xylem
Let's Solve Water

Installation, Operation, and
Maintenance Manual

882901_15.0

P7030, P7035, P7040

FLYGT
a xylem brand

Table of Contents

1 Introduction and Safety

1.1 Introduction

Purpose of the manual

The purpose of this manual is to provide the 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 equipment must never run dry during operation. The volute must be filled with liquid during 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.
- 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 original Xylem spare parts that are provided by an Ex-approved Xylem representative.
- The thermal contacts that are fitted to the stator windings must be connected correctly to a separate motor control circuit and in use. The thermal contacts shall be connected to a monitoring device, which disconnects the power supply immediately upon activation. This action prevents the rise of temperatures above the temperature value for the approval classification.
- The width of flameproof joints is more than the values specified in the tables of the EN/IEC 60079-1 standard. For information contact the manufacturer.
- The gap of flameproof joints is less than the values specified in Table 2 of the EN/IEC 60079-1 standard. For information contact the manufacturer.
- It is NOT allowed to repair the flameproof joints.

ATEX and IECEx

Pump	Minimum Ambient Temperature	Maximum Ambient Temperature
7020	–20°C	60°C
7030, 7035, 7040	–20°C	60°C

FM

Pump	Maximum Ambient Temperature
7020	40°C
7030, 7035, 7040	40°C

Fasteners

The screws used for the assembly of the various parts of explosion-proof enclosures must be of quality higher than or equal to A4–80.

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. Examples of condition-monitoring devices include, but are not limited to, the following:

- Level indicators
- Temperature detectors in addition to the stator thermal detectors

Any thermal detectors or thermal protection devices delivered with the pump must be installed and in use at all times.

The site owner is responsible for selection, installation, and proper maintenance of functional monitoring equipment for motor protection.

1.5 Special hazards

1.5.1 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.

1.5.2 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.
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

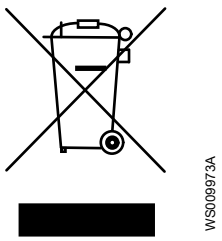
CAUTION: Radiation Hazard

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 End of life product disposal

Handle and dispose of all waste in compliance with local laws and regulations.

Correct disposal of this product — WEEE Directive on waste electrical and electronic equipment



This marking on the product, accessories or literature indicates that the product should not be disposed of with other waste at the end of its working life.

To prevent possible harm to the environment or human health from uncontrolled waste disposal, please separate these items from other types of waste and recycle them responsibly to promote the sustainable reuse of material resources.

Waste from electrical and electronic equipment can be returned to the producer or distributor.

1.8 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.

1.9 Warranty

For information about warranty, see the sales contract.

2 Transportation and Storage

2.1 Examine the delivery

2.1.1 Examine the package

1. Examine the package for damaged or missing items upon delivery.
2. Record any damaged or missing items on the receipt and freight bill.
3. If anything is out of order, then file a claim with the shipping company.

   If the product has been picked up at a distributor, make a claim directly to the distributor.

2.1.2 Examine the unit

1. Remove packing materials from the product.

   Dispose of all packing materials in accordance with local regulations.
2. To determine whether any parts have been damaged or are missing, examine the product.
3. If applicable, unfasten the product by removing any screws, bolts, or straps.

   Use care around nails and straps.
4. If there is any issue, then contact a sales representative.

2.2 Transportation guidelines

2.2.1 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 correctly fastened during transportation, and cannot roll or fall over.

2.2.2 Lifting

Always inspect the lifting equipment and tackle before starting any work.

WARNING: Crush Hazard

Always lift the unit by its designated lifting points.

Use suitable lifting equipment and ensure that the product is properly harnessed.

Wear personal protective equipment.

Stay clear of cables and suspended loads.

NOTICE:

Never lift the unit by its cables or hose.

Lifting equipment

Lifting equipment is always required to handle the unit. The lifting equipment must fulfill the following requirements:

- The minimum height between the lifting hook and the floor must be sufficient to lift the unit. Contact a Xylem representative for more information.
- 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 correctly anchored and in good condition.
- The lifting equipment must support the weight of the entire assembly. Only authorized personnel may use the lifting equipment.
- 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

Improperly-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 (–58ºF) to +60°C (+140ºF).

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.

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.

Water-glycol mixtures: Units equipped with an internal closed-loop 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.

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.

Long-term storage

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

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

3 Product Description

3.1 Products included

Pump model	Standard	EX
7030.090		X
7030.180	X	
7035.090		X
7035.180	X	
7040.090		X
7040.180	X	

3.2 Pump design

Intended Use

The product is intended for moving wastewater, sludge, raw and clean water. Always follow the limits that are given in *Application limits* on page 84. If there is a question regarding the intended use of the equipment, then contact a Xylem 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 rated explosion-proof or intrinsically-safe, then see the specific explosion-proof information in the safety chapter before taking any further actions.

NOTICE:

Do NOT use the unit in highly corrosive liquids.

3.3 Parts

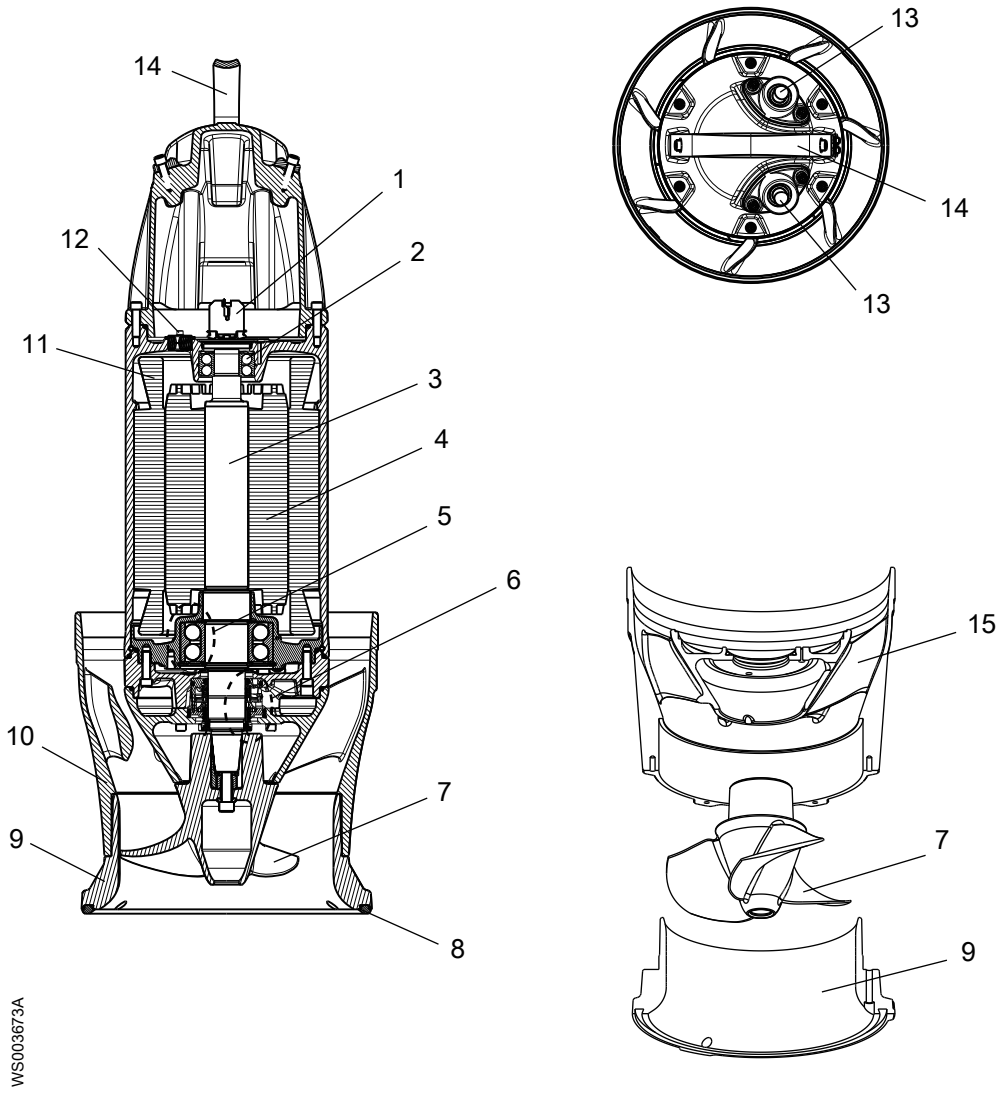


Figure 1: Section view, top view and exploded view of hydraulic parts.

Position	Part	Description
1	Terminal board	
2	Support bearing	Two-row ball bearing
3	Shaft	Stainless steel, with an integrated rotor
4	Rotor	
5	Main bearings	Two-row angular contact ball bearing in O-arrangement
6	Mechanical seals	Inner and outer mechanical seals
–	Seal housing	The housing acts as a buffer between the pumped fluid and the electric motor. It includes: • Inner and outer seals • An oil that lubricates the seals
7	Propeller	
8	Seal ring	
9	Bellmouth	With integrated relief groove
10	Pump housing	

Position	Part	Description
11	Stator	Equipped with temperature sensors in windings
12	Electrical lead-through unit	
13	Cable entry	
14	Lifting handle	
15	Guide vanes	

Spare part requirements

The following applies when servicing or repairing the pump:

- 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, please contact your local sales and service representative.

3.4 Monitoring equipment

The following monitoring systems can be used:

- MiniCAS II
- MAS 801
- MAS 711

MiniCAS II This is the most-basic alternative. MiniCAS II can protect the pump against the following:

- Over-temperature in the stator windings
- Leakage in the inspection chamber

MAS 711 This is a more advanced system, and is used when more monitoring channels are required.MAS 711 requires a separate signal cable, with 12 or 24 leads.

MAS 801 This is the most advanced monitoring system. With the MAS 801, the analog signals from the sensor are converted to digital signals inside the pump. The digitalized monitoring signals are transmitted using the control cores in the SUBCAB™ power cables. This allows a broad range of sensor signals, and eliminates the need for a separate signal cable.

Ex-proof pumps

Ex-proof pumps must have the thermal contacts or the thermistors connected to the control panel.

The sensors must be connected to either of the Flygt monitoring relays or an equivalent.

General

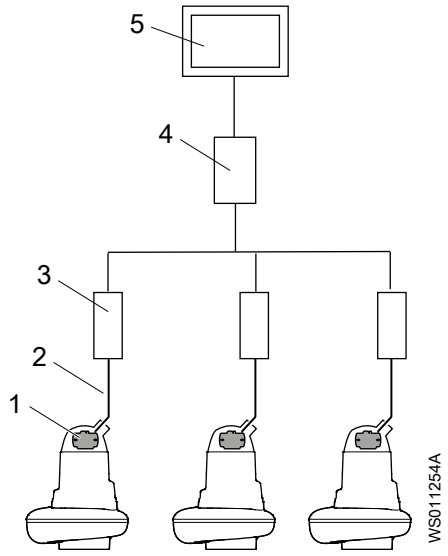
- The monitoring equipment must be of a design that prevents automatic restart.
- Information in the junction box of the pump indicates whether the pump is equipped with optional sensors.

3.5 The MAS 801 monitoring equipment

3.5.1 MAS 801

With the MAS 801, one control unit can be used for several pumps, up to a maximum ten pumps.

Each pump has a built-in PEM and has its own base unit.



1. Pump electronic module (PEM)
2. Combined power and signal cable
3. Base unit (BU)
4. Central unit (CU)
5. Human-machine interface FOP 402

Figure 2: MAS 801

MAS 801 features include the following:

- Eight standard pump sensors
- SUBCAB® cables contain both signal leads and power leads.
- One central unit for maximum ten pumps
- One graphical touch panel shows information for multiple pumps.

3.5.2 FLS: float switch sensor

The float switches are leakage sensors.

The float switches are located in the junction box, and in the lower part of the stator housing or leakage chamber.

3.5.3 Vibration in three directions

A vibration sensor that is located in the PEM measures vibration speed in three directions.

Two adjustable alarm limits can be applied for each measurement direction:

- Early warning: “B”-alarm
- Pump stop: “A”-alarm

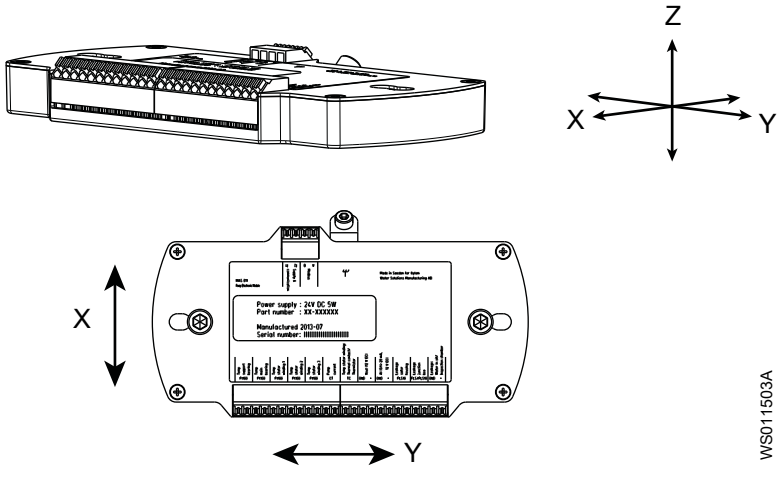


Figure 3: Vibration directions with reference to the PEM

The definitions of X, Y and Z are the same, whether or not the pump is in a vertical or horizontal position.

3.5.4 Bearing temperature measurement

Pt100 sensors monitor the bearing temperatures to protect the pump from the consequences of a bearing failure.

Main bearing

Main bearing temperature monitoring is standard in the MAS 711 and MAS 801.

Support bearing

Support bearing temperature monitoring is an option in the MAS 711 and MAS 801.

Alarms

Two adjustable alarm limits can be used:

- Early warning: “B”-alarm
- Pump stop: “A”-alarm

3.5.5 Stator temperature monitoring methods

The purpose of stator-winding temperature monitoring is to make the motor shut off at high temperature. There are two monitoring methods, depending on the types of thermal sensors chosen.

Table 1: Stator temperature monitoring configuration

Configuration with thermal switches	Configuration with thermistors
• Three thermal switches, connected in series, are incorporated in the coil ends of the stator winding. The switches are normally closed, and open at 140°C (285°F). • One Pt100 sensor is incorporated in one of the windings.	• Three thermistors, PTC, connected in series, are incorporated in the coil ends of the stator windings. T_{Ref}=140°C (285°F). • One Pt100 sensor is incorporated in one of the windings.

By using an analogue sensor, two adjustable alarm limits can be used, one for warning (“B”-alarm) and one for pump stop (“A”-alarm).

3.5.5.1 Temperature sensors

Table 2: Thermal contact

Description	Measured value	Fault values
The thermal contact is a normally closed contact.	0–3 ohm, unless the wires are long.	An infinite value (open circuit) indicates either high temperature or a fault. Examples of faults include a broken wire, or a bad contact in a connector.

Table 3: PTC thermistor

Description	Measured value	Fault values
The PTC thermistor is a semiconductor device.	Resistance at normal temperature: • 50–100 ohm (150–300 ohm for three in series).	• Above the tripping point, T_{Ref}, the resistance increases dramatically to several kilohm. • An infinite value (open circuit) indicates a fault. Examples of faults include a broken wire, or a bad contact in a connector. • A value close to zero indicates a short circuit in the wiring.

Table 4: Pt100 sensor

Description	Measured value	Fault values
The Pt100 sensor is a resistor changing value almost linearly with temperature.	Resistance: • 100 ohm at 0ºC (32ºF) • 107.79 ohm at room temperature (20ºC, 68ºF) • 138.5 ohm at 100ºC (212ºF) For resistance data between 0–160ºC (32–320ºF), see *Pt100 resistance* on page 84.	> 200 ohm (approximate) can indicate the following situations: • Broken sensor • Bad contact • Broken lead < 70 ohm (approximate) indicates: • Short circuit

NOTICE:

Never connect the Pt100 transducer to a voltage higher than 2.5 V.

For information on the various configurations of contacts, thermistors and sensors that are used to monitor stator winding temperature, see *Stator temperature monitoring methods*.

3.5.6 Pump current and power monitoring

Pump current

Pump current is an important parameter in itself, which the MAS 801 can also use to record running time, number of starts and other operating diagnostics. This information is fundamental for monitoring operation, maintenance planning, and fault diagnosis.

Pump current in one phase is standard with the MAS 801.

Pump current in three phases

Pump current in three phases is also possible with the MAS 801. To track pump current in three phases with the MAS 801, the following are needed:

- Three current transformers in the control cabinet
- The PAN 312 power analyzer

The current transformers are connected to the PAN 312. The PAN 312 transmits the data to the CU and the PEM in the MAS 801 system.

Power monitoring: PAN 312

The optional Flygt power analyzer PAN 312 allows the following parameters to be monitored:

- Three-phase power
- Power factor
- System voltage
- Voltage imbalance
- Pump current in three phases
- Current imbalance

3.6 Monitoring with MAS 711

The MAS 711 monitoring equipment can be used with pump models P7030, P7035, and P7040, in applications with only one (1) motor cable. The motor cable must be screened.

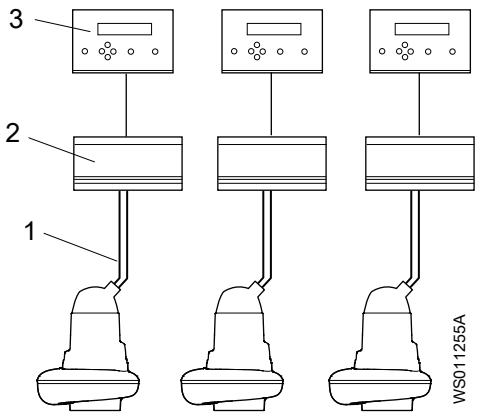
Pumps with the standard MAS 711 equipment use a 12-lead auxiliary cable, plus 4 leads from the motor cable, for the following:

- Thermal switches for stator temperature monitoring (three in series) or PTC thermistors
- Leakage sensor in the inspection chamber
- Leakage sensor in the junction box
- Analogue temperature sensor (Pt100) for main bearing temperature monitoring
- Analogue temperature sensor (Pt100) for stator winding temperature in one phase
- Vibration sensor VIS 10

- Analogue temperature sensor (Pt100) for support bearing temperature monitoring
- Pump memory

3.6.1 MAS 711

With MAS 711, a base unit and a display unit are required for each pump.



1. Separate cables for signal and power
2. Base unit
3. MAS 711 display unit

Figure 4: MAS 711

MAS 711 features include the following:

- Five standard pump sensors
- Separate SUBCAB® cables for power and signal
- Text display is dedicated to one pump.

3.6.2 Sensors

Temperature sensors

Table 5: Thermal switch

Description	Measured value	Fault values
The thermal switch is a normally closed contact.	0-3 ohm, unless the wires are very long.	An infinite value (open circuit) indicates either high temperature or a fault (a wire is broken or there is a bad contact in a connector).

Table 6: PTC-thermistor

Description	Measured value	Fault values
The PTC-thermistor is a semiconductor device.	Resistance at normal temperature: • 50-100 ohm (150-300 ohm for three in series).	• Above the tripping point, T_{Ref}, the resistance increases dramatically to several kohm. • An infinite value (open circuit) indicates a fault (a wire is broken or there is a bad contact in a connector). • A value close to zero indicates a short circuit in the wiring.

Table 7: Pt100 sensor

Description	Measured value	Fault values
The Pt100 sensor is a resistor changing value almost linearly with temperature.	Resistance: • 100 ohm at 0ºC (32ºF) • 107.79 ohm at room temperature (20ºC, 68ºF) • 138.5 ohm at 100ºC (212ºF) For resistance data between 0–160 0ºC (32–212ºF), see *Pt100 resistance* on page 84.	> 200 ohm (approx.) can indicate the following situations: • Broken sensor • Bad contact • Broken lead < 70 ohm (approx) indicates: • Short circuit.

NOTICE:

Never connect the Pt100 transducer to a voltage higher than 2.5 V.

For information on the various configurations of switches, thermistors and sensors used to monitor stator winding temperature, see *Stator temperature monitoring methods* on page 16.

FLS

Table 8: Float switch sensor (FLS)

Description	Measured value	Fault values
The float switches are leakage sensors.	Resistance. 2 sensor variants: FLS: • Normal: 1530 ohm • Alarm: 330 ohm FLS 10: • Normal: 1200 ohm • Alarm: 430 ohm	> 10% (approx.) deviation from rated ohm values indicates sensor fault, or fault in the wiring.

VIS10

Table 9: Vibration sensor (VIS10)

Description	Measured value	Fault values
The vibration sensor located in the junction box measures vibrations in one direction. The output is a 4-20 mA signal proportional to the vibration level.	Current, 4-20 mA	• >> 20 mA indicates a short circuit. • << 4 mA indicates a fault. • A zero value indicates a broken wire or bad contact in a connector.

