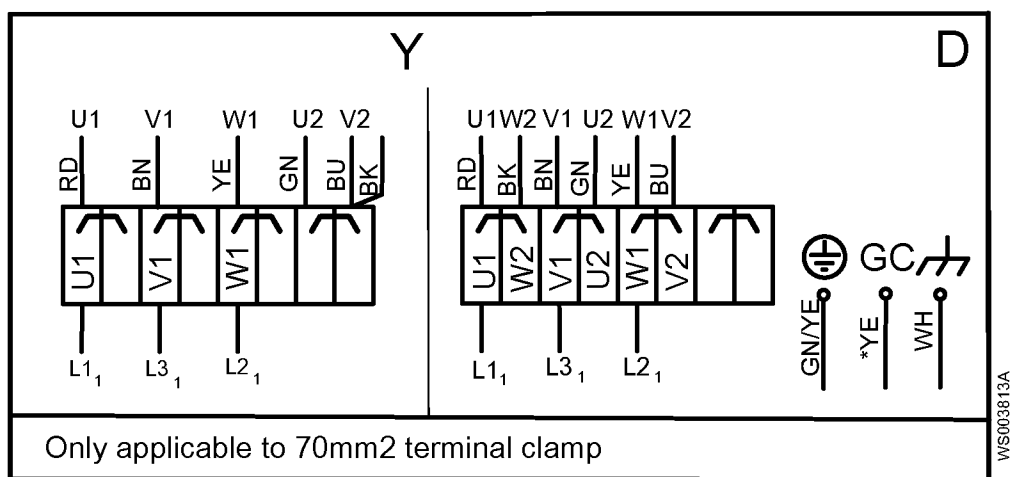


Figure 15: Y or D-connection

9-leads connection

One cable (left) and two cables (right) Y-parallel connection. For 3153, only the one-cable diagram applies.

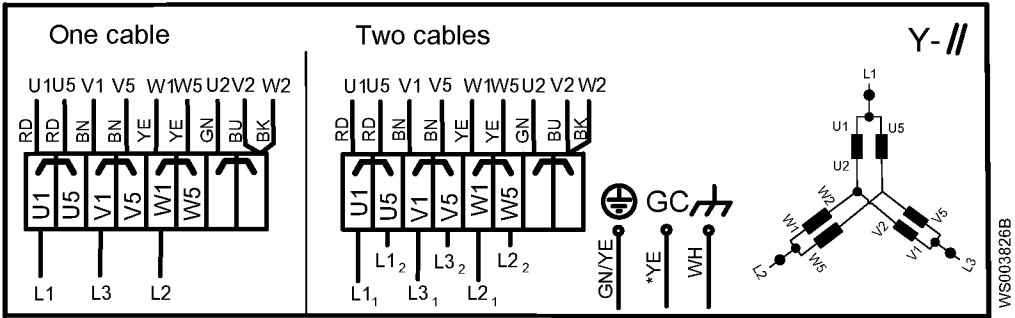


Figure 16: Y-parallel connection

One cable (left) and two cables (right) Y-serial connection. For 3153, only the one-cable diagram applies.

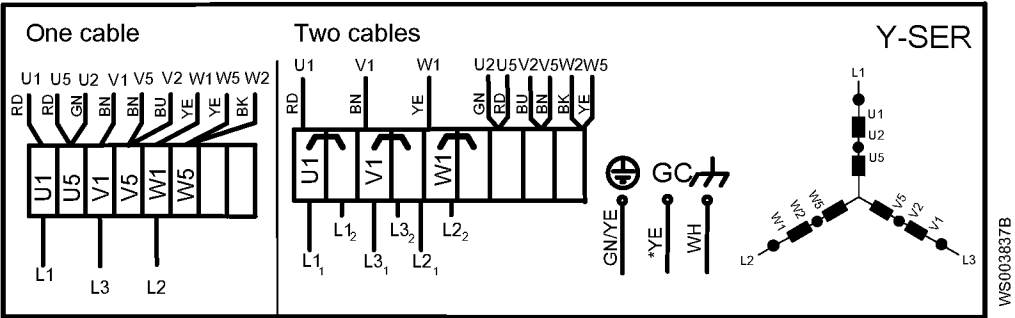


Figure 17: Y-serial connection

Screened cable connection

Cable without separate ground conductor. Screen as ground conductor.

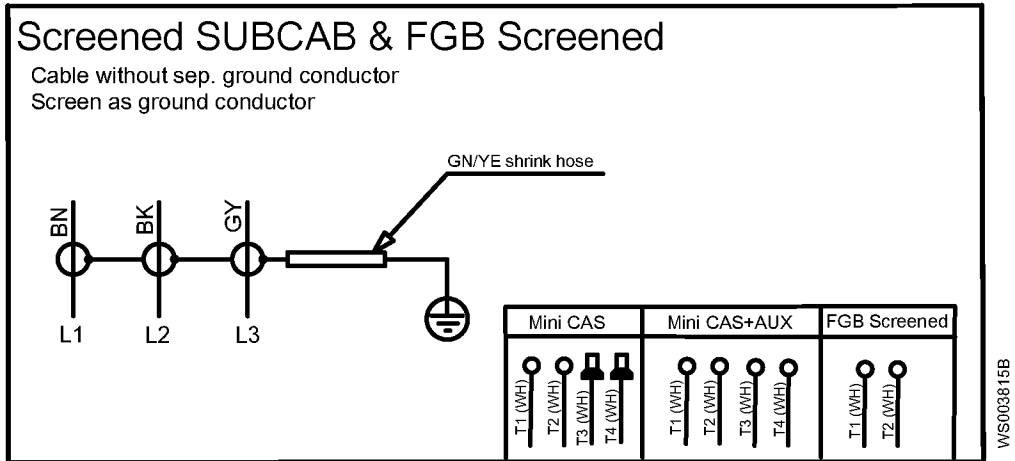


Figure 18: Screened SUBCAB and FGB Screened

* For screened SUBCAB T3 and T4 shall also be twisted separately.

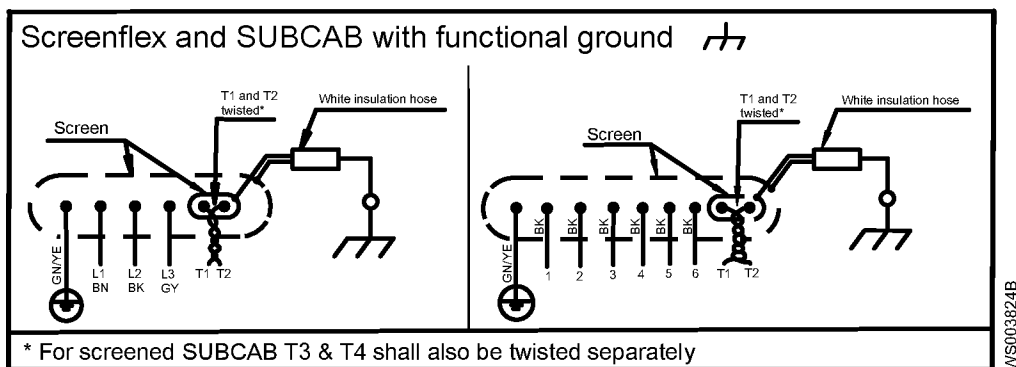


Figure 19: Screenflex and SUBCAB with functional ground

4.2.5 Sensor connection

4.2.5.1 Connection to the pump

Color and marking of control leads			
Control	SUBCAB 4GX/7G and Screenflex	SUBCAB AWG	SUBCAB Screened
T1	WH T1	OG	WH T1
T2	WH T2	BU	WH T2
T3	-	-	WH T3
T4	-	-	WH T4

Figure 20: Color and marking of control leads

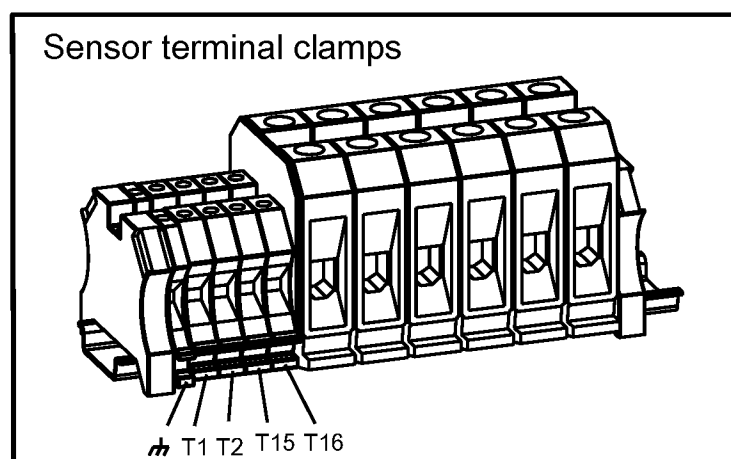
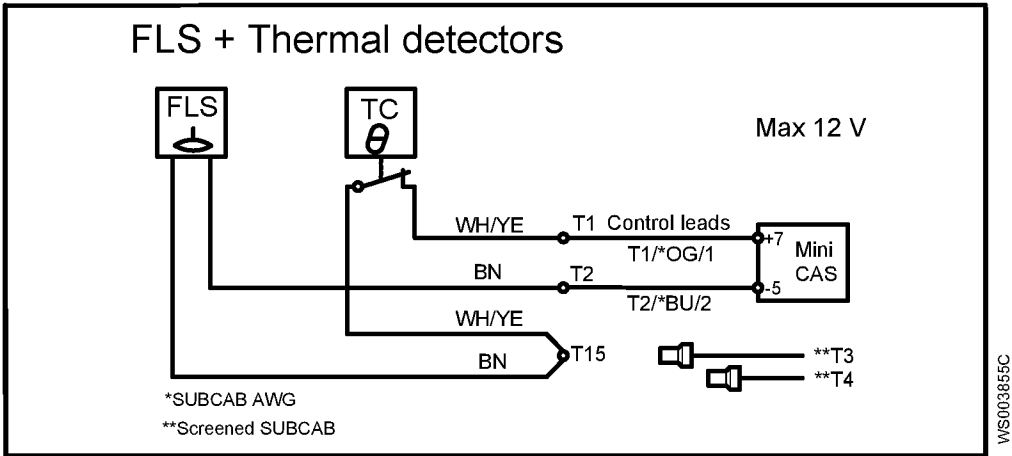


