

Installation, Operation, and Maintenance Manual

8150.020/.190 Bravo 600



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Introduction and Safety

Introduction

Purpose of this manual

The purpose of this manual is to provide necessary information for:

- Installation
- Operation
- Maintenance



CAUTION:

Read this manual carefully before installing and using the product. Improper use of the product can cause personal injury and damage to property, and may void the warranty.

NOTICE:

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

Safety



WARNING:

- The operator must be aware of safety precautions to prevent physical injury.
- Any pressure-containing device can explode, rupture, or discharge its contents if it is over-pressurized. Take all necessary measures to avoid over-pressurization.
- 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. This includes any modification to the equipment or use of parts not provided by Grindex. If there is a question regarding the intended use of the equipment, please contact an Grindex representative before proceeding.
- This manual clearly identifies accepted methods for disassembling units. These methods must be adhered to. Trapped liquid can rapidly expand and result in a violent explosion and injury. Never apply heat to impellers, propellers, or their retaining devices to aid in their removal.



CAUTION:

You must observe the instructions contained in this manual. Failure to do so could result in physical injury, damage, or delays.

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
- 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:		<ul style="list-style-type: none"> • A potential situation which, if not avoided, could result in undesirable conditions • A practice not related to personal injury

Hazard categories

Hazard categories can either fall under hazard levels or let specific symbols replace the ordinary hazard level symbols.

Electrical hazards are indicated by the following specific symbol:



These are examples of other categories that can occur. They fall under the ordinary hazard levels and may use complementing symbols:

- Crush hazard
- Cutting hazard
- Arc flash hazard

Environmental safety**The work area**

Always keep the station clean to avoid and/or discover emissions.

Waste and emissions regulations

Observe these safety regulations regarding waste and emissions:

- Dispose appropriately of all waste.
- Handle and dispose of the processed liquid in compliance with applicable environmental regulations.
- Clean up all spills in accordance with safety and environmental procedures.
- Report all environmental emissions to the appropriate authorities.

Electrical installation

For electrical installation recycling requirements, consult your local electric utility.

Recycling guidelines

Always recycle according to the guidelines listed below:

1. Follow local laws and regulations regarding recycling if the unit or parts are accepted by an authorized recycling company.
2. If the first guideline is not applicable, then return the unit or parts to the nearest Grindex representative.

User safety

General safety rules

These safety rules apply:

- Always keep the work area clean.
- Pay attention to the risks presented by gas and vapors in the work area.
- Avoid all electrical dangers. Pay attention to the risks of electric shock or arc flash hazards.
- Always bear in mind the risk of drowning, electrical accidents, and burn injuries.

Safety equipment

Use safety equipment according to the company regulations. Use this safety equipment within the work area:

- Hard hat
- Safety goggles, preferably with side shields
- Protective shoes
- Protective gloves
- Gas mask
- Hearing protection
- First-aid kit
- Safety devices

NOTICE:

Never operate a unit unless safety devices are installed. Also see specific information about safety devices in other chapters of this manual.

Electrical connections

Electrical connections must be made by certified electricians in compliance with all international, national, state, and local regulations. For more information about requirements, see sections dealing specifically with electrical connections.

Hazardous liquids

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 work with biologically hazardous liquids are vaccinated against diseases to which they may be exposed.
- Observe strict personal cleanliness.

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	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 1. Remove contaminated clothing. 2. Wash the skin with soap and water for at least 1 minute. 3. Seek medical attention, if necessary.

Ex-approved products

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

Personnel requirements

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

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

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

Product and product handling requirements

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

- Only use the product in accordance with the approved motor data.
- You must fully submerge the Ex-approved product during normal operation. Dry running during service and inspection is only permitted outside the classified area.
- Before you start work on the product, make sure that the product and the control panel are isolated from the power supply and the control circuit, so they cannot be energized.
- Do not open the product while it is energized or in an explosive gas atmosphere.
- Make sure that thermal contacts are connected to a protection circuit according to the approval classification of the product, and that they are in use.
- Intrinsically safe circuits are normally required for the automatic level-control system by the level regulator if mounted in zone 0.
- The yield stress of fasteners must be in accordance with the approval drawing and the product specification.
- Do not modify the equipment without approval from an authorized Grindex representative.
- Only use parts that are provided by an authorized Grindex representative.

Guidelines for compliance

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

Minimum permitted liquid level

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

Monitoring equipment

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

- Level indicators
- Temperature detectors

Product warranty

Coverage

Grindex undertakes to remedy the following faults in products sold by Grindex under the following conditions:

- The faults are due to defects in design, materials or workmanship.
- The faults are reported to an Grindex representative within the warranty period.
- The product is used only under the conditions described in this manual.
- The monitoring equipment incorporated in the product is correctly connected and in use.
- All service and repair work is done by personnel authorized by Grindex.
- Genuine Grindex parts are used.

Limitations

The warranty does not cover faults caused by the following:

- Deficient maintenance
- Improper installation
- Modifications or changes to the product and installation carried out without consulting Grindex
- Incorrectly executed repair work
- Normal wear and tear

Grindex assumes no liability for the following:

- Bodily injuries
- Material damages
- Economic losses

Warranty claim

Grindex products are high-quality products with expected reliable operation and long life. However, should the need arise for a warranty claim, please contact your Grindex representative.

Spare parts

Grindex guarantees that spare parts will be available for 10 years after the manufacture of this product has been discontinued.

Transportation and Storage

Inspect the delivery

Inspect the package

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

Inspect the unit

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

Transportation guidelines

Precautions



WARNING:

- Stay clear of suspended loads.
- Observe accident prevention regulations in force.

Position and fastening

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

Lifting



WARNING:

- Crush hazard. The unit and the components can be heavy. Use proper lifting methods and wear steel-toed shoes at all times.
- Lift and handle the product carefully, using suitable lifting equipment.
- The product must be securely harnessed for lifting and handling. Use eyebolts or lifting lugs if available.
- Always lift the unit by its lifting handle. Never lift the unit by the motor cable or by the hose.
- Do not attach sling ropes to shaft ends.

Lifting equipment

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

- The minimum height (contact Grindex for information) between the lifting hook and the floor must be sufficient to lift the unit.
 - The lifting equipment must be able to hoist the unit straight up and down, preferably without the need for resetting the lifting hook.
 - The lifting equipment must be securely anchored and in good condition.
 - The lifting