xylem
Let's Solve Water

Installation, Operation, and Maintenance Manual

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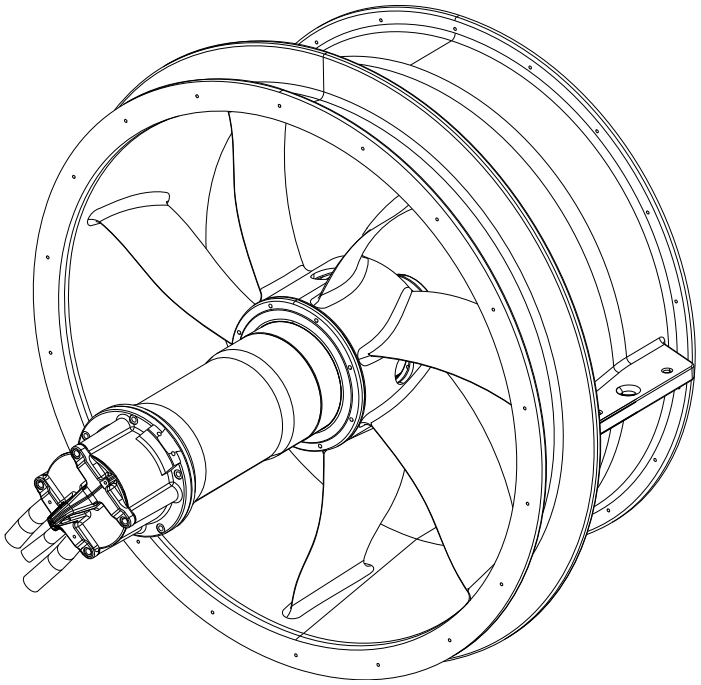


P7900

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 Special hazards

1.4.1 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.

1.4.2 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.

1.5 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

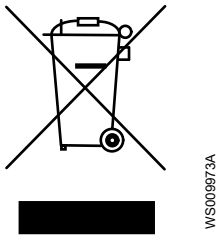
CAUTION: Radiation Hazard

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.

1.6 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.

1.7 Spare parts

CAUTION:

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

1.8 Warranty

For information about warranty, see the sales contract.

2 Transportation and Storage

2.1 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

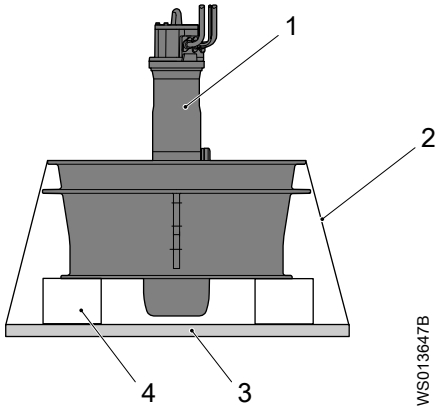
2.2.1 Precautions

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.

Positioning and fastening

Make sure that the pump is correctly positioned and fastened during transportation, and cannot roll or fall over.



1. Pump
2. Strap
3. Pallet
4. Wood block

Figure 1: The correct positioning and fastening during transportation

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:

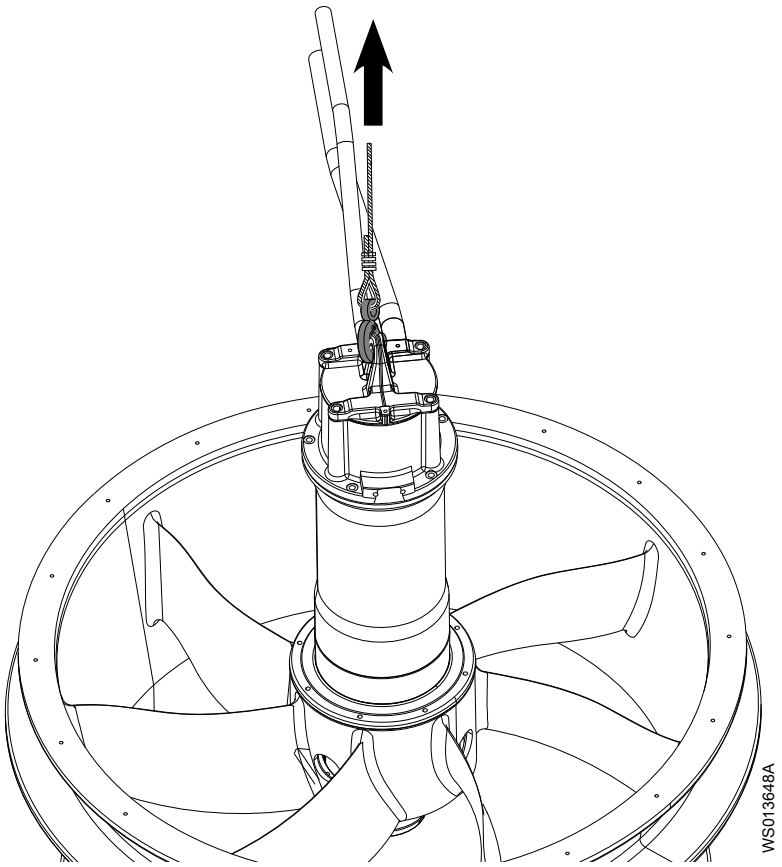
- The minimum height between the lifting hook and the floor must be sufficient to lift the unit. Contact a Xylem representative for more information.
- The lifting equipment must be able to hoist the unit straight up and down, preferably without the need for resetting the lifting hook.
- The lifting 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

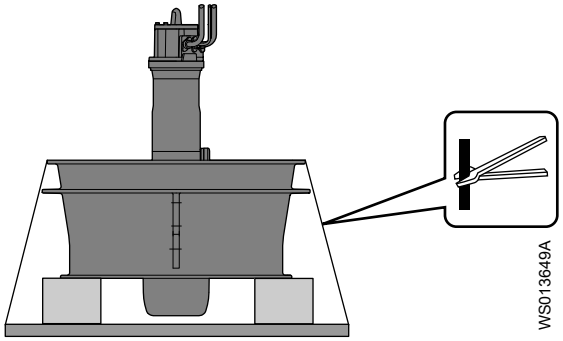
Improperly-dimensioned lifting equipment can lead to injury. A site-specific risk analysis must be done.

2.2.3 Lift and remove the pump from the transport vehicle

1. Fit a crane hook to the lifting eye on the top of the drive unit.



2. Lift the pump by using the correct lifting equipment.
3. Put the pump upright on a rigid horizontal surface so that it cannot fall over.
4. Cut the transportation strap.



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.

2.4 Storage guidelines

Storage location

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

NOTICE:

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

NOTICE:

Do not place heavy weights on the packed product.

Freezing precautions

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

Follow these guidelines to avoid freezing damage:

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

Long-term storage

If the unit is stored 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 Pump design

Intended Use

The product is intended for moving raw and clean water. Always follow the limits that are given in *Application limits* on page 71. If there is a question regarding the intended use of the equipment, then contact a Xylem representative before proceeding.

NOTICE:

Do NOT use the unit in highly corrosive liquids.

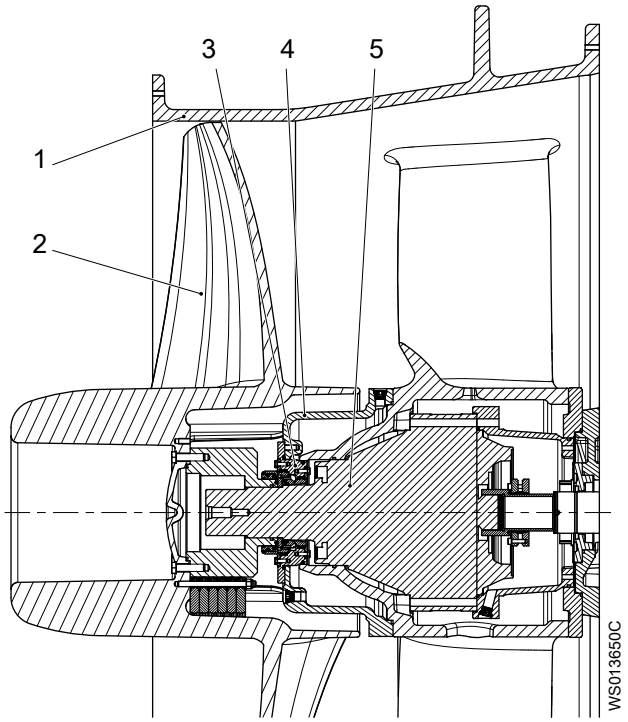
3.1.1 Spare part requirements

The following applies when the unit is serviced or repaired:

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

3.2 Major hydraulic parts

This section shows the major parts of the hydraulic unit.



1. Pump housing
2. Propeller
3. Outer mechanical seal
4. Oil housing
5. Gear box

3.3 Drive units

P7900

Voltage range	Drive units	Maximum number of starts per hour
Up to 1 kV	665	15

Voltage range	Drive units	Maximum number of starts per hour
	705	15
	735	15
	765	15
Up to 1 kV	706	10
	736	10
	766	10

3.4 The MAS 801 monitoring equipment

3.4.1 FLS: float switch sensor

The float switches are leakage sensors.

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

3.4.2 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

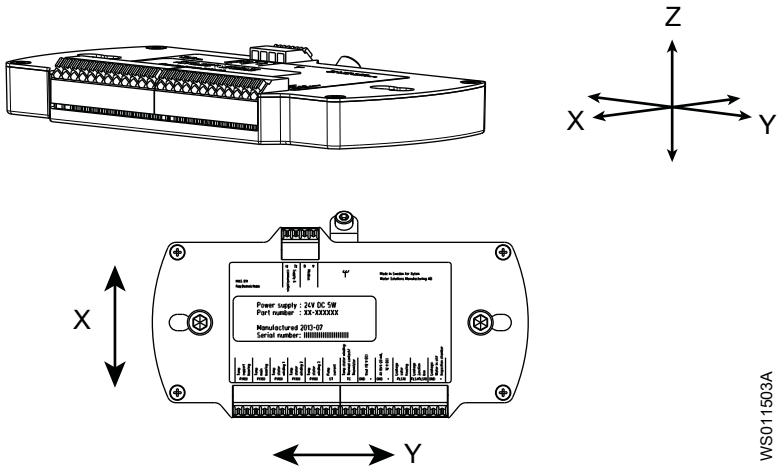


Figure 2: Vibration directions with reference to the PEM

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

3.4.3 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. The Pt100 sensor is pressed by a spring against the outer ring of the ball bearing.

Support bearing

Support bearing temperature monitoring is an option in the MAS 711 and MAS 801. The Pt100 sensor is pressed by a spring against the outer ring of the roller bearing.

Alarms

Two adjustable alarm limits can be used:

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

3.4.4 Stator temperature monitoring methods

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

By using an analogue sensor, two adjustable alarm limits can be used, one for warning (“B”-alarm) and one for pump stop (“A”-alarm). The configurations which can be used for monitoring the stator winding temperature depend upon the voltage range of the drive unit. See *Drive units* on page 10 for the voltage range for each drive unit.

Up to 1 kV drive units

Table 1: Stator temperature monitoring configuration, up to 1 kV

Standard / Optional	Monitoring configuration description
Standard	• Three thermal contacts, connected in series, are incorporated in the coil ends of the stator winding. The contacts are normally closed, and open at 140°C (285°F). • One Pt100 sensor is incorporated in one of the windings.
	Or:
	• 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.
Optional	• Three thermal contacts, connected in series, are incorporated in the coil ends of the stator winding. The contacts are normally closed, and open at 140°C (285°F). • Three Pt100 sensors, one for each phase, are incorporated in the windings.
	Or:
	• Three thermistors, PTC, connected in series, are incorporated in the coil ends of the stator windings. T_{Ref}=140°C (285°F). • Three Pt100 sensors, one for each phase, are incorporated in the windings.

3.4.4.1 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 71.	> 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* on page 15.

3.4.5 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

3.5 The MAS 711 monitoring equipment

The MAS 711 system

MAS 711 (Monitoring and Status) is a monitoring system for Flygt pumps. It monitors and stores measurements from a number of sensors (temperature, leakage, and vibration). These are used to:

- Protect the pump by raising an alarm when undesirable events occur.
- Track operational data.

Alarm levels can be set so that the operator is notified when an alarm event has occurred. Depending on the alarm/event configuration, the MAS 711 system may stop the pump.

The base unit stores all measurement data on its embedded server.

The system also includes a pump memory module, storing identity data of the pump.

The parameters that are tracked are chosen by the customer, and may include the following:

- Temperature:
  - Main bearing
  - Support bearing
  - Stator winding
- Vibration
- Leakage:
  - In the stator housing or inspection chamber
  - In the junction box
  - Water in the oil chamber (if applicable)
- Power monitoring

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

Pump current

Pump current is an important parameter in itself, which the MAS 711 can also use to record running time, number of starts and other operating diagnostics.

Pump current is not measured using the 12/24 lead monitoring cable. To measure it, the control cabinet must be equipped with a current transformer. Alternatively the Flygt power analyzer PAN 312 is used, requiring three transformers. The measurement results are transmitted to MAS 711 over a serial link (Modbus).

This information is fundamental for monitoring operation, maintenance planning, and fault diagnosis.

Signal cables

The pump is delivered with the signal cable (also known as “auxiliary,” “control” or “pilot” cable) mounted. The following SUBCAB signal cables are available:

- 12x1.5 mm^2 (unscreened, also known as unshielded). Conductors 1-12.
- 24x1.5 mm^2 (unscreened, also known as unshielded). Conductors 1-24.
- S12x1.5 mm^2 (screened, also known as shielded). Conductors 1-12.
- S24x1.5 mm^2 (screened, also known as shielded). Conductors 1-24.

The number of conductors that are required to connect the sensors to the monitoring system depends on the number and type of sensors being used.

Sensors, drive units up to 1 kV

The drive units in this voltage range are shown in *Drive units* on page 10.

Table 5: Sensors for pumps using drive units up to 1 kV

Parameter Monitored	Sensor	Signal Cable, Number of Leads Required	Standard or Optional
Vibration	VIS 10	24	Optional
Leakage in the junction box	Float switch leakage sensor (FLS)	12	Standard
Stator winding temperature in one phase	Pt100 analog temperature sensor in one stator winding	12	Standard
Stator winding temperature	Thermal contacts (3), or	12	Standard
	PTC-thermistors (3)	24	Optional
Stator winding temperature in phases 2 and 3	Pt100 analog temperature sensors in two additional stator windings	24	Optional
Main bearing temperature	Pt100 analog temperature sensor	12	Standard

Parameter Monitored	Sensor	Signal Cable, Number of Leads Required	Standard or Optional
Leakage in the stator housing or inspection chamber	Float switch leakage sensor (FLS)	12	Standard
Water in oil: standard drive units only. (Not applicable for drive units with internal closed-loop cooling.)	Capacitive leakage sensor (CLS)	24	Optional
Support bearing temperature	Pt100 analog temperature sensor	24	Optional
Pump memory	Printed circuit board for pump memory includes a temperature sensor.	12	Standard
Pump current	A current transformer in the control cabinet is required.		
Power monitoring	Separate electronic instrument using three current transformers.		Optional

For more information on the stator temperature monitoring, see *Stator temperature monitoring methods* on page 15.

3.5.1 FLS: float switch sensor

The float switches are leakage sensors.

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

3.5.2 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.

3.5.3 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. The Pt100 sensor is pressed by a spring against the outer ring of the ball bearing.

Support bearing

Support bearing temperature monitoring is an option in the MAS 711 and MAS 801. The Pt100 sensor is pressed by a spring against the outer ring of the roller bearing.