3.6.3 Stator temperature monitoring methods

The purpose of stator-winding temperature monitoring is to make the motor shut off at high temperature. There are two monitoring methods, depending on the types of thermal sensors chosen.

Table 10: Stator temperature monitoring configuration

Configuration with thermal switches	Configuration with thermistors
• Three thermal switches, connected in series, are incorporated in the coil ends of the stator winding. The switches are normally closed, and open at 140°C (285°F). • One Pt100 sensor is incorporated in one of the windings.	• Three thermistors, PTC, connected in series, are incorporated in the coil ends of the stator windings. T_{Ref}=140°C (285°F). • One Pt100 sensor is incorporated in one of the windings.

By using an analogue sensor, two adjustable alarm limits can be used, one for warning (“B”-alarm) and one for pump stop (“A”-alarm).

3.6.4 Pump memory

The pump memory is located inside the junction box of the pump. The memory is loaded with data from the factory, which is then uploaded to the MAS system at first start-up.

The data that is uploaded contains the following features:

- Data plate information
- Sensor types and alarm settings recommended by the manufacturer
- Operational data and data to support service:
  - Histograms of temperatures, vibrations, and cycle length
  - Start and stop registration
  - Service log with a maximum of 200 lines of text
  - Conditions to prompt for service based on for example, running time, number of starts and stops or specific dates

For more information, see the MAS 711 Installation and User Manual.

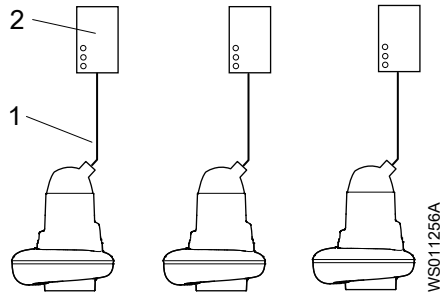
3.7 Monitoring with MiniCAS II

This table shows the parameters which can be tracked with the MiniCAS II monitoring system.

Parameter	Sensor	Standard or optional
Stator winding temperature	One of the following choices: • Standard: 3 thermal switches • Optional: 3 PTC thermistors	Standard
Leakage in the inspection chamber	Float switch leakage sensor (FLS)	Standard
Leakage in the junction box	Float switch leakage sensor (FLS)	Optional

3.7.1 MiniCAS II

One MiniCAS II is required for each pump.



1. Combined power and signal cable
2. MiniCAS II

MiniCAS II features include the following:

- Two pump sensors
- Signal leads are incorporated in the SUBCAB® power cable.
- LED alarm indication

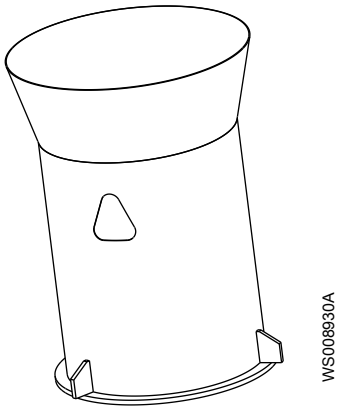
3.8 Column adapters

There are two accessories which can be used to install these pumps in slightly larger columns:

- Diffuser adapter
- Flange adapter

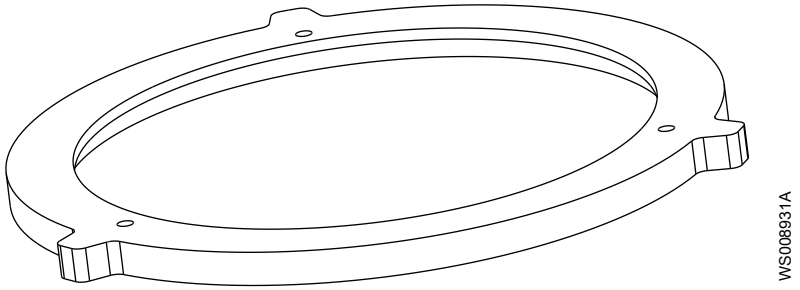
Diffuser adapter

The diffuser adapter is lowered into the column before the pump is installed. No fastening is needed.



Pump		Diameter of Existing Column, mm (in)	Adapter Part Number
7030		800 (31.5)	769 73 21
		700 (27.6)	769 73 20
7035	Long motor	800 (31.5)	769 73 13
		700 (27.6)	769 73 12
	Short motor	800 (31.5)	769 73 11
		700 (27.6)	769 73 10
7040	Long motor	800 (31.5)	769 73 03
		700 (27.6)	769 73 02
	Short motor	800 (31.5)	769 73 01
		700 (27.6)	769 73 00

Flange adapter

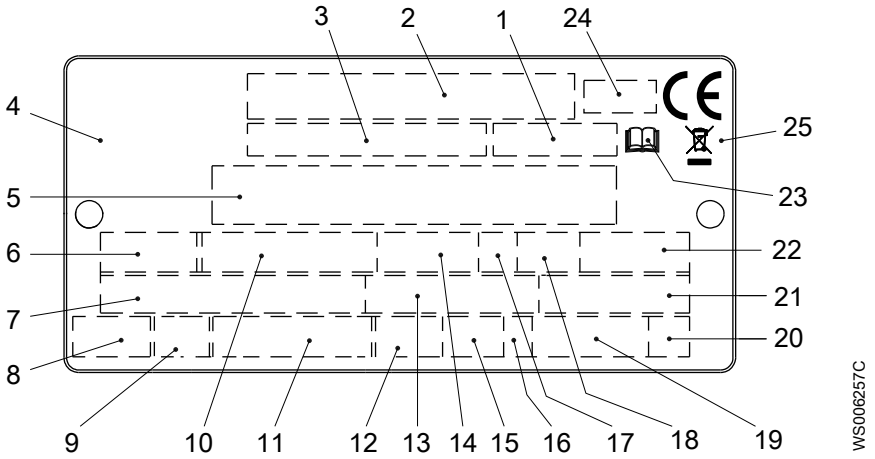


The flange adapter is bolted to the bottom of the specially-drilled bell mouth.

Pump	Diameter of Existing Column, mm (in)	Adapter Part Number
7030	800 (31.5)	773 75 21
7030	700 (27.6)	773 75 20
7035	800 (31.5)	773 75 11
7035	700 (27.6)	773 75 10
7040	800 (31.5)	773 75 01
7040	700 (27.6)	773 75 00

3.9 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.



1. Curve code or Propeller code
2. Serial number
3. Product number
4. Country of origin
5. Additional information
6. Phase; type of current; frequency
7. Rated voltage
8. Thermal protection
9. Thermal class
10. Rated shaft power
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
25. WEEE-Directive symbol

Figure 5: The data plate

3.10 Motor regulation

This product is submersible and therefore exempted from the motor efficiency requirement, in accordance with EU commission regulation 2019/1781 Article 2(2)(e).

3.11 Approvals

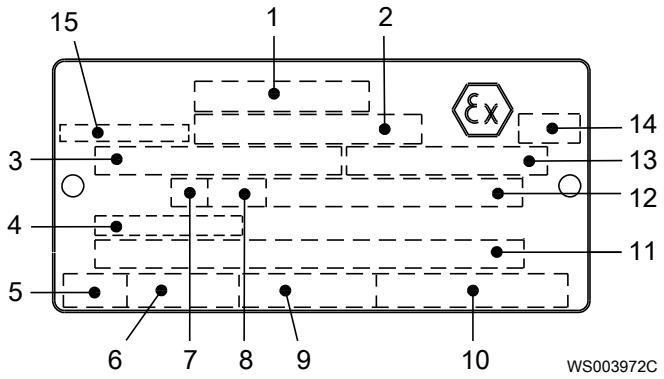
Product approvals for hazardous locations

Pump	Approval
7030.090 7035.090 7040.090	European Norm (EN) • ATEX Directive • EN 60079-0:2012/A11:2013, EN 60079-1:2014, EN ISO 80079-36:2016, EN ISO 80079-37:2016 • Ⓔx II 2 G Ex db h IIB T3 Gb

Pump	Approval
	IEC • IECEx scheme • IEC 60079-0:2011, IEC 60079-1:2014; IEC 80079-36:2016; IEC 80079-37:2016 • Ex db h 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.

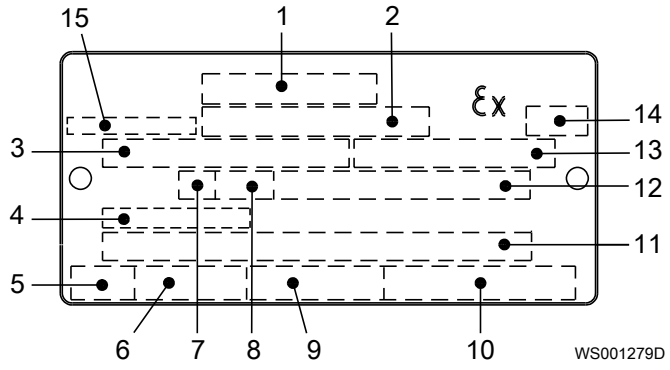


1. Approval
2. Approval authority and Approval number
3. Approved drive unit
4. Cable entry temperature
5. Stall time
6. Starting current or Rated current
7. Duty class
8. Duty factor
9. Input power
10. Rated speed
11. Additional information
12. Maximum ambient temperature
13. Serial number
14. ATEX marking
15. Country of origin

IEC approval plate

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

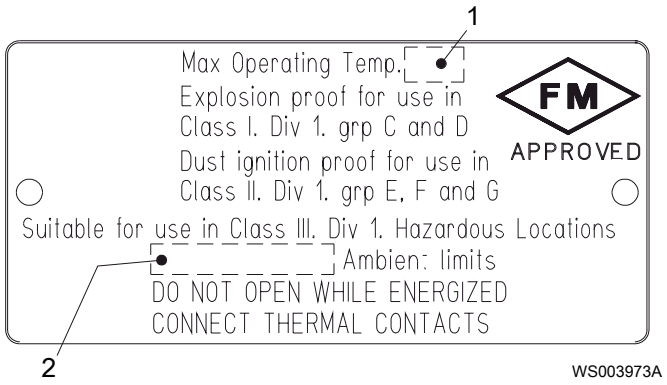
International Norm; not for EU member countries.



1. Approval
2. Approval authority and Approval number
3. Approved drive unit
4. Cable entry temperature
5. Stall time
6. Starting current or Rated current
7. Duty class
8. Duty factor
9. Input power
10. Rated speed
11. Additional information
12. Maximum ambient temperature
13. Serial number
14. ATEX marking
15. Country of origin

FM approval plate

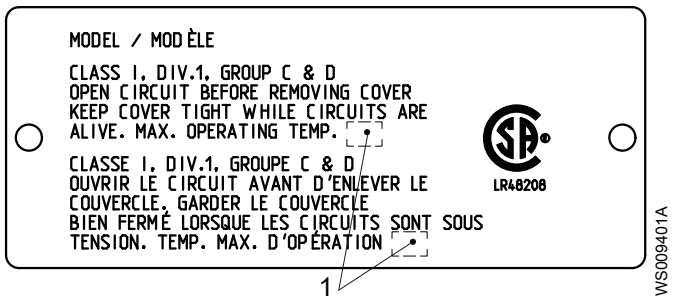
This illustration describes the FM approval plate and the information that is contained in its fields.



1. Temperature class
2. Maximum ambient temperature

CSA approval plate

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



1. Temperature class

3.12 Product denomination

Reading instruction

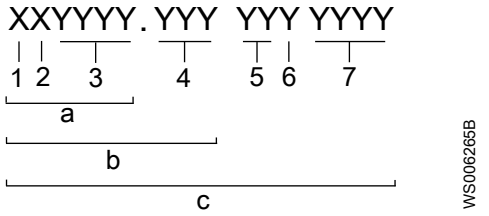
In this section, code characters are illustrated accordingly:

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



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

Type of Callout	Number	Indication
	6	Production cycle
	7	Running number

4 Installation

4.1 Precautions

Before starting work, make sure that the safety instructions 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: 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 rated explosion-proof or intrinsically-safe, then see the specific explosion-proof information in the safety chapter before taking any further actions.

DANGER: Inhalation Hazard

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

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 before you install the pump.

4.1.1 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 rated explosion-proof or intrinsically-safe, then see the specific explosion-proof information in the safety chapter before taking any further actions.

Authority regulation

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

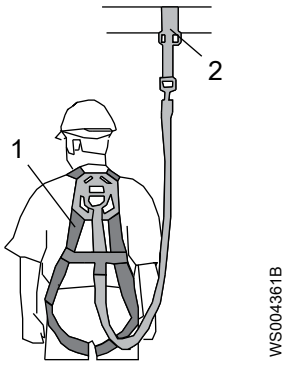
4.1.2 Falling

CAUTION: Fall Hazard

Slips and falls can cause severe injuries. Watch your step.

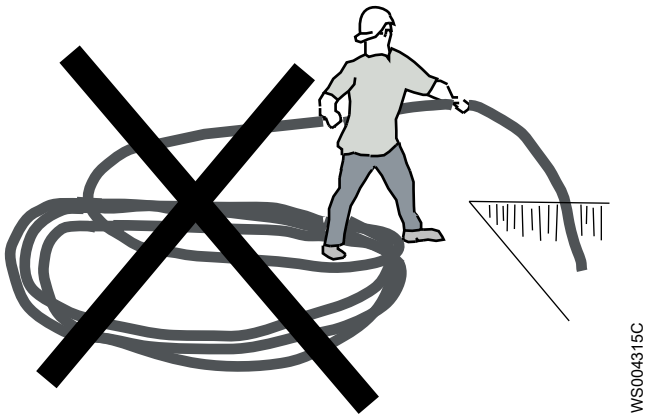
To minimize the risk of falling, observe the following:

- Use appropriate personal protection equipment when working in or near open basins, shafts, or trenches.



1. Fall protection harness
2. Anchoring point

- Make sure that all safety guards are in place and secure, and that there is a suitable barrier around the work area.
- Wear clean slip-resistant shoes.
- Make sure that any ladders or climbing equipment that is used is correctly sized and in good working condition.
- Never stand in coiled cables, ropes or wires, or between them and the open shaft or basin.



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.

4.2 Cables

General requirements

- The voltage drop in a long cable must be taken into account. Always follow the local regulations for voltage drop.
- If a Variable Frequency Drive (VFD) is used, then the screened cable must be used according to the European CE and EMC requirements. For more information, contact a sales or authorized service representative (VFD-supplier).
- All unused conductors must be insulated.
- The cable entry seal sleeve and washers must conform to the outside diameter of the cable.

Cable condition

- The cable must not have any sharp bends, and not be pinched.

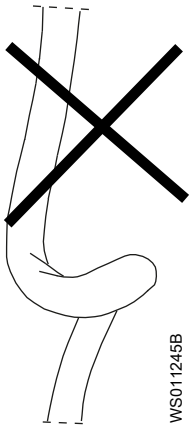


Figure 6: Kinked cable

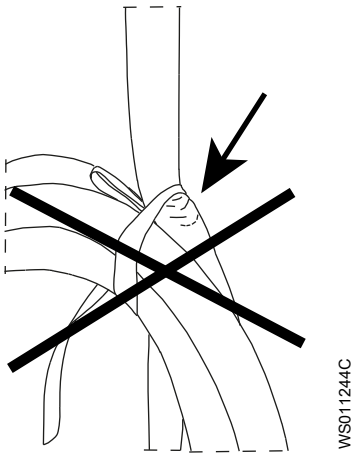


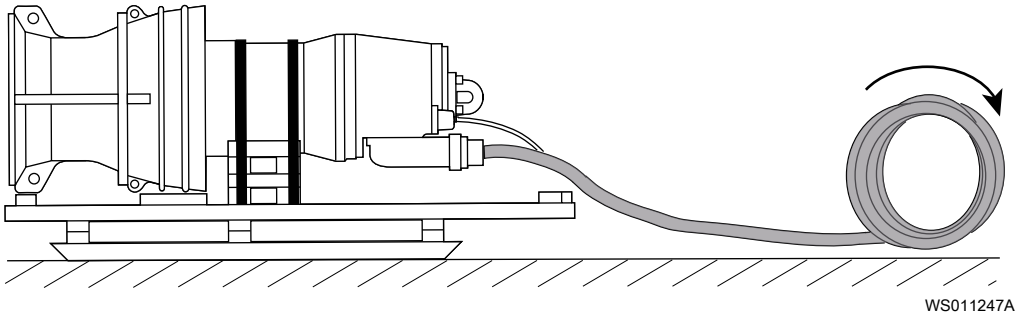
Figure 7: Pinched cable

- If the outer jacket of the cable is damaged, then replace the cable.
- The cable must not be damaged and must not have indentations or be embossed at the cable entry.
- If the cable has been used before, then a short piece must be peeled off when refitting it. This prevents the cable entry seal sleeve from closing around the cable at the same point.
- The cable must not be exposed for long periods to direct UV light. The cable ends must be protected from water during storage.

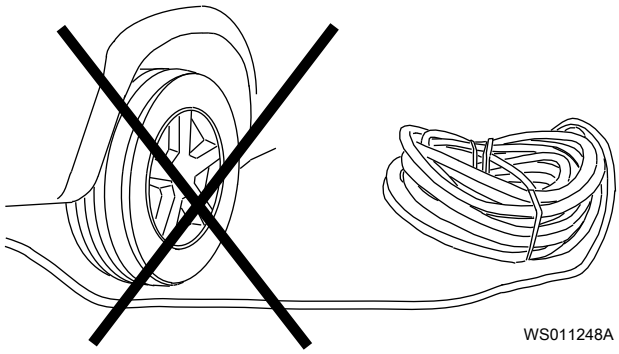
Cable handling

To install cables, follow these requirements:

- Start at the pump and carefully roll out the cable.



- When pulling the cable, do not exceed the maximum permissible tensile force.
- Do not bend the cable to a radius smaller than the recommended minimum bending radius.The recommended minimum bending radius is 10 times the diameter of the cable.
- Make sure that vehicles cannot run over the cable.



- All cables lose flexibility at lower temperatures. Use extra care when the cable is cold.Do not work with a cable whose temperature is below –30°C (–22°F).

4.3 Requirements for the cable handling system

Cable system overview

When the pump is installed in a discharge tube, it is critically important that a correct cable support and protection system is used. Correct cable support is especially important with long cables and closed discharge tubes. Due to the complexity of designing cable support, it is highly recommended to use the Flygt Lift and Cable Handling System. The Flygt system provides spring-controlled tensioning and an integrated guide wire system.

If the cables are supported by another system, then the cable support system must have the following characteristics:

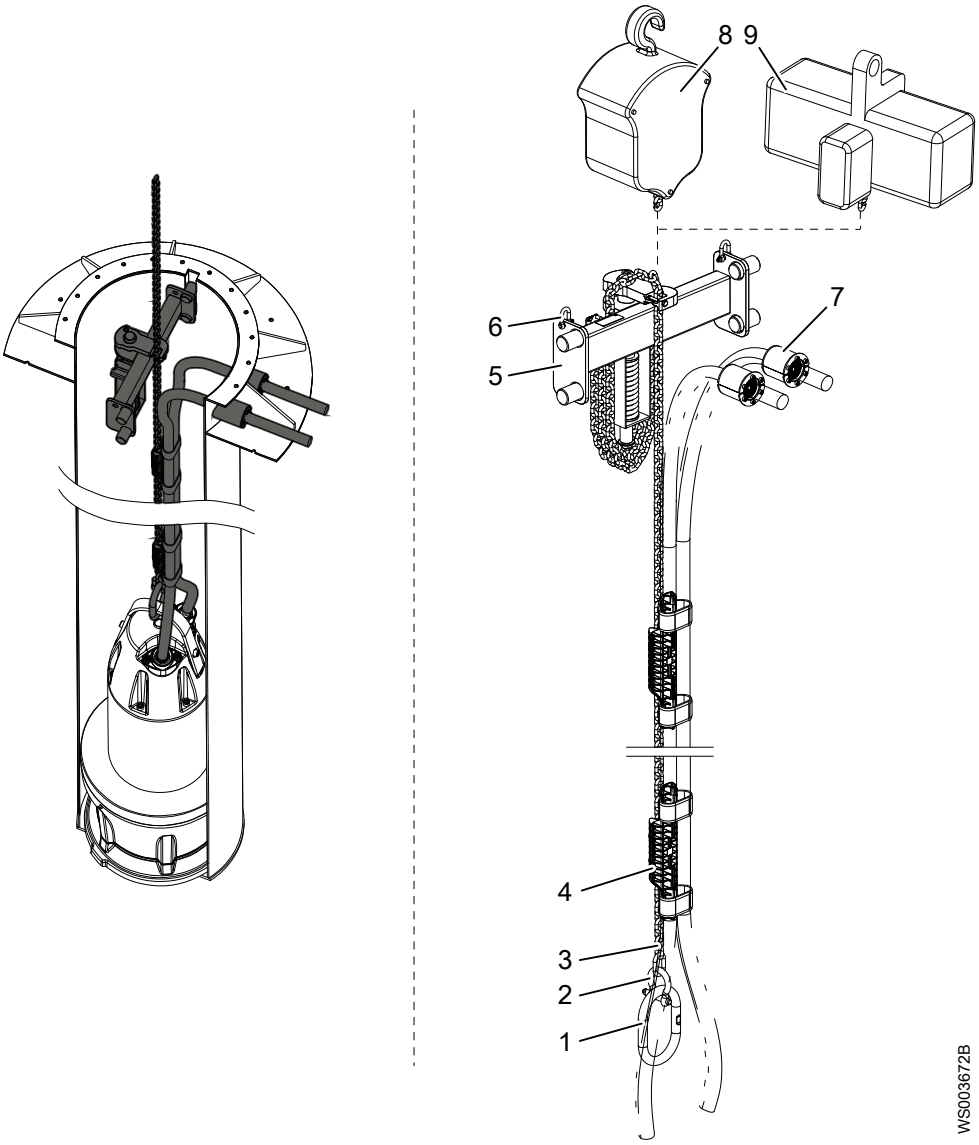
- Cables must be supported in such a way, that they do not come in contact with any hard surface which could abrade the cable sheathing. Examples of surfaces include pump and tube components, lifting cables or wires and any other hardware.
- Cables should be bundled together, by using components that do not cut or abrade the cables.
- Correct strain relief and support at prescribed intervals must be provided.