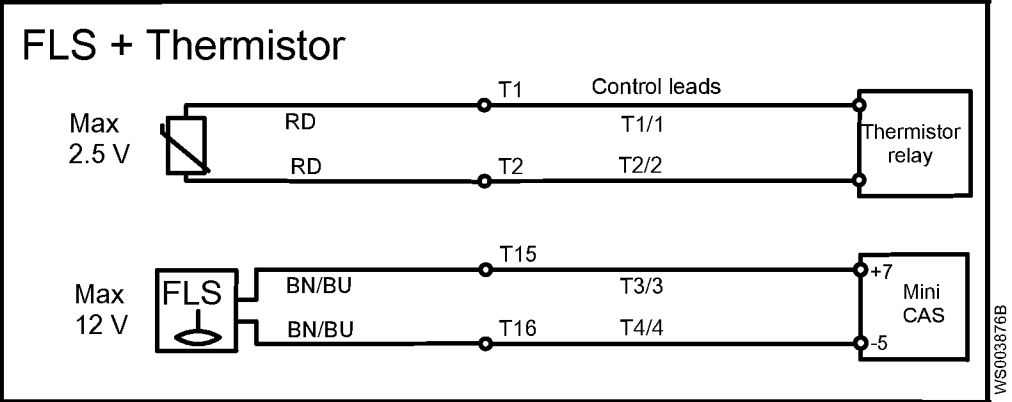
Figure 21: Sensor terminal clamps

FLS 10 and Thermal detectors



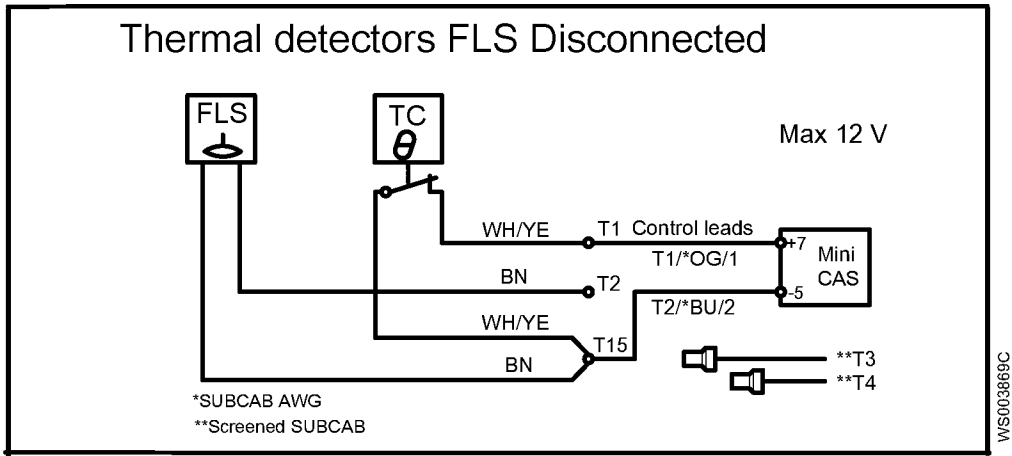
∞ Ohm	Overtemperature
1200 Ohm	OK
430 Ohm	Leakage

FLS 10 and Thermistor



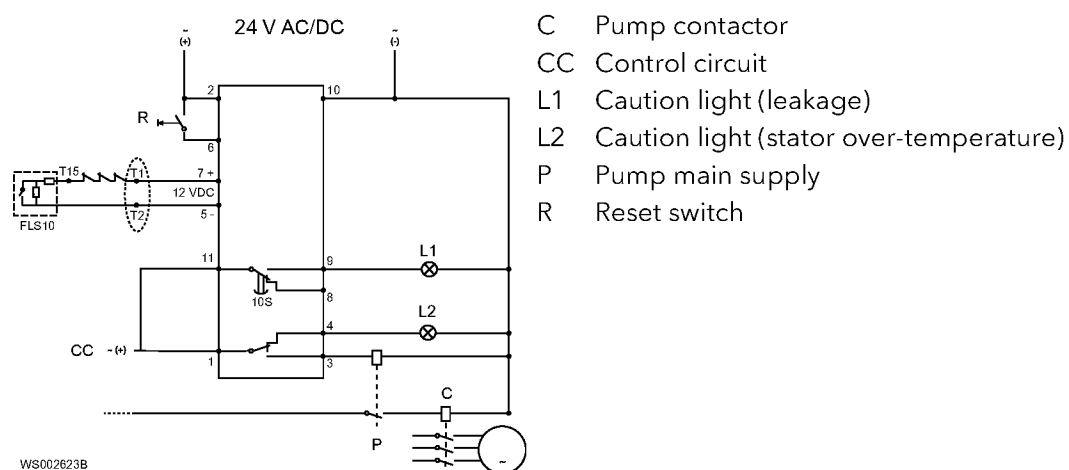
T=25°C (77°F)	R ≤ 100 Ohm
T=135°C (275°F) (T _{REF} -5°C (23°F))	R ≤ 550 Ohm
T=145°C (293°F) (T _{REF} +5°C (41°F))	R ≤ 1330 Ohm

Thermal detectors, FLS disconnected



4.2.5.2 Connection to the monitoring equipment

MiniCAS II



4.3 T-installation: Bleed air before starting pump

1. Open valve D and bleed out the air. See the following figure.

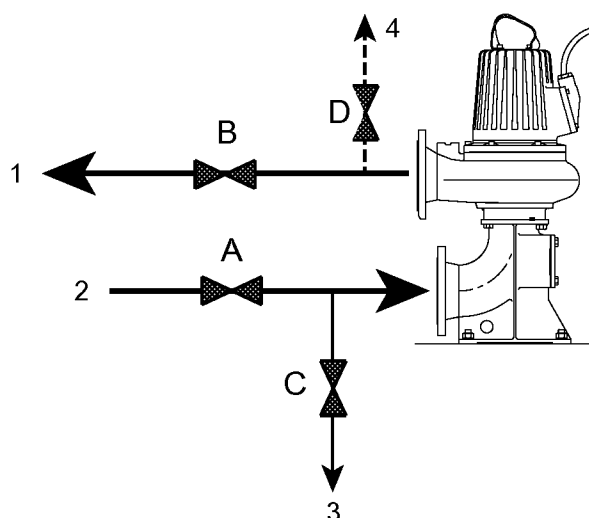


Figure 22: T-installation, valves A–D

2. Close valve D before the pump is started.

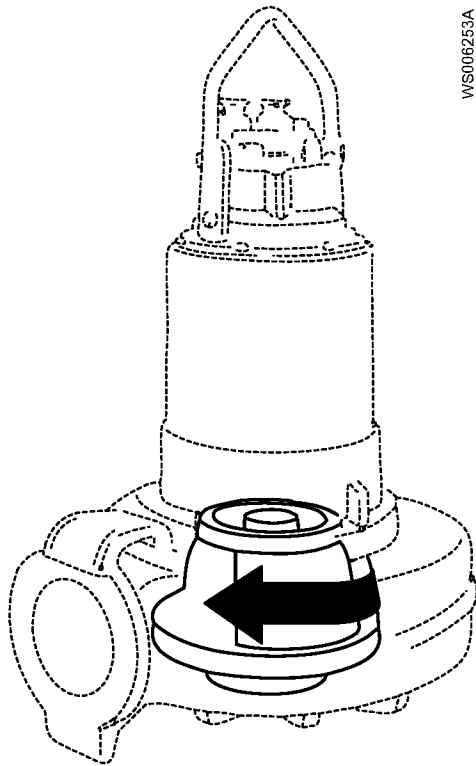
4.4 Check the impeller rotation



CAUTION: Crush Hazard

The starting jerk can be powerful. Make sure nobody is close to the unit when it is started.

1. Start the motor.
2. Stop the motor after a few seconds.
3. Check that the impeller rotates according to this illustration.



The correct direction of impeller rotation is clockwise when you look at the pump from above.

4. If the impeller rotates in the wrong direction, then transpose two phase leads (3-phase) and do this procedure again.

5 Operation

5.1 Precautions

Before taking the unit into operation, check the following:

- All recommended safety devices are installed.
- The cable and cable entry have not been damaged.
- All debris and waste material has been removed.

NOTICE:

Never operate the pump with the discharge line blocked, or the discharge valve closed.

WARNING: Crush Hazard

Risk of automatic restart.



Distance to wet areas



WARNING: Electrical Hazard

Risk of electrical shock or burn. You must connect an additional ground- (earth-) fault protection device to the grounded (earthed) connectors if persons are likely to come into contact with liquids that are also in contact with the pump or pumped liquid.



CAUTION: Electrical Hazard

Risk of electrical shock or burn. The equipment manufacturer has not evaluated this unit for use in swimming pools. If used in connection with swimming pools then special safety regulations apply.

Noise level

NOTICE:

The sound power level of the product is lower than 70 dB(A). However, in some installations the resulting sound pressure level may exceed 70 dB(A) at certain operating points on the performance curve. Make sure that you understand the noise level requirements in the environment where the product is installed. Failure to do so may result in hearing loss or violation of local laws.

5.2 Estimate zinc anode replacement intervals

The mass and surface area of the zinc anodes are designed to protect the pump surface for 1 year in sea water with an average temperature of 20°C (68°F). Shorter inspection intervals and anode replacement can be required, depending upon the water temperature and the chemical composition as well as the presence of other metals in the vicinity of the pump.

The rate of zinc consumption, and the appropriate inspection intervals, can be estimated by measuring how much zinc is consumed during the first two months following installation.

Anodes are replaced when the anode mass is reduced to a selected fraction of its initial mass. The recommended interval for the selection fraction is 0.25-0.50 (25-50%).

1. Remove, weigh, and reinstall one or more of the exterior zinc anodes before starting up the pump.
2. After two months, remove and weigh the same zinc anode or anodes again.

3. Divide the lapsed time in days (between steps 1 and 2) by the anode weight loss in grams to get the calculated anode consumption rate (days/gram).
If multiple anodes were weighed, then use the anode which has lost the most weight for this calculation.
4. Calculate future replacement intervals so that they occur when the selected fraction of zinc is remaining.

5.3 Start the pump



CAUTION: Crush Hazard

The starting jerk can be powerful. Make sure nobody is close to the unit when it is started.

NOTICE:

Make sure that the rotation of the impeller is correct. For more information, see Check the impeller rotation.

1. Remove the fuses or open the circuit breaker, and check that the impeller can rotate freely.



WARNING: Crush Hazard

Never put your hand into the pump housing.

2. Conduct insulation test phase to ground. To pass, the value must exceed 5 megaohms.
3. Check that the monitoring equipment works.
4. Start the pump.

6 Maintenance

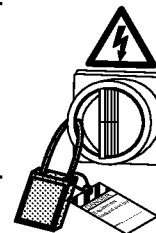
Precautions

Before starting work, make sure that the safety instructions in the chapter *Introduction and Safety* (page 3) have been read and understood.



DANGER: Crush Hazard

Moving parts can entangle or crush. Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.



WARNING: Biological Hazard

Infection risk. Rinse the unit thoroughly with clean water before working on it.



CAUTION: Crush Hazard

Make sure that the unit cannot roll or fall over and injure people or damage property.

Make sure that you follow these requirements:

- Check the explosion risk before you weld or use electrical hand tools.
- Allow all system and pump components to cool before you handle them.
- Make sure that the product and its components have been thoroughly cleaned.
- Make sure that the work area is well-ventilated before you open any vent or drain valves, remove any plugs, or disassemble the unit.
- Do not open any vent or drain valves or remove any plugs while the system is pressurized. Make sure that the pump is isolated from the system and that pressure is relieved before you disassemble the pump, remove plugs, or disconnect piping.

Ground continuity verification

A ground (earth) continuity test must always be performed after service.

Maintenance guidelines

During the maintenance and before reassembly, always remember to perform these tasks:

- Clean all parts thoroughly, particularly O-ring grooves.
- Change all O-rings, gaskets, and seal washers.
- Lubricate all springs, screws, O-rings with grease.

During the reassembly, always make sure that existing index markings are in line.

The reassembled drive unit must always be insulation-tested and the reassembled pump must always be test-run before normal operation.

6.1 Torque values

All screws and nuts must be lubricated to achieve correct tightening torque. Screws that are screwed into stainless steel must have the threads coated with suitable lubricants to prevent seizing.

If there is a question regarding the tightening torques, please contact the local sales and service representative.