Alarms

Two adjustable alarm limits can be used:

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

3.5.4 Stator temperature monitoring methods

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

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

monitoring the stator winding temperature depend upon the voltage range of the drive unit. See *Drive units* on page 10 for the voltage range for each drive unit.

Up to 1 kV drive units

Table 6: Stator temperature monitoring configuration, up to 1 kV

Standard / Optional	Monitoring configuration description
Standard	• Three thermal contacts, which are connected in series, are incorporated in the coil ends of the stator winding. The contacts are normally closed, and open at 140°C (285°F). • One Pt100 sensor is incorporated in one of the windings.
	Or:
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Optional	• Three thermal contacts, which are connected in series, are incorporated in the coil ends of the stator winding. The contacts are normally closed, and open at 140°C (285°F). • Three Pt100 sensors, one for each phase, are incorporated in the windings.
	Or:
	• Three thermistors, PTC, connected in series, are incorporated in the coil ends of the stator windings. T_{Ref}=140°C (285°F) • Three Pt100 sensors, one for each phase, are incorporated in the windings.

3.5.4.1 Temperature sensors

Table 7: 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 8: 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 9: 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 71.	> 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* on page 15.

3.5.5 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:

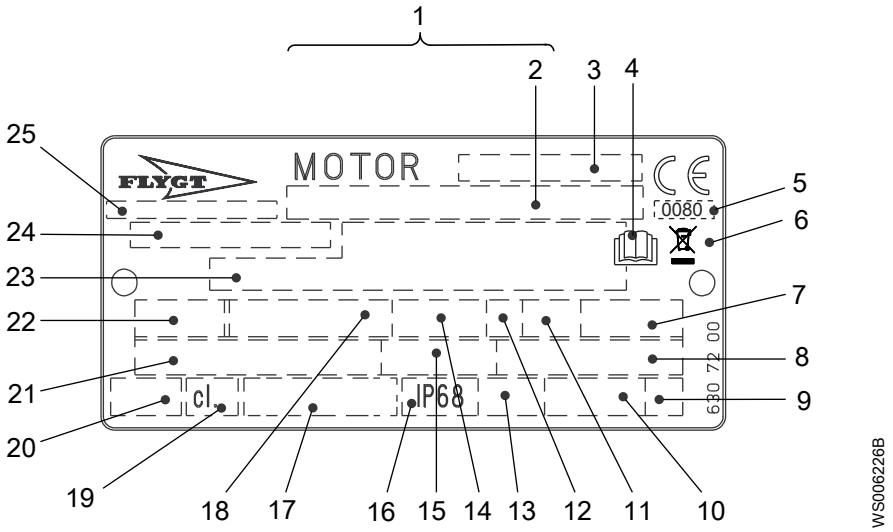
- Data plate information
- Sensor types and alarm settings recommended by the manufacturer
- Operational data and data to support service:
  - Histograms of temperatures, vibrations, and cycle length
  - Start and stop registration
  - Service log with a maximum of 200 lines of text
  - Conditions to 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.

3.6 The data plates

The data plates include key product specifications.

Drive unit

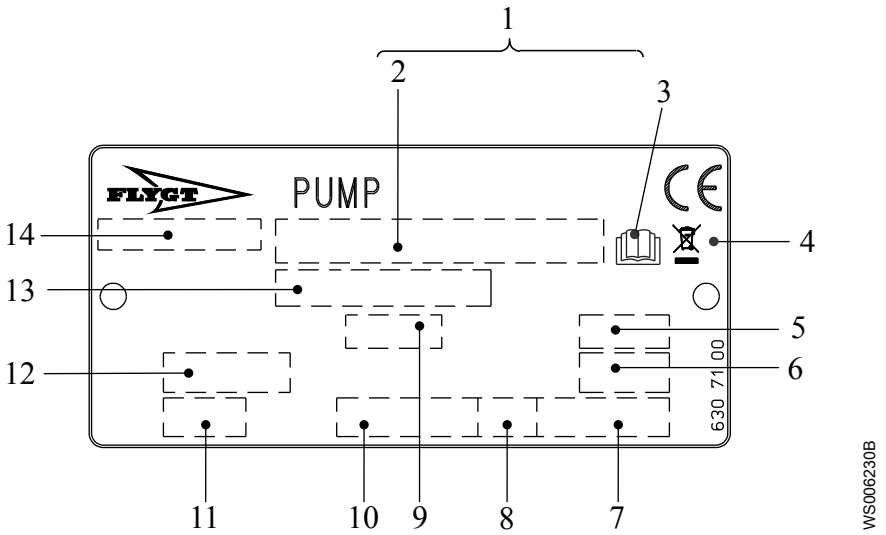


1. Serial number
2. Product code and number
3. Motor denomination
4. Read installation manual
5. Notified body, only for EN-approved Ex products
6. WEEE-Directive symbol
7. Maximum ambient temperature
8. Power factor
9. Locked rotor code letter
10. Product weight
11. Duty factor
12. Duty class
13. Maximum submergence
14. Rated speed
15. Rated current
16. Degree of protection
17. International standard
18. Rated shaft power
19. Thermal class
20. Thermal protection

21. Rated voltage
22. Phase; Type of current; Frequency
23. Additional information
24. Product number
25. Country of origin

Figure 3: The drive unit plate valid from 990101

Hydraulic unit



1. Serial number
2. Product code and number
3. Read installation manual
4. WEEE-Directive symbol
5. Impeller diameter
6. Propeller blade angle
7. Product weight
8. Direction of rotation: L=left, R=right
9. Impeller or Propeller code
10. Rated speed
11. Pressure class
12. Column diameter or Inlet and outlet diameter
13. Product number
14. Country of origin

Figure 4: The hydraulic unit plate

3.7 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).

3.8 Product denomination

Reading instruction

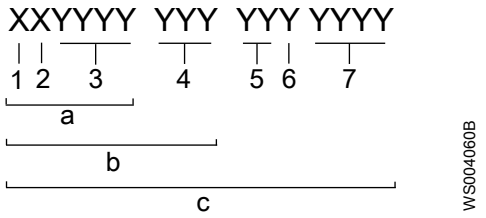
In this section, code characters are illustrated accordingly:

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	Drive unit
	5	Production year
	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.

Authority regulation

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

Fasteners

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

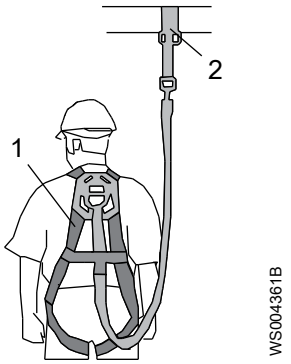
4.1.1 Falling

CAUTION: Fall Hazard

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

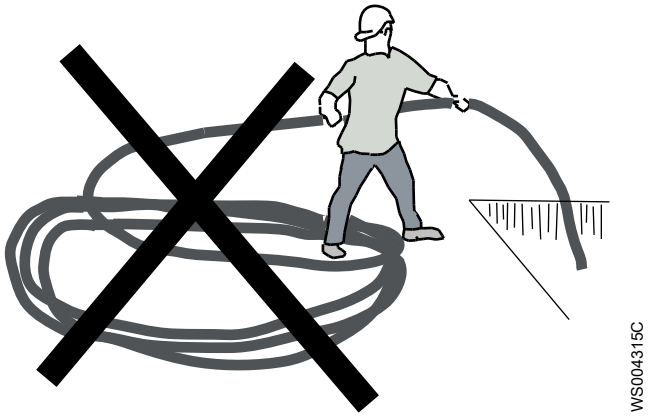
To minimize the risk of falling, observe the following:

- 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.



4.1.2 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.

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.

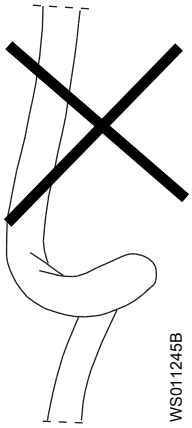


Figure 5: Kinked cable

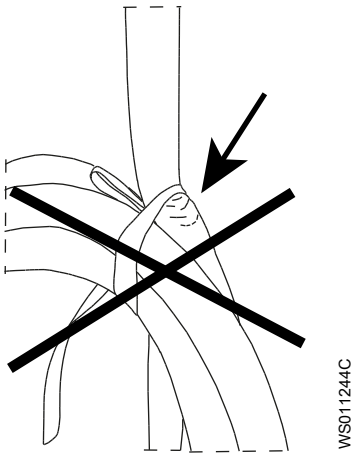


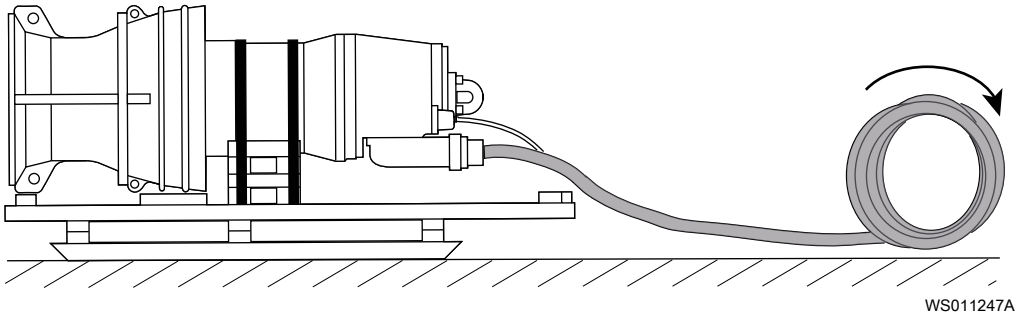
Figure 6: Pinched cable

- 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.

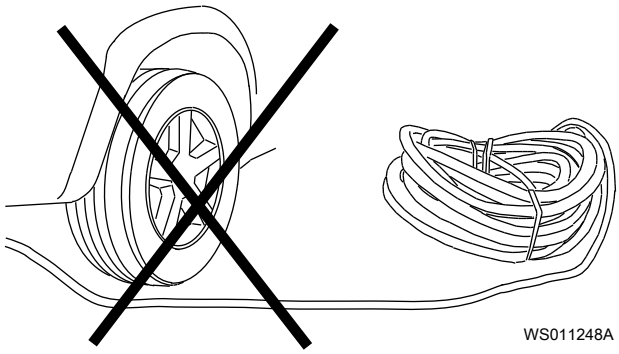
Cable handling

To install cables, follow these requirements:

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

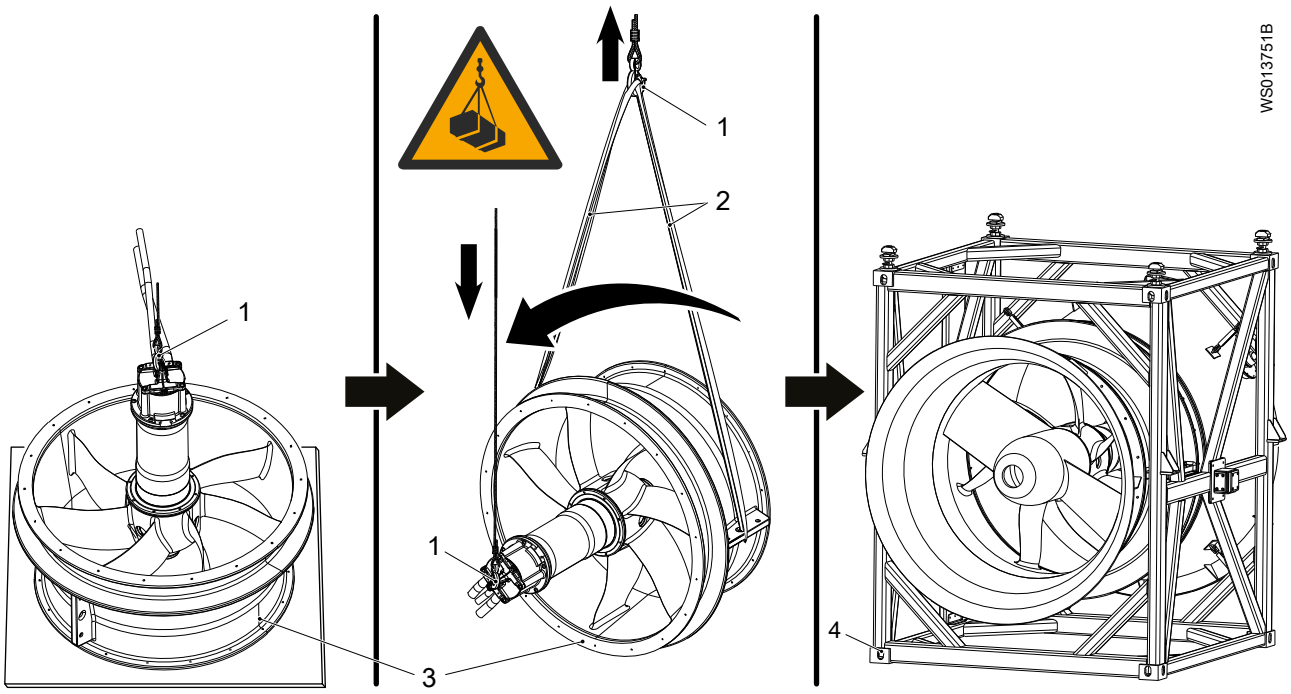


- When pulling the cable, do not exceed the maximum permissible tensile force.
- Do not bend the cable to a radius smaller than the recommended minimum bending radius.The recommended minimum bending radius is 10 times the diameter of the cable.
- Make sure that vehicles cannot run over the cable.



- 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 Rotate the pump



1. Crane hook
2. Lifting straps
3. Pump housing
4. Frame

1. Attach a crane hook to the pump handle.
2. Attach straps between the pump housing and a second crane.
3. Lift the pump in the pump handle.
4. By using the cranes, rotate the pump to a horizontal position.
5. Install the pump in the frame and tighten all fasteners.

Install the discharge cone and the inlet cone.

4.4 Install the pump

Consult the nearest local sales and service representative regarding the following:

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

NOTICE:

Do not run the pump dry.

NOTICE:

Never force piping to make a connection with a pump.

Before installation, check the following:

- An applicable cable support and protection system is used.
- The propeller rotates in the correct direction.

  If the rotation is not in the correct direction, then the pump can lift and start rotating inside the tube. This movement can seriously damage the equipment.
- The rubber seal ring underneath the pump is in position.
- There is no damage to, or unwanted material on, the pump seat.

- There is no large amount of unwanted construction material under the pump tube, or at the pump intake. If unwanted material is present, then there is a risk that it can get sucked into the pump and cause propeller damage.
- The pump control is set to turn off the pump at or above the minimum operating water level for this pump installation.
- The submersion depth is maximum 20 m (65 ft).

4.5 Make the electrical connections

4.5.1 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.
- The environment must be appropriate for medium-voltage (1.2–10 kV) cables and electrical work.
- 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.

4.5.2 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

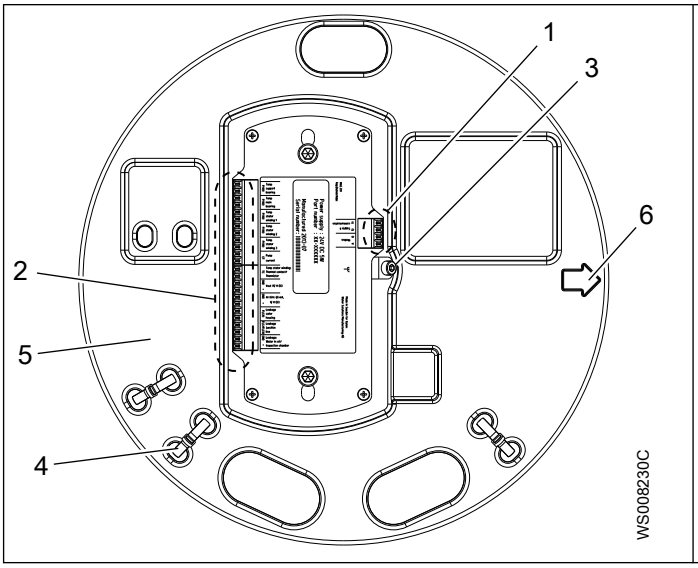
If the power cable is jerked loose, then the ground (earth) conductor must be the last conductor to come loose from its terminal. Make sure that the ground (earth) conductor is longer than the phase conductors at both ends of the cable.