Consequence of an inadequate cable support

The movement of the cable due to inadequate cable support can cause the signal leads to fail. The failure of the signal leads indicates that the other parts of the cable are vulnerable to damage. Continuing to operate the product can result in a hazardous situation. For a safe operation, the cable must be replaced and the support for the cable must be enhanced.

The Flygt Lift & Cable Handling System

The following figure shows major parts of the optional Flygt Lift & Cable Handling System, designed for this pump.



1. Eye
2. Shackle
3. Chain sling
4. Cable holder unit
5. Console
6. Shackle
7. Motor cable entrance unit
8. Optional block and tackle, manually operated
9. Optional block and tackle, electrically operated

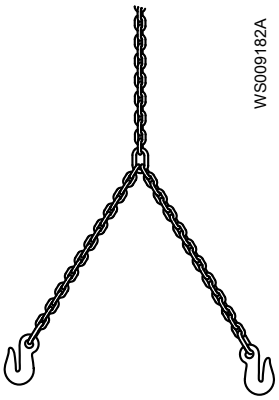
Instructions for installing the cable handling system

Instructions for installing the Flygt Lift & Cable Handling System are given in the document "Installation, Operation and Maintenance, Flygt Lift & Cable Handling System". For more information, contact your local Xylem representative.

4.4 Install the diffuser adapter

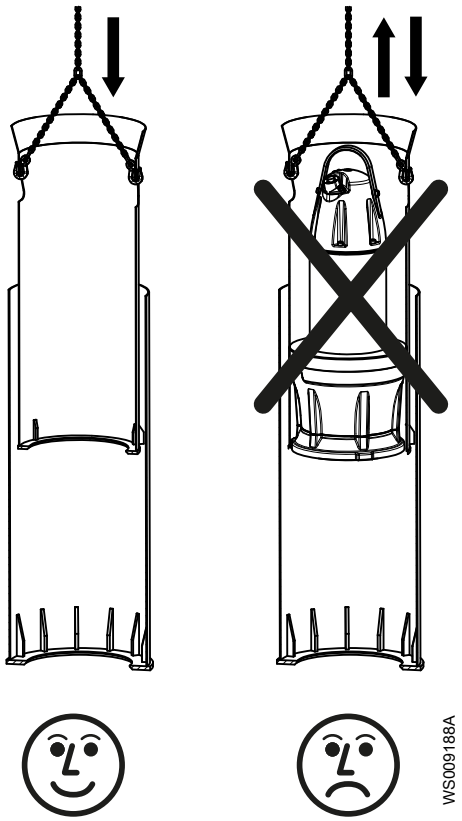
Necessary equipment:

- Lifting chain with two hooks. See the illustration.

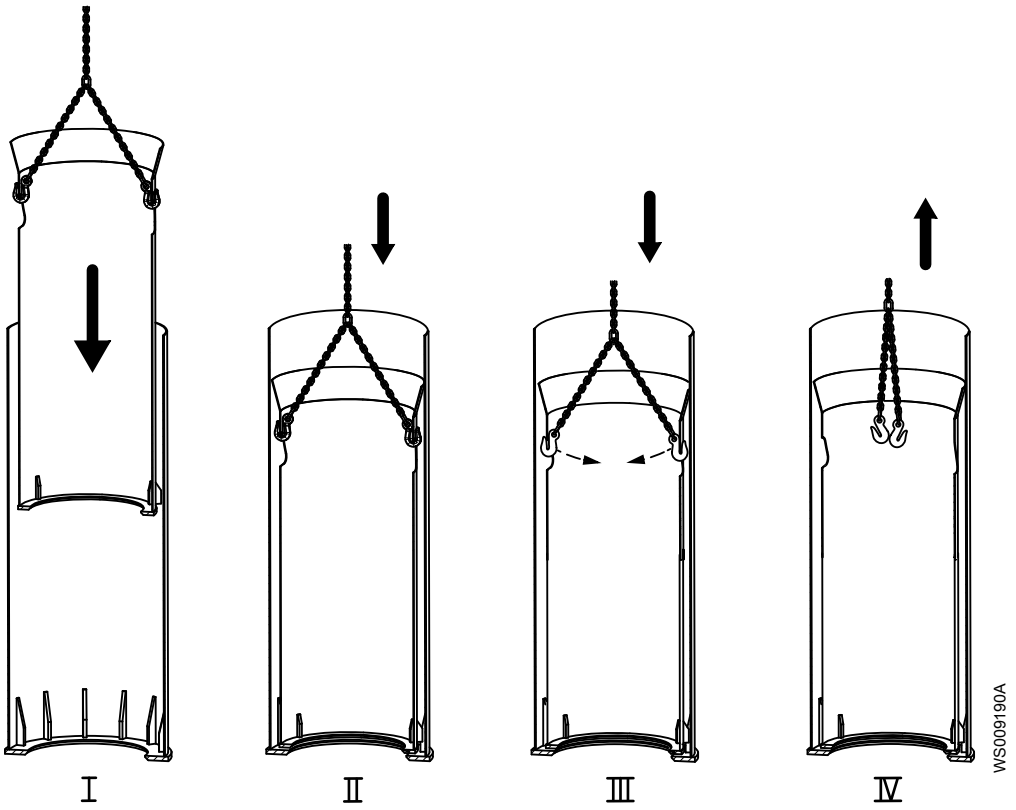


This procedure is only required when a diffuser adapter is used to adapt a wider column pipe to a more narrow pump. See *Column adapters* on page 20.

1. Put the two lifting hooks through the triangular holes of the adapter, from the inside.
2. Lift the adapter, without the pump.



3. Lower the adapter into the column, until it bottoms out on the bottom of the column.
4. Lower the lifting chain further until the hooks fall out of the triangular holes. Remove the lifting arrangement.



Install the pump. See *Install the pump* on page 32.

4.5 Install the pump

Consult the nearest Xylem representative regarding the following topics:

- Sizing of the pump, piping station, and access frame
- Choice of auxiliary equipment
- Other aspects of installation

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 rated explosion-proof or intrinsically-safe, then see the specific explosion-proof information in the safety chapter before taking any further actions.

WARNING: Explosion/Fire Hazard

Before starting any permit-required hot work such as welding, gas cutting, grinding, or using electrical handtools, do the following: 1. Check the explosion risk. 2. Provide sufficient ventilation.

WARNING: Fall Hazard

Check that suitable barriers for the work area are in place.

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: Crush Hazard

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

NOTICE:

Do not run the pump dry.

NOTICE:

Never force piping to make a connection with a pump.

The pump is usually installed in a vertical discharge tube on a pump seat, which is incorporated in the lower end of the tube. No anchoring is required because the weight of the pump is sufficient to keep it in place. The pumps are equipped with anti-rotation devices.

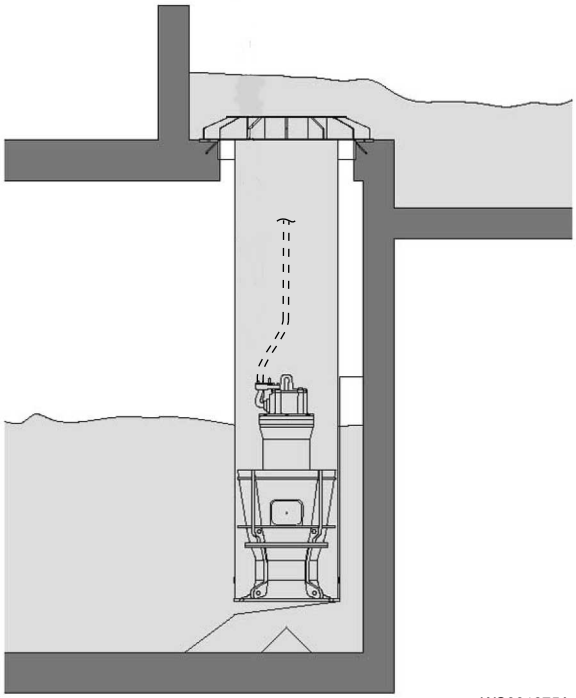
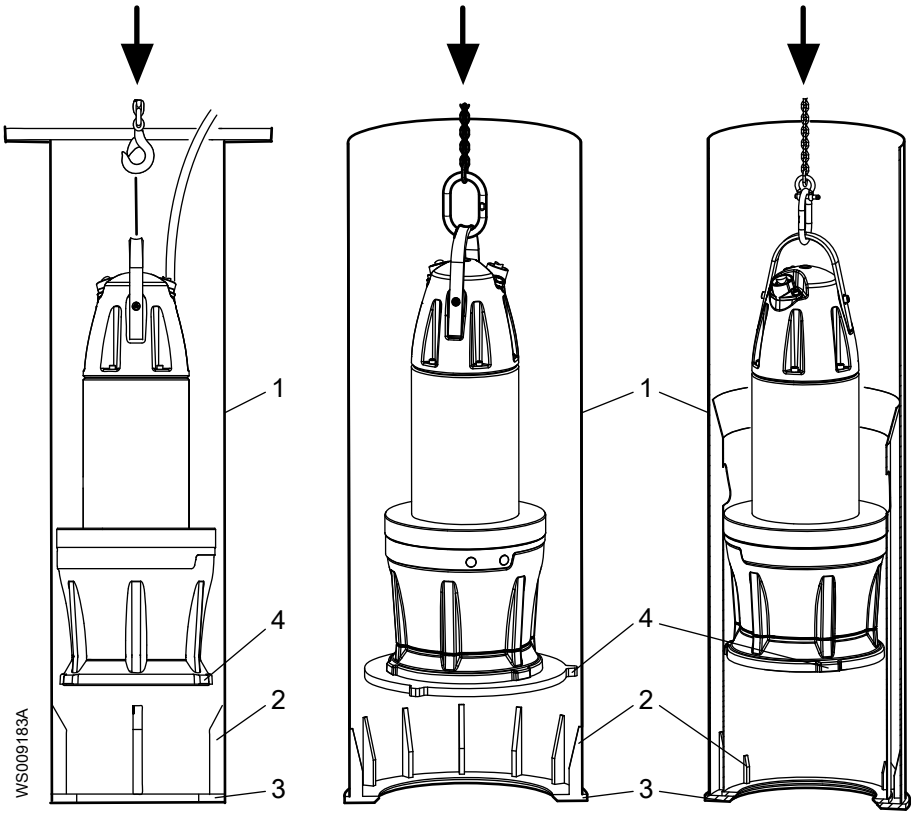


Figure 8: Pump in the discharge tube. A generic propeller pump is shown.



1. Discharge column
2. Antirotation gusset (stop vanes)
3. Pump seat
4. Anti-rotation device on hydraulic end

Figure 9: Without adapter, with flange adapter, and with diffuser adapter

When the pump is installed in a discharge tube, the following must be considered:

- A suitable cable support and protection system must be used.

Before installation, check the following:

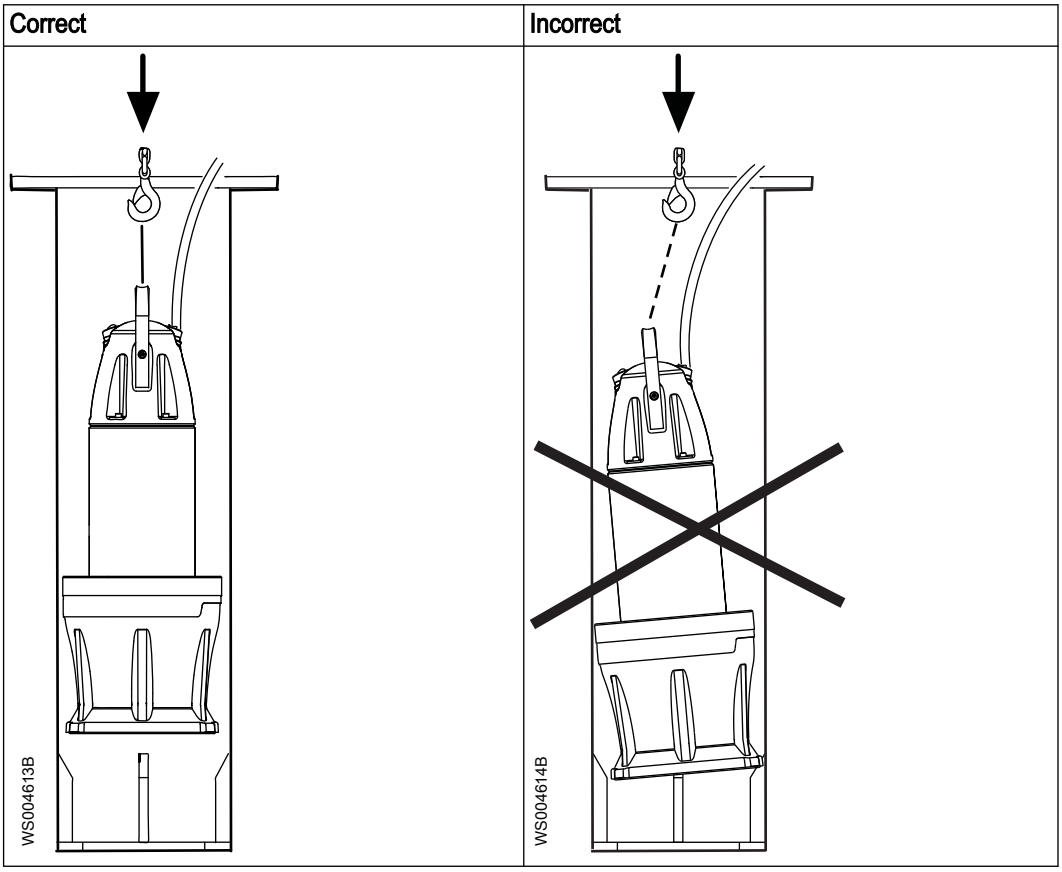
- The rubber seal ring underneath the pump is in place.
- There is no damage to, or debris on, the pump seat.
- There is no large construction debris under the pump tube. If debris is present, then there is a risk that it gets sucked into the pump and cause propeller damage.

1. Make sure that the pump control is set to turn off the pump at or above the minimum operating water level for this pump installation.
2. If a diffuser adapter will be used at the site, then make sure that the adapter is in place. See *Install the diffuser adapter* on page 30.
3. Check that the cables and cable entries have not been damaged during transport.
4. Secure the cables so that they can be fed into the column in a controlled manner.

   When the pump is lowered into the column, the cables must be fed into the column at the same speed as the pump is lowered.

5. After cable preparation, lower the pump into the pump column.

   Make sure that the pump does not tilt on the stop vanes, which are at the bottom of the column.



6. Lower the pump to its bottom position, at the same time carefully moving it back and forth between the nearest anti-rotation gusset.

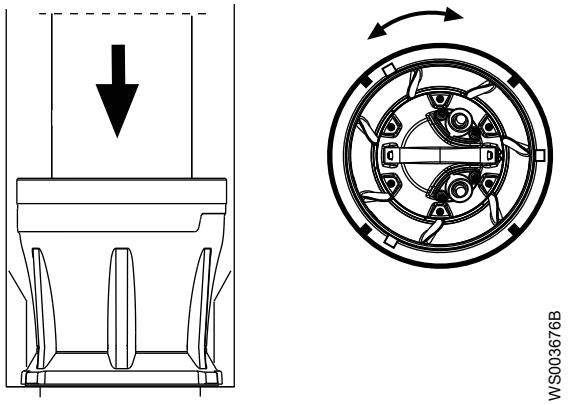


Figure 10: Lower the pump while moving between anti-rotation gussets

7. Lift the pump slightly again, approximately 2–3 cm (1 in). Turn it counterclockwise until the anti-rotation device on the hydraulic end lands against the nearest adjacent vanes.

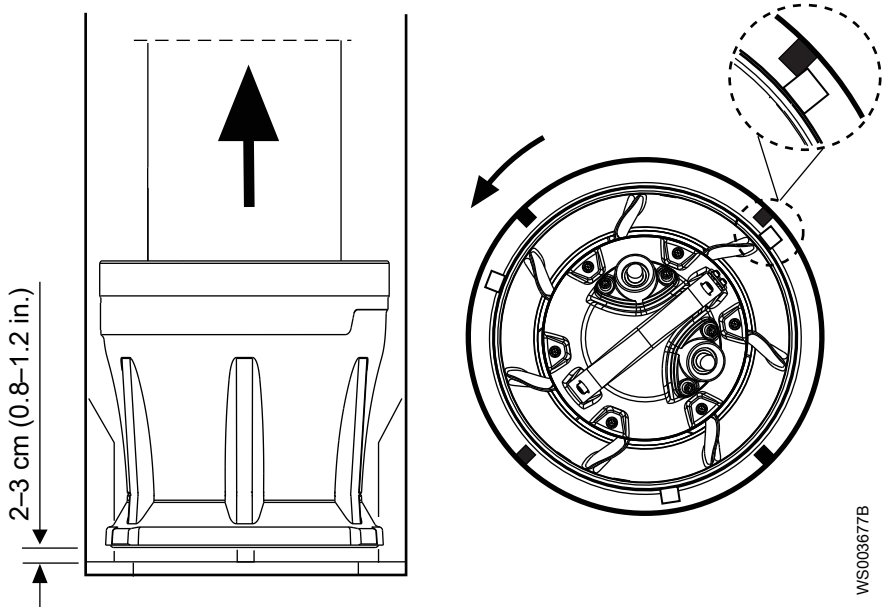


Figure 11: Turn the pump until the anti-rotation device is in place.

8. Lower the pump to its final bottom position.

   No more anchoring of the pump is required. Maximum permissible submersion depth is 20 m (65 ft).

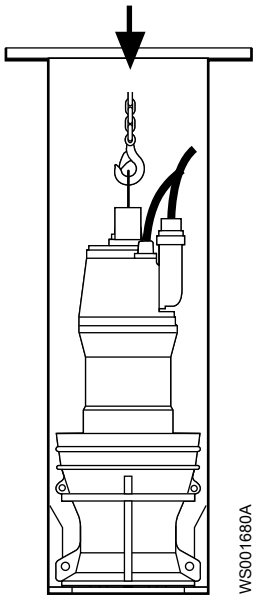


Figure 12: Lower the pump to its final bottom position. A generic propeller pump is shown.

9. If the recommended cable handling system is used, then follow the instructions to finish the cable connection. See the document "Installation, Operation and Maintenance, Flygt Lift and Cable Handling System."
10. If the recommended cable handling system is not used, then fasten the power cables on the cable holder and run them to the electric junction box.

    Make sure that the cables have no sharp bends, are not pinched, and do not disturb the water flow.

4.6 Make the electrical connections

4.6.1 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: 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 the electrical installation:

- If the pump will be connected to the public mains, then the supply authority must be notified before installing the pump. When the pump is connected to the public power supply, it can 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 follow the specified voltage on the yellow sticker close to the cable entry.
- If the operation can be intermittent, such as S3 periodic duty, then the pump must be supplied with monitoring equipment supporting such operation.
- The thermal contacts must be connected to a protection circuit in accordance with the product approvals.
- The thermal contacts or thermistors must be in use.
- For FM-approved pumps, a leakage sensor must be connected and in use to meet approval requirements.
- Specially approved pumps must be earthed (grounded) at the external grounding (earthing) site on the outside of the drive unit, to meet approval requirements.