Screws and nuts

Table 1: Stainless steel, A2 and A4, torque Nm (ft-lbs)

Property class	M4	M5	M6	M8	M10	M12	M16	M20	M24	M30
50	1.0 (0.74)	2.0 (1.5)	3.0 (2.2)	8.0 (5.9)	15 (11)	27 (20)	65 (48)	127 (93.7)	220 (162)	434 (320)
70, 80	2.7 (2)	5.4 (4)	9.0 (6.6)	22 (16)	44 (32)	76 (56)	187 (138)	364 (268)	629 (464)	1240 (915)
100	4.1 (3)	8.1 (6)	14 (10)	34 (25)	66 (49)	115 (84.8)	248 (183)	481 (355)	–	–

Table 2: Steel, torque Nm (ft-lbs)

Property class	M4	M5	M6	M8	M10	M12	M16	M20	M24	M30
8.8	2.9 (2.1)	5.7 (4.2)	9.8 (7.2)	24 (18)	47 (35)	81 (60)	194 (143)	385 (285)	665 (490)	1310 (966.2)
10.9	4.0 (2.9)	8.1 (6)	14 (10)	33 (24)	65 (48)	114 (84)	277 (204)	541 (399)	935 (689)	1840 (1357)
12.9	4.9 (3.6)	9.7 (7.2)	17 (13)	40 (30)	79 (58)	136 (100)	333 (245)	649 (480)	1120 (825.1)	2210 (1630)

Hexagon screws with countersunk heads

For hexagon socket head screws with countersunk head, maximum torque for all property classes must be 80% of the values for property class 8.8 above.

6.2 Change the coolant

This image shows the plugs that are used to change the coolant.

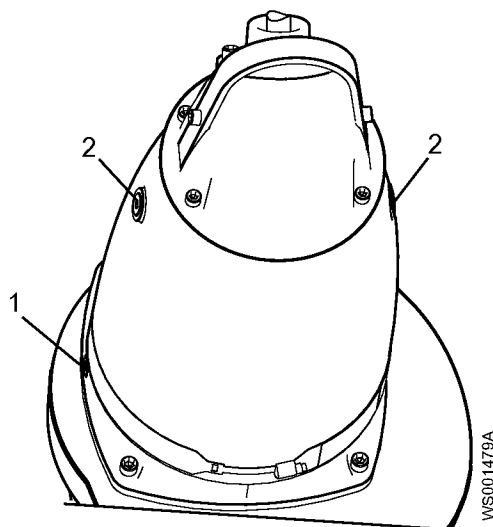


Figure 23: With a cooling jacket

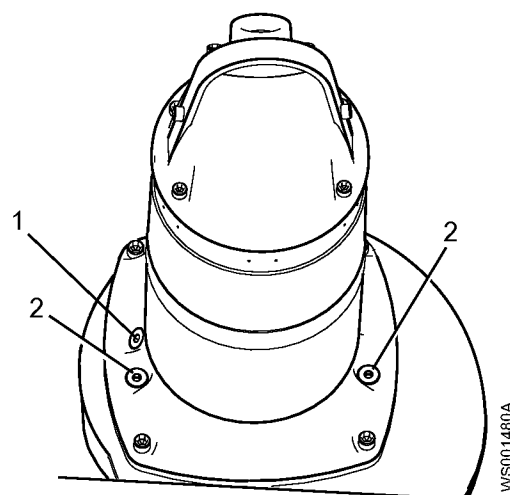


Figure 24: Without a cooling jacket

1. Inspection plug
2. Coolant plugs

6.2.1 Empty the coolant

**CAUTION: Compressed Gas Hazard**

Air inside the chamber may cause parts or liquid to be propelled with force. Be careful when opening. Hold a rag over the plug to prevent liquid from spraying out.

1. Empty the coolant in the inspection chamber:

- a) Remove the inspection plug.

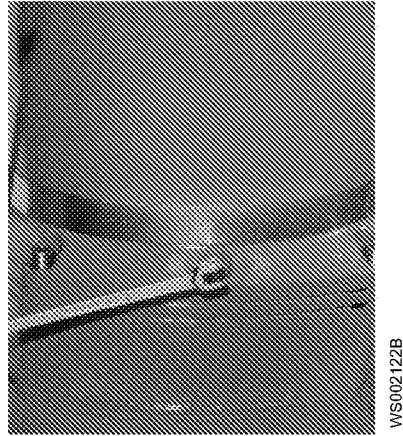


Figure 25: With a cooling jacket

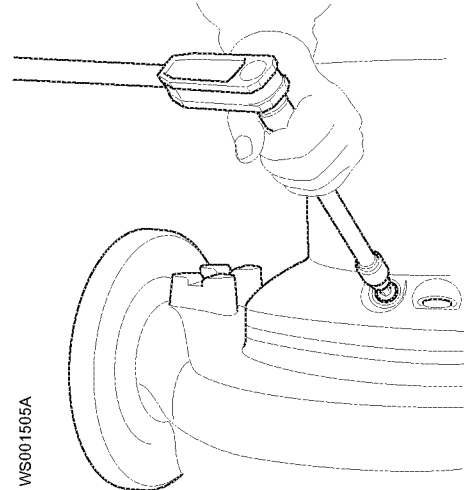


Figure 26: Without a cooling jacket

- b) Pump out any coolant from the inspection chamber, as shown here.

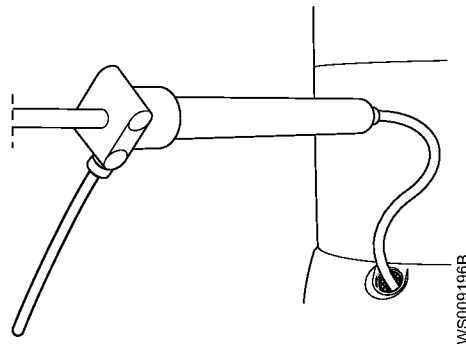


Figure 27: With a cooling jacket

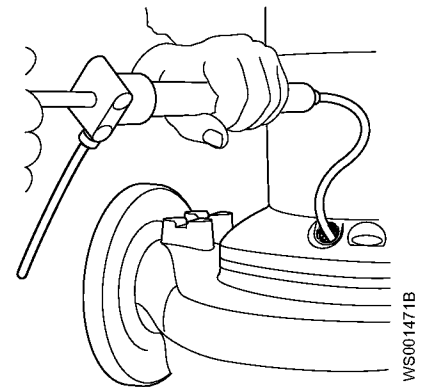
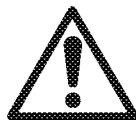


Figure 28: Without a cooling jacket

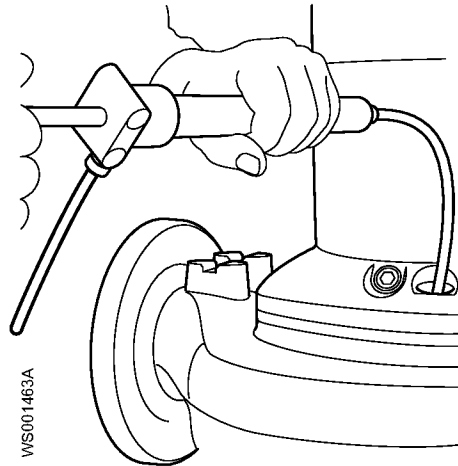
- c) Fit a new O-ring and re-install the inspection plug. Tighten the plug.
Tightening torque: 44 Nm (33 ft-lbs)
2. To empty the coolant with the pump upright, do the following:
This method is applicable only for pumps without cooling jackets.
- a) Remove the coolant plugs.



CAUTION: Compressed Gas Hazard

Air inside the chamber may cause parts or liquid to be propelled with force. Be careful when opening. Hold a rag over the plug to prevent liquid from spraying out.

- b) Use a pump to remove the coolant.



3. If it is necessary to separate the drive unit from the hydraulic unit, then do the following:
 - a) Carefully open the coolant plugs to relieve any built-up pressure inside the cooling jacket.



CAUTION: Compressed Gas Hazard

Air inside the chamber may cause parts or liquid to be propelled with force. Be careful when opening. Hold a rag over the plug to prevent liquid from spraying out.

- b) After venting any built-up pressure in the cooling jacket, re-install the coolant plugs.
 - c) Remove the pump housing screws.
 - d) Remove the drive unit from the pump housing.
-

NOTICE:

Do not allow the weight of the pump to rest on any portion of the impeller. The impeller must not be allowed to make contact with the concrete floor or other hard or rough surfaces.

4. To empty the coolant with the pump in a horizontal position, do the following:
 - a) Place the pump horizontally, so that one of the coolant plugs is at the lowest point of the pump, to ensure that the coolant will drain completely.

It is important to empty all of the coolant.
 - b) Place a container under the pump.
 - c) Remove the coolant plugs and empty the coolant.

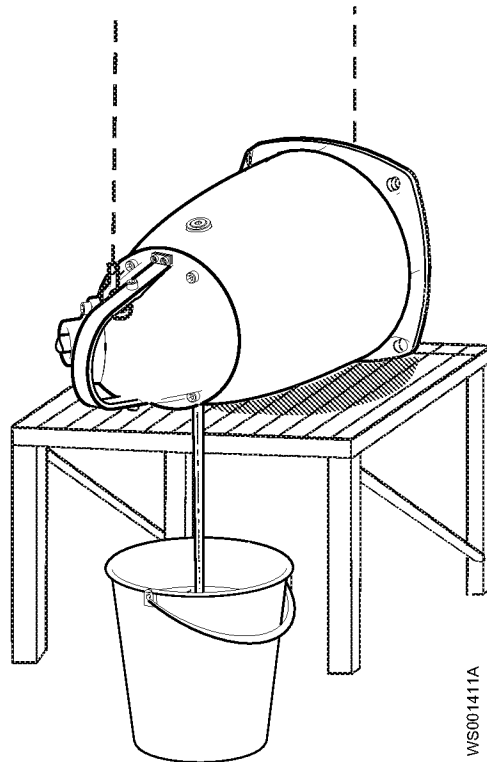


Figure 29: With a cooling jacket

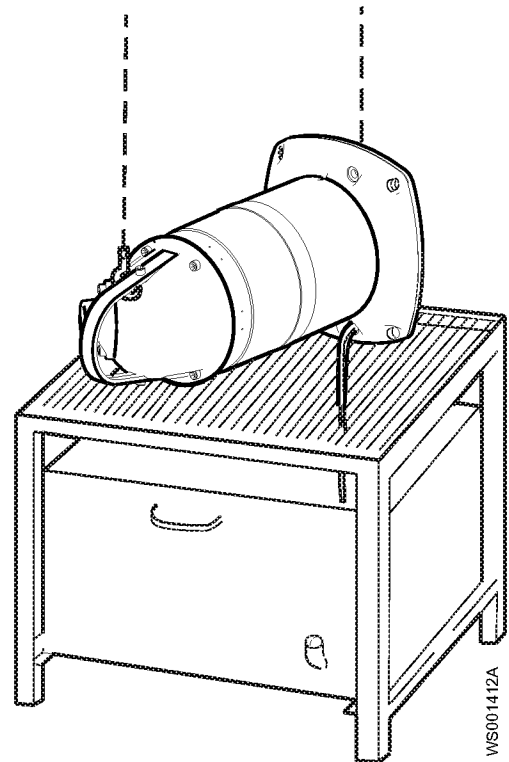


Figure 30: Without a cooling jacket

6.2.2 Fill with coolant

Use a coolant that is a mixture of 70% deionized or distilled water, and 30% DOWCAL 200™ monopropylene glycol. If DOWCAL 200™ from Dow Chemical Company is not available, then contact your local Xylem representative. The monopropylene glycol must fulfill the Xylem material standard M0800.82.0002.

NOTICE:

Deionized or distilled water must be used in the water-glycol mixture.

If the pumped liquid includes potable water or substances to be ingested, then contact your local Xylem sales representative.