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.

4.5.3 Connect the cables: Standard pumps with MAS 801

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

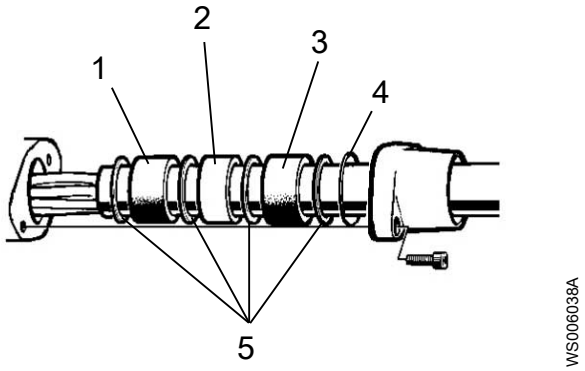


1. PEM communication terminals
2. PEM control terminals
3. Functional ground
4. Cable tie
5. Terminal plate
6. Index arrow. The index arrow on the terminal plate is aligned with the cable inlet.

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

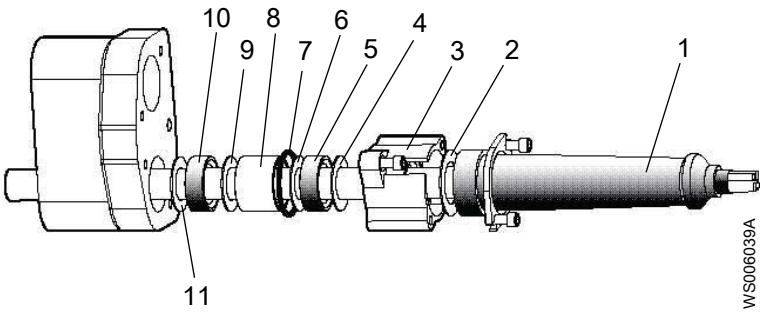
   See the chapter “Installation” in the SIO Manual for the MAS 801 monitoring equipment.
3. If they are not already connected, then connect the T1 and T2 leads integrated in the SUBCAB cable to the PEM. See the illustration and table in *Terminals used in standard applications* on page 28.
4. If they are not already connected, then connect the power leads:
   a) Check the data plate to determine which connection is valid for the voltage supply.
   b) Connect the power leads to the terminal board connection U1, U2, V1, V2, W1, W2, and ground (earth) according to the cable chart.

      See *Cable charts* on page 36.
5. Install the entrance flange:
   a) Fit the entrance flange parts according to the illustration for the correct drive unit.



1. Seal sleeve
2. Spacer ring
3. Seal sleeve
4. O-ring
5. Washer

Figure 7: Drive units 705–776



1. Protective sleeve
2. Washer
3. Connection flange
4. Washer
5. Seal sleeve
6. Washer
7. O-ring
8. Spacer ring
9. Washer
10. Seal sleeve
11. Washer

Figure 8: Drive unit

Pumps with drive units 705–776 are also equipped with a cable holder illustrated here.

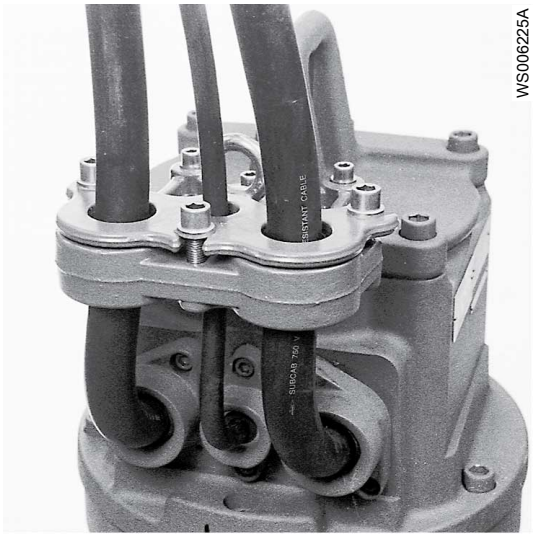


Figure 9: Cable holder. Pumps equipped with MAS 801 do not have the auxiliary cable.

b) Fit the protective rubber sleeve onto the cable where it leaves the connection housing.

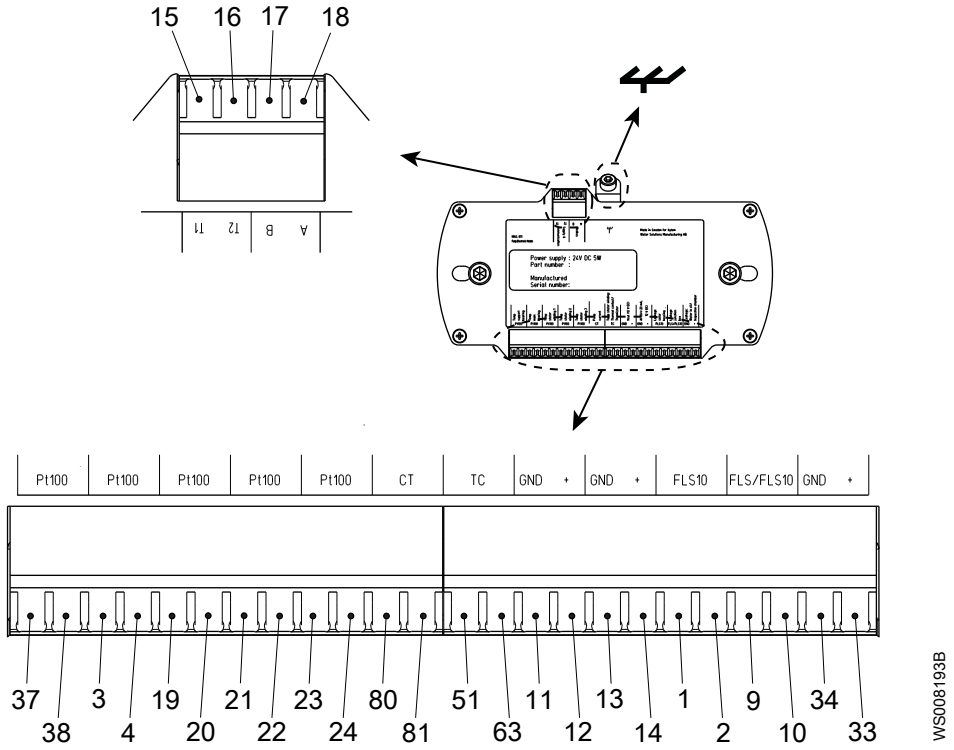
   The rubber sleeve must have the correct size to give the correct compression around the cable.

c) Attach the connection flange to the entrance flange.

   Make sure that the seal sleeve is not misaligned with the rubber sleeve. Check that the entrance flange supports the cable so that it cannot be excessively bent.

6. Connect the SUBCAB cable phase leads to the starter equipment according to the diagram in *Power cable phase sequence* on page 33.
7. 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.

4.5.3.1 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

4.5.4 Connect the cables: Pumps with MAS 711

1. Connect the monitoring equipment.
2. Connect the cable to the terminal board:
   - If the MAS 711 system is used, then connect the cable to its terminal board according to the illustration and table in *MAS 711 sensor connections* on page 31.

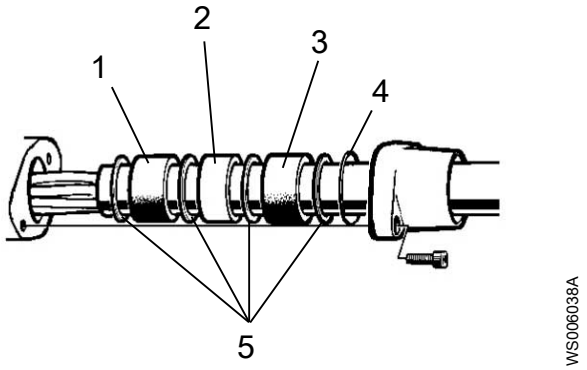
   NOTICE:

   As the cable ends are sealed to eliminate moisture entrainment during transport and storage, no wire markings for the sensors at the outlet end of the cable are made at the factory. Markings must therefore be carried out during installation of the unit.
3. Synchronize the MAS 711 base unit and the pump memory at the first installation:

a) Check that the communication between the pump and the MAS base unit is activated.
b) Upload the factory settings of sensors and related parameters by choosing the command "copy all from pump memory to MAS". For more information about the MAS installation, see the Installation and User Manual for the MAS 711 monitoring equipment.

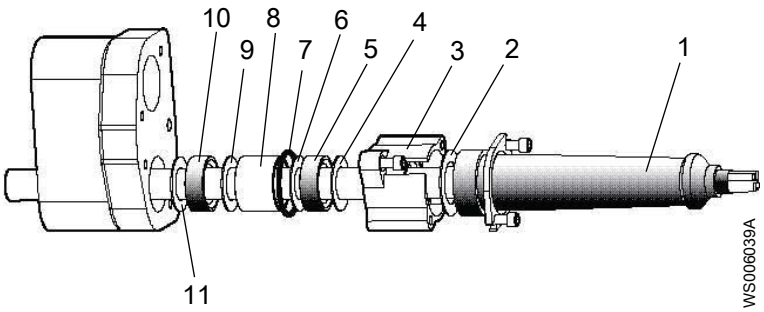
4. Connect the power cable:
   a) Check the data plate to determine which connection is valid for the voltage supply.
   b) Arrange the connection on the terminal board.
   c) Connect the power cable leads to the terminal board connection U1, U2, V1, V2, W1, W2, and ground (earth) according to the cable chart.

      See *Cable charts* on page 36.
   d) If control elements are present and not used, then cut and cap them.
5. Install the entrance flange:
   a) Fit the entrance flange parts according to the illustration for the correct drive unit.



1. Seal sleeve
2. Spacer ring
3. Seal sleeve
4. O-ring
5. Washer

Figure 10: Drive units 705–776



1. Protective sleeve
2. Washer
3. Connection flange
4. Washer
5. Seal sleeve
6. Washer
7. O-ring
8. Spacer ring
9. Washer
10. Seal sleeve
11. Washer

Figure 11: Drive unit

Pumps with drive units 705–776 are also equipped with a cable holder illustrated here.

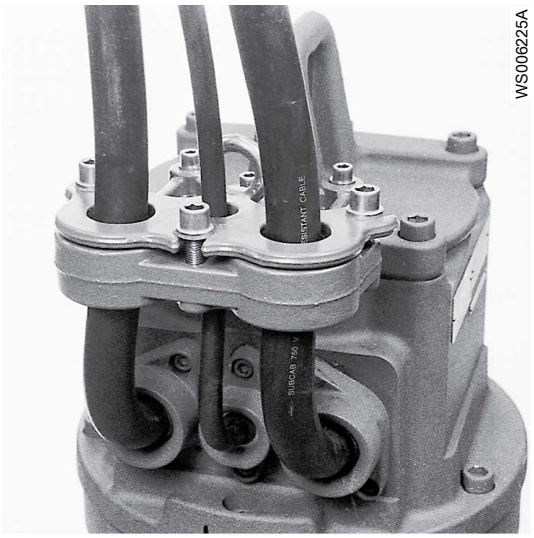


Figure 12: Cable holder

b) Fit the protective rubber sleeve onto the cable where it leaves the connection housing.

   The rubber sleeve must have the correct size to give the correct compression around the cable.

c) Attach the connection flange to the entrance flange.

   Make sure that the seal sleeve is not misaligned with the rubber sleeve. Check that the entrance flange supports the cable so that it cannot be excessively bent.

6. Connect the starter equipment:
   a) Connect the power cable to the starter equipment according to the diagram in *Power cable phase sequence* on page 33.
   b) Connect the auxiliary cable to the starter equipment.

4.5.4.1 MAS 711 sensor connections

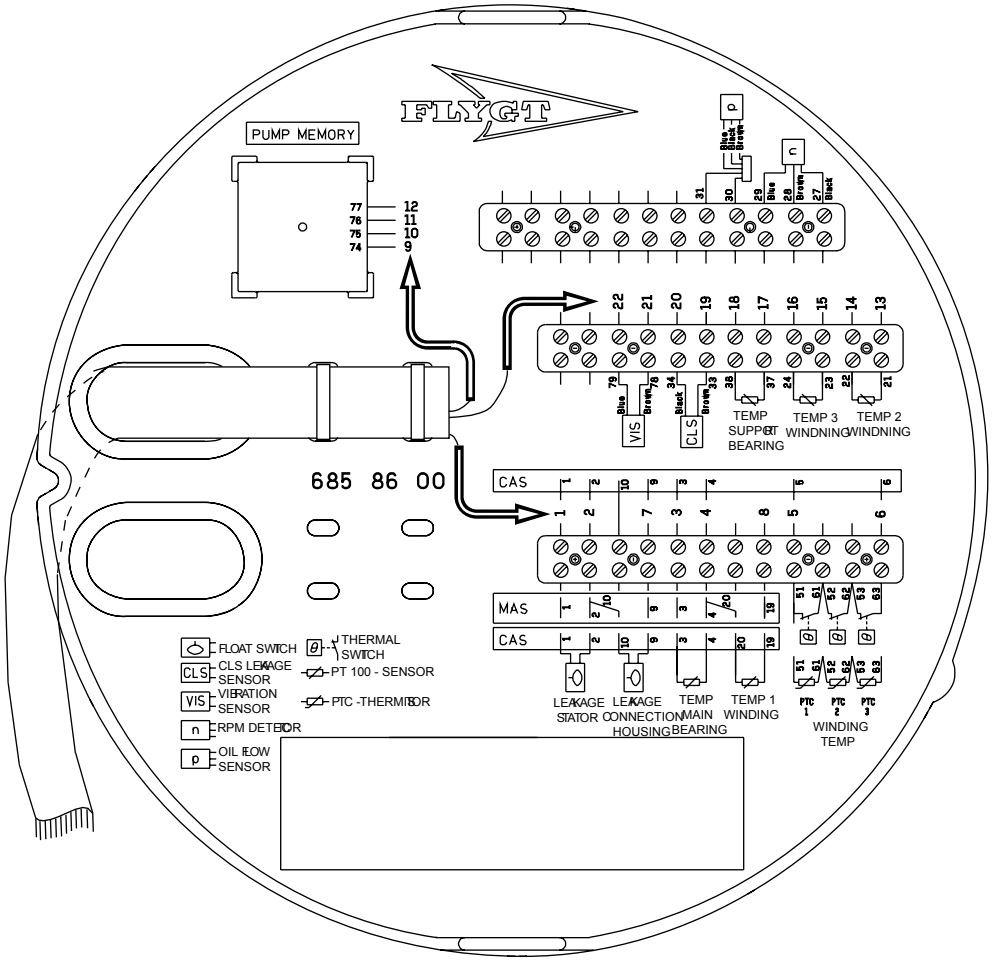


Figure 13: Connections at the product. Arrows indicate SUBCAB cable lead numbers.