Motor and short-circuit protection

A qualified electrician must select the size of motor protection breakers and fuses, so that it is sufficient for the specific motor data such as rated current and starting current.

It is important that the short-circuit protection is not over-dimensioned. Over-dimensioned fuses and motor protection breakers decrease the protection for the motor.

- The fuse rating and the cables must be in accordance with the local rules and regulations.
- The fuses and circuit breakers must have the correct rating. The pump overload protection must be connected and set to the rated current. See the data plate and if applicable the cable chart for the rated current. The starting current in direct-on-line start can be up to six times higher than the rated current.

4.6.2 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.

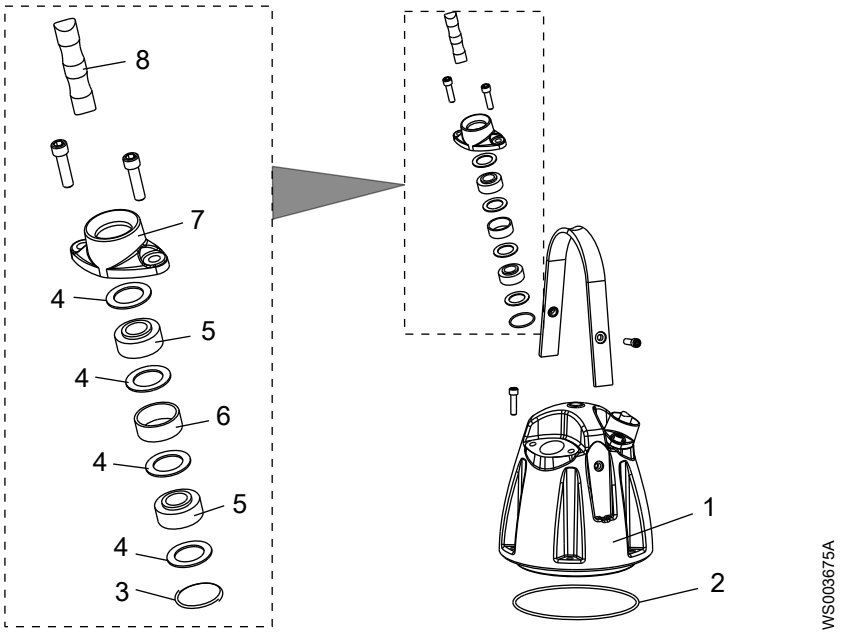
WARNING: Electrical Hazard

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.

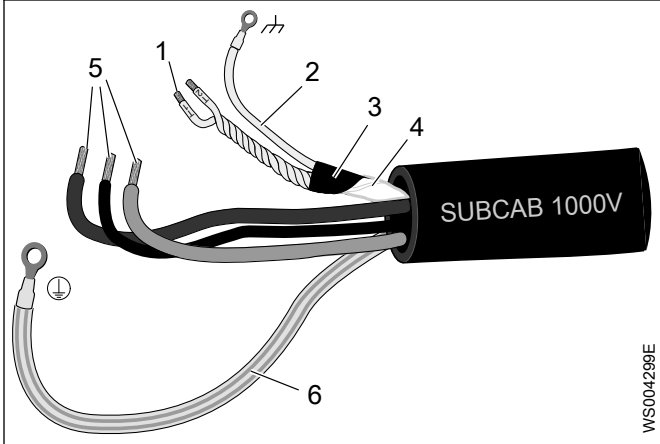
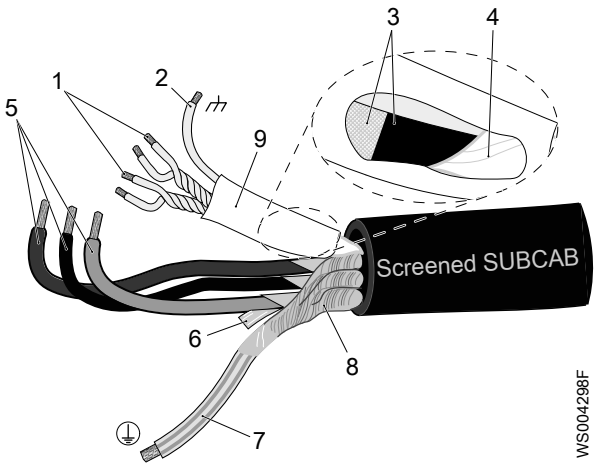
4.6.3 Cable entry parts



Position	Part
1	Entrance cover
2	O-ring
3	O-ring
4	Washer
5	Seal sleeve
6	Spacer ring
7	Entrance flange
8	Cable

4.6.4 Prepare the SUBCAB™ cables

This section applies to SUBCAB™ cables with twisted-pair control conductors.

The prepared SUBCAB™ cable	The prepared screened SUBCAB™ cable, without cable lugs
	
1. T1+T2 twisted pairs in control element 2. Drain wire in control element (tinned copper strands) with shrink tube 3. Aluminum and textile layers 4. Insulation jacket or plastic jacket, for the control element 5. Power conductors 6. Ground (earth) conductor with yellow-green shrink tube	1. T1+T2 and T3+T4 twisted pairs in control element 2. Drain wire in control element (tinned copper strands) with shrink tube 3. Aluminum and textile layers 4. Insulation jacket or plastic jacket, for the control element 5. Power conductors 6. Plastic laminated aluminum foil, screen 7. Ground (earth) conductor with yellow-green shrink tube 8. Uncovered screen/braided wire 9. shrink tube

1. Peel off the outer jacket at the end of the cable.
2. Prepare the control element:
   a) Peel the insulation jacket or plastic jacket.
   b) Peel the aluminum and textile layers.

      The aluminum foil is a conductive screen. Do not peel more than necessary, and remove the peeled foil.

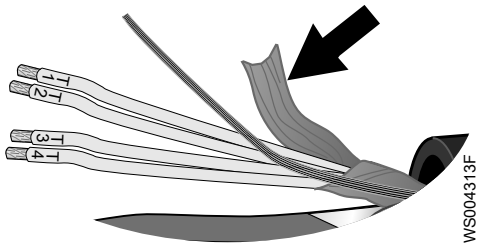


Figure 13: Aluminum foil on the control element.

   c) Put a white shrink tube over the drain wire.
   d) Twist T1+T2 and T3+T4.
   e) Put a shrink tube over the control element.

      Make sure that the conductive aluminum foil and drain wire are covered.
3. Prepare the ground (earth) conductor of the SUBCAB™ cable:
   a) Peel the yellow-green insulation from the ground (earth) conductor.
   b) Check that the ground (earth) conductor is at least 10% longer than the phase conductors in the cabinet.
   c) If applicable, put a cable lug on the ground conductor.
4. Prepare the ground (earth) conductor of the screened SUBCAB™ cable:
   a) Untwist the screens around the power conductors.
   b) Twist all power conductor screens together to create a ground (earth) conductor.
   c) Put a yellow-green shrink tube over the ground (earth) conductor.

Leave a short piece uncovered.

d) Check that the connected ground (earth) conductor has sufficient slack. The conductor must stay connected even if the power conductors are pulled loose.

5. Prepare the power conductors:
   a) Remove the aluminum foil around each power conductor.
   b) Peel the insulation from each power conductor.
6. Prepare the ends of the ground (earth) conductor, the power conductors, and the drain wire:

Connection type	Action
Screw	Fit cable lugs to the ends.
Terminal block	Fit end sleeves or leave the ends as they are.

4.6.5 Connect the cables: Standard pumps with MAS 801

This procedure must not be used for Ex-proof applications. If the pump is used in an Ex-proof environment, then use the procedure that is described in *Connect the cables: Ex-proof pumps with MAS 801* on page 42.

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.

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

1. Install the monitoring equipment. See the System Installation and Operation (SIO) Manual for the MAS 801 monitoring equipment.
2. To connect the signal leads to the MAS BU, do the following:
   a) Connect the two signal leads that are integrated in the SUBCAB® cable, T1 and T2, to the MAS BU.

      See the chapter “Installation” in the SIO Manual for the MAS 801 monitoring equipment.
   b) If it is not already connected, then connect the functional ground to the MAS BU.
3. To gain access to the terminal board, remove the entrance cover and the O-ring from the stator housing.
4. If they are not already connected, then connect the T1 and T2 leads and functional ground which are integrated in the SUBCAB cable to the PEM. See the illustration and table in *Terminals used in standard applications* on page 42.
5. Make sure that all thermal contacts or thermistors which are incorporated in the pump are correctly connected to the PEM.
6. If they are not already connected, then connect the power leads:
   a) Examine the data plate to see which connections are required for the power supply.
   b) Arrange the connections to the terminal board in accordance with the required power supply.
   c) Connect the mains leads: L1, L2, L3, and ground (earth).

      See the applicable cable chart.

      The ground (earth) lead must be longer than the phase leads in the junction box of the pump.

      The following table shows how much extra length is required for the ground (earth) lead.

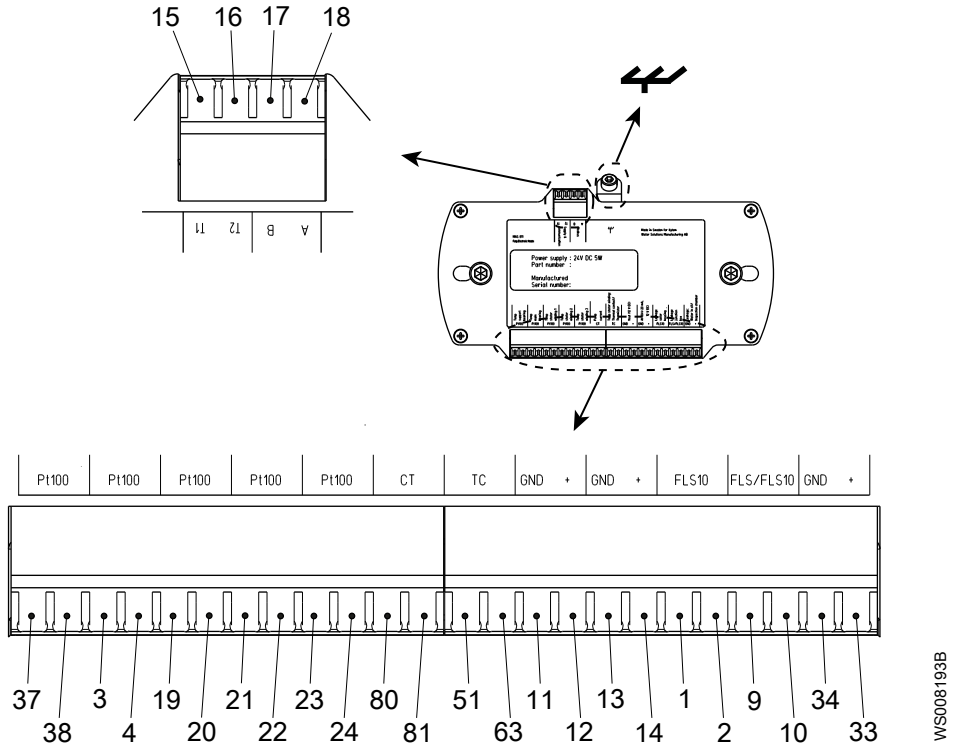
Pump	Extra length of ground conductor, mm (in.)
7030, 7035, 7040	120 (4.8)

7. Make sure that the pump is correctly connected to ground (earth).

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.
10. Connect the SUBCAB cable phase leads to the starter equipment according to the diagram in *Power cable phase sequence* on page 47.
11. Perform the system setup by using the Setup wizard and other commissioning procedures in the chapter “System Setup” in the SIO Manual for the MAS 801.
12. Insulate the unused T3, T4 leads.

    Insulating the unused T3, T4 leads is preferable to clipping them off. If the T1, T2 leads become damaged, then the T3, T4 leads can be used instead.

4.6.5.1 Terminals used in standard applications



Terminal	Description	Terminal	Description
37, 38	Temperature support bearing, Pt100	13, 14	Analog input 0/4 -20 mA, +12 VDC, GND
3, 4	Temperature main bearing, Pt100	1, 2	Leakage: Inspection chamber or stator housing, FLS/FLS10
19, 20	Temperature stator winding 1, Pt100	9, 10	Leakage, junction box: FLS/ FLS10
21, 22	Temperature stator winding 2, Pt100	34, 33	Leakage, inspection chamber: FLS10. Water in oil: CLS
23, 24	Temperature stator winding 3, Pt100	15	T1 power supply and communication
80, 81	Pump current, CT	16	T2 power supply and communication
51, 63	Temperature stator winding: Thermal contact or thermistor, TC	17	Not used
11, 12	V_{out} +12 VDC, GND	18	Not used

4.6.6 Connect the cables: Ex-proof pumps with MAS 801

For Ex-proof applications, the stator winding temperature sensors are not connected to terminals 51 and 63 on the PEM. They are connected to the T3 and T4 terminals on the separate plinth.

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.

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

1. Install the monitoring equipment. See the System Installation and Operation (SIO) Manual for the MAS 801 monitoring equipment.
2. To connect the signal leads to the MAS BU, do the following:
   a) Connect the two signal leads that are integrated in the SUBCAB® cable, T1 and T2, to the MAS BU.

      See the chapter “Installation” in the SIO Manual for the MAS 801 monitoring equipment.
   b) If it is not already connected, then connect the functional ground to the MAS BU.
3. Connect T3 and T4 from the thermal contacts or thermistors.

   The stator winding temperature sensors are connected to the T3 and T4 terminals on the separate plinth.

Option	Description
Thermal contacts	Connect the thermal contacts in the contactor coil circuit so that the circuit breaks directly. Use an auxiliary relay for the thermal contact status signals.
Thermistors	Connect the leads to a SIL-approved thermistor relay.

   For more information, see the SIO Manual for the MAS 801.
4. To gain access to the terminal board, remove the entrance cover and the O-ring from the stator housing.
5. If they are not already connected, then connect the T1 and T2 leads and functional ground which are integrated in the SUBCAB cable to the PEM. See the illustration and table in *Terminals used in Ex applications* on page 44.
6. If they are not already connected, then connect the power leads as follows:
   a) Examine the data plate to see which connections are required for the power supply.
   b) Arrange the connections to the terminal board in accordance with the required power supply.
   c) Connect the mains leads: L1, L2, L3, and ground (earth).

      See the applicable cable chart.

      The ground (earth) lead must be longer than the phase leads in the junction box of the pump.

      The following table shows how much extra length is required for the ground (earth) lead.

Pump	Extra length of ground conductor, mm (in.)
7030, 7035, 7040	120 (4.8)

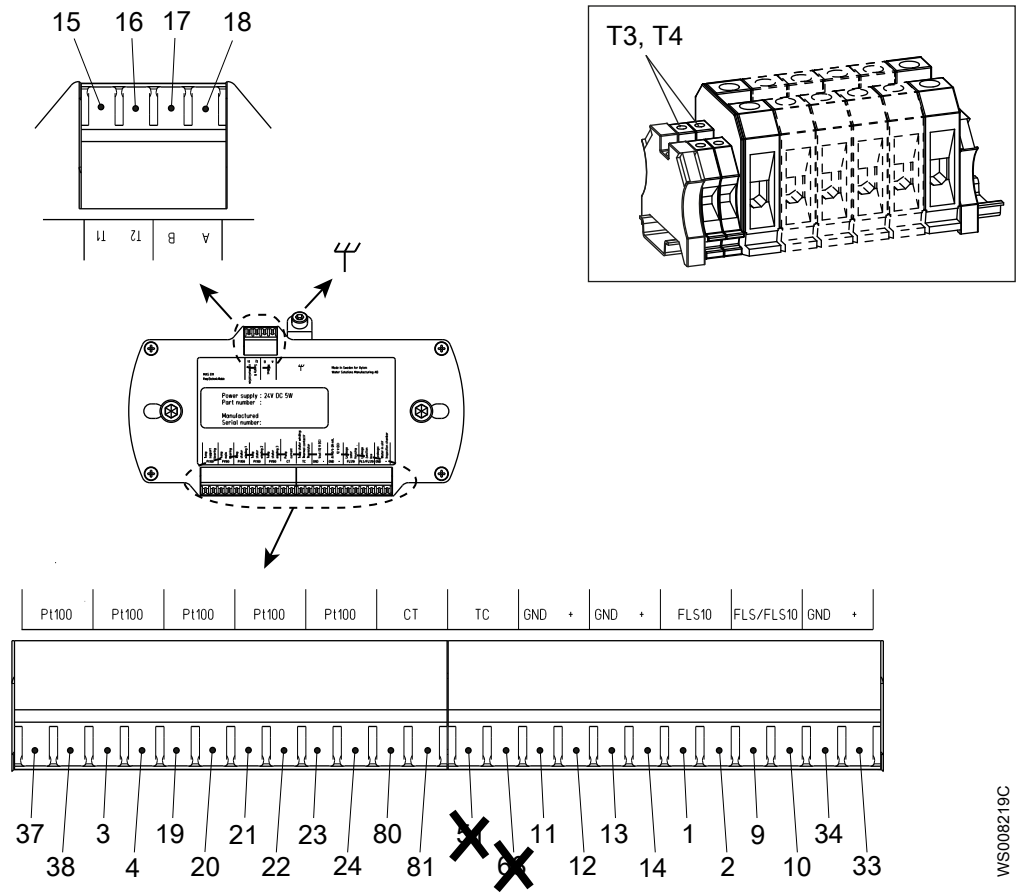
7. Make sure that the pump is correctly connected to ground (earth).
8. Install the entrance cover and the O-ring on the stator housing.
9. Fasten the screws on the entrance flange so that the cable insertion assembly bottoms out.

10. Connect the SUBCAB cable phase leads to the starter equipment according to the diagram in *Power cable phase sequence* on page 47.
11. Perform the system setup by using the Setup wizard and other commissioning procedures in the chapter “System Setup” in the SIO Manual for the MAS 801.

4.6.6.1 Terminals used in Ex applications

For Ex applications, the stator winding temperature sensors are not connected to terminals 51 and 63 on the PEM. They are connected to the T3 and T4 terminals on the separate plinth.

- Thermal contacts must be wired separately to break contactor circuit directly.
- Thermistors must be wired to a Safety Integrity Level (SIL)-approved thermistor relay.



Terminal	Description	Terminal	Description
37, 38	Temperature support bearing, Pt100	1, 2	Leakage: Inspection chamber or stator housing, FLS/FLS10
3, 4	Temperature main bearing, Pt100	9, 10	Leakage junction box, FLS/ FLS10
19, 20	Temperature stator winding 1, Pt100	34, 33	Leakage, inspection chamber: FLS10
21, 22	Temperature stator winding 2, Pt100	15	T1 power supply and communication
23, 24	Temperature stator winding 3, Pt100	16	T2 power supply and communication
80, 81	Pump current, CT	17	Not used
11, 12	V_{out} +12 VDC, GND	18	Not used

Terminal	Description	Terminal	Description
13, 14	Analog input 0/4 -20 mA, +12 VDC, GND	T3, T4	Temperature stator winding: Thermal contact or thermistor, TC

4.6.7 Connect the cables: Pumps with MiniCAS or MAS 711

4.6.7.1 Connect the SUBCAB 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.

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 the applicable cable chart.

   The ground (earth) lead must be 120 mm (4.8 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, and twist the leads together.
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.

4.6.7.2 Connect the SUBCAB cable to the starter and MiniCAS 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 rated explosion-proof or intrinsically-safe, then see the specific explosion-proof 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.

1. If thermal contacts are included in the pump installation, then connect the T1 and T2 control conductors to the MiniCAS II monitoring equipment. Twist the monitoring wires together.
2. If thermistors are included in the pump installation, and screened or auxiliary cable is used, then connect T1(1) and T2(2) to thermistor relay, and T3(3) and T4 (4) to MiniCAS II.
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* on page 48.
4. 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.

4.6.7.3 Connect the SUBCAB cables to the starter and MAS 711 monitoring equipment

This section provides connections for MAS 711 using 12–lead sensor cable and four power cable leads. It is applicable to pump models 7030, 7035 and 7040, with one screened motor cable.

This configuration requires screened cables.

The T1–T4 leads are used only for pump memory.