1. Fill with coolant until it overflows through the opposite hole, as shown here.

Pump	Quantity, L (qt.)	
	With cooling jacket	Without cooling jacket
3153	10.5 (11.2)	2.2 (2.3)

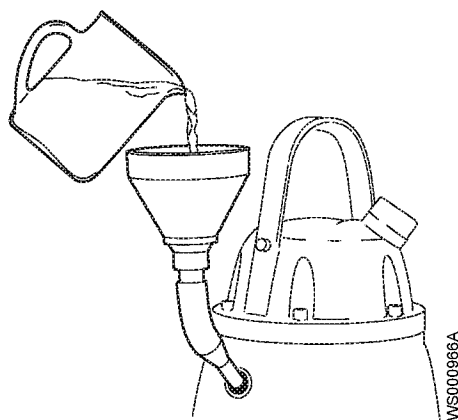


Figure 31: With cooling jacket

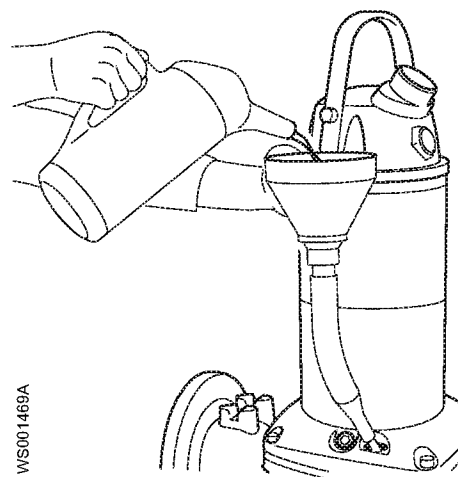


Figure 32: Without cooling jacket

2. Fit new O-rings and re-install the coolant plugs. Tighten the plugs.
Tightening torque: 44 Nm (33 ft-lb)

6.3 Service the pump

Type of service	Purpose	Inspection interval
Initial inspection	A Xylem-authorized personnel checks the pump condition. From the results, the personnel recommends the intervals for the periodical inspection and major overhaul for the installation.	Within the first year of operation.
Periodical inspection	The inspection prevents operational interruptions and machine breakdowns. The measures to increase performance and pump efficiency are decided for each application. They can include such things as impeller trimming, wear part control and replacement, control of zinc-anodes and control of the stator.	Up to 12,000 hours or three years, whichever comes first. Applies to normal applications and operating conditions at media (liquid) temperatures <40°C (104°F).
Major overhaul	The overhaul lengthens the operating lifetime of the product. It includes the replacement of key components and the measures that are taken during an inspection.	Up to 24,000 hours or six years, whichever comes first. Applies to normal applications and operating conditions at media (liquid) temperatures <40°C (104°F).

NOTICE:

Shorter intervals may be required when the operating conditions are extreme, for example with very abrasive or corrosive applications or when the liquid temperatures exceed 40°C (104°F).

6.3.1 Inspection

Service item	Action
Cable	1. If the outer jacket is damaged, replace the cable. 2. Check that the cables do not have any sharp bends and are not pinched.
Connection to power	Check that the connections are properly secured.
Electrical cabinets	Check that they are clean and dry.
Impeller	1. Check the impeller clearance. 2. Adjust the impeller, if necessary.

Service item	Action
Inspection chamber	1. Drain all liquid, if any. 2. Check the resistance of the leakage sensor. Normal value approximately 1200 ohms, alarm approximately 430 ohms.
Insulation	Use a megger maximum 1000 V. 1. Check that the resistance between the ground (earth) and phase lead is more than 5 megohms. 2. Conduct a phase-to-phase resistance check.
Junction box	Check that it is clean and dry.
Level regulators	Check the condition and functionality.
Lifting device	Check that the local safety regulations are followed.
Lifting handle	1. Check the screws. 2. Check the condition of the lifting handle and the chain. 3. If necessary, replace.
O-rings	1. Replace the oil plug O-rings. 2. Replace the O-rings at the entrance or junction cover. 3. Grease the new O-rings.
Overload protection and other protections	Check the correct settings.
Personnel safety devices	Check the guard rails, covers, and other protections.
Rotation direction	Check the impeller rotation.
Seal housing	1. Fill with new coolant, if necessary. 2. Check that the freezing point is lower than -13°C (9°F).
Terminal board	Check that the connections are properly secured.
Thermal contacts	Normally closed circuit; interval 0–1 ohm.
Thermistor	Check the resistance is between 20–250 ohms and the measured voltage is maximum 2 V DC.
Voltage and amperage	Check the running values.

6.3.2 Major overhaul

The basic repair kit includes O-rings, seals, and bearings.

For a major overhaul, do the following in addition to the tasks listed under Inspection.

Service item	Action
Support and main bearing	Replace the bearings with new bearings.
Mechanical seal	Replace with new seal units.

6.3.3 Service in case of alarm

For information about indication values for sensors, see *Sensor connection* (page 31).

Alarm source	Action
FLS10	1. Drain the fluid in the inspection chamber. 2. Check the coolant level. Fill with new coolant if necessary. 3. Check the freezing point (lower than -13°C or 9°F). Check the inspection chamber again after one week of operation. If leakage has occurred, then do the following: 1. Drain the fluid. 2. Change the mechanical seal unit. 3. Replace with new coolant.

Alarm source	Action
The thermistor/Thermal contact	1. Check the coolant level (pump with cooling jacket). 2. Check the start and stop levels.
The overload protection	Check that the impeller can rotate freely.

6.4 Replace the impeller

Required tools:

- 12 mm hexagon bit adapter with an extension of at least a 100 mm (4 in)
- Rod (wood or plastic) for locking the impeller in place



CAUTION: Cutting Hazard

Worn parts can have sharp edges. Wear protective clothing.

NOTICE:

When laying the pump on its side, do not allow the weight of the pump to rest on any portion of the impeller. The impeller must not be allowed to make contact with the concrete floor or other hard and rough surfaces.

NOTICE:

If you fail with the impeller installation, you must redo the installation procedure from the beginning.

6.4.1 Replace the impeller for wet installation

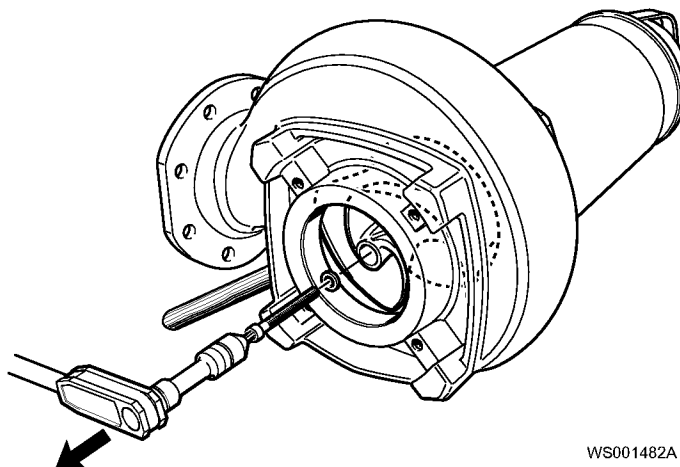
6.4.1.1 Remove the impeller: wet installation



CAUTION: Cutting Hazard

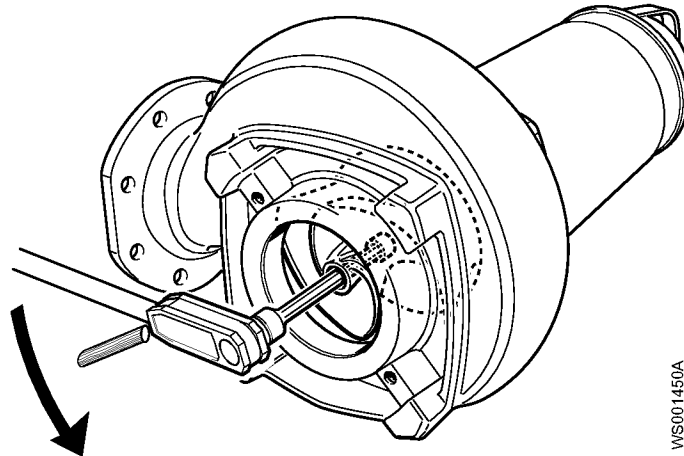
Sharp edges. Wear protective clothing.

1. Place the pump in a horizontal position.
2. Remove the impeller:
 - a) Remove the flush valve cover and its O-ring.
 - b) Lock the impeller in place by inserting a rod through the hole.
 - c) Remove the impeller screw.

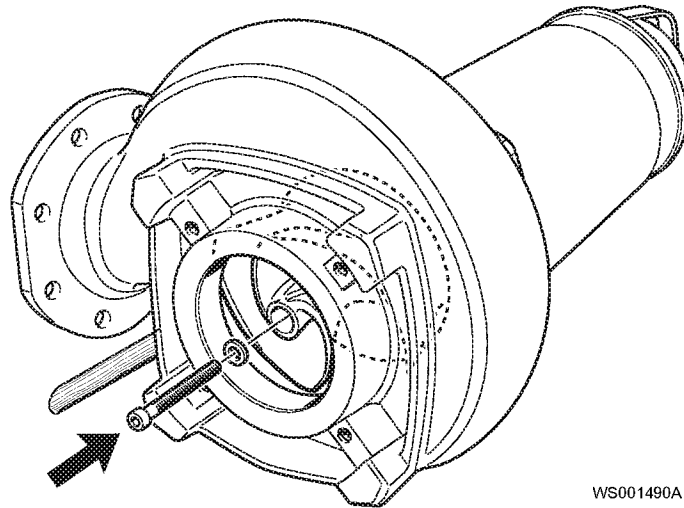


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- d) Turn the adjustment screw counterclockwise until the impeller breaks free from the shaft.



e) Hand-tighten the impeller screw to prevent it from falling off.

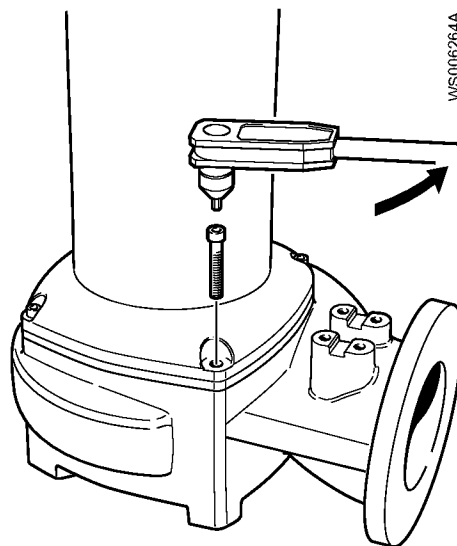


f) Remove the rod.

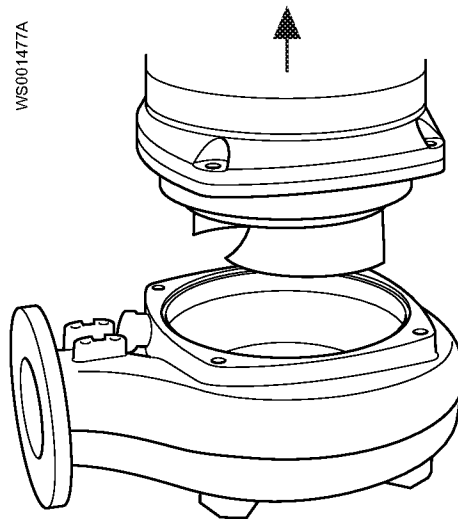
3. Raise the pump.

4. Remove the drive unit from the pump housing:

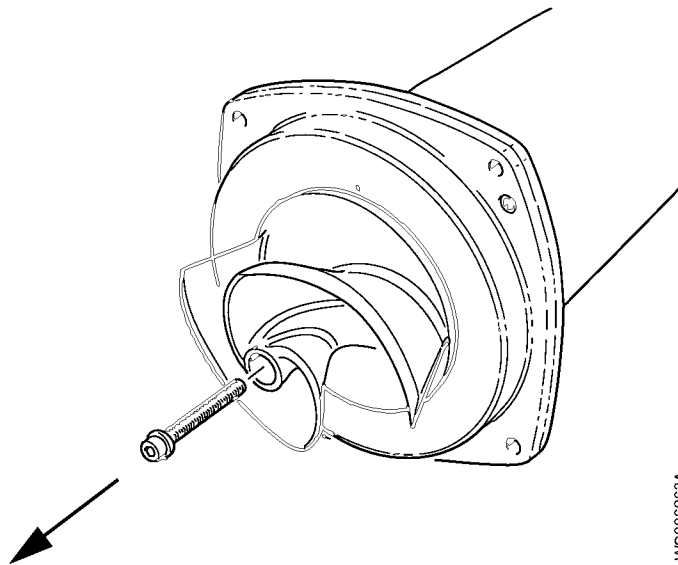
a) Remove the pump housing screws.