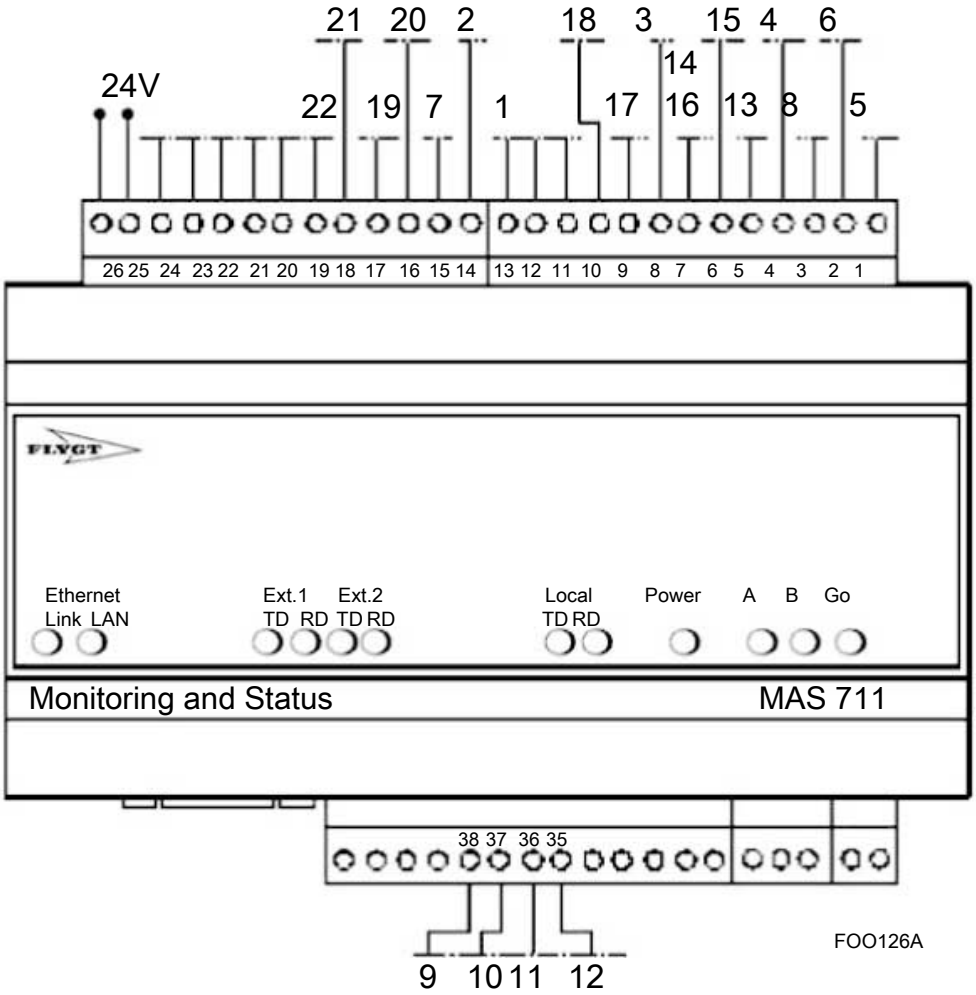


Figure 14: Connections at the MAS 711 base unit

This table shows how the conductors are connected to the different sensors.

Sensor		Terminal block	Conductor number for 12-lead cable	Conductor for 24-lead cable
Float switch in the stator house[1]		1	1	1
		2	2	2
Float switch in the junction box		9	7	7
		2	—	—
Pt100 in the main bearing[2]		3	3	3
		4	4	4
Pt100 in the support bearing		37	—	17
		38	—	18
Thermal switches or thermistors in the stator		5	5	5
		6	6	6
CLS sensor in the oil housing	+	33	—	19
	–	34	—	20

1 The leakage sensor in the stator housing and the leakage sensor in the junction box use the same terminal (terminal 2) on the terminal block.

2 The Pt100 sensors in the main bearing and the support bearing use the same terminal (terminal 4) on the terminal block.

Sensor		Terminal block	Conductor number for 12-lead cable	Conductor for 24-lead cable
Pt100 in the stator winding 1		19	8	8
		4	—	—
Pt100 in the stator winding 2		21	—	13
		22	—	14
Pt100 in the stator winding 3		23	—	15
		24	—	16
Memory module RS-485 B		74	9	9
Memory module RS-485 A		75	10	10
Memory module supply, ground (earth)		76	11	11
Memory module supply, 12 VDC+		77	12	12
Vibration sensor VIS 10	+	78	—	21
	–	79	—	22

4.5.5 Power cable phase sequence

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

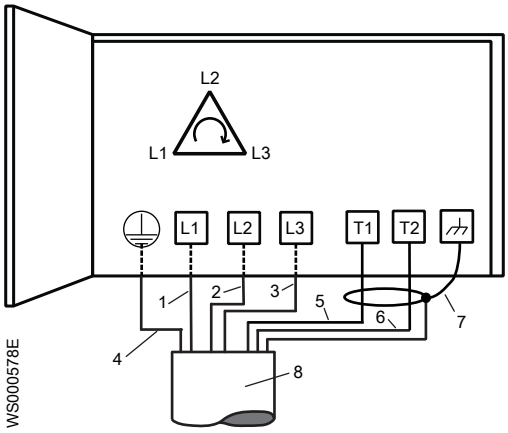


Figure 15: Correct phase sequence

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

4.5.6 Identifying signal leads connected to the PEM, thermal contacts, or thermistors

This section is for pumps with the MAS 801™.

There can be 1–4 SUBCAB cables. Each cable contains both power conductors and signal conductors. Only the signal conductors from one cable are used.

Labels are attached to the SUBCAB cable which is used for communication when there is more than one SUBCAB cable. This section gives instructions for identifying which cable is used for communication, when the label is missing.

A multimeter can be used to identify the following:

- Which signal leads are connected to the PEM
- For explosion-proof pumps: which leads are connected to the thermal contacts or thermistors

Unused leads in the pump are isolated.

4.5.6.1 Measure the resistance

At the PEM, T1 is + and T2 is −.

1. Select a SUBCAB cable.
2. Use a multimeter to measure the resistance across T1–T2.

   Measure both polarities.

T1–T2 resistance	T1–T2 resistance Opposite polarity	Conclusion
70–130 kilohms	∞ ohm	The PEM is connected to this cable.
∞ ohm: infinite resistance	∞ ohm	The PEM is not connected to this cable.

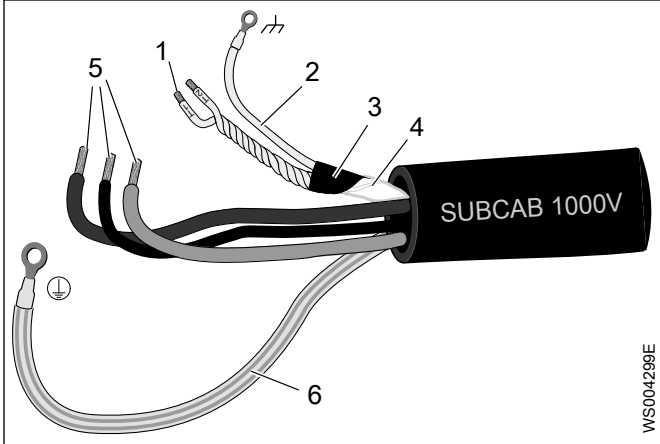
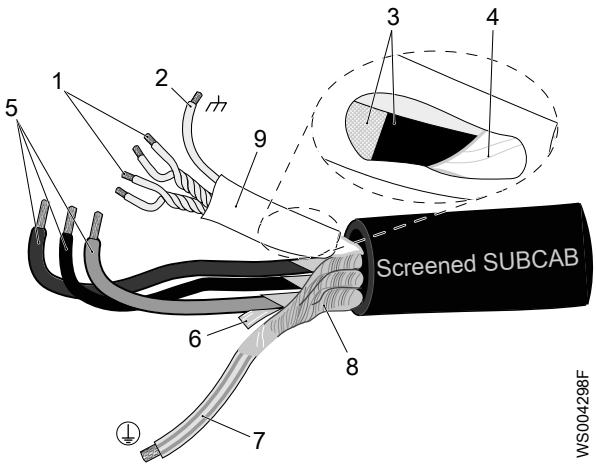
3. Ex-proof pumps only: Use a multimeter to measure the resistance across T3–T4.

T3–T4 resistance	Stator temperature sensors
∞ ohm	The T3–T4 signal leads of this cable are not used.
0–5 ohm	Thermal contacts are connected to this cable.
150–300 ohm	Thermistors are connected to this cable.

4. Repeat this process on the other cables until the signal leads which are used for communication, have been identified.

4.5.7 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.

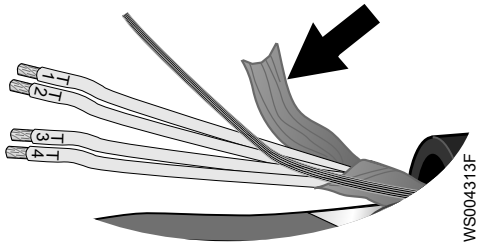


Figure 16: Aluminum foil on the control element.

   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 Cable charts

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.

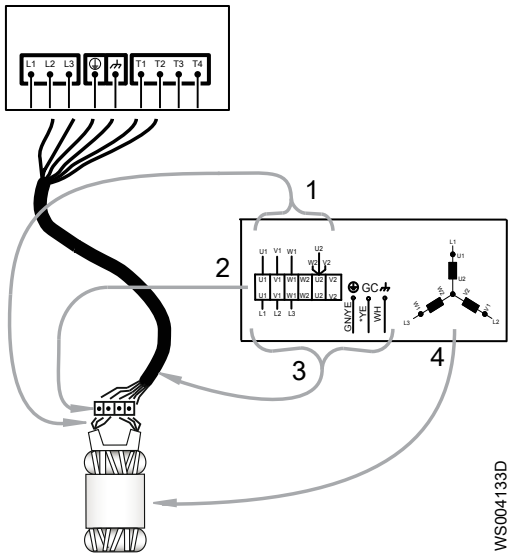
Stator leads connection to terminal board

Terminal board	Stator leads connection to terminal board			
	3 leads Y	6 leads D	6 leads Y	6 leads Y/D
U1	U	U1	U1	U1
V1	V	V1	V1	V1
W1	W	W1	W1	W1
W2	-	W2	W2	W2
U2	-	U2	U2	U2
V2	-	V2	V2	V2

WS007848A

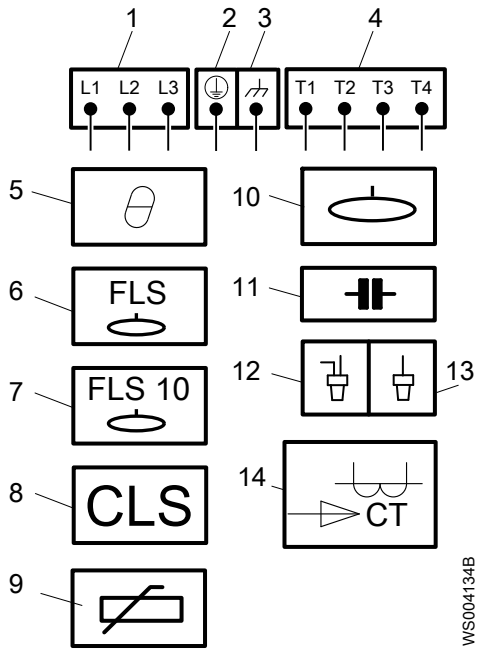
Connection locations

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



WS004133D

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

3-phase connection, screened

If a separate control cable is used, then the control conductors in the power cable are never used.

The following figure shows screened SUBCAB cable without a separate ground conductor. The ground conductor is made of stranded ground conductors. T1 and T2 are twisted together.

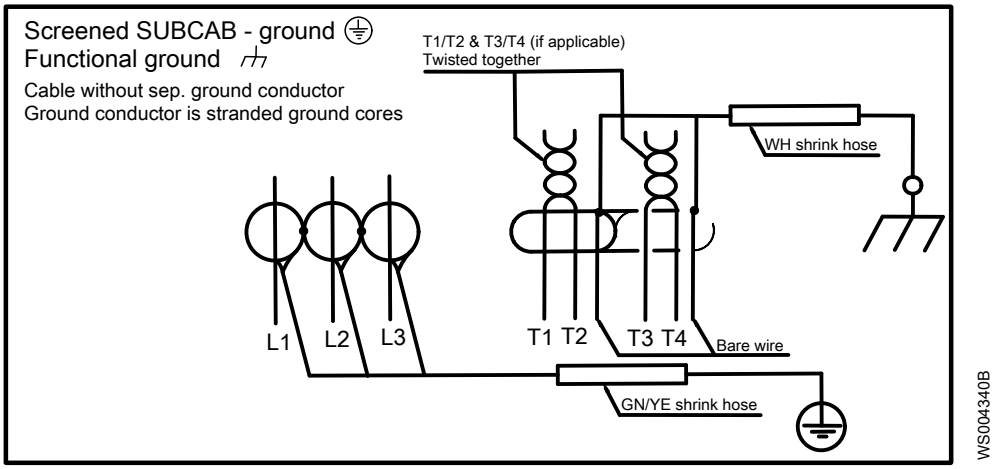


Figure 17: Without separate ground conductor

The following figure shows screened SUBCAB with a functional ground. T1 and T2 are twisted together.