1. Connect the sensors as shown in the following figure and tables.

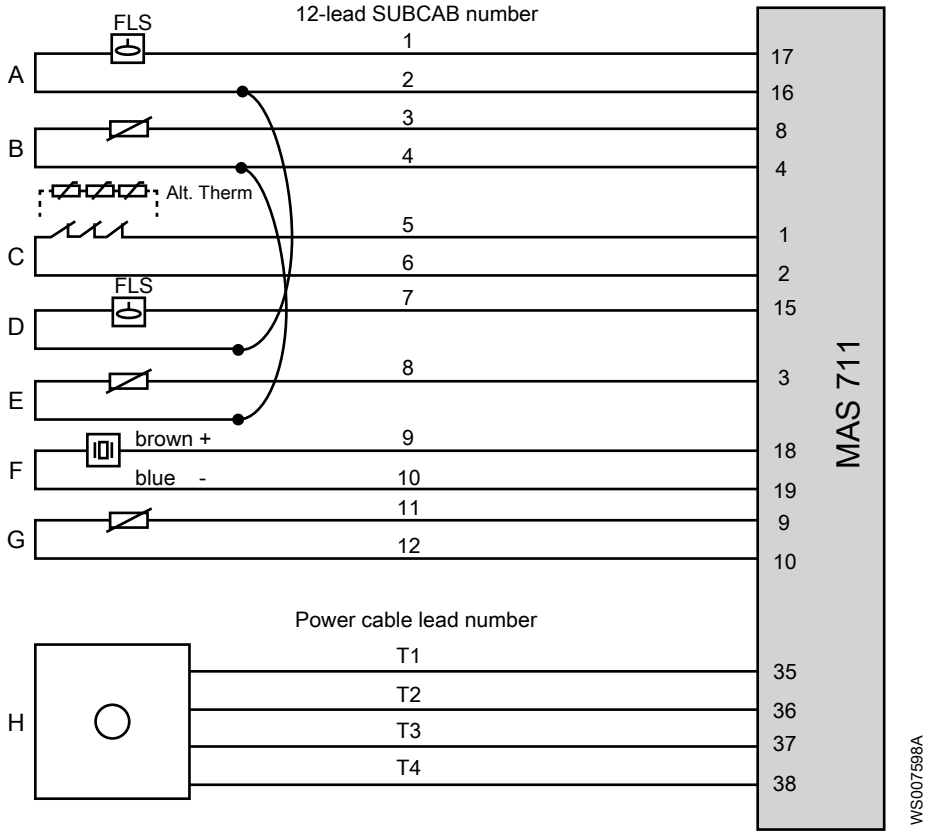


Figure 14: Connection for MAS 711 using 12–lead sensor cable and power cable leads

Item	Description	Connection
A	Inspection chamber leakage	12–lead sensor cable
B	Main bearing, Pt100	12–lead sensor cable
C	Stator winding, thermal switches	12–lead sensor cable

Item	Description	Connection
D	Junction box leakage	12–lead sensor cable
E	Stator winding 1, Pt100	12–lead sensor cable
F	Vibration, VIS10	12–lead sensor cable
G	Support bearing, Pt100	12–lead sensor cable
H	Pump memory	Power cable sensor leads

Table 11: Pump memory

Power Cable Lead Number	Description
T1	Supply 12V +
T2	Supply, ground
T3	RS485A
T4	RS485B

Table 12: Vibration, VIS10

12–lead SUBCAB Number	Color
9	Brown, +
10	Blue, –

2. 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* on page 48.
3. 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.

4.6.8 Power cable phase sequence

In the following figure, the triangle marked “L1,” “L2” and “L3” shows the phase sequence.

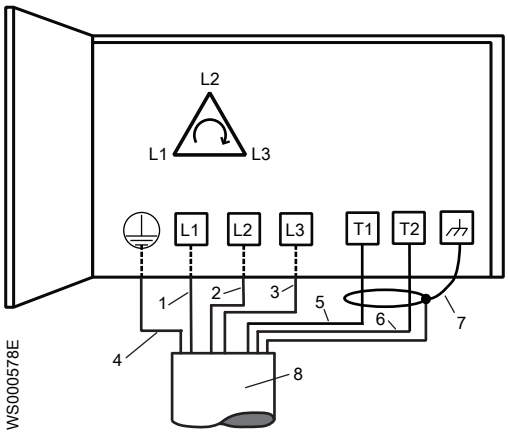


Figure 15: Correct phase sequence

Item	Description	
1	L1 cable lead	Brown
2	L2 cable lead	Black
3	L3 cable lead	Gray
4	Earth PE or ground lead cable	
5	T1 cable lead (control element)	In cables with both power conductors and

Item	Description	
6	T2 cable lead (control element)	control element. MAS 801: See the SIO manual for T1, T2, and drain wire connections.
7	Screen (drain wire)	
8	Power cable to unit	

4.6.9 Cable bending radius, weight and diameter

Table 13: SUBCAB®

Cable	Minimum bending radius in mm	Weight in kg/m	Outer diameter, minimum-maximum in mm
4G4 + 2x1.5	200	0.63	Ø 20.0–22.0
4G6 + 2x1.5	240	0.83	Ø 24–26
4G10 + S(2x0.5)	240	0.85	Ø 24–26
4G16 + S(2x0.5)	260	1.13	Ø 26–28
4G25 + S(2x0.5)	320	1.70	Ø 32–34
4G35 + S(2x0.5)	350	2.24	Ø 35–37
3x50 + 2G35/2 + S(2x0.5)	350	2.6	Ø 35–37
3x70 + 2G35/2 + S(2x0.5)	380	3.3	Ø 38–41

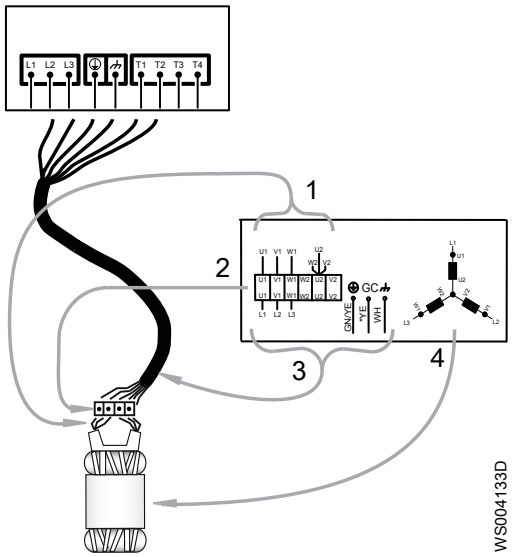
Table 14: SUBCAB® screened cables

Cable	Minimum bending radius in mm	Weight in kg/m	Outer diameter, minimum-maximum in mm
S3x6 + 3x6/3 + S(4x0.5)	200	0.55	Ø 20–22
S3x10 + 3x10/3 + S(4x0.5)	240	0.95	Ø 24–26
S3x16 + 3x16/3 + S(4x0.5)	240	1.1	Ø 24–26
S3x25 + 3x16/3 + S(4x0.5)	290	1.4	Ø 29–31
S3x35 + 3x16/3 + S(4x0.5)	320	2.0	Ø 32–34
S3x50 + 3x25/3 + S(4x0.5)	380	3.0	Ø 38–40
S3x70 + 3x35/3 +2 S(2x0.5)	420	3.5	Ø 42–44

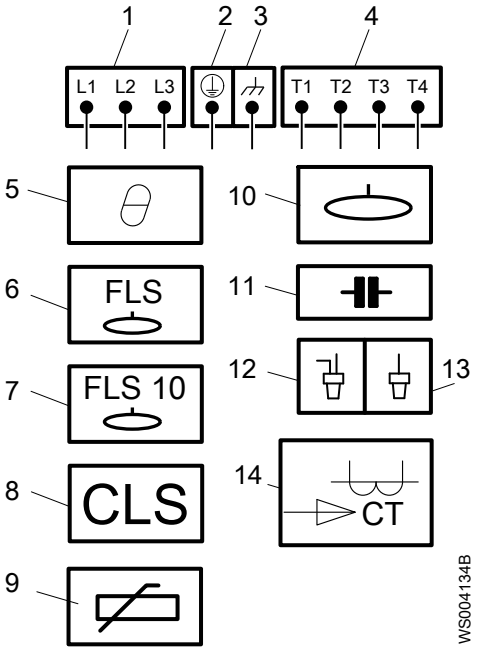
4.7 Cable charts

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)



1. Starter equipment and mains leads (L1, L2, L3)
2. Ground (earth)
3. Functional ground
4. Control leads (T1, T2, T3, T4)
5. Thermal contact
6. FLS
7. FLS 10
8. CLS
9. Thermistor
10. Level sensor
11. Capacitor
12. Crimp connection
13. Crimp isolation
14. Current transformer

4.7.1 Colors and markings of leads

Motor Connection

COLOR STANDARD

BN = Brown
BK = Black
WH = White
OG = Orange
GN = Green
GN/YE = Green-Yellow
RD = Red
GY = Grey
BU = Blue
YE = Yellow

STATOR LEADS

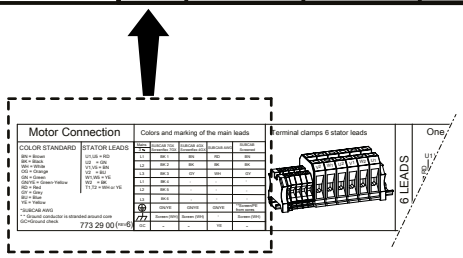
U1,U5 = RD
U2 = GN
V1,V5 = BN
V2 = BU
W1,W5 = YE
W2 = BK
T1,T2 = WH or YE

*SUBCAB AWG
* * Ground conductor is stranded around core
GC=Ground check

773 29 00 (REV 9)

Colors and marking of the main leads

Mains 3 ~	SUBCAB 7GX Screenflex 7GX	SUBCAB 4GX Screenflex 4GX	SUBCAB AWG	SUBCAB Screened
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	-	-	-
⏚	GN/YE	GN/YE	GN/YE	**Screen/PE from cores
⏚	Screen (WH)	Screen (WH)	-	Screen (WH)
GC	-	-	YE	-



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See *Color code standard* on page 50.

Color code standard

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

4.7.2 Motor connection

See the data plate for the applicable connection diagram.

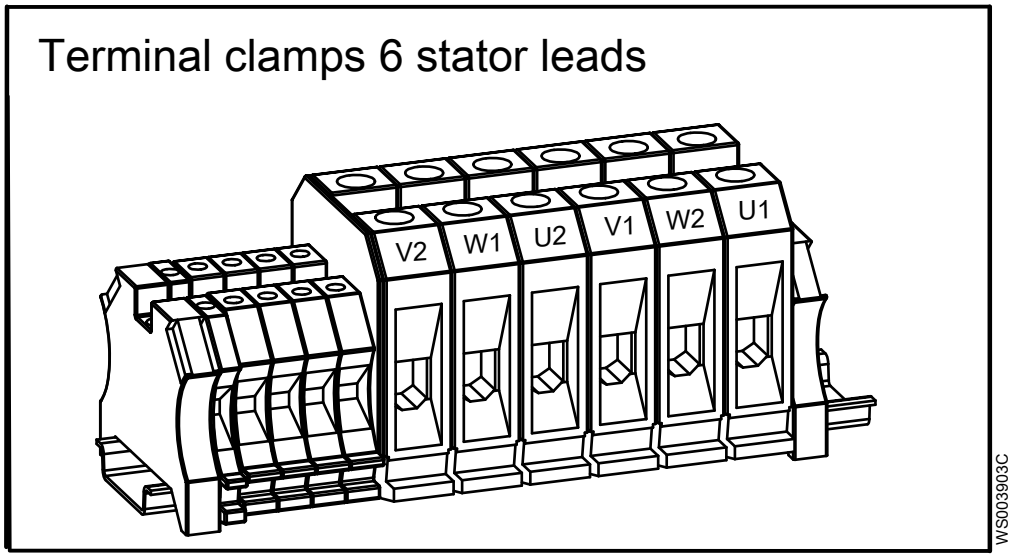


Figure 16: Terminal clamps, 6 stator leads

6 leads

One cable (left) and two cables (right) Y-connection. Applicable to: 4–50 mm^2.

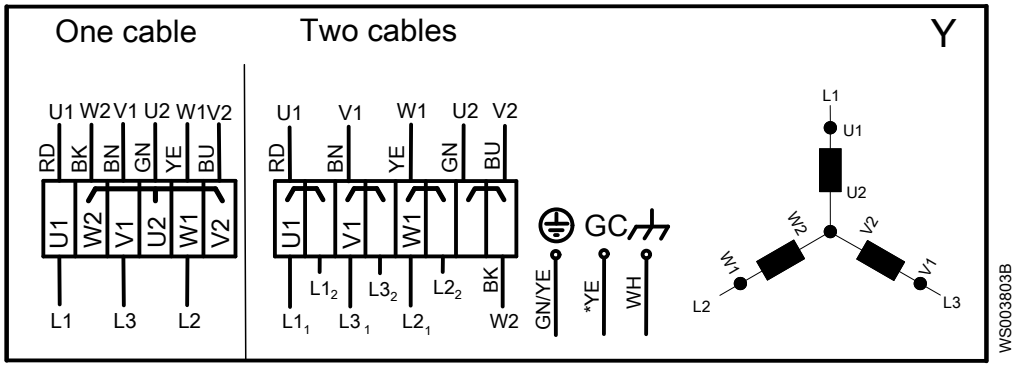


Figure 17: Y-connection, 4–50 mm^2

One cable (left) and two cables (right) D-connection. Applicable to: 4–50 mm^2.

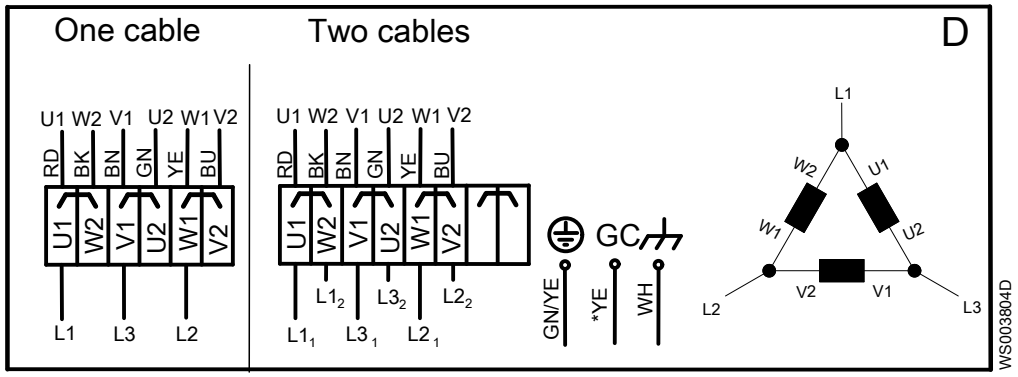


Figure 18: D-connection, 4–50 mm^2

Only for one cable, Y- and D-connection. Applicable to: 70 mm^2.

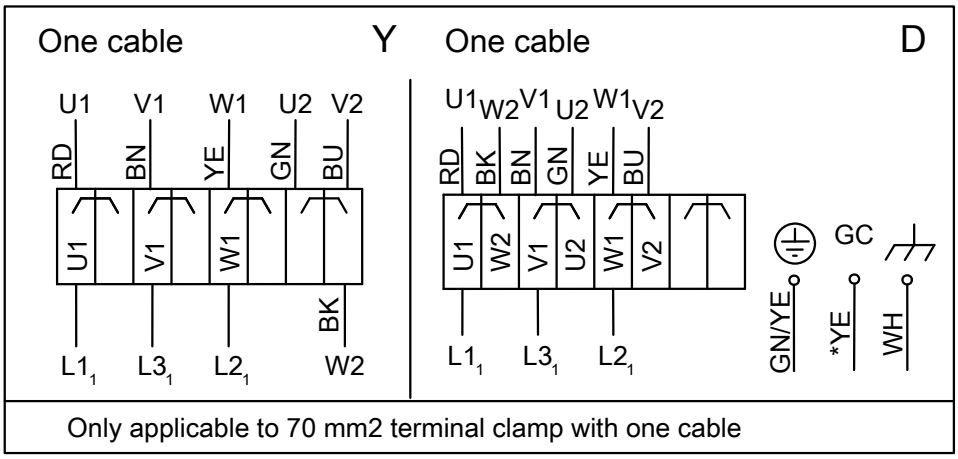


Figure 19: Y- and D-connection, 70 mm^2

One cable (left) and two cables (right) D-connection. Applicable to: 95–120 mm^2.

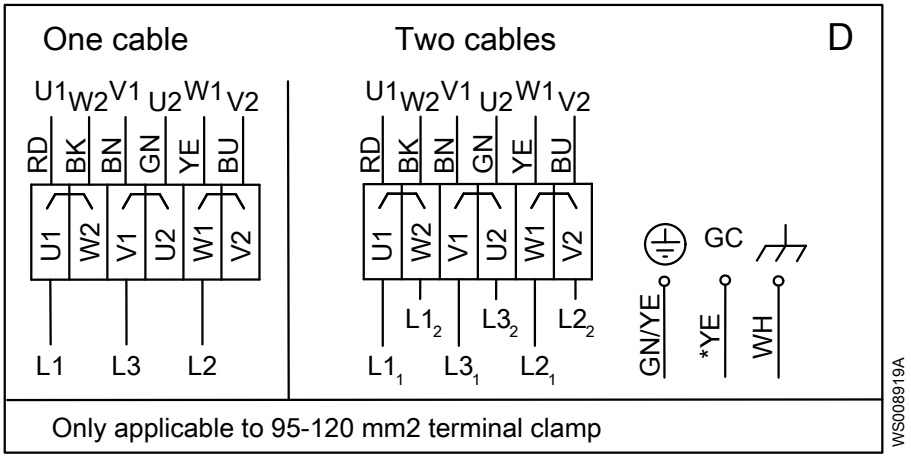


Figure 20: D-connection, 95–120 mm^2

One cable (left) and two cables (right) Y/D-connection.

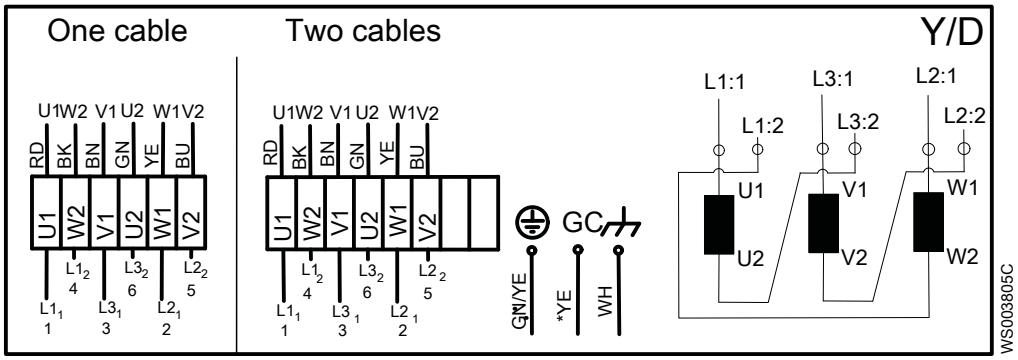


Figure 21: Y/D-connection

9 leads

One cable (left) and two cables (right) Y-parallel connection. Not applicable with P7035 or P7040.

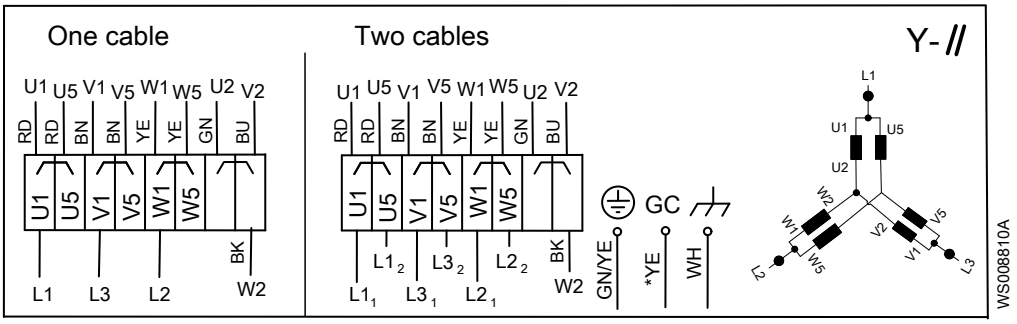


Figure 22: Y-parallel connection: P7030 only

One cable (left) and two cables (right) Y-serial connection. Not applicable with P7035 or P7040.

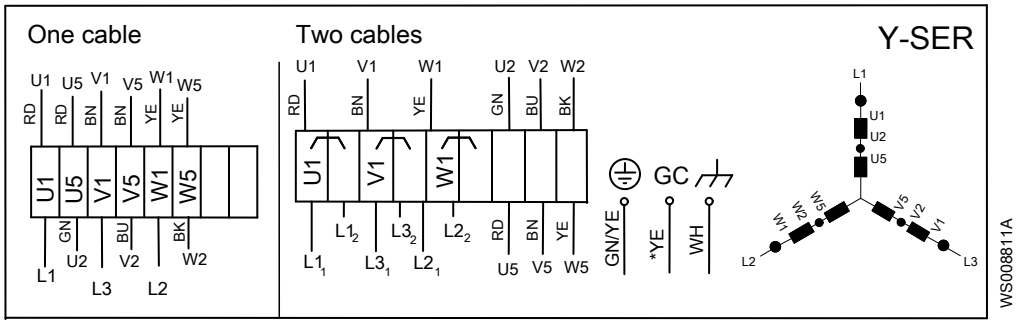


Figure 23: Y-serial connection: P7030 only

Screened cables

Cable without separate ground conductor. Screen as ground conductor.