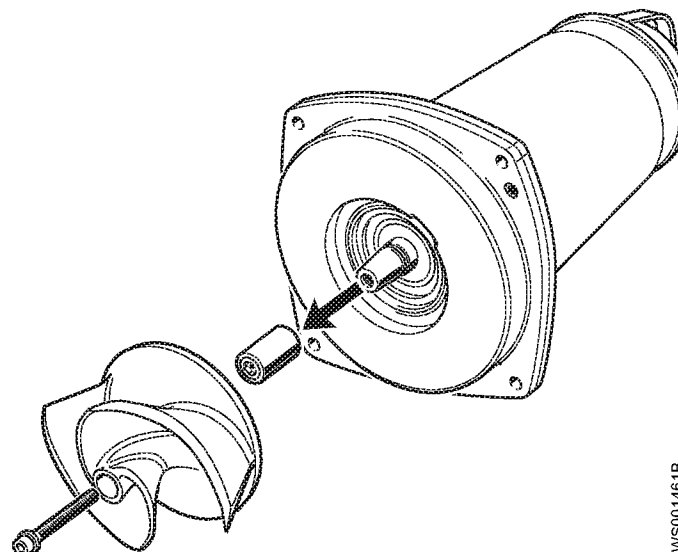
b) Remove the drive unit from the pump housing.



5. Remove the impeller:
- Place the drive unit horizontally.
 - Remove the impeller screw.



- Remove the impeller and the conical sleeve.



6.4.1.2 Install the impeller: wet installation

1. Prepare the shaft:

- a) Polish off any flaws with a fine emery cloth.

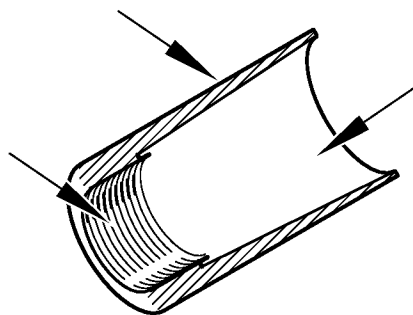
The end of the shaft must be clean and free from burrs.

- b) Coat the inner conic, the outer cylindrical surfaces, and the thread of the conical sleeve with a thin layer of grease.

The proper lubrication is grease for bearings, for example Exxon Mobil Unirex N3, Mobil Mobilith SHC 220 or equivalent.

NOTICE:

Surplus grease can cause the impeller to become loose. Remove surplus grease from conical and/or cylindrical surfaces of shafts and/or sleeves.



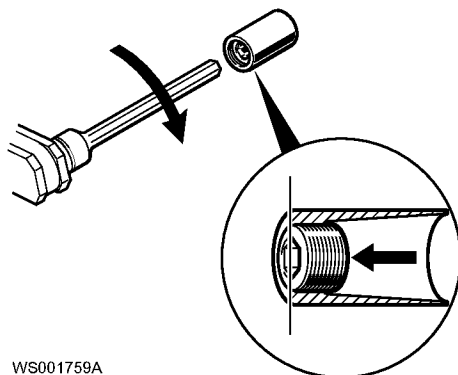
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2. Mount the impeller:

- a) Lubricate the threads of the impeller screw and the washer.

Always use a new impeller screw.

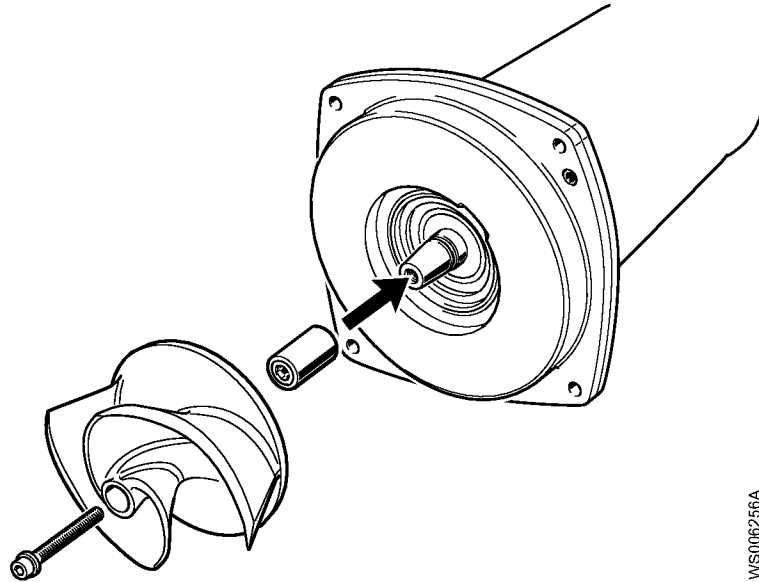
- b) Adjust the adjustment screw so that it is flush with the sleeve.



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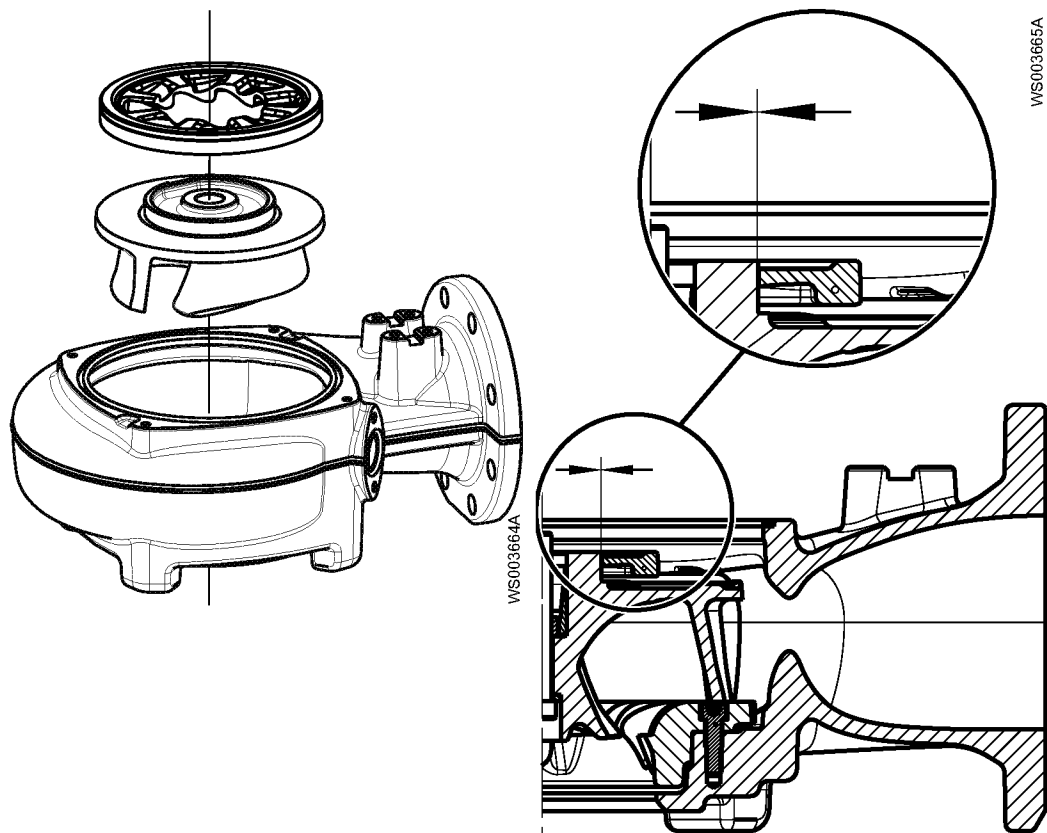
- c) Fit the sleeve and impeller to the shaft.

- d) Hand-tighten the impeller screw to prevent it from falling off.



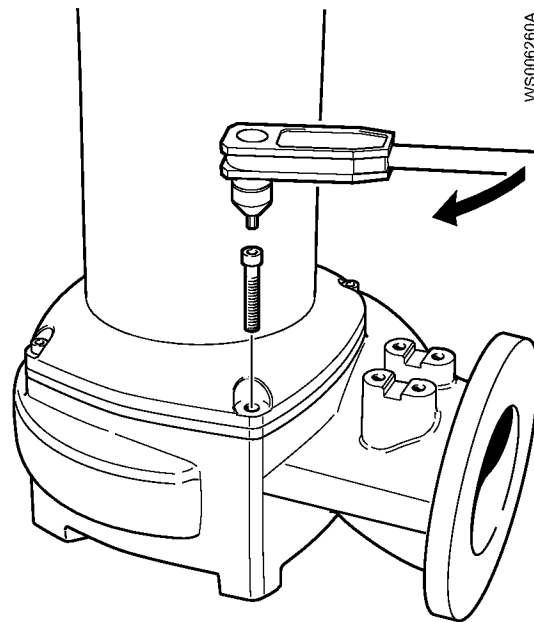
3. If applicable, check that the clearance between the impeller and the insert ring is maximum 1 mm (0.04 in) radial. If not, send the pump for service.

The insert ring is pressed into the seal housing cover.

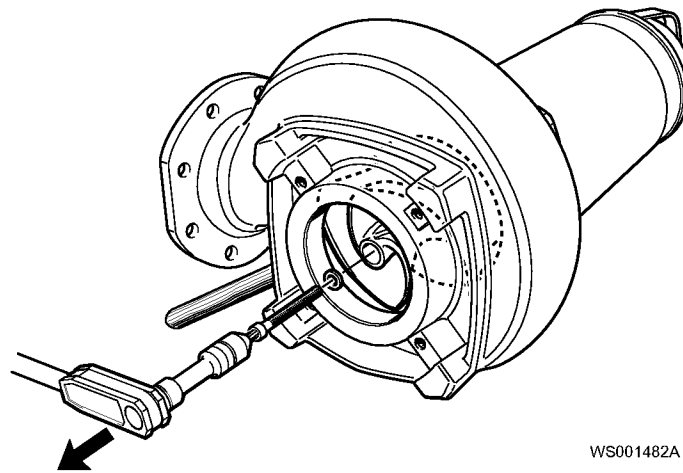


4. Fit the pump housing:
- Fit a new and lubricated O-ring on the seal housing cover.
 - Lubricate the pump housing screws.
 - Raise the drive unit.
 - Place the drive unit into the pump housing.
 - Adjust its position so that the inspection hole is on the same side as the flush valve.
 - Tighten the screws in diagonal sequence.

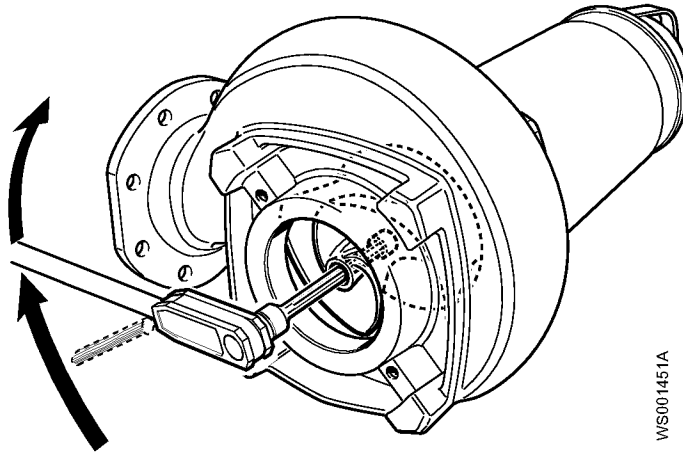
For tightening torque, see *Torque values* (page 37).