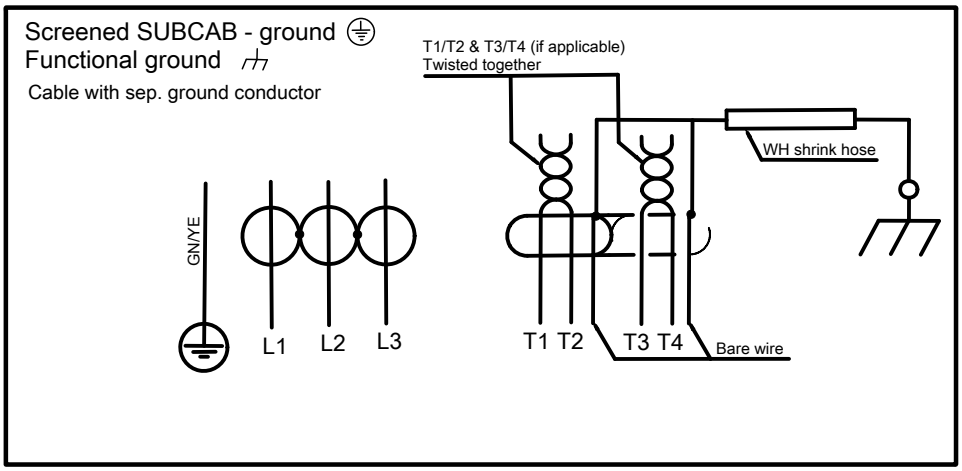


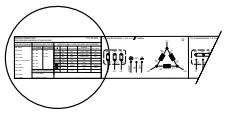
Figure 18: With functional ground

4.6.1 Colors and markings of leads

MOTOR CONNECTION
COLORS AND MARKING OF MAIN LEADS

773 30 00 (REV 4)

COLOR STANDARD	STATOR LEAD COLORS		MOTOR CABLE LEAD COLORS AND MARKING				
	LV Stators	MV Stators	3 ~	SUBCAB	SUBCAB AWG	SUBCAB S6x95+95+S(4x0.5)	MV cables
BK - Black	U1 - RD	U - BK	L1	BN	RD	1 WH , 4 WH	BK
BN - Brown	U2 - GN	V - BK	L2	BK	BK	2 WH , 5 WH	BK
BU - Blue	V1 - BN	W - BK	L3	GY	WH	3 WH , 6 WH	BK
GN - Green	V2 - BU		T1, T2	WH	WH	WH	-
GN/YE - Green/Yellow	W1 - YE		T3, T4	WH	WH	WH	-
GY - Grey	W2 - BK		⏚	GN/YE	GN/YE	GN/YE	GN/YE
OG - Orange			⏚	WH	-	WH	WH
RD - Red	VOLTAGE DENOMINATIONS		GC	-	YE	-	-
WH - White	LV - Low voltage						
YE - Yellow	MV - Medium voltage						



WS004335C

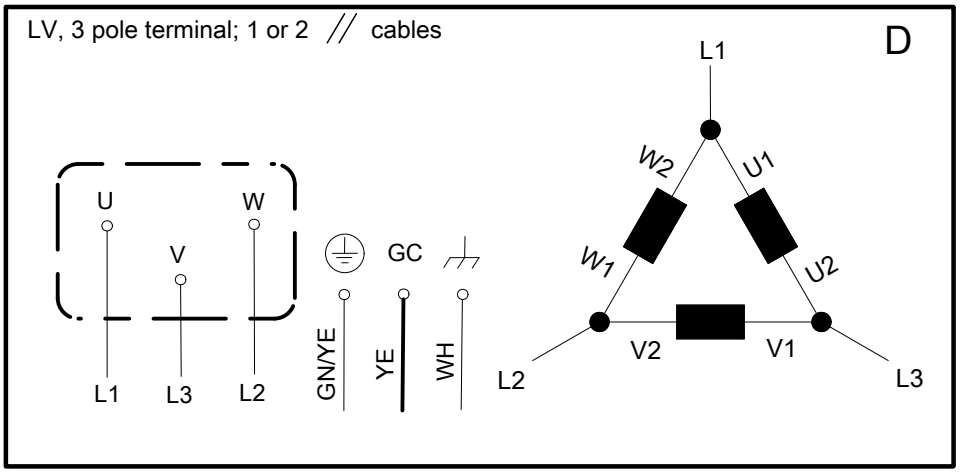
Color code standard

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

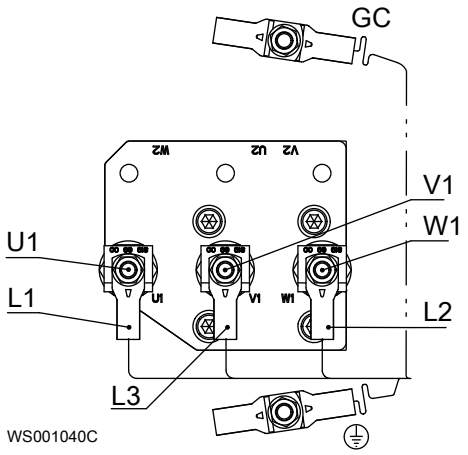
4.6.2 Power wiring diagrams: Drive units up to 1.1 kV

4.6.2.1 D-connection, 3-pole terminal

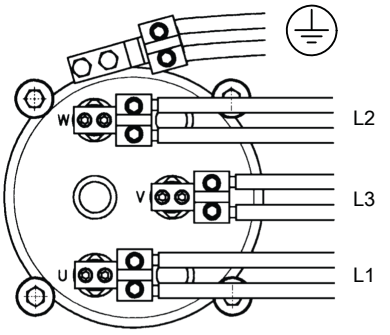
Schematic diagram



Drive units with small connection housing

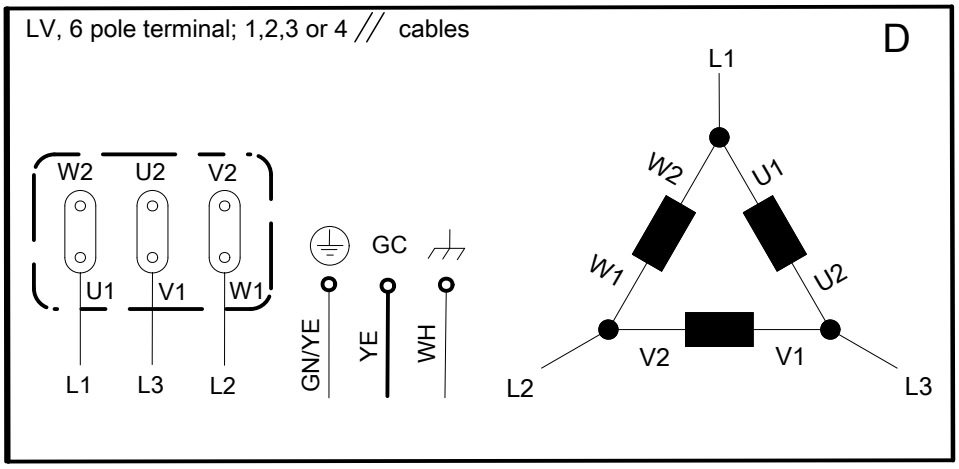


Drive units with large connection housing

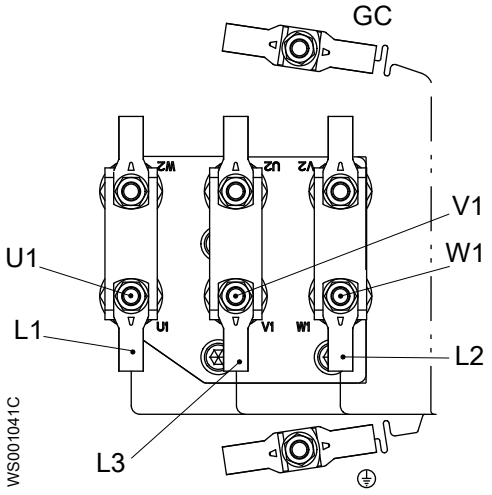


4.6.2.2 D-connection, 6-pole terminal; 1 cable

Schematic diagram

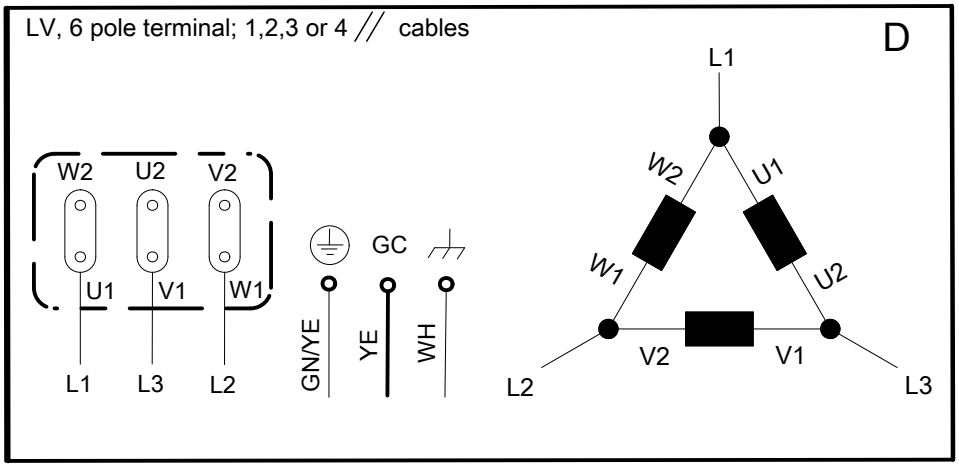


Drive units with small connection housing

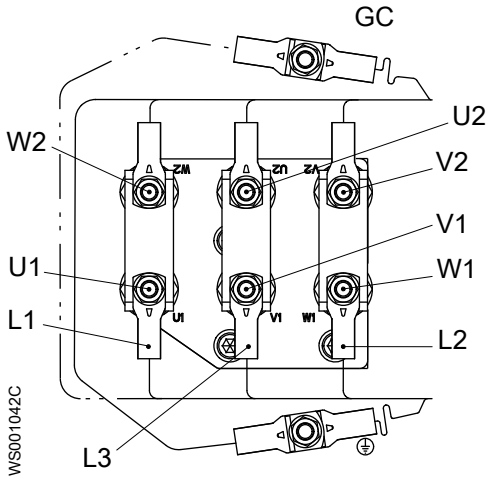


4.6.2.3 D-connection, 6-pole terminal; 2 cables

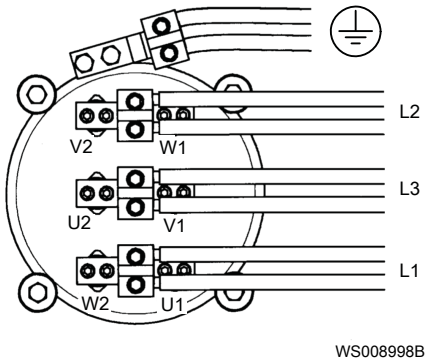
Schematic diagram



Drive units with small connection housing

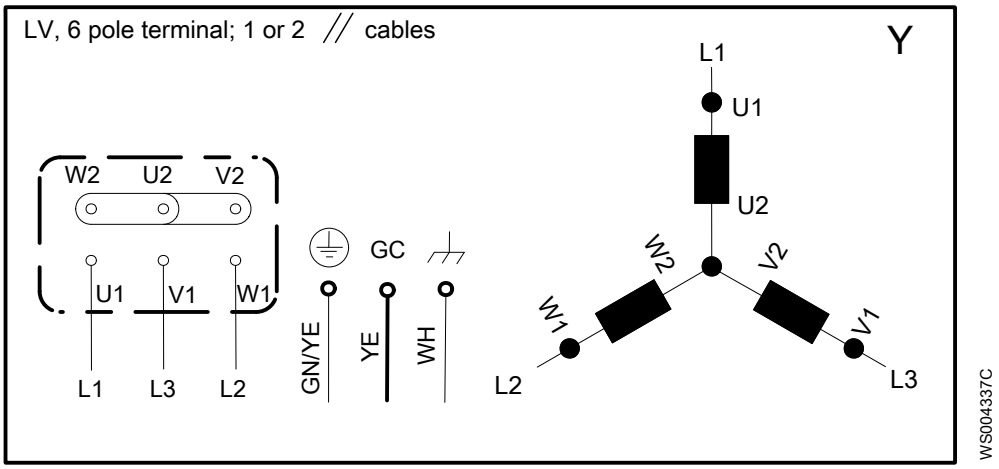


Drive units with large connection housing

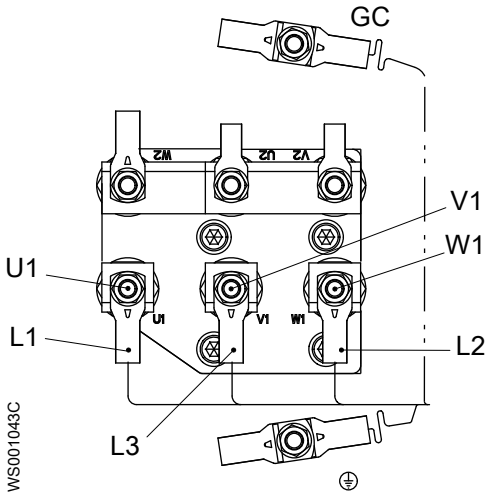


4.6.2.4 Y-connection

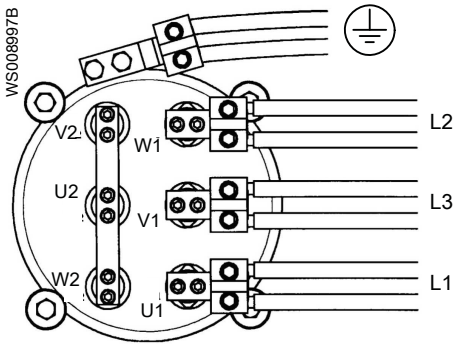
Schematic diagram



Drive units with small connection housing: 1 cable



Drive units with large connection housing: 2 cables



4.7 Check the impeller rotation

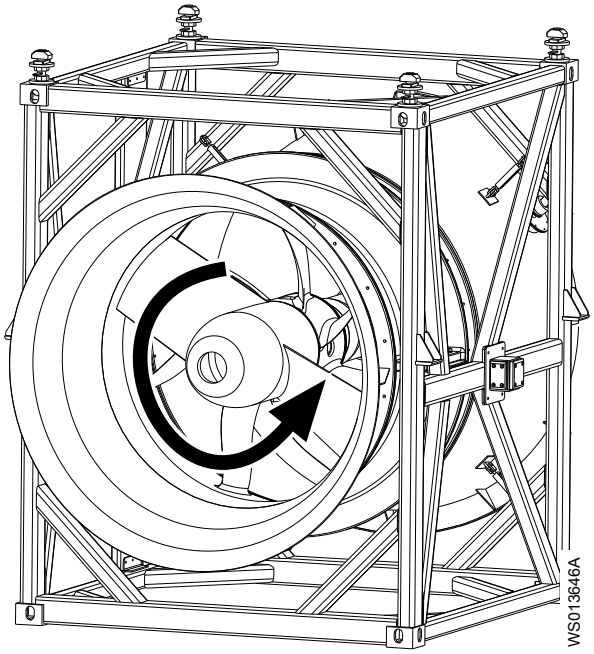
CAUTION: Crush Hazard

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 direction of rotation.

   The correct direction of propeller rotation is counterclockwise when viewed from the propeller end of the unit.



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 33.

   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.

5.2 Noise level

In certain installations and at certain operating points on the pump performance curve, the sound pressure level can exceed 70 dB(A). Pumps with power output greater than 30 kW, as shown in the diagram below, may have a sound pressure level between 70 dB(A) and maximum 85 dB(A) at the best efficiency point.

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.

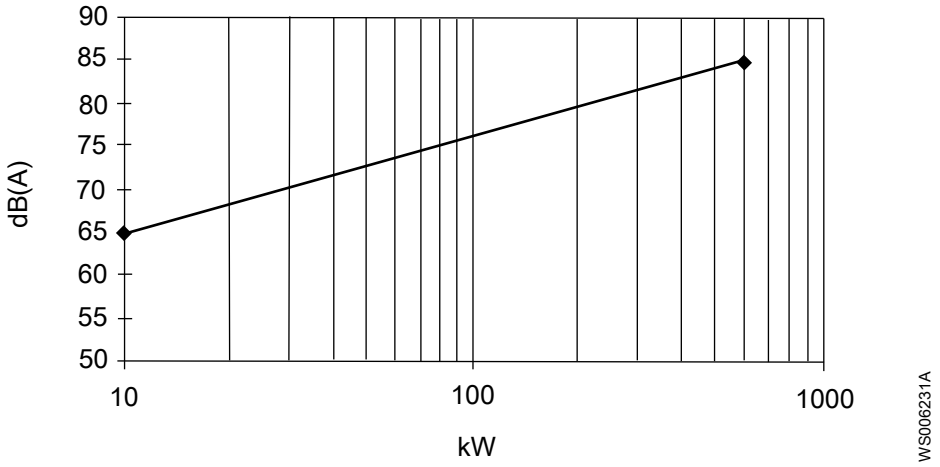


Figure 19: Sound pressure

5.3 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.

5.4 Start the pump

CAUTION: Crush Hazard

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

1. Check that:
   a) The monitoring equipment works.
   b) The starter equipment is installed according to the instructions from the manufacturer.
   c) All the alarms function.
   d) The lubricant is at the correct level.
2. Remove the fuses or open the circuit breaker, and check that the impeller can be rotated freely.

WARNING: Crush Hazard

Never put your hand into the pump housing.

   Make sure that the propeller rotates in the correct direction. See *Check the impeller rotation* on page 42.
3. Conduct insulation test phase to ground. To pass, value must exceed 5 megohms. See *Checking insulation and sensors*.
4. Start the pump.