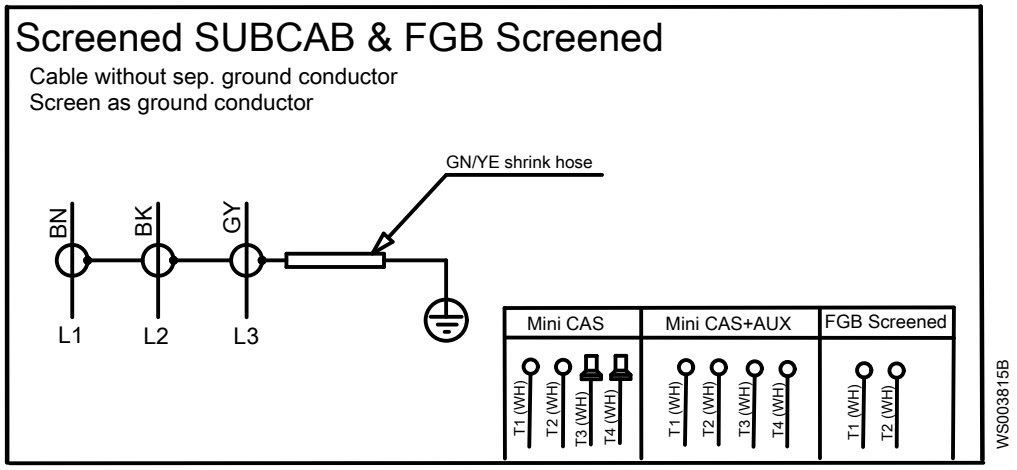


Figure 24: Screened SUBCAB and FGB Screened

4.7.3 MAS 711 connections

For the MAS 711 connection diagram, see *Connect the SUBCAB cables to the starter and MAS 711 monitoring equipment* on page 46.

4.7.4 Sensor connection: MiniCAS

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

WS003843B

Figure 25: Color and marking of control leads

See *Color code standard* on page 50.

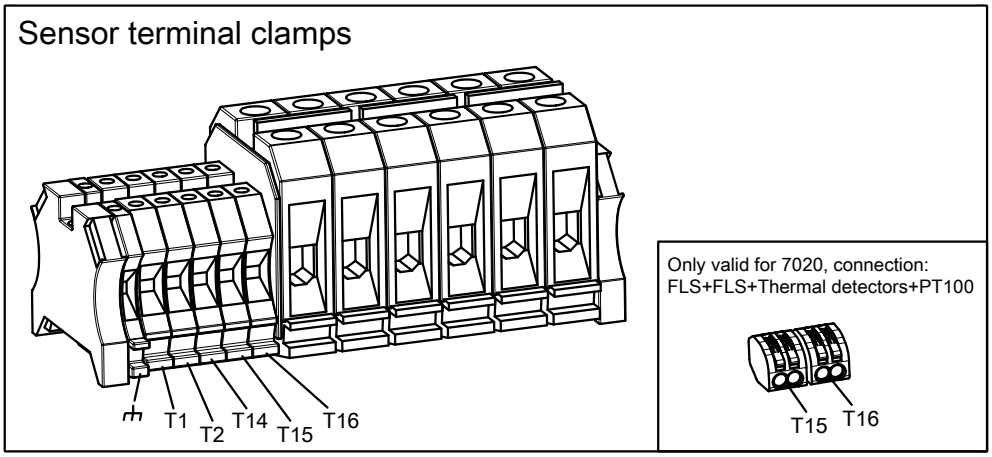


Figure 26: Sensor terminal clamps. Additional terminal clamps are shown at insert at lower right; only valid for P7020, connection: FLS + FLS + thermal detectors + Pt100.

4.7.5 MiniCAS connections

FLS and thermal detectors

Thermal detector, Ohms	Description
∞	Overtemperature
1200	OK
430	Leakage

The values have a 10 % tolerance.

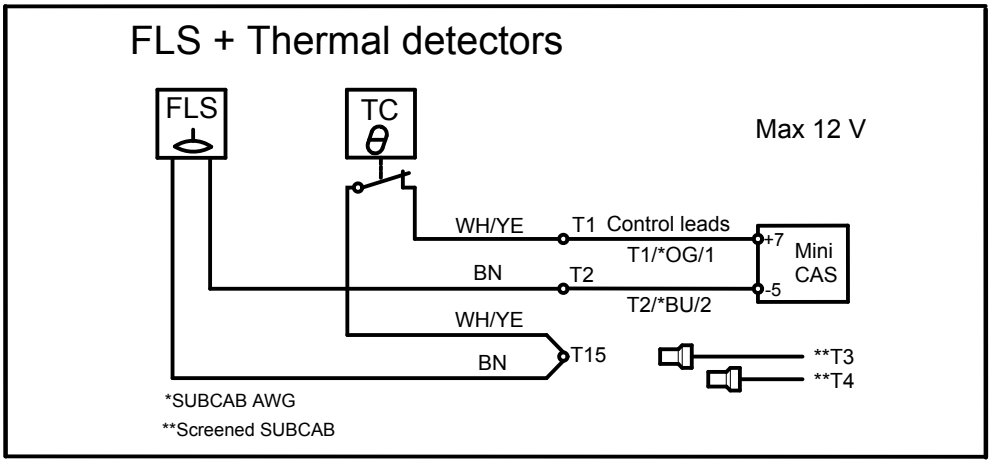


Figure 27: 1 FLS + thermal detectors

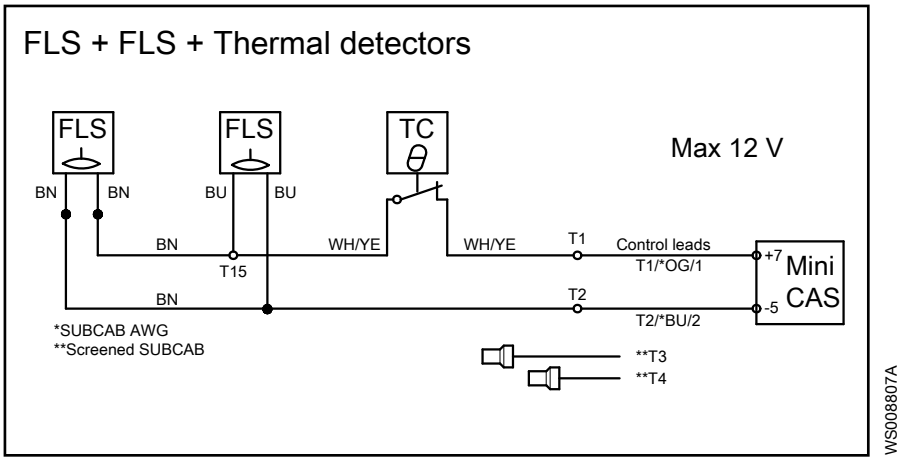


Figure 28: 2 FLS + thermal detectors

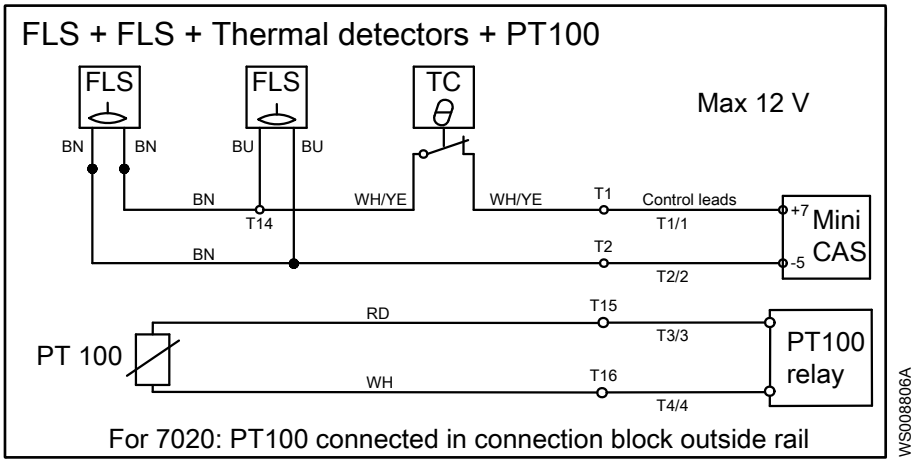


Figure 29: 2 FLS + thermal detectors + Pt100 (main bearing)

FLS 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

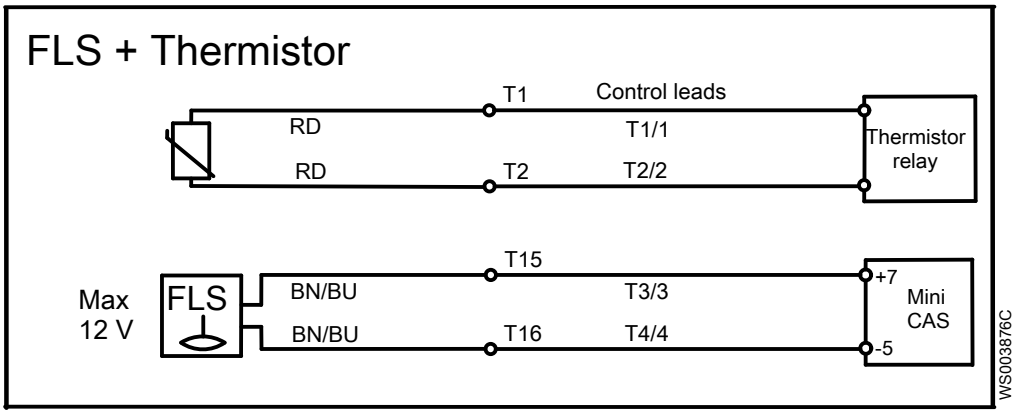


Figure 30: 1 FLS + thermistor

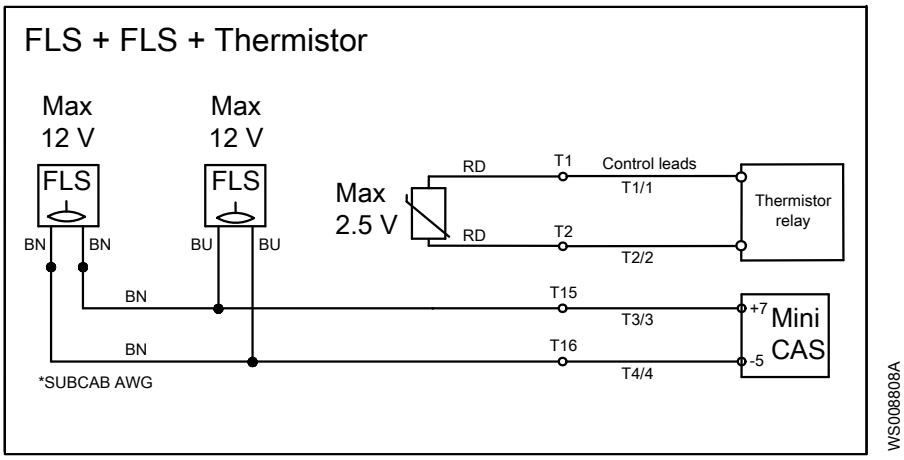


Figure 31: 2 FLS + thermistor

Thermal detectors; FLS disconnected

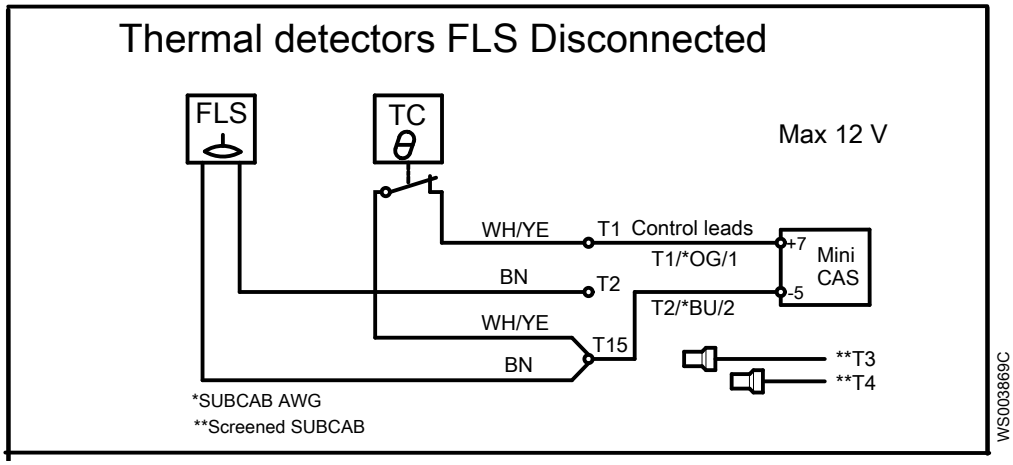


Figure 32: Thermal detectors connected, and FLS disconnected

Screened cables

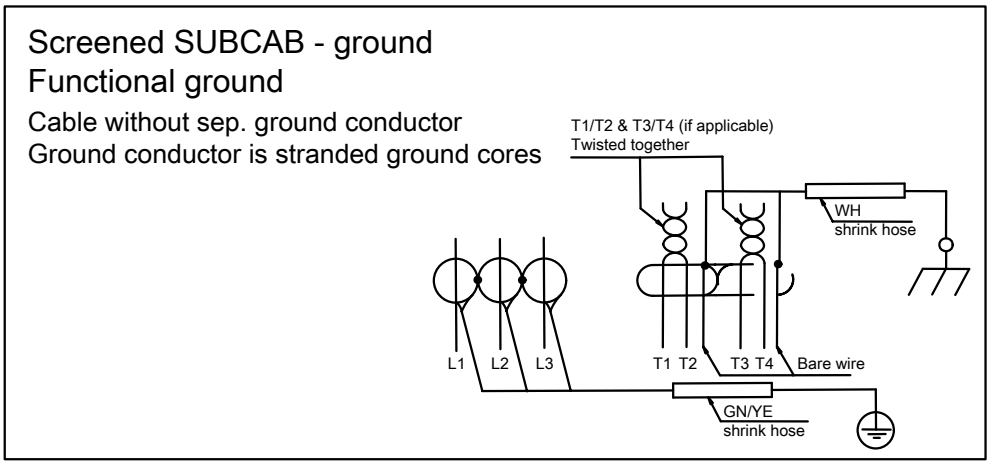
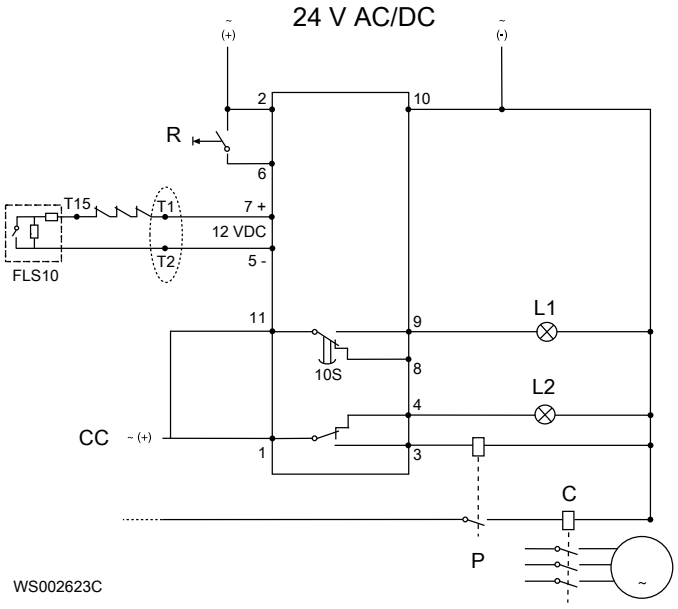


Figure 33: Cable without separate ground conductor. Ground conductor is stranded ground cores.

MiniCAS II



C Pump contactor
CC Control circuit
L1 Caution light (leakage)
L2 Caution light (stator over-temperature)
P Pump main supply
R Reset switch

4.8 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.

If the propeller rotates in the wrong direction, then the pump lifts up and rotates, which can damage the cables.

1. Start the motor.
2. Stop the motor after a few seconds.
3. Check the propeller rotation.

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

Direction of propeller rotation. Generic pump shown.

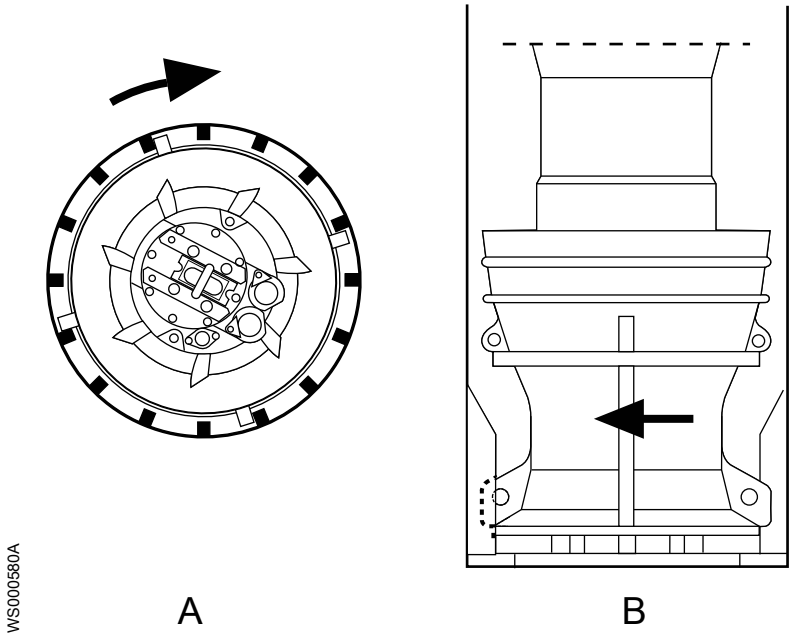


Figure 34: Top view (A) and side view (B)

4. If the impeller/propeller rotates in the wrong direction, then check that the phase leads are correctly connected. See *Power cable phase sequence* on page 47.

   After reconnecting phase leads, 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.

CAUTION: Thermal Hazard

The surfaces or parts of the unit may become hot during operation. Allow surfaces to cool before starting work, or wear heat-protective clothing.

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

6.1 Precautions

Before starting work, make sure that the safety instructions 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.

DANGER: Inhalation Hazard

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

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.
- Before starting work, make sure that the work area is well-ventilated.
- 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.

6.1.1 Rotating propeller

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.

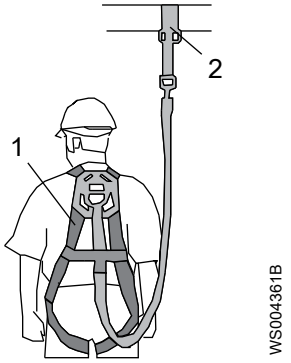
6.1.2 Falling

CAUTION: Fall Hazard

Slips and falls can cause severe injuries. Watch your step.

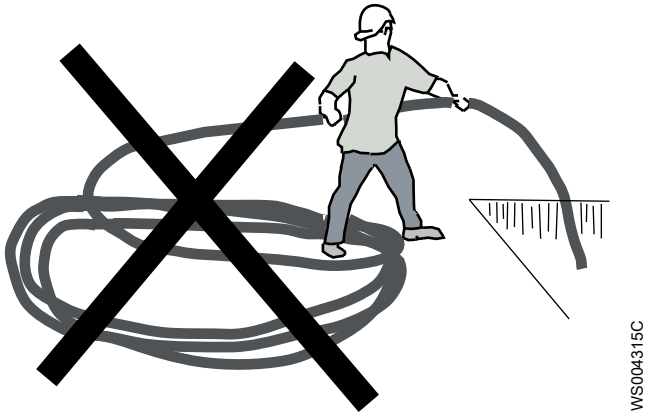
To minimize the risk of falling, observe the following:

- Use appropriate personal protection equipment when working in or near open basins, shafts, or trenches.



1. Fall protection harness
2. Anchoring point

- Make sure that all safety guards are in place and secure, and that there is a suitable barrier around the work area.
- Wear clean slip-resistant shoes.
- Make sure that any ladders or climbing equipment that is used is correctly sized and in good working condition.
- Never stand in coiled cables, ropes or wires, or between them and the open shaft or basin.



Diffuser adapter

When the pump is lifted for maintenance, then make sure that the diffuser adapter remains at the bottom of the column.

6.2 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 applicable lubricants to prevent seizing.

If there is a question regarding the tightening torques, then contact a sales or authorized service representative.

Screws and nuts

Table 15: Stainless steel, A2 and A4, torque Nm (lbf·ft)

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 16: Steel, torque Nm (lbf·ft)

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)

Table 17: Brass, torque Nm (lbf·ft)

M5	M8	M10
2.7 (2.0)	11 (8.1)	22 (16.2)

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.