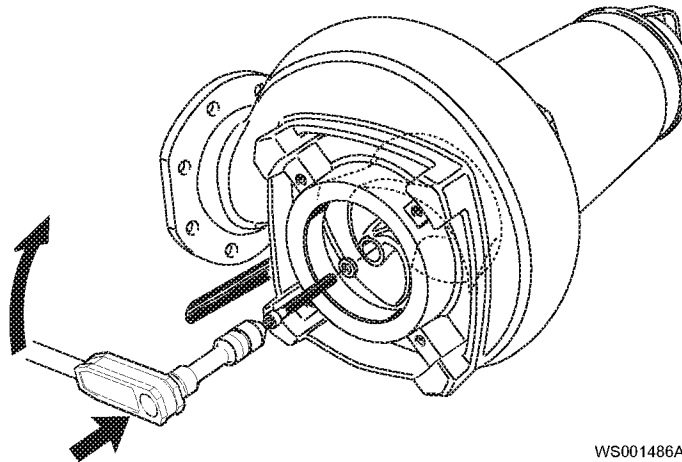
5. Remove the impeller screw:
 - a) Place the pump horizontally.
 - b) Lock the impeller in place by inserting a rod through the hole.
 - c) Remove the impeller screw and the washer.



6. Adjust the impeller:
 - a) Using a hexagon-bit adapter, turn the adjustment screw clockwise until the impeller makes contact with the pump housing.
For tightening torque, see *Torque values* (page 37).
 - b) Tighten it a further 1/8 turn (45°).



7. Fasten the impeller:
- Fit the lubricated washer and impeller screw.
 - Tighten the impeller screw.
For tightening torque, see *Torque values* (page 37).
 - Tighten it a further 1/8 turn (45°).

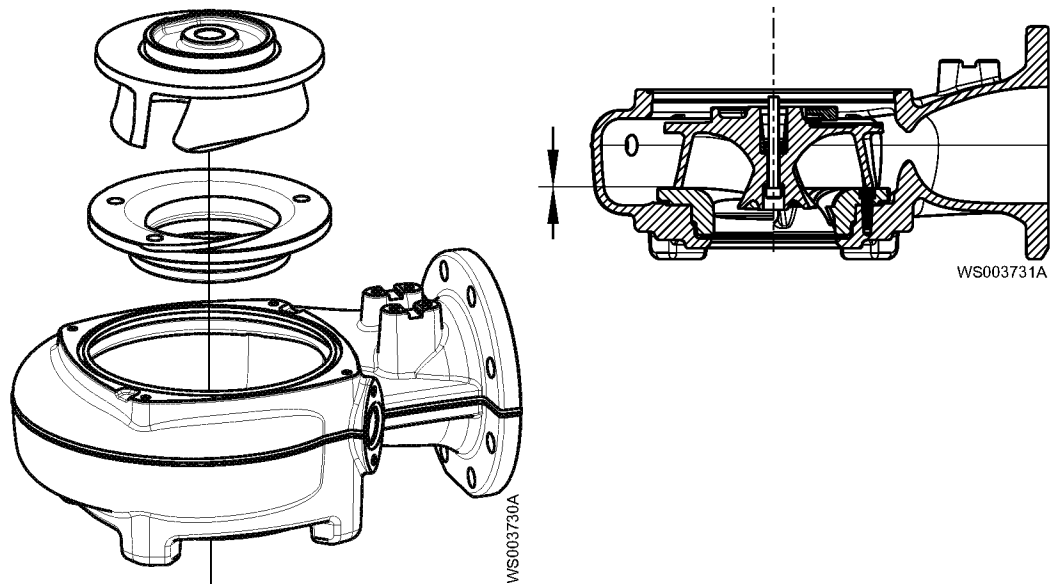


- Remove the rod that is used to lock the impeller.
- Fit the O-ring and flush valve cover and fasten it with screws.
For tightening torque, see *Torque values* (page 37).
- Check that the impeller can rotate freely.

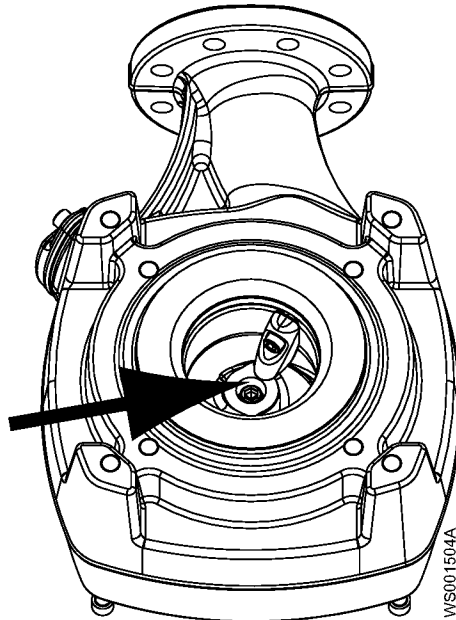
**WARNING: Crush Hazard**

Beware of the pinch point hazard between the rotating impeller and the guide pin.

8. Check that the clearance between the impeller and the insert ring is 0.1–0.5 mm (0.004–0.02 in).



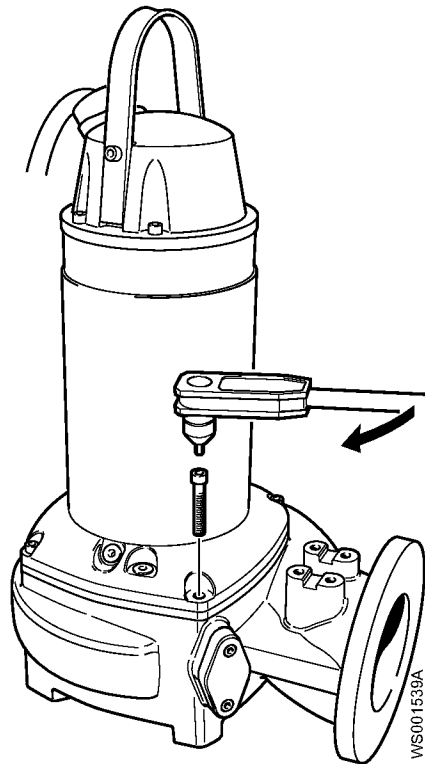
9. If applicable, adjust the clearance to 0.1–0.5 mm (0.004–0.02 in) between the guide pin and the impeller.



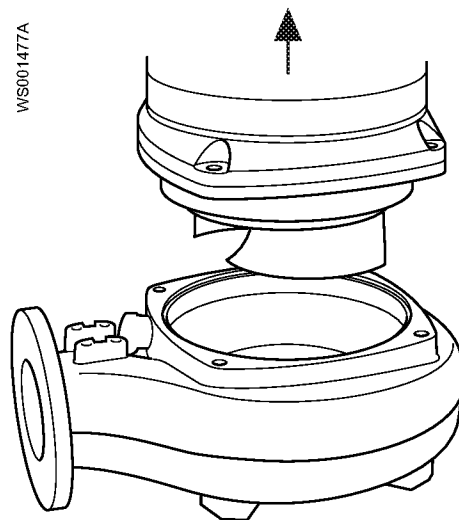
6.4.2 Replace the impeller for dry installation

6.4.2.1 Remove the impeller: dry installation

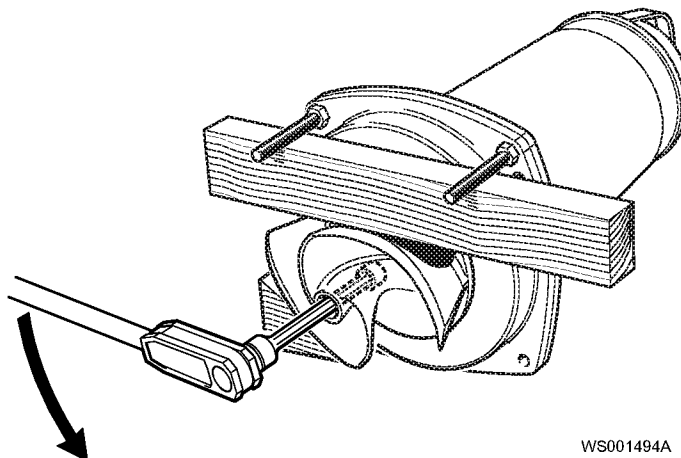
1. Remove the drive unit from the pump housing:
 - a) Remove the pump housing screws.



b) Remove the drive unit from the pump housing.

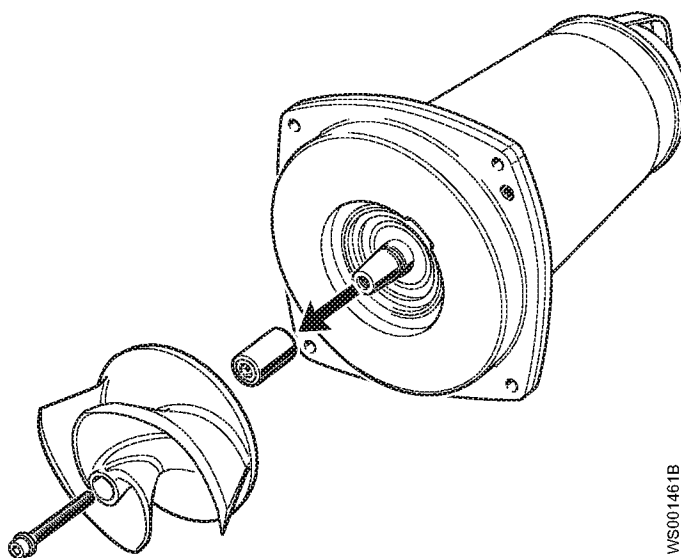


2. Remove the impeller:
 - a) Place the drive unit horizontally.
 - b) Lock the impeller as shown in the figure.
 - c) Remove the impeller screw.



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- d) Turn the adjustment screw counterclockwise until the impeller breaks free from the shaft.
- e) Remove the impeller and the conical sleeve.



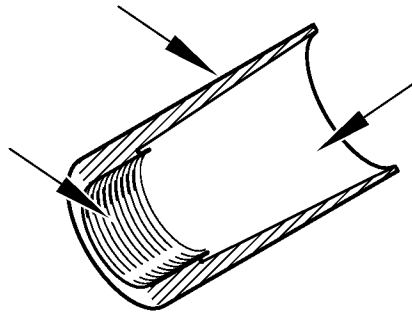
WS001461B

6.4.2.2 Install the impeller: dry installation

1. Prepare the shaft:
 - a) Polish off any flaws with a fine emery cloth.
The end of the shaft must be clean and free from burrs.
 - b) Coat the inner conic, the outer cylindrical surfaces, and the thread of the conical sleeve with a thin layer of grease.
The proper lubrication is grease for bearings, for example Exxon Mobil Unirex N3, Mobil Mobilith SHC 220 or equivalent.

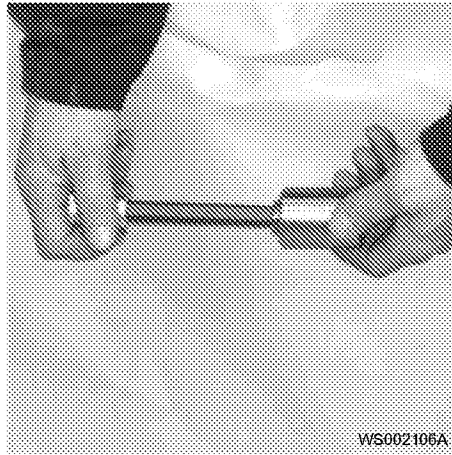
NOTICE:

Surplus grease can cause the impeller to become loose. Remove surplus grease from conical and/or cylindrical surfaces of shafts and/or sleeves.