Check that:

- The machine works without noise or vibration.
- All electrical values are correct.
- All accessories work correctly.

Record any abnormalities.

5.5 Modifications for freezing conditions

If the pump is installed in such a way that it can be exposed to temperatures at or below the freezing point (that is, the pump is not totally submerged), then special modifications must be made to the pump and the installation.

For more information, please contact your local sales and service representative.

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.

WARNING: Biological Hazard

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

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.

The following requirements apply:

- Make sure that all safety guards are in place and secure.
- Make sure that equipment is in place so that the unit cannot roll or fall over during the maintenance process.
- Make sure that you have a clear path of retreat.
- Never work alone.
- Check the explosion risk before you weld or use electrical hand tools.
- 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.
- Depressurize and empty the coolant system for T and Z installations, and all installations with external cooling.

Ground continuity verification

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

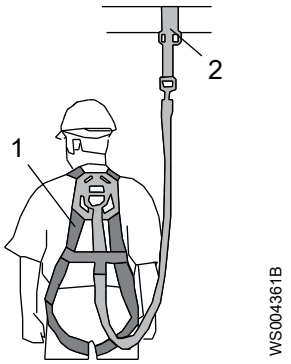
6.1.1 Falling

CAUTION: Fall Hazard

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

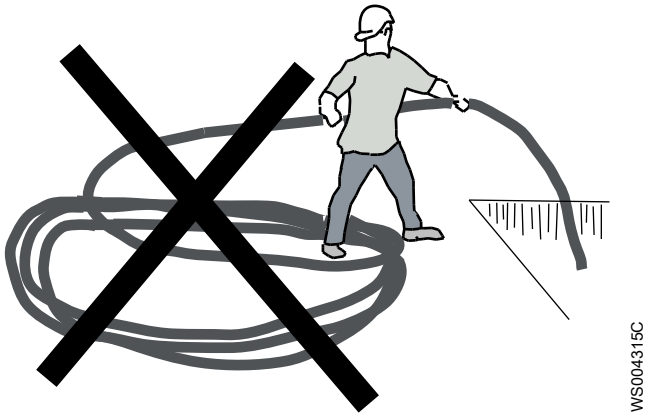
To minimize the risk of falling, observe the following:

- 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.



6.2 Service

Regular inspection and service of the pump makes sure that operation will be more reliable.

Every time the site is visited, visually examine the accessories and sump for corrosion, wear or damage.

Table 10: Service intervals

Type of service	Purpose	Interval
Initial inspection	To make a check up of the pump condition by an authorized Xylem service representative and, based on the result and findings from these measures, to determine the intervals for periodical inspection and major overhaul for the specific installation.	In the first year of operation.

Type of service	Purpose	Interval
Periodical inspection	To prevent operational interruptions and machine breakdown. Measures to secure performance and efficiency are defined and decided for each individual application. It can include such things as impeller trimming, wear part control and replacement, control of zinc-anodes and control of the stator.	12,000 hours or 3 years, whichever comes first. Applies to normal applications and operating conditions at media (liquid) temperatures < 40°C (104°F).
Major overhaul	To secure a long operating lifetime for the product. It includes the replacement of key components and the measures that are taken during an inspection.	24,000 hours or 6 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).

6.2.1 Inspection

CAUTION: Compressed Gas Hazard

Air inside may cause parts or liquid to be propelled with force. Be careful when opening.

Regular inspection and service of the pump makes sure that the operation is more reliable.

Do the following to service the pump:

Part to service	Action
Pump exterior	Check the entire pump and the cables for external mechanical damage.
Cable	1. If the outer jacket is damaged, replace the cable. 2. Check that the cables do not have any sharp bends and are not pinched. 3. Check that the leads and cable entry screws are correctly connected and tightened to the correct torque.
Lifting handle	Check the lifting handle for corrosion or other damage.
Junction box	1. General: Check that it is clean and dry. If it is wet: a. Check the cable entry. b. Replace the O-rings. Fit new O-rings to all O-ring seal joints which are opened during inspection. 2. Terminal board: Check that the connections are properly secured.
Junction box insulation: Drive units up to 1.1 kV	Check the condition and function. See *Check the insulation, up to 1 kV drives or generators* on page 51.

Part to service	Action
Stator housing Drive units with oil as the seal lubricant.	1. Check that it is clean and dry. – If there is oil in the stator housing, then drain and clean it. Check the stator housing again after one week of operation. If there is still oil in the stator housing, then change the seals. – If there is water in the stator housing and there was water in the oil, change the seals immediately. – If there is water in the stator housing, but there was no water in the oil, check all other connections. 2. Replace the O-rings.
Oil housing Drive units with oil as the seal lubricant	1. Check the oil quality: – If there is water in the oil, then drain the oil and replace with new oil. After one week of operation, check the oil quality again. – If the oil is free from water, then fill the oil to the correct level, if necessary. 2. Replace the filling plug O-rings.
Hydraulic parts	1. Check the general condition of the impeller or propeller and the wear ring. 2. Replace if necessary. 3. If applicable, check O-ring.
Zinc anodes	Check and change if necessary.
Screw joints	Check all externally accessible screw joints, and tighten if necessary to the correct torque. See *Torque values* on page 65.
Electrical cabinets	Check that it is clean and dry.
Connection to power	Check that the connections are properly secured.
Level regulators	Check the condition and function. See *Check the leakage detectors* on page 52.
Temperature sensors	Check the condition and function. See *Check the temperature sensors* on page 51.

After any service involving the power connections, you must check the rotation before operating the pump. See *Check the impeller rotation* on page 42.

6.2.2 Major overhaul

1. Perform a complete inspection service. See *Inspection* on page 49.
2. Do these additional steps:

Part to service	Action
Motor: insulation check Drive units up to 1.1 kV	Check that the resistance between earth and phase lead is more than 5 MΩ. Use a 500 VDC or 1000 VDC insulation and continuity tester.
Cable	Check that the rubber sheathing is undamaged. Change if necessary.
Oil housing	Change the lubricant.
General dismantling and cleaning	1. Dismantle the pump completely. 2. Clean all the parts. 3. Reassemble after replacing bearings, O-rings, and seals.
Bearings	Replace the bearings with new bearings.
O-rings and other rubber sealing parts	Replace O-rings and other rubber sealing parts.
Seals	Replace with new seals.

Part to service	Action
Sensors	Check the following: 1. Stator temperature sensors 2. Bearing temperature sensors 3. FLS and CLS sensors See *Check the temperature sensors* on page 51 and *Check the leakage detectors* on page 52.
Impeller or propeller	Check the general impeller or propeller status. Change if necessary. Check general wear ring status. Change if necessary.
Zinc anodes	Check their condition. Replace if necessary.
Screw joints	Check all externally accessible screw joints and tighten if necessary to the correct torque. See torque table and Parts List.
Lifting handle	Check its condition. Replace if necessary.
Painting	Touch up any painting if necessary.
Rotational direction	Check the impeller or propeller rotation direction. See *Check the impeller rotation* on page 42.
Voltage and amperage	Check the running values.
Electrical cabinets or panels	Check that it is clean and dry.
Connection to power	Check the cable connections. Tighten if necessary.
Overload protection and other protections	Check the correct settings.
Level regulators	Check condition and function.

After any service involving the power connections, check the rotation before operating the pump. See *Check the impeller rotation* on page 42.

6.2.3 Checking insulation and sensors

It is important that the checks for motor insulation, temperature sensors and leakages sensors are performed correctly and using appropriate tools. Parts of the unit, for example temperature sensors or the PEM, can be damaged if a megger or other device is used to apply a voltage higher than 2.5 V.

Use the following table to choose the appropriate procedures.

Item	Section
Motor insulation, drive units or generators up to 1 kV	*Check the insulation, up to 1 kV drives or generators* on page 51
Thermal contacts	*Check the temperature sensors* on page 51
PTC thermistors	
Pt100	
FLS leakage detector	*Check the leakage detectors* on page 52

6.3 Check the insulation, up to 1 kV drives or generators

1. Check that the resistance between earth and phase lead is more than 5 MΩ.
   Use a 500 VDC or 1000 VDC megger.
2. Keep a record of the results.

6.4 Check the temperature sensors

If the unit 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. Check the status of the sensor and wiring by measuring the resistance according to the values in *Product Description* on page 10.
3. Measure between each sensor lead and ground (earth) to establish that the resistance is infinite (or at least several megohms).

6.5 Check the leakage detectors

If the unit 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 stator housing, according to the values in *Product Description* on page 10.
2. Check the float switch (FLS) in the junction box or connection housing.
3. If the drive unit is equipped with a CLS water-in-oil sensor in the oil housing, then check the CLS by following this procedure.
   a) Connect the CLS to a 12 VDC supply.

      The sensor must have the correct polarity to be checked. However, a switched plus and minus does not damage the sensor.
   b) Use the multimeter as an ammeter and connect it in series with the sensor.
   c) If the sensor is accessible, then check: the alarm function by gripping the sensor with the hand.

      Skin tissue and blood contain a high content of water.

   For interpretation of the CLS measurement results, see *Product Description* on page 10.

6.5.1 FLS

Table 11: 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.

6.6 Change the seal oil

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

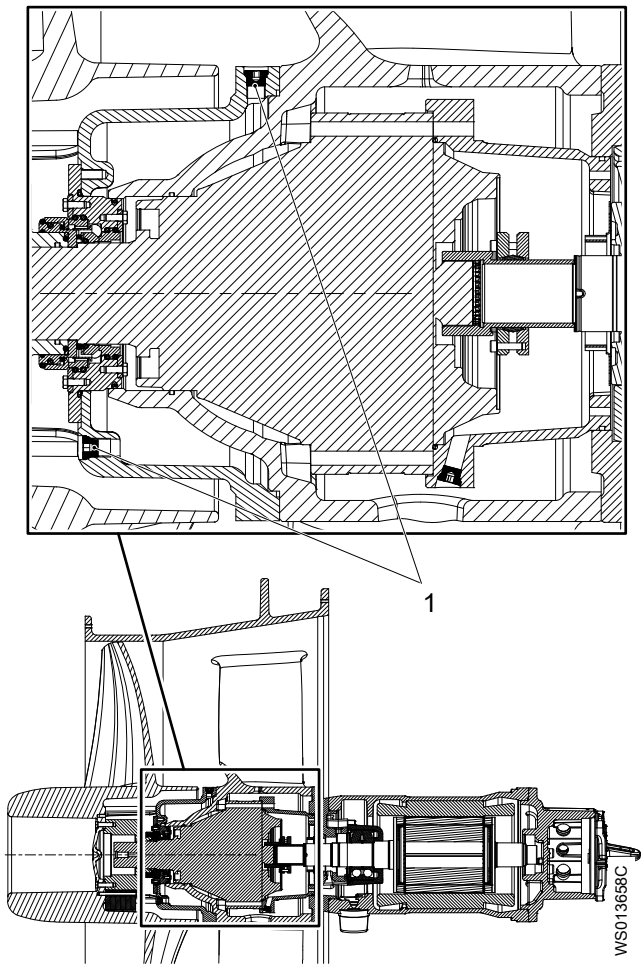
Examples of suitable oil types are the following:

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

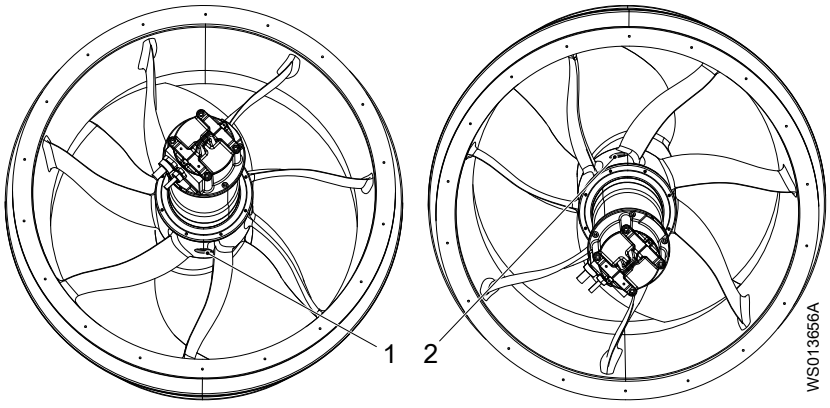
The amount of oil that is required is 5.6 L (5.9 quarts).

Table 12: Spare part numbers

Item	Part number
Oil plug	809 35 00
O-ring	82 72 95



1. Seal oil plugs, 3x



1. Seal oil drain plug
2. Seal oil fill plug

Empty the oil

1. Put a container under the oil drain hole.
2. Unscrew the oil plugs.

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.

3. Replace the O-rings.
4. When the oil has been emptied, then install the oil plugs.
   If new oil must be added directly, then only the oil drain plug must be installed now.
   Tightening torque: 50 Nm (37 lbf·ft)

Fill with oil

1. Fill up with the new oil.
2. Replace the O-rings.
3. Install the oil plugs.
   Tightening torque: 50 Nm (37 lbf·ft)

6.7 Change the gear oil

For the intervals between major overhauls, see *Major overhaul* on page 50.

Examples of suitable oil types are the following:

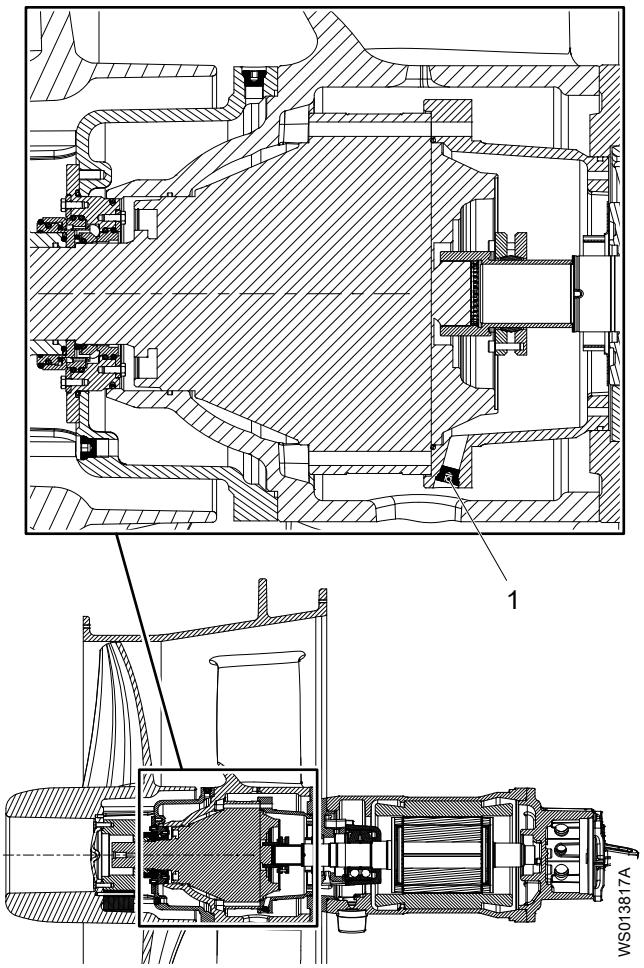
- Mobil SHC 626

Table 13: Oil volume

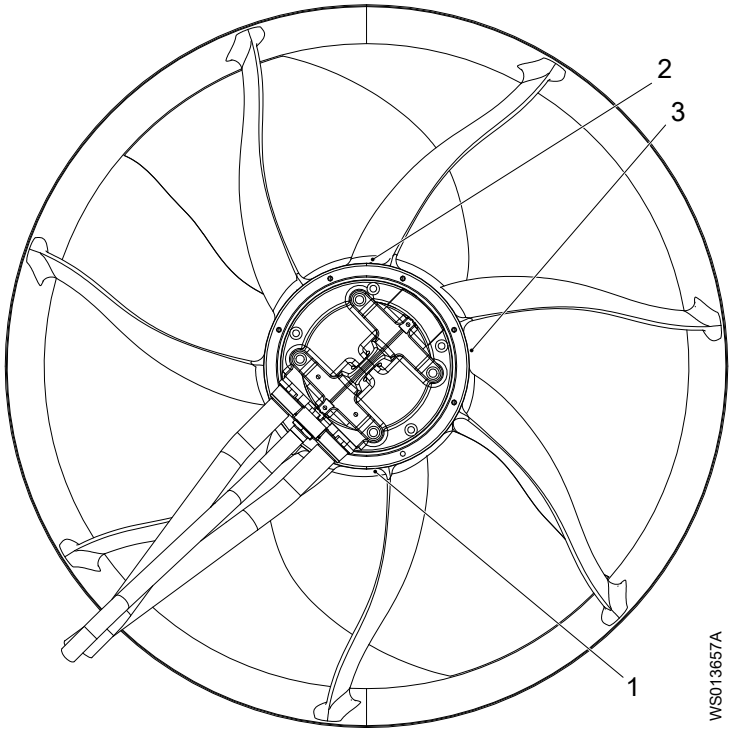
Gear ratio	Oil volume, L (quarts)
6.0	11.5 (12.2)
4.889	16 (16.9)

Table 14: Spare part numbers

Item	Part number
Oil plug	82 88 20
O-ring	82 72 95



1. Gear oil plugs, 3x



1. Gear oil drain plug
2. Gear oil fill plug
3. Gear oil level plug

Empty the oil

1. Put a container under the oil drain hole.
2. Unscrew the oil plugs.

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.