6.3 Check the temperature sensors

If the pump is connected to the MAS monitoring system, then it is recommended that the sensors be checked in the MAS unit. Otherwise, use a multimeter.

The different types of temperature sensors are:

- Thermal switches
- PTC-thermistors
- Pt100

NOTICE:

Do not use a megger or other device applying a higher voltage than 2.5 V.

1. Disconnect the sensor wires.
2. Measure the resistance to check the status of the sensor and wiring according to the values in *Sensors* on page 18.
3. Measure between each sensor lead to ground (earth) to establish that the resistance is infinite (or at least several Megaohm).

6.4 Check the leakage sensors

If the pump is connected to the MAS monitoring system, then it is recommended that the sensors be checked in the MAS unit. Otherwise, use a multimeter.

1. Check the float switch (FLS) in the inspection chamber, according to the values in *Sensors* on page 18.

   Measure ohms by using a multimeter to establish either of the conditions below (or both if the sensor is accessible).
2. Check the float switch (FLS) in the junction box (connection housing).

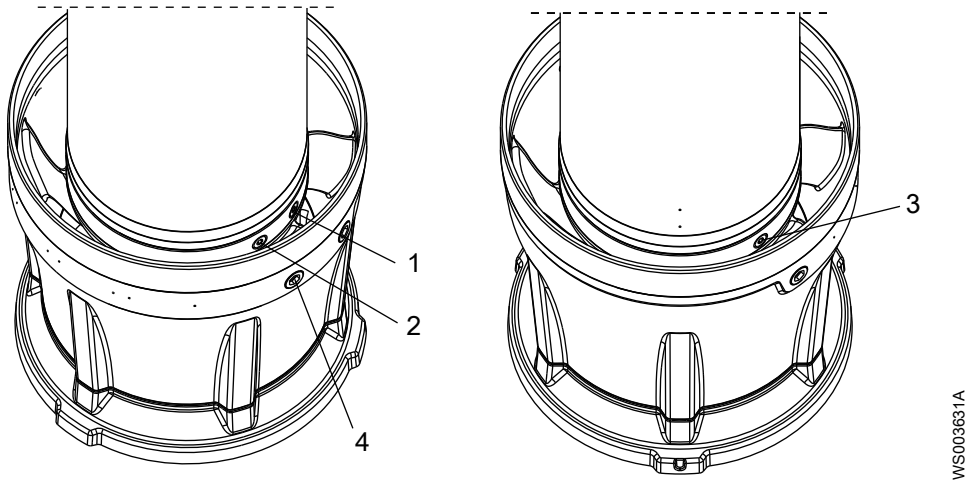
6.4.1 FLS

Table 18: Float switch sensor (FLS)

Description	Measured value	Fault values
The float switches are leakage sensors. The float switches are located in the lower part of the stator housing and in the junction box.	Resistance. 2 sensor variants: FLS: • Normal: 1530 ohm • Alarm: 330 ohm FLS 10: • Normal: 1200 ohm • Alarm: 430 ohm	> 10% (approx.) deviation from rated ohm values indicates sensor fault, or fault in the wiring.

6.5 Changing the oil

This figure shows where the plugs for change of oil are placed on the unit.



1. Oil plug
2. Inspection plug
3. Oil plug
4. Outer screw

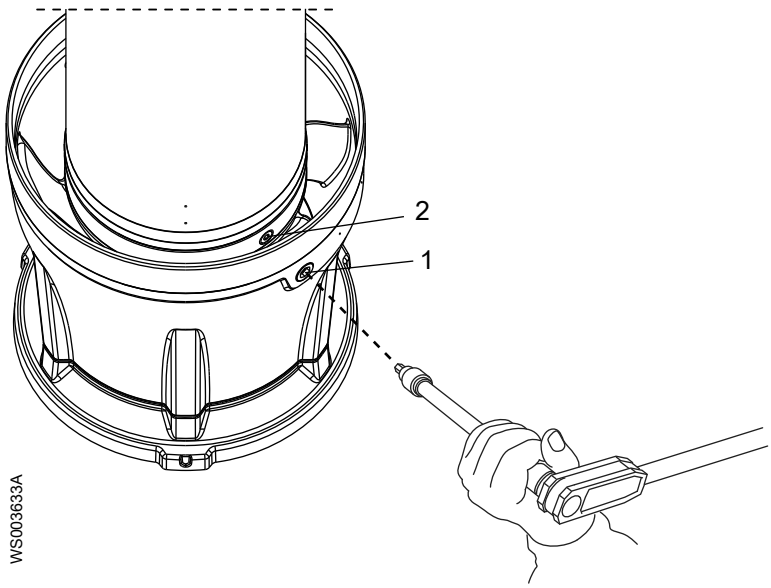
Figure 35: With a cooling jacket

6.5.1 Empty the oil

CAUTION: Compressed Gas Hazard

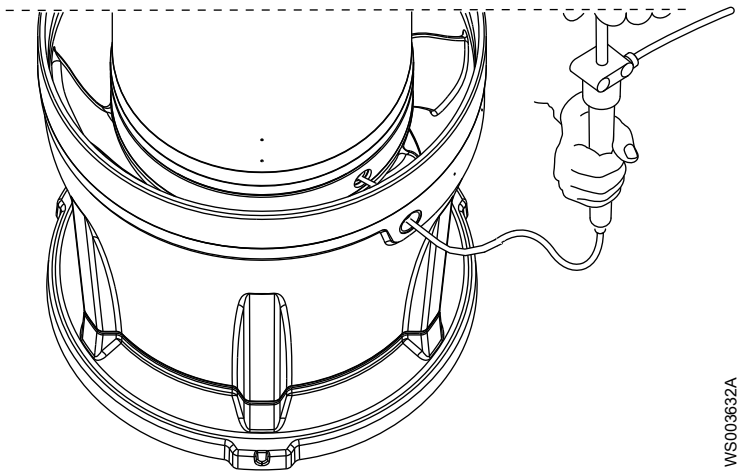
Air inside the chamber may cause parts or liquid to be propelled with force. Be careful when opening. Allow the chamber to de-pressurize before removal of the plug.

1. Remove the outer screw and the inner screw of both oil plugs, and the inspection plug, on the hydraulic part.



1. Outer screw
2. Inner screw

2. Thread the hose of the hand-pump through the inner and outer holes into the seal chamber.



3. Pump out any liquid from the seal chamber.
4. Remove the inspection plug.
5. Pump out any liquid from the inspection chamber.
6. Reassemble the inspection plug with a new O-ring. Remount the plug and tighten.
   Tightening torque: 44 Nm (33 ft-lb)
7. Remount the outer screw for the inspection plug.
   Tightening torque: 76 Nm (57 ft-lb)

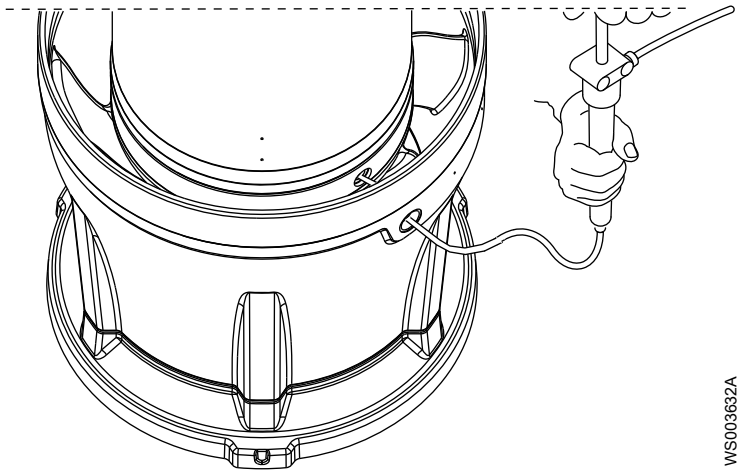
6.5.2 Fill with oil

The pump is delivered with a tasteless, odorless, medical white oil of paraffin type that fulfills FDA 172.878.

Examples of suitable oil types are the following:

- Statoil MedicWay 32™
- BP Enerpar M 004™
- Shell Ondina 927™
- Shell Ondina X430™

1. Thread the hose of the hand-pump through both of the holes into the seal chamber.



2. Pump oil into the seal chamber until it overflows through the opposite hole.

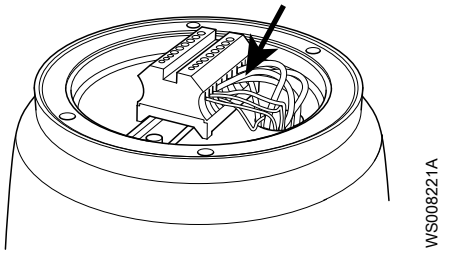
Table 19: Approximate oil quantities

Pump	Quantity, L (qt)
7030	2.4 (2.5)
7035	3.6 (3.8)
7040	3.8 (4.0)

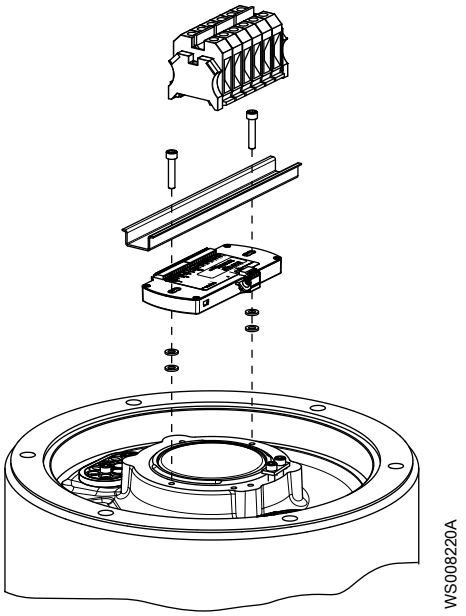
3. Replace the O-rings with new ones.
4. Remount the oil plugs and tighten.
   Tightening torque: 44 Nm (33 ft-lb)
5. Remount the outer screws for the oil plug.
   Tightening torque: 76 Nm (57 ft-lb)

6.6 Pumps with MAS 801: Replace the PEM

1. Remove the entrance cover and cable leads.
2. To remove the terminal block and rail, follow this procedure:
   a) Disconnect the remaining leads from the terminal block.



b) Remove the screws securing the rail under the terminal block and the PEM.
c) Lift out the terminal block and the rail.



3. To remove the PEM, follow this procedure:
   a) Disconnect the communication terminals T1 and T2 from the PEM.
   b) Disconnect the control terminals on the PEM.

      For Ex-proof pumps, do not disconnect T3 and T4 from the separate plinth.
   c) Disconnect the functional ground.
   d) Lift out the PEM.
4. To install the new PEM, follow this procedure:
   a) Fit the new PEM into position. Temporarily secure with two screws.
   b) Connect the functional ground.
   c) Connect the control terminals.

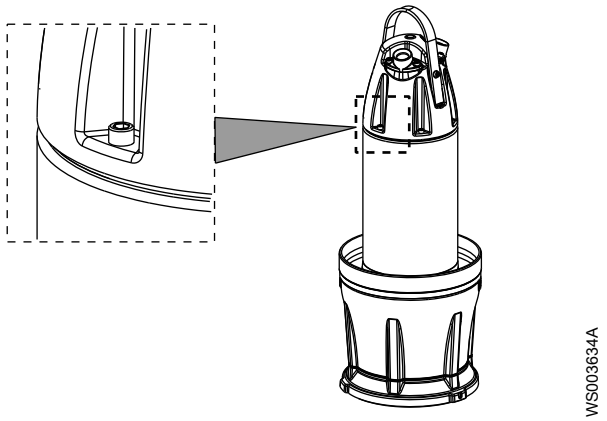
      For Ex-proof pumps, do not use connections 51 and 63 on the PEM. For Ex-proof pumps, T3 and T4 must be connected to the separate plinth.
   d) Connect the communication terminals T1 and T2.
   e) Remove the two screws that temporarily secure the PEM.
5. Install the rail and terminal block. Secure with two screws.
6. Reconnect the cable leads to the terminal block.
7. To download information to the PEM, see the System Installation and Operation (SIO) Manual for the MAS 801 monitoring equipment.

6.7 Preparing for work on the hydraulic end

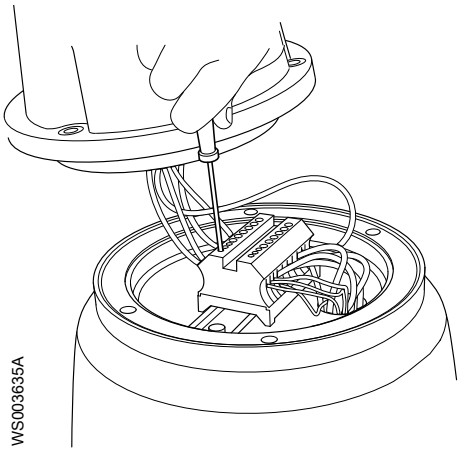
Some maintenance work on the hydraulic end of the pump, such as changing the impeller or replacing zinc anodes, requires that the pump be turned upside-down.

6.7.1 Remove the entrance cover

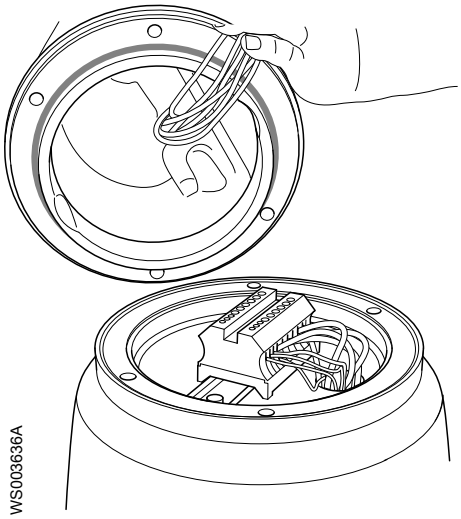
1. Remove the entrance cover screws.



2. Disconnect the cable leads.



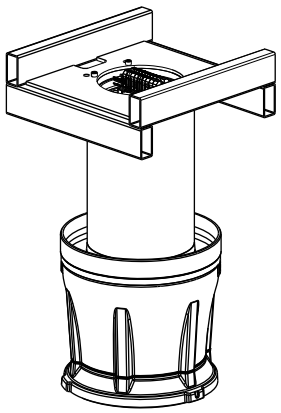
3. Lift off the entrance cover.



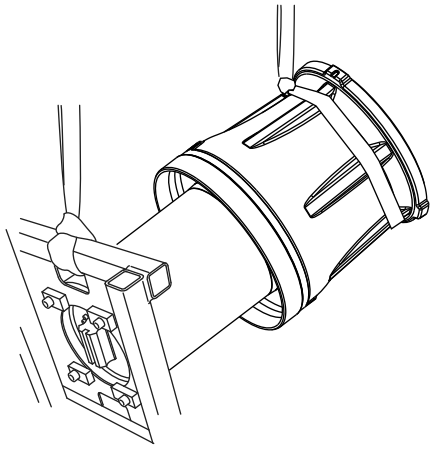
6.7.2 Attach the assembly and dismantling stand

Two lifting devices are required for this task.

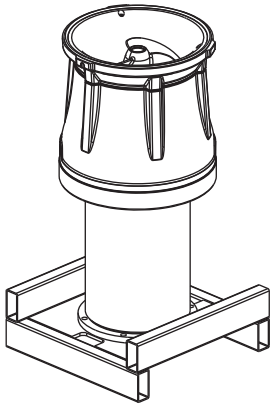
1. Bolt the assembly/dismantling stand (605 70 00) in position. Secure it using the screws for the entrance cover.



2. Attach lifting straps as shown in the following figure, and lift the pump.



3. Place the drive unit upside down on the stand.



6.8 Replacing the propeller

Required tools:

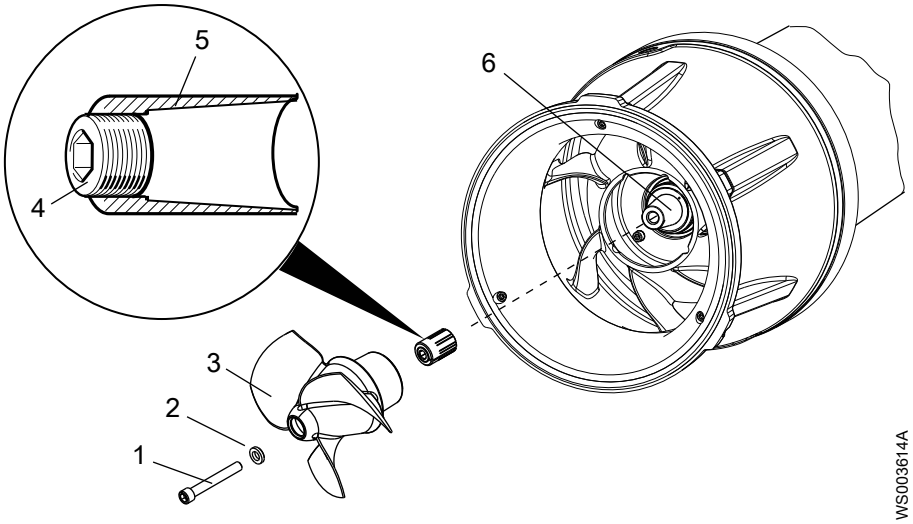
- Stand 605 70 00
- 14 mm hexagon bit adapter with an extension bar
- Trim tool (17 mm hexagon bit adapter with an extension bar)
- Rod (wood or plastic) for locking the impeller in place.

CAUTION: Cutting Hazard

Worn parts can have sharp edges. Wear protective clothing.

During this procedure the pump is upside down. The stand 605 70 00 is used to support the pump in the upside down position. For instructions for attaching the stand, see *Preparing for work on the hydraulic end* on page 67.

The propeller parts are shown in the following figure.



1. Propeller screw
2. Washer
3. Propeller
4. Adjustment screw
5. Conical sleeve
6. Conical shaft end

6.8.1 Measure the clearance

Depending on the type of media that is being pumped the pump will be more or less exposed to wear, mainly in the gap between the propeller blades and the pump housing.

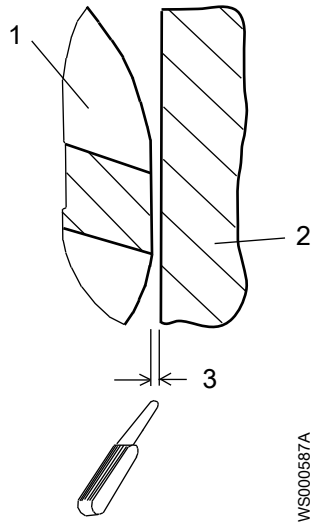
The clearance between the propeller blades and the pump housing will increase. The effect of this is that the capacity as well as the efficiency will drop. It should be noted that these effects are not linearly proportional to the size of the clearance, but progressive.

Operating the pump when the blade–housing clearance has reached or exceeded the clearance threshold will result in a loss of capacity (flow) and pump efficiency.

It is therefore recommended that the blade–housing clearance be checked at routine inspections and worn parts be replaced as necessary. If the measured blade–housing clearance exceeds the critical limit, then we recommend that the efficiency drop be evaluated and replacement of worn parts be considered.

1. Measure the clearance between the propeller blades and the pump housing in a few places to get an average value.

   The blade–housing clearance can vary slightly as the propeller might not be perfectly centered due to manufacturing tolerances.



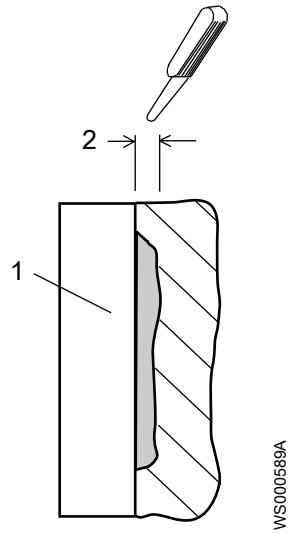
1. Propeller
2. Pump housing
3. Critical clearance

Figure 36: Critical clearance

Pump	Clearance threshold for efficiency drop, mm (in)
7030	1.3 (0.051)
7035	1.2 (0.047)
7040	1.6 (0.063)

If the measured clearance is less than the threshold value given in the table above, then the rest of the steps in this section can be omitted. If the measured clearance is greater than the threshold value in the table above, then proceed as follows:

2. Measure the wear in the pump housing with a thickness gauge by placing the edge of a ruler across the surface of the housing.