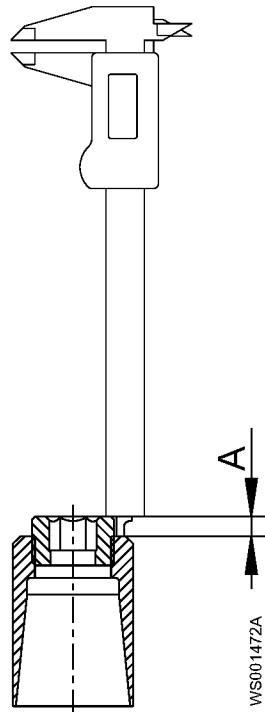


2. Mount the impeller:

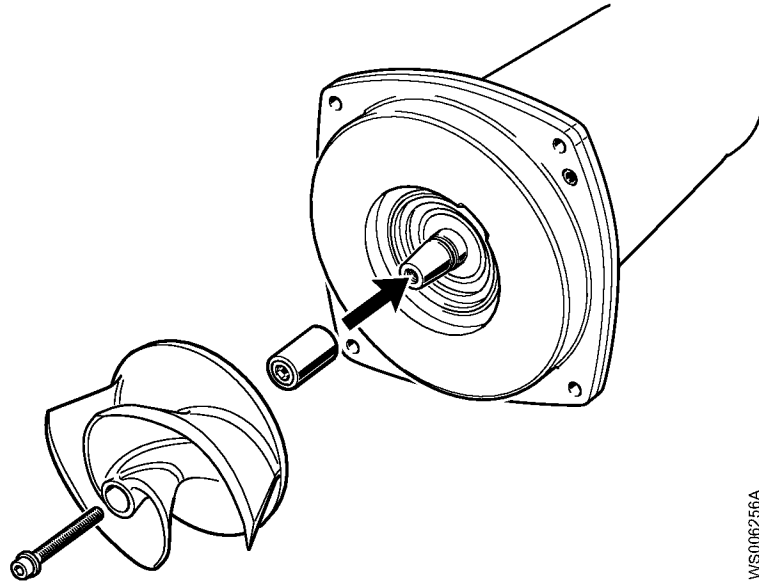
- a) Lubricate the threads of the impeller screw and the washer.
Always use a new impeller screw.
- b) Unscrew the adjustment screw approximately 5 mm (0.2 in.).



- c) Measure and note the distance A.

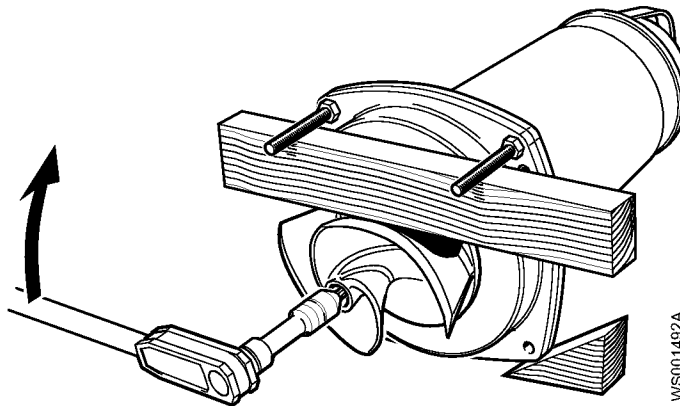


- d) Fit the sleeve and the impeller to the shaft.



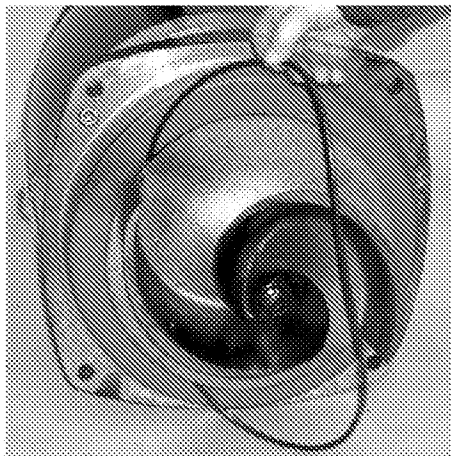
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e) Fit the impeller screw and washer and tighten.



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3. Make sure that the O-ring is removed from the seal housing cover.

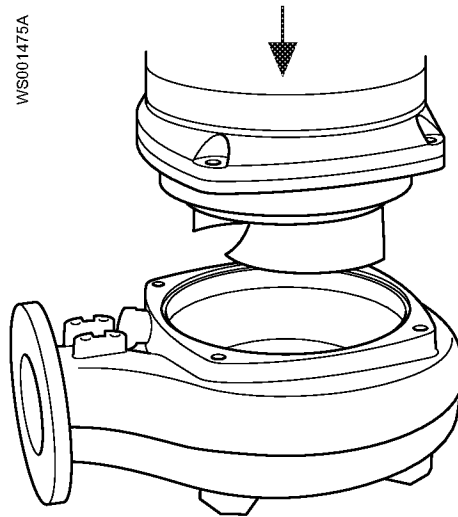


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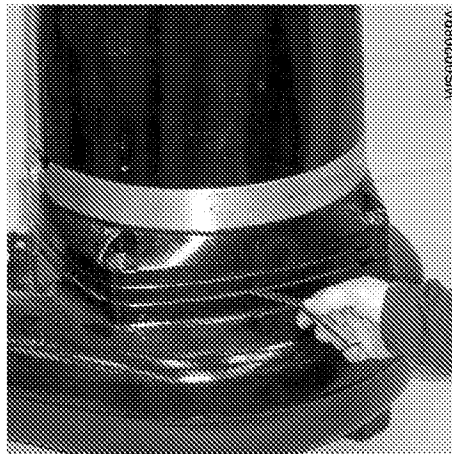
4. Measure the trim distance:

a) Place the drive unit in the pump housing.

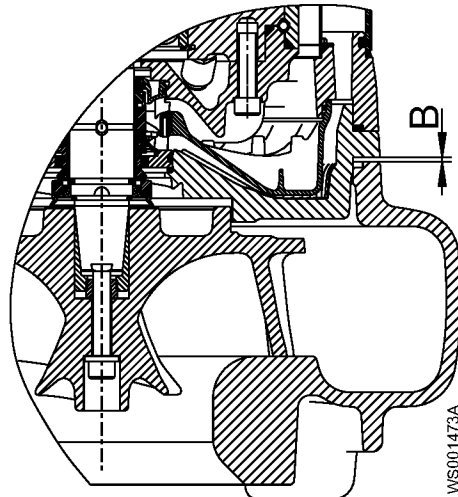
Make sure that the drive unit is parallel with the pump housing by hand-tightening the pump housing screws.



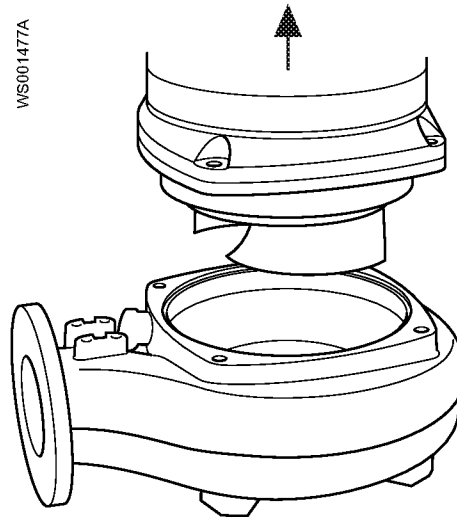
- b) Check the distance between the seal housing cover and the pump housing with a feeler gauge.
Check diagonally at four points.



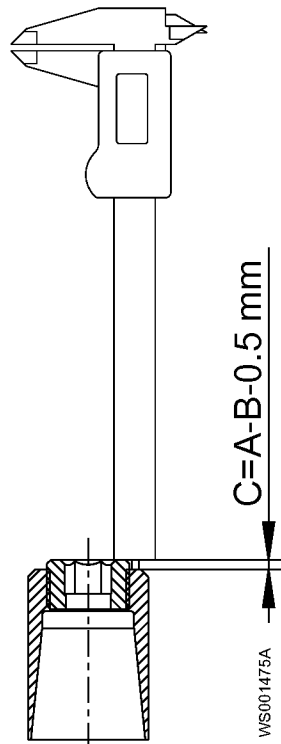
- c) Note the largest distance B.



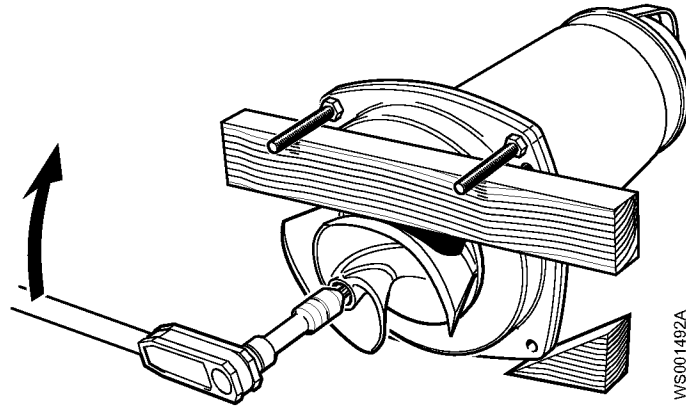
- d) Lift the drive unit out of the pump housing and remove the impeller and conical sleeve.



5. Trim to the correct distance:
 - a) Calculate the measure C according to the formula shown in the image.

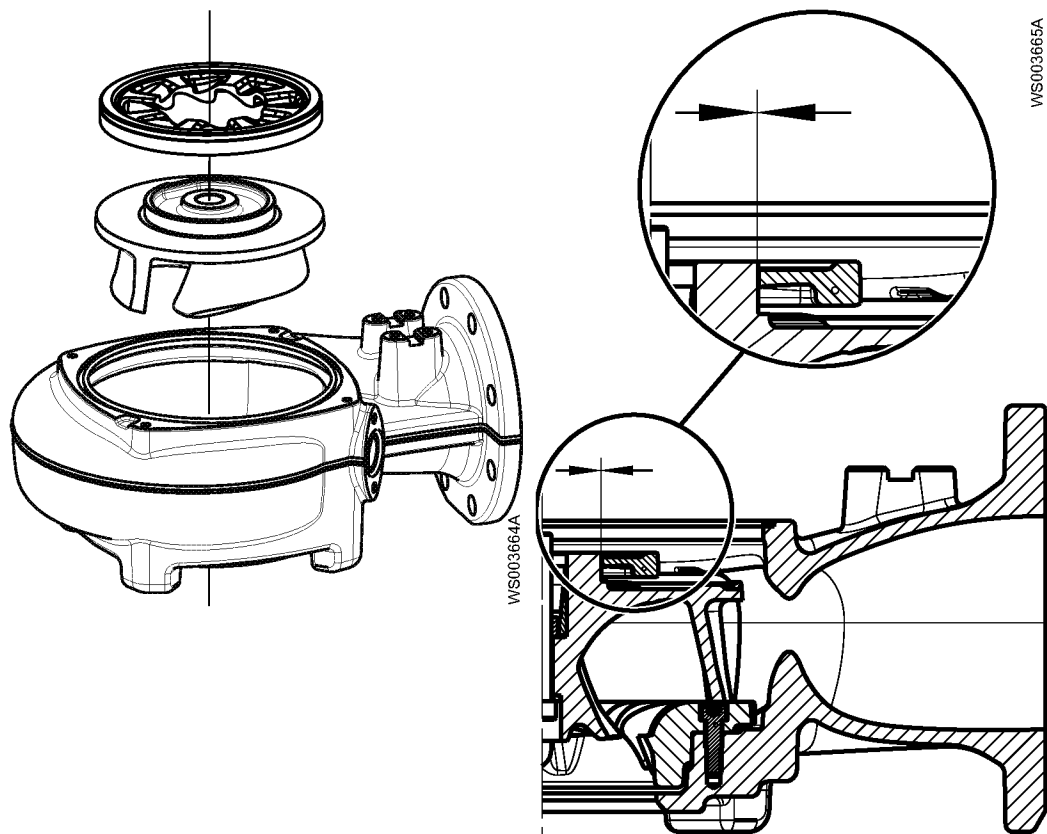


- b) Turn the adjustment screw until C is reached.
6. Fasten the impeller:
 - a) Fit the sleeve, impeller, lubricated washer with a lubricated impeller screw.
 - b) Tighten the impeller screw.
For tightening torque, see *Torque values* (page 37).
 - c) Tighten it further 1/8 turn (45°).