3. Replace the O-rings.
4. When the oil has been emptied, then install the oil plugs.
   If new oil must be added directly, then only the oil drain plug must be installed now.
   Tightening torque: 50 Nm (37 lbf·ft)

Fill with oil

1. Fill up with the new oil.
   The oil level must be below the oil level hole.
2. Replace the O-rings.
3. Install the oil plugs.
   Tightening torque: 50 Nm (37 lbf·ft)

6.8 Replace the hydraulic parts

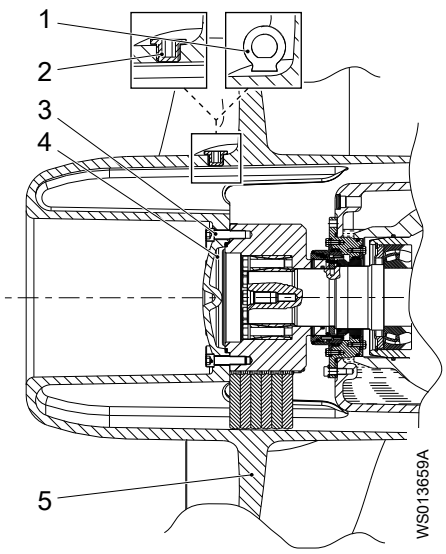
6.8.1 Rotating propeller

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.

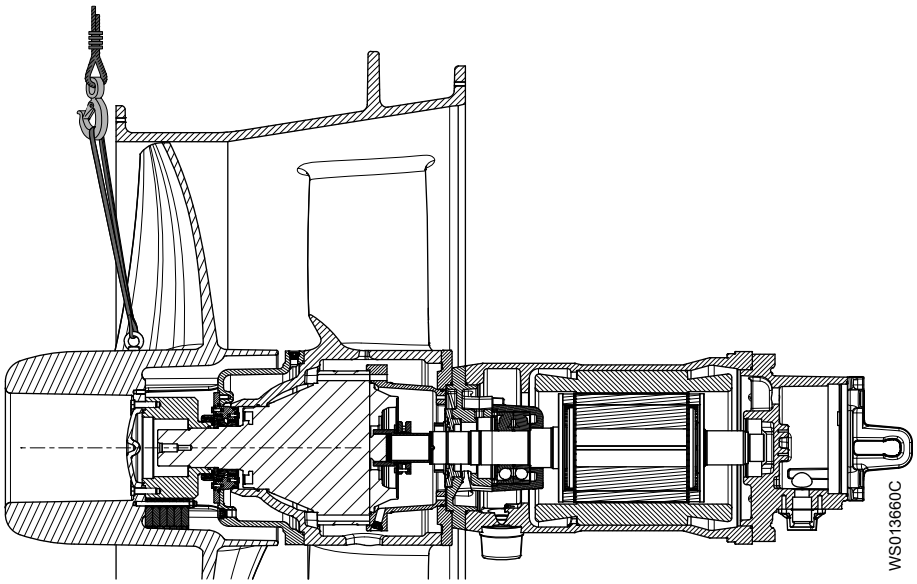
6.8.2 Disassemble the pump

6.8.2.1 Remove the propeller



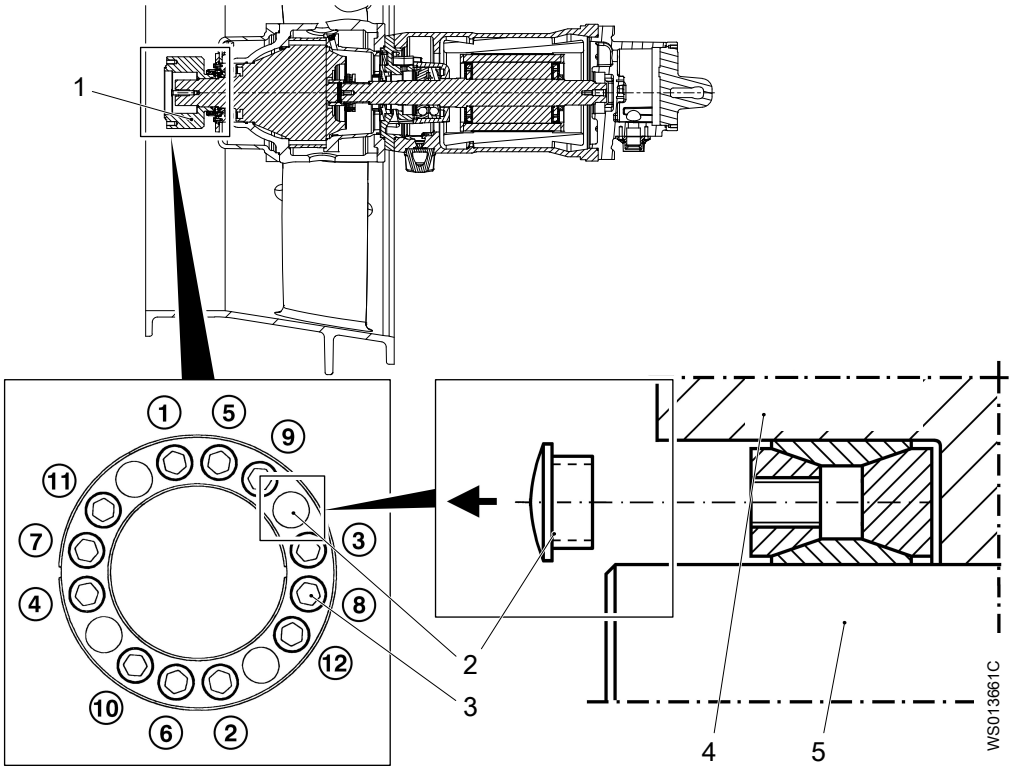
1. Lifting eye unit
2. Plug
3. Screws
4. O-ring
5. Propeller

1. Remove the plug.
2. Install the lifting eye unit.
3. Remove the screws.
4. Remove the propeller.



5. Discard the O-ring.

6.8.2.2 Remove the locking assembly



1. Locking assembly
2. Plug × 4
3. Screw × 12
4. Propeller hub
5. Shaft

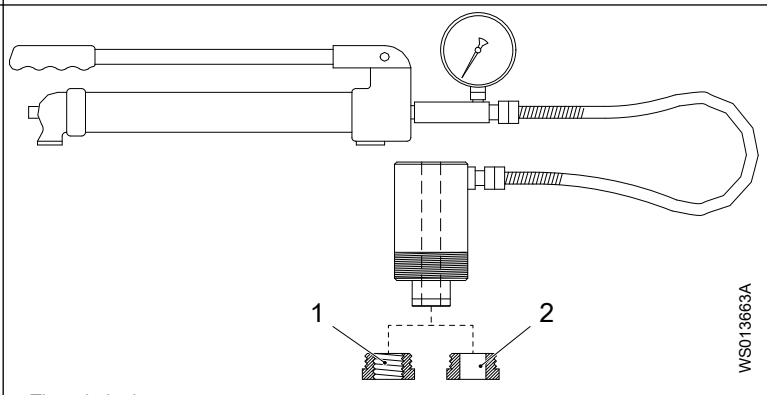
1. Remove the screws.

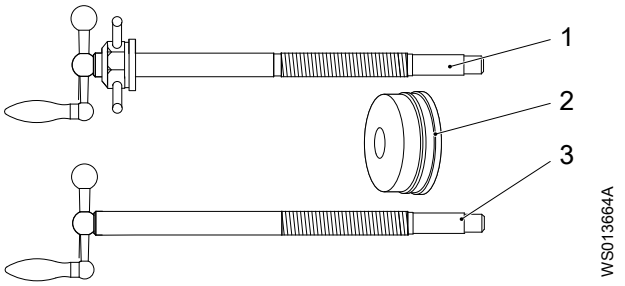
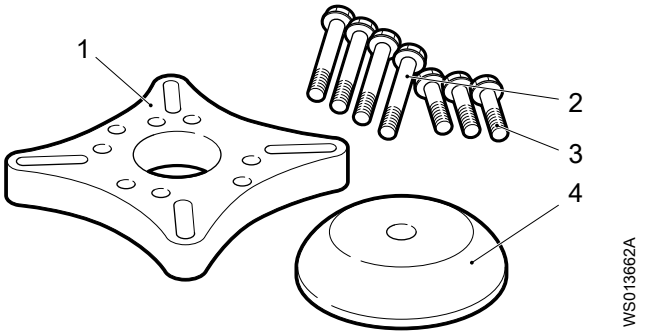
   The locking assembly should become released.

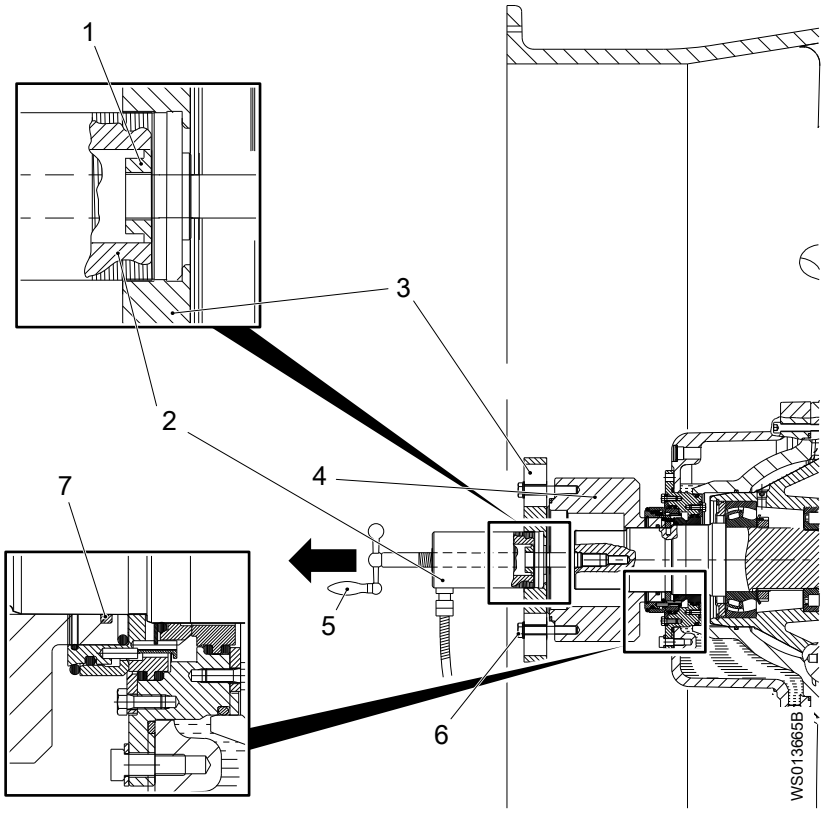
2. If the assembly stays locked after loosening the screws, then do the following:
   a) Remove the four plugs.
   b) Install four of the screws that were removed.
   c) Tighten the screws evenly until the locking assembly is released.
   d) Remove the screws.

6.8.2.3 Remove the propeller hub

Table 15: Tools

Tool	Illustration
Hydraulic pump 14-57 21 04	 1. Threaded adapter 2. Non-threaded adapter

Tool	Illustration
Basic repair kit 436 19 00	 1. Screw unit 432 50 00 2. Washer 432 43 00 3. Puller screw unit 432 51 00
Hub tool 436 18 00	 1. Cross piece 432 44 00 2. Screw 432 53 00, M16 3. Screw 432 55 00, M12 4. Washer 432 45 00



1. Threaded adapter
2. Hydraulic pump
3. Cross piece
4. Propeller hub
5. Puller screw unit
6. Screw, M16
7. O-ring 82 74 14

Figure 20: Overview

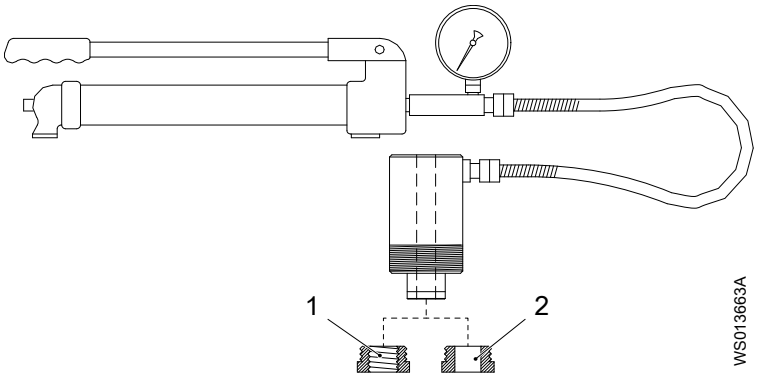
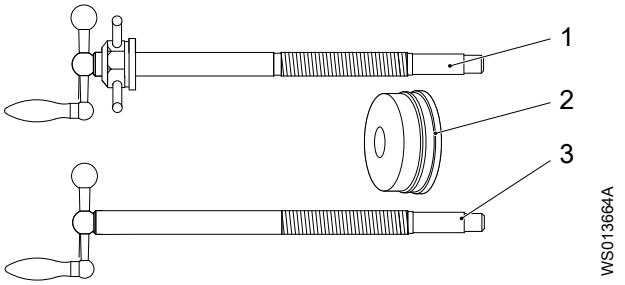
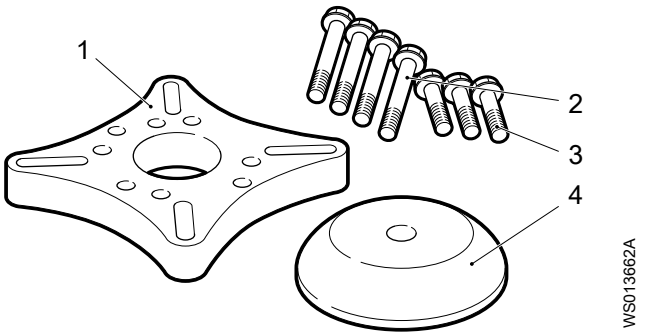
1. Put the cross piece over the propeller hub.
2. Install the screws.