1. Ruler
2. Wear

3. Replace parts according to the table.

Pump	Wear measured, mm (in)	Action
7030	0.3 (0.012)	Replace the propeller
	1.0 (0.039)	Replace the bellmouth

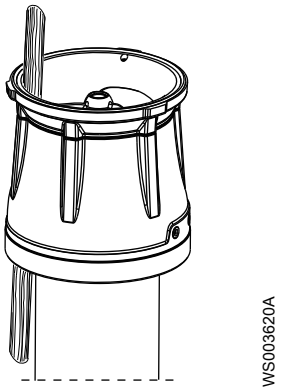
Pump	Wear measured, mm (in)	Action
7035	0.3 (0.012)	Replace the propeller
	0.9 (0.035)	Replace the bellmouth
7040	0.4 (0.016)	Replace the propeller
	1.2 (0.047)	Replace the bellmouth

6.8.2 Remove the propeller

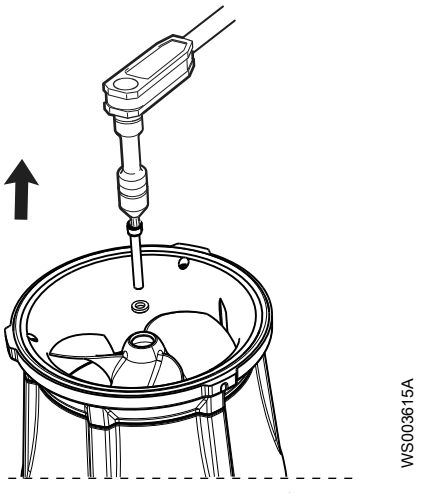
CAUTION: Cutting Hazard

Sharp edges. Wear protective clothing.

1. Lock the propeller in place by inserting a rod or piece of wood through the pump housing outlet.

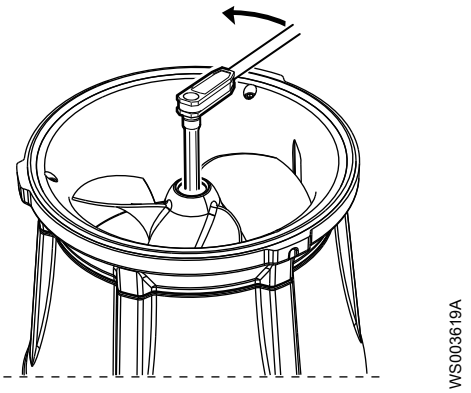


2. Loosen the propeller:
   a) Remove the propeller screw and washer.

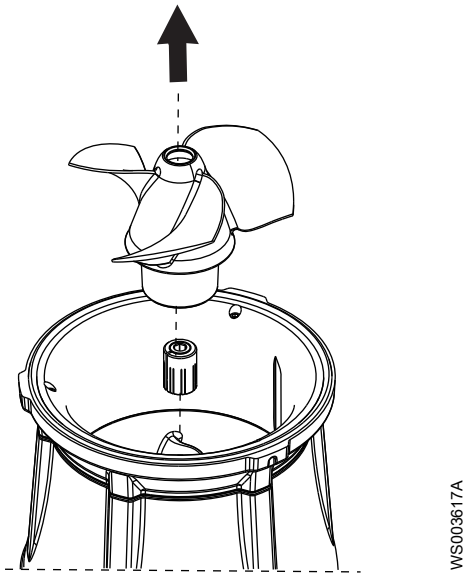


   b) Turn the adjustment screw counterclockwise until the propeller breaks free from the shaft.

      Use the trim tool.



3. Remove the propeller and the propeller sleeve.



6.8.3 Install the propeller

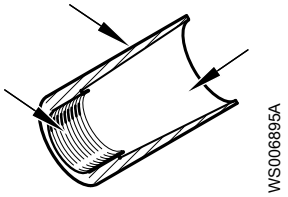
1. Prepare the shaft:
   a) Polish off any flaws by using a fine emery cloth.

      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.

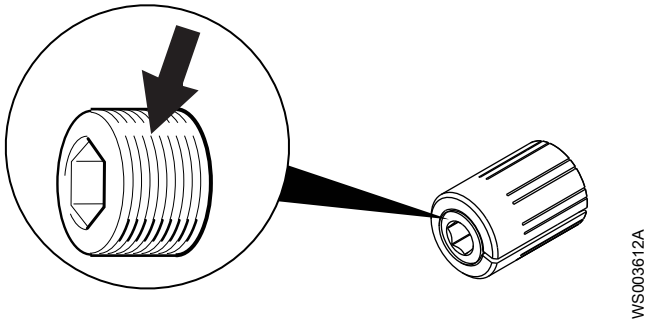
      The correct lubrication is grease for bearings, for example Exxon Mobil Unirex N3, Mobil Mobilith SHC 220 or equivalent.

      NOTICE:

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

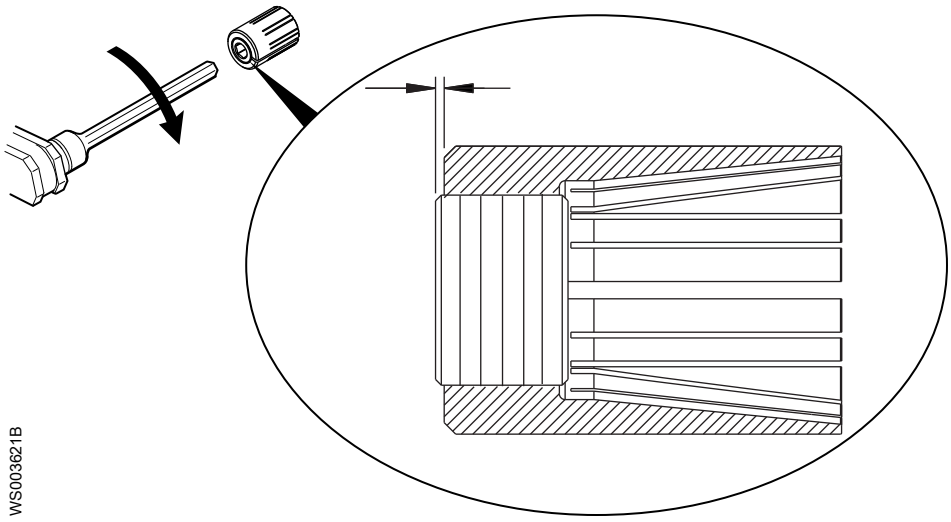


2. Mount the propeller:
   a) Adjust the trim screw so that it aligns with the bottom surface of the sleeve.



b) Turn the adjustment screw 3/4 of a turn, so that it juts out from the sleeve approximately 1.5 mm (0.06 in).

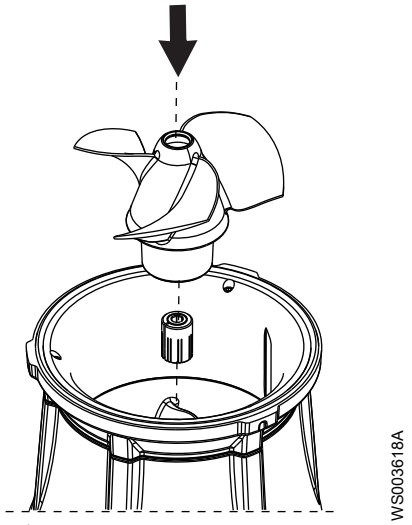
Use the trim tool.



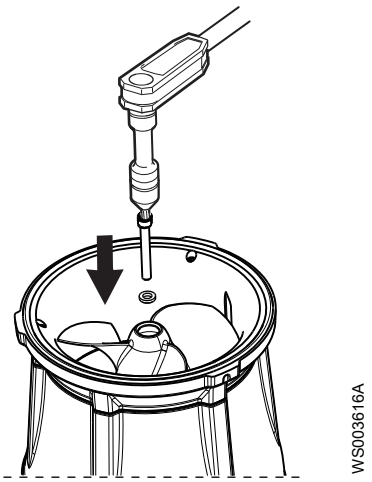
c) Fit the sleeve onto the shaft.

d) Carefully fit the propeller to the shaft.

Make sure that the sleeve and propeller are pushed on straight onto the shaft. If not they might get stuck part way on.



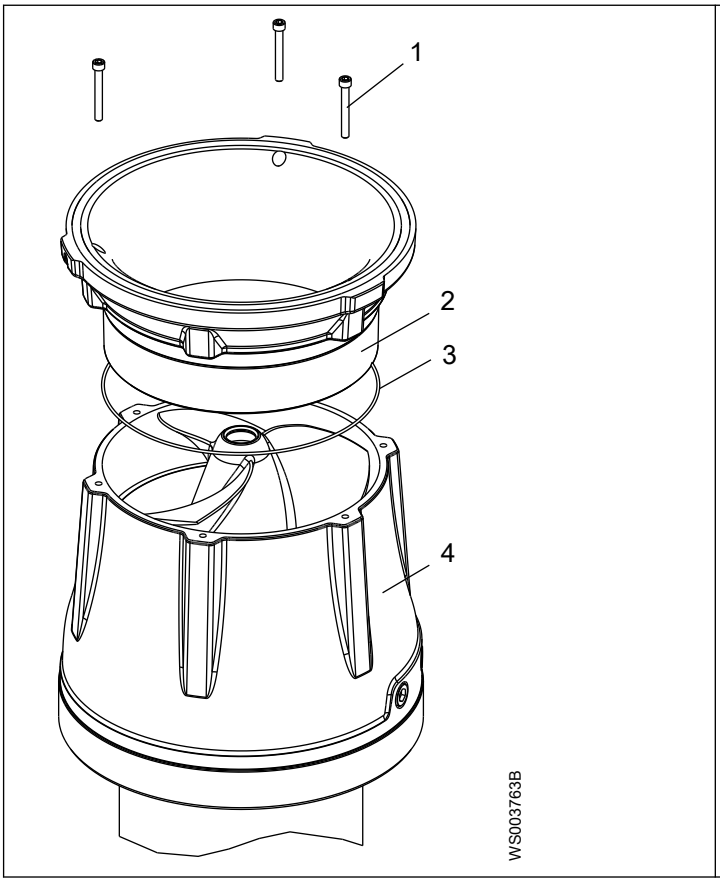
3. Fit the propeller screw and washer.



4. Tighten the propeller screw.
5. Tighten the propeller screw a further 1/8 turn (45°).
6. Check that the propeller can rotate freely.

6.9 Replace the bellmouth

1. Remove the three hexagonal screws securing the bellmouth.
   If there are zinc anodes, then six hexagonal screws must be removed.



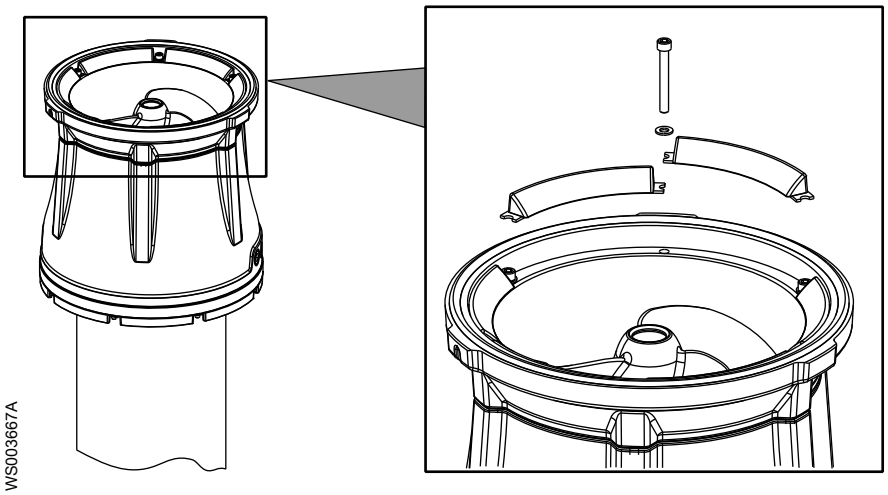
1. Hexagonal screws
2. Bellmouth
3. O-ring (optional)
4. Pump housing

2. Lift off the bellmouth.
3. Put the new bellmouth in place.
   The O-ring is delivered from the factory but does not need to be replaced after initial use.

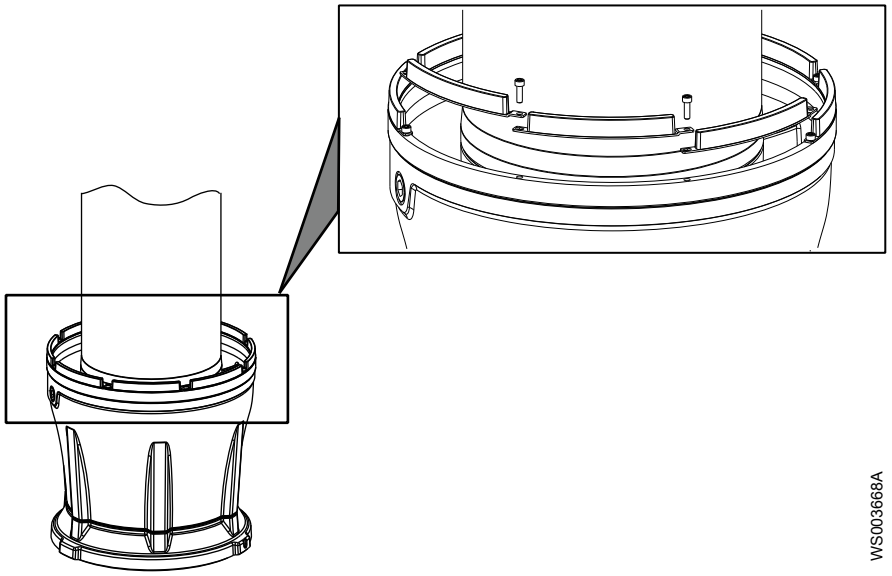
4. If zinc anodes are used, then remount them.
5. Fasten the screws.

6.10 Replace the zinc anodes

1. Loosen the hexagonal screws securing the zinc anodes at the inlet.



2. Replace the zinc anodes and fasten the screws.
3. Loosen the hexagonal screws securing the anodes at the outlet.



4. Replace the zinc anodes and fasten the screws.

6.11 Service the pump

Type of maintenance	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 overhaul for the installation.	Within the first year of operation.

Type of maintenance	Purpose	Inspection interval
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).
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).

6.11.1 Inspection

Service item	Action
Cable	1. If the outer jacket is damaged, then 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.
Propeller	1. Check the propeller clearance. 2. Replace the propeller, if necessary.
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 If the pump is connected to the MAS monitoring system, then it is recommended that the sensors be checked in the MAS unit. Otherwise, use a multimeter. For values, see *Sensors* on page 18.
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.

Service item	Action
Junction box	1. General: Check that it is clean and dry. If it is wet, then do the following: a. Check the cable entry. b. Replace the O-rings. New O-rings should be fitted to all O-ring seal joints opened during inspection. 2. Check the resistance of the leakage sensor. If the pump is connected to the MAS monitoring system, then it is recommended that the sensors be checked in the MAS unit. Otherwise, use a multimeter. Normal value approximately 1530 ohms, alarm approximately 330 ohms. For values, see *Sensors* on page 18. 3. Terminal board: Check that the connections are properly tightened.
Level regulators	Check the condition and functionality.
Lifting device	Check that the local safety regulations are followed.
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 propeller rotation.
Seal housing	Fill with new oil, if necessary.
Terminal board	Check that the connections are properly secured.
Temperature sensors, MAS monitoring system: – Thermal contact – Thermistor – Pt100	If the pump is connected to the MAS monitoring system, then it is recommended that the sensors be checked in the MAS unit. Otherwise, use a multimeter. Do not use a device applying a higher voltage than 2.5 V. 1. Disconnect the sensor leads. 2. Measure the resistance to check the status of the sensor and leads according to values in *Sensors* on page 18. Make sure to select values for the appropriate sensor, monitoring equipment, and sensor combination. 3. Measure between each sensor lead to ground (earth) to establish that the resistance is infinite (or at least several Megaohms).
Thermal contacts, MiniCAS	Normally closed circuit, interval 0–1 ohm.
Thermistor, MiniCAS	Check the resistance is between 20–250 ohms and the measured voltage is maximum 2 V DC.
Voltage and amperage	Check the running values.

6.11.2 Major overhaul

For a major overhaul, take this action 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 unit.

6.11.3 Service in case of alarm

Alarm source	Action
FLS10	1. Drain the fluid in the inspection chamber. 2. Check the oil level. Fill with new oil if necessary. 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 the oil with new oil.
The thermistor/thermal contact	Check the start and stop levels.
The overload protection	Check that the propeller can rotate freely.

7 Troubleshooting

7.1 Electrical troubleshooting

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

7.2 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.

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.
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.

If the problem persists, then contact a sales or authorized service representative.

Always state the serial number of the product, see *Product Description* on page 12.

7.3 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.

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 a sales or authorized 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.

If the problem persists, then contact a sales or authorized service representative.

Always state the serial number of the product, see *Product Description* on page 12.

7.4 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.

If the problem persists, then contact a sales or authorized service representative.

Always state the serial number of the product, see *Product Description* on page 12.

7.5 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.

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 the clearance between the propeller and the pump housing.
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, notify a certified electrician.
The phase currents vary, or they are too high.	Contact a sales or authorized 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: Contact a sales or authorized 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 a sales or authorized service representative.
There is a malfunction in the overload protection.	Replace the overload protection.

Always state the serial number of the product, see *Product Description* on page 12.

7.6 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.

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.	See *Check the impeller rotation* on page 57.
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 the clearance between the propeller and the pump housing.
The pipes are obstructed.	Clean out the pipes to ensure a free flow.
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 the product, see *Product Description* on page 12.

8 Technical Reference

8.1 Application limits

Data	Description
Liquid temperature	Maximum 40°C (104°F)
Depth of immersion	Maximum 20 m (65 ft)
pH of the pumped media	5.5–14
Liquid density	1100 kg/m³ (9.2 lb per US gal) maximum

8.2 Pt100 resistance

This table shows the relationship between temperature (°C) and resistance (ohms).

T, °C	R, ohms	T, °C	R, ohms	T, °C	R, ohms	T, °C	R, ohms	T, °C	R, ohms
0	100.00	33	112.83	66	125.54	99	138.12	132	150.57
1	100.39	34	113.22	67	125.92	100	138.50	133	150.95
2	100.78	35	113.61	68	126.31	101	138.88	134	151.33
3	101.17	36	113.99	69	126.69	102	139.26	135	151.70
4	101.56	37	114.38	70	127.07	103	139.64	136	152.08
5	101.95	38	114.77	71	127.45	104	140.02	137	152.45
6	102.34	39	115.15	72	127.84	105	140.39	138	152.83
7	102.73	40	115.54	73	128.22	106	140.77	139	153.20
8	103.12	41	115.93	74	128.60	107	141.15	140	153.58
9	103.51	42	116.31	75	128.98	108	141.53	141	153.95
10	103.90	43	116.70	76	129.37	109	141.91	142	154.32
11	104.29	44	117.08	77	129.75	110	142.29	143	154.70
12	104.68	45	117.47	78	130.13	111	142.66	144	155.07
13	105.07	46	117.85	79	130.51	112	143.04	145	155.45
14	105.46	47	118.24	80	130.89	113	143.42	146	155.82
15	105.85	48	118.62	81	131.27	114	143.80	147	156.19
16	106.24	49	119.01	82	131.66	115	144.17	148	156.57
17	106.63	50	119.40	83	132.04	116	144.55	149	156.94
18	107.02	51	119.78	84	132.42	117	144.93	150	157.31
19	107.40	52	120.16	85	132.80	118	145.31	151	157.69
20	107.79	53	120.55	86	133.18	119	145.68	152	158.06
21	108.18	54	120.93	87	133.56	120	146.06	153	158.43
22	108.57	55	121.32	88	133.94	121	146.44	154	158.81
23	108.96	56	121.70	89	134.32	122	146.81	155	159.18
24	109.35	57	122.09	90	134.70	123	147.19	156	159.55
25	109.73	58	122.47	91	135.08	124	147.57	157	159.93
26	110.12	59	122.86	92	135.46	125	147.94	158	160.30
27	110.51	60	123.24	93	135.84	126	148.32	159	160.67
28	110.90	61	123.62	94	136.22	127	148.70	160	161.04
29	111.28	62	124.01	95	136.60	128	149.07		
30	111.67	63	124.39	96	136.98	129	149.45		

T, °C	R, ohms		T, °C	R, ohms		T, °C	R, ohms		T, °C	R, ohms		T, °C	R, ohms
31	111.94		64	124.77		97	137.36		130	149.82			
32	112.45		65	125.16		98	137.74		131	150.20			

Xylem |’zīləm|

1) The tissue in plants that brings water upward from the roots;
2) a leading global water technology company.

We’re a global team unified in a common purpose: creating advanced technology solutions to the world’s water challenges. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. Our products and services move, treat, analyze, monitor and return water to the environment, in public utility, industrial, residential and commercial building services settings. Xylem also provides a leading portfolio of smart metering, network technologies and advanced analytics solutions for water, electric and gas utilities. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise with a strong focus on developing comprehensive, sustainable solutions.

For more information on how Xylem can help you, go to www.xylem.com

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The original instruction is in English. All non-English instructions are translations of the original instruction.

882901_15.0_en-US_2021-03_IOM_P7030, P7035, P7040