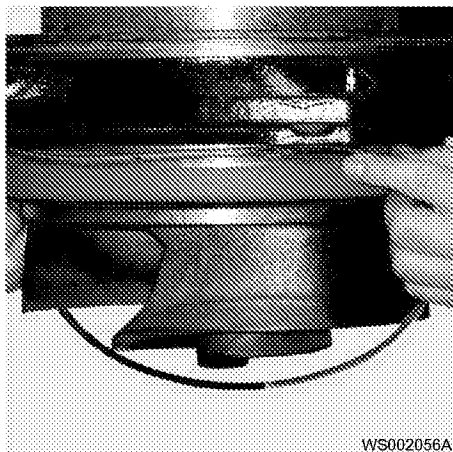


7. If applicable, check that the clearance between the impeller and the insert ring is maximum 1 mm (0.04 in.) radial. If not, send the pump for service.

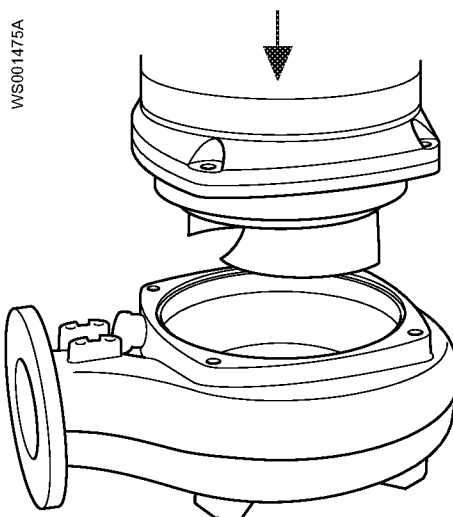
The insert ring is pressed into the seal housing cover.



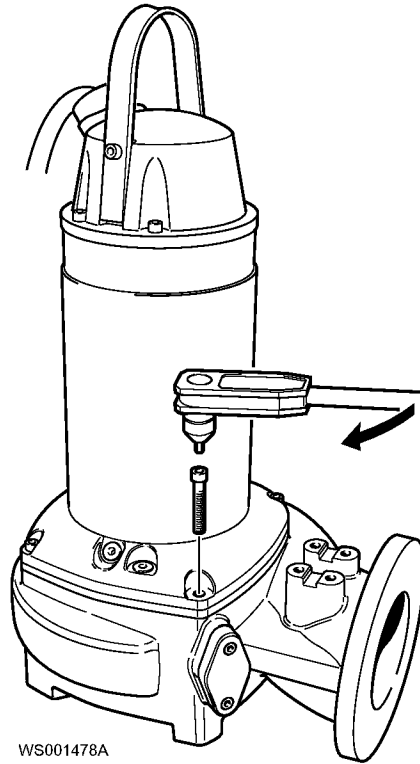
8. Install the drive unit in the pump housing:
- Fit a new and lubricated O-ring to the seal housing cover.



- b) Place the drive unit in the pump housing.



- c) Adjust the position of the drive unit so that the inspection hole is on the same side as the flush valve.
- d) Tighten the lubricated screws diagonally.
- For tightening torque, see *Torque values* (page 37).



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If you need to adjust the impeller, redo the replace the impeller procedure from the beginning.

7 Troubleshooting

Introduction



DANGER: Electrical Hazard

Troubleshooting a live control panel exposes personnel to hazardous voltages. Electrical troubleshooting must be done by a qualified electrician.

Follow these guidelines when troubleshooting:

- Disconnect and lock out the power supply except when conducting checks that require voltage.
- Make sure that no one is near the unit when the power supply is reconnected.
- When troubleshooting electrical equipment, use the following:
 - Universal instrument multimeter
 - Test lamp (continuity tester)
 - Wiring diagram

7.1 The pump does not start



DANGER: Crush Hazard

Moving parts can entangle or crush. Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.



WARNING: Electrical Hazard

The permanent-magnet motor generates voltage when the shaft rotates, even if power sources are disconnected. Never perform any electrical work if the shaft could rotate.

NOTICE:

Do NOT override the motor protection repeatedly if it has tripped. Doing so may result in equipment damage.

Cause	Remedy
An alarm signal has been triggered on the control panel.	Check that: • The impeller rotates freely. • The sensor indicators do not indicate an alarm. • The overload protection is not tripped. If the problem still persists: Contact the local sales and service representative.
The pump does not start automatically, but can be started manually.	Check that: • The start level regulator is functioning. Clean or replace if necessary. • All connections are intact. • The relay and contactor coils are intact. • The control switch (Man/Auto) makes contact in both positions. Check the control circuit and functions.

Cause	Remedy
The installation is not receiving voltage.	Check that: • The main power switch is on. • There is control voltage to the start equipment. • The fuses are intact. • There is voltage in all phases of the supply line. • All fuses have power and that they are securely fastened to the fuse holders. • The overload protection is not tripped. • The motor cable is not damaged.
The impeller is stuck.	Clean: • The impeller • The sump in order to prevent the impeller from clogging again.

Always state the serial number of your product, see *Product Description* (page 10).

7.2 The pump does not stop when a level sensor is used



DANGER: Crush Hazard

Moving parts can entangle or crush. Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.



WARNING: Electrical Hazard

The permanent-magnet motor generates voltage when the shaft rotates, even if power sources are disconnected. Never perform any electrical work if the shaft could rotate.

Cause	Remedy
The pump is unable to empty the sump to the stop level.	Check that: • There are no leaks from the piping and/or discharge connection. • The impeller is not clogged. • The non-return valve(s) are functioning properly. • The pump has adequate capacity. For information: Contact the local sales and service representative.
There is a malfunction in the level-sensing equipment.	• Clean the level regulators. • Check the functioning of the level regulators. • Check the contactor and the control circuit. • Replace all defective items.
The stop level is set too low.	Raise the stop level.

Always state the serial number of your product, see *Product Description* (page 10).

7.3 The pump starts-stops-starts in rapid sequence

Cause	Remedy
The pump starts due to back-flow which fills the sump to the start level again.	Check that: • The distance between the start and stop levels is sufficient. • The non-return valve(s) work(s) properly. • The length of the discharge pipe between the pump and the first non-return valve is sufficiently short.

Cause	Remedy
The self-holding function of the contactor malfunctions.	Check: • The contactor connections. • The voltage in the control circuit in relation to the rated voltages on the coil. • The functioning of the stop-level regulator. • Whether the voltage drop in the line at the starting surge causes the contactor's self-holding malfunction.

Always state the serial number of your product, see *Product Description* (page 10).

7.4 The pump runs but the motor protection trips



DANGER: Crush Hazard

Moving parts can entangle or crush. Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.



WARNING: Electrical Hazard

The permanent-magnet motor generates voltage when the shaft rotates, even if power sources are disconnected. Never perform any electrical work if the shaft could rotate.

NOTICE:

Do NOT override the motor protection repeatedly if it has tripped. Doing so may result in equipment damage.

Cause	Remedy
The motor protection is set too low.	Set the motor protection according to the data plate and if applicable the cable chart.
The impeller is difficult to rotate by hand.	• Clean the impeller. • Clean out the sump. • Check that the impeller is properly trimmed.
The drive unit is not receiving full voltage on all three phases.	• Check the fuses. Replace fuses that have tripped. • If the fuses are intact, then notify a certified electrician.
The phase currents vary, or they are too high.	Contact the local sales and service representative.
The insulation between the phases and ground in the stator is defective.	1. Use an insulation tester. With a 1000 V DC megger, check that the insulation between the phases and between any phase and ground is > 5 megaohms. 2. If the insulation is less, then do the following: Contact the local sales and service representative.
The density of the pumped fluid is too high.	Make sure that the maximum density is 1100 kg/m ³ (9.2 lb/US gal) • Change the impeller, or • Change to a more suitable pump • Contact the local sales and service representative.
There is a malfunction in the overload protection.	Replace the overload protection.

Always state the serial number of your product, see *Product Description* (page 10).

7.5 The pump delivers too little or no water



DANGER: Crush Hazard

Moving parts can entangle or crush. Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.



WARNING: Electrical Hazard

The permanent-magnet motor generates voltage when the shaft rotates, even if power sources are disconnected. Never perform any electrical work if the shaft could rotate.

NOTICE:

Do NOT override the motor protection repeatedly if it has tripped. Doing so may result in equipment damage.

Cause	Remedy
The impeller rotates in the wrong direction.	• If it is a 3-phase pump, then transpose two phase leads. • If it is a 1-phase pump, then do the following: Contact the local sales and service representative.
One or more of the valves are set in the wrong positions.	• Reset the valves that are set in the wrong position. • Replace the valves, if necessary. • Check that all valves are correctly installed according to media flow. • Check that all valves open correctly.
The impeller is difficult to rotate by hand.	• Clean the impeller. • Clean out the sump. • Check that the impeller is properly trimmed.
The pipes are obstructed.	To ensure a free flow, clean out the pipes.
The pipes and joints leak.	Find the leaks and seal them.
There are signs of wear on the impeller, pump, and casing.	Replace the worn parts.
The liquid level is too low.	• Check that the level sensor is set correctly. • Depending on the installation type, add a means for priming the pump, such as a foot valve.

Always state the serial number of your product, see *Product Description* (page 10).

8 Technical Reference

8.1 Application limits

Data	Description
Liquid temperature	40°C (104°F) maximum For P- and S-installations without a cooling jacket, the pump can be operated only when the sump level is at least 10 mm above the stator housing. Warm-liquid version: 70°C (158°F) maximum Warm-liquid version must have cooling jacket.
pH of the pumped media (liquid)	5.5–14
Liquid density	1100 kg/m ³ (9.2 lb per US gal) maximum
Depth of immersion	Maximum 20 m (65 ft)
Other	For the specific weight, current, voltage, power ratings, and speed of the pump, see the data plate of the pump.

8.2 Motor data

Feature		Description
Motor type	Versions .091, .095, .181, .185, .350, .390, .660, .670	Squirrel-cage induction motor
	Versions .800, .810, .820, .830, .840, .850	- Squirrel-cage induction motor - Line-started, permanent-magnet synchronous motor
	Versions .860, .870	Line-started, permanent-magnet synchronous motor
Frequency		50 Hz or 60 Hz
Supply		3-phase
Starting method		- Direct on-line - Star-delta - Soft starter - Variable Frequency Drive (VFD)
Maximum starts per hour		30 evenly spaced starts per hour
Code compliance		IEC 60034-1
Voltage variation without overheating		±10%, if it does not run continuously at full load
Voltage imbalance tolerance		2%
Stator insulation class		H (180°C [360°F])

Motor encapsulation

Motor encapsulation is in accordance with IP68.

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- 1) The tissue in plants that brings water upward from the roots
- 2) A leading global water technology company

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