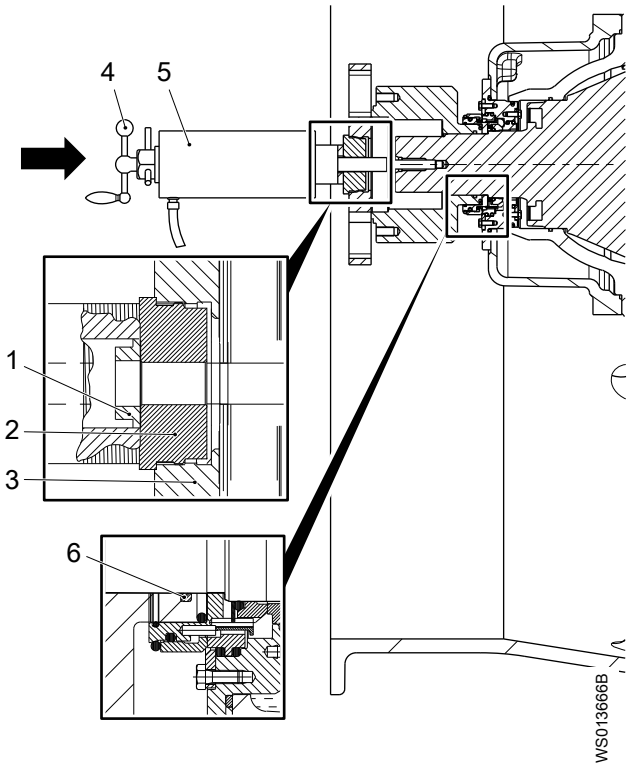
3. Install the threaded adapter.
4. Install the hydraulic pump into the cross piece.
5. Install the puller screw into the hydraulic pump.
6. By using the hydraulic pump, apply pressure until the propeller hub is released.
7. Remove the hydraulic pump and the cross piece.
8. Remove the propeller hub and the O-ring.

6.8.3 Assemble the pump

6.8.3.1 Install the propeller hub

Table 16: Tools

Tool	Illustration
Hydraulic pump 14-57 21 04	 1. Threaded adapter 2. Non-threaded adapter
Basic repair kit 436 19 00	 1. Screw unit 432 50 00 2. Washer 432 43 00 3. Puller screw unit 432 51 00
Hub tool 436 18 00	 1. Cross piece 432 44 00 2. Screw 432 53 00, M16 3. Screw 432 55 00, M12 4. Washer 432 45 00



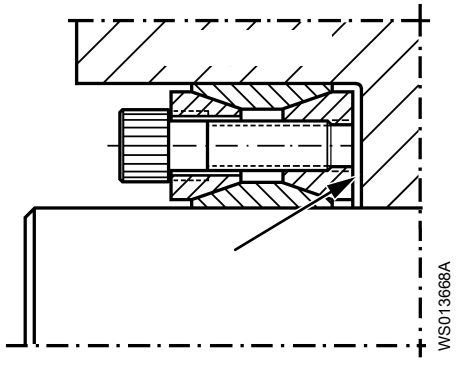
1. Non-threaded adapter
2. Washer
3. Cross piece
4. Screw unit
5. Hydraulic pump
6. O-ring

Figure 21: Overview

1. Install the O-ring.
2. Put the propeller hub on the shaft.
3. Put the cross piece over the propeller hub.
4. Install the adapter into the cross piece.
5. Install the non-threaded adapter.
6. Install the screw unit into the hydraulic pump.
7. By using the hydraulic pump, apply pressure until the propeller hub is seated.

6.8.3.2 Install the locking assembly

1. Install the locking assembly over the shaft and into the base of the propeller hub.
2. Lubricate by using grease as illustrated.
   Layer thickness: 3 mm (0.18 in)



3. Clean the locking assembly.
4. Lubricate all contact surfaces and threads by using a thin layer of oil.
5. Tighten the screws in sequence:
   The locking assembly must be seated during the tightening.

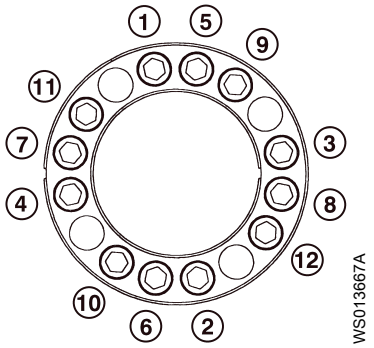


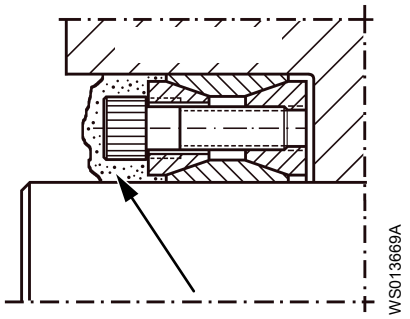
Figure 22: Screw numbers

Table 17: Screw sequence

Order	Screw numbers
1	1, 2
2	3, 4
3	5, 6
4	7, 8
5	9, 10
6	11, 12

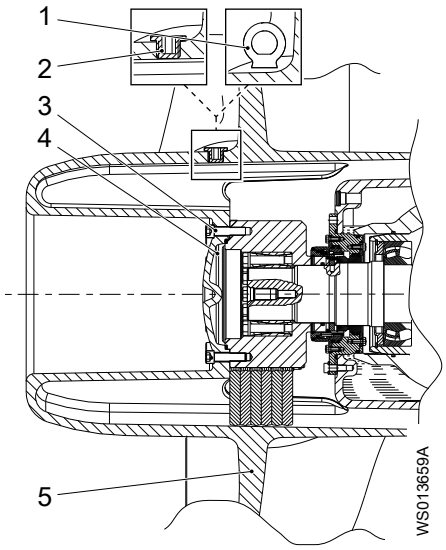
a) Tighten the screws according to the sequence.
   Tightening torque: 70 Nm (52 lbf·ft)
b) Tighten the screws again according to the sequence.
   Tightening torque: 154 Nm (114 lbf·ft)
c) Tighten the screws again according to the sequence.
   Tightening torque: 230 Nm (170 lbf·ft)

6. Cover the screw heads by using grease.



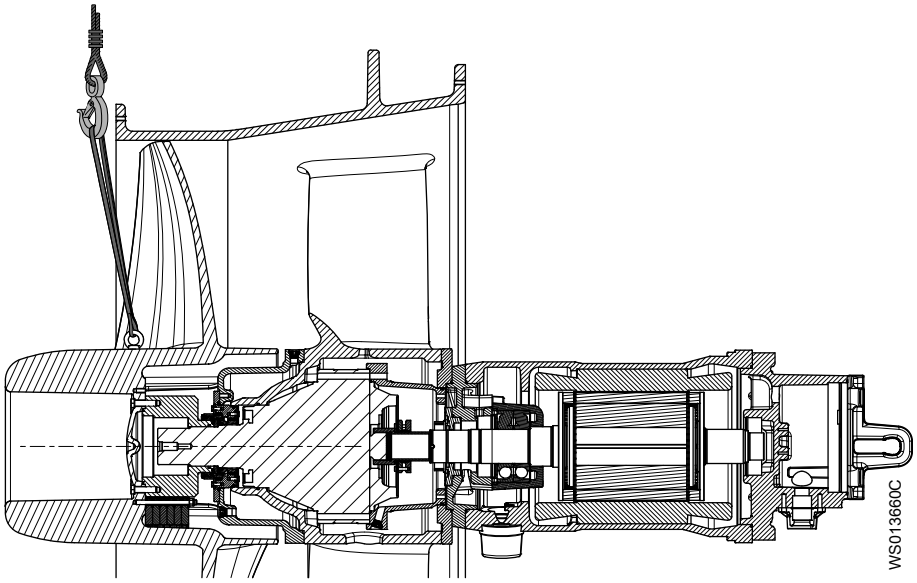
7. Check that the hub can be rotated by hand.

6.8.3.3 Install the propeller



1. Lifting eye unit
2. Plug
3. Screws
4. O-ring
5. Propeller

1. Install the O-ring.
2. Remove the plug.
3. Install the lifting eye unit.
4. Lift the propeller.



5. Align the holes of the propeller hub with the holes of the propeller.
6. Lubricate the screws.
   Lubricant: Loctite No. 4KM51
7. Install and tighten the screws in sequence:

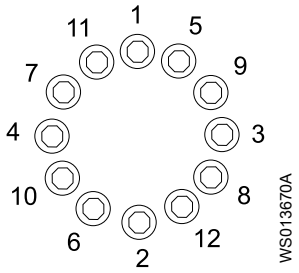


Figure 23: Screw numbers

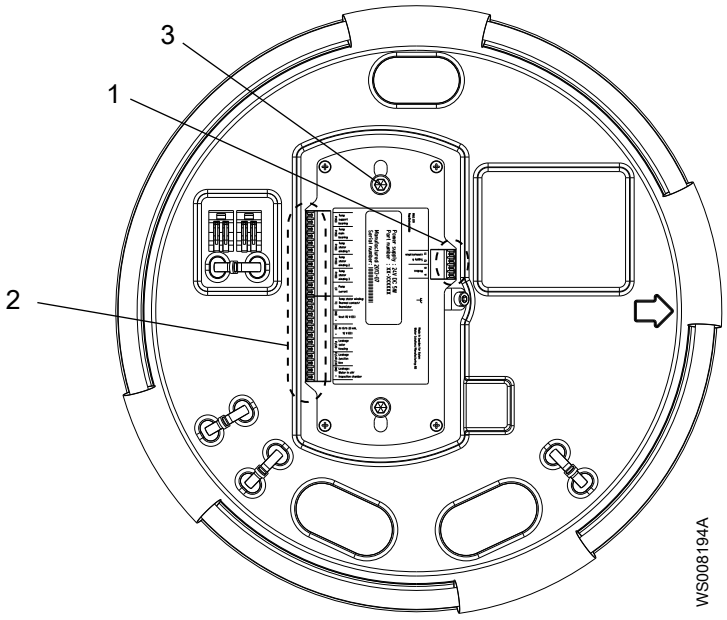
Table 18: Screw sequence

Order	Screw numbers
1	1, 2
2	3, 4
3	5, 6
4	7, 8
5	9, 10
6	11, 12

a) Tighten the screws according to the sequence.
   Tightening torque: 62 Nm (46 lbf·ft)
b) Tighten the screws again according to the sequence.
   Tightening torque: 125 Nm (93 lbf·ft)
c) Tighten the screws again according to the sequence.
   Tightening torque: 187 Nm (138 lbf·ft)
d) Tighten the screws a last time according to the sequence.
   Tightening torque: 187 Nm (138 lbf·ft)

8. Remove the lifting eye unit.
9. Install the plug.

6.9 Pumps with MAS 801: Replace the PEM



1. PEM communication terminals
2. PEM control terminals
3. Screws securing PEM

1. Disconnect the communication terminals.
2. Disconnect the control terminals on the PEM.

   For specially-approved pumps, do not disconnect T3 and T4 from the separate plinth.
3. Disconnect the functional ground.
4. Remove the two screws securing the PEM.
5. Lift out the PEM.
6. Fit the new PEM into place. Secure with two screws.
7. Connect the functional ground.
8. Connect the control terminals.

   For specially-approved pumps, do not use connections 51 and 63 on the PEM. For EX-pumps, T3 and T4 must be connected to the separate plinth.
9. Connect the communication terminals.
10. To download information to the PEM, see the System Installation and Operation (SIO) Manual for the MAS 801 monitoring equipment.

6.10 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 19: 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 20: 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 21: 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.

6.11 Tools

Beside ordinary tools, the following tools are required to do the necessary maintenance of the pump.

Part number	Denomination	Parts		Qty
		Part number	Denomination	
82 30 92	Lifting eye, M16			2
82 30 93	Lifting eye, M20			2
82 23 62	Nut, M20			2
82 35 26	Washer			2
84 13 60	Three jaw puller			1
84 15 17	C-wrench			1
332 91 00	Spring puller tool			1
436 18 00	Hub tool			1
		432 44 00	Cross piece	1
		432 45 00	Washer	1
		432 53 00	Screw, M16	4
		432 55 00	Screw, M12	3
436 19 00	Basic repair kit III			1
		432 43 00	Washer	1
		432 50 00	Screw unit	1
		432 51 00	Puller screw unit	1
584 71 00	Mounting / dismounting tool			2
		82 23 62	Nut	4
		82 37 07	Washer	4
		441 95 00	Puller screw	1
443 85 00	Washer			1
582 65 00	Stand unit			1
582 66 00	Stand unit			1
584 84 00	Puller ring			1
628 94 00	Lifting eye unit			1
		81 62 43	Screw	1
		82 23 61	Nut	1
		82 37 07	Washer	2
		83 30 85	Lifting eye	1
		628 93 00	Instruction card	1
847 76 00	Measuring tool For gearbox unit			1

Part number	Denomination	Parts		Qty
		Part number	Denomination	
14-57 21 04	Hydraulic pump			1
702 76 00	Lifting eye unit			1

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. If the problem still persists: Contact a sales or authorized service representative.
The pump does not start automatically, but can be started manually.	Check that: • The start level regulator is functioning. Clean or replace if necessary. • All connections are intact. • The relay and contactor coils are intact. • The control switch (Man/Auto) makes contact in both positions. Check the control circuit and functions.

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

Always state the serial number of the product, see *Product Description* on page 10.

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.

Always state the serial number of the product, see *Product Description* on page 10.

7.4 The pump starts-stops-starts in rapid sequence

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

Always state the serial number of the product, see *Product Description* on page 10.

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 that the impeller is properly trimmed.
The drive unit is not receiving full voltage on all three phases.	• Check the fuses. Replace fuses that have tripped. • If the fuses are intact, then notify a certified electrician.
The phase currents vary, or they are too high.	Contact a sales or authorized service representative.
The insulation between the phases and ground in the stator is defective.	See *Check the insulation, up to 1 kV drives or generators* on page 51.
The density of the pumped fluid is too high.	Make sure that the maximum density is 1100 kg/m3 (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 10.

8 Technical Reference

8.1 Application limits

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

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			

8.3 Cable bending radius, weight and diameter

Control cables

Table 22: SUBCAB™ control cables

This table shows the minimum bending radius, weight, and outer diameter for SUBCAB control cables.

Cable	Minimum bending radius in mm	Weight in kg/m	Outer diameter, minimum-maximum in mm
12x1.5 mm^2	190	0.53	Ø 18.2–21.2
24x1.5 mm^2	250	0.90	Ø 24.9–28.9
S12x1.5 mm^2	300	0.78	Ø 29.9–31.0
S24x1.5 mm^2	350	1.59	Ø 33.0–37.0

Power cables with power cores and control element

Table 23: Screened SUBCAB

Cable	Minimum bending radius in mm	Weight in kg/m	Outer diameter, minimum-maximum in mm
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
S3x95 + 3x50/3 + 2S(2x0.5)	440	4.6	Ø 44–47
S3x120 + 3x70/3 + 2S(2x0.5)	500	5.5	Ø 50–52
S6x95 + 95 + S(4x0.5)	570	7.6	Ø 57–60

Table 24: SUBCAB

Cable	Minimum bending radius in mm	Weight in kg/m	Outer diameter, minimum-maximum in mm
4 G 16 + S(2x0.5)	260	1.13	Ø 26–28
4 G 25 + S(2x0.5)	320	1.7	Ø 32–34
4 G 35 + 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
3x95 + 2G50/2 + S(2x0.5)	470	4.5	Ø 47–50
3x120 + 2G70/2 + S(2x0.5)	540	5.7	Ø 54–56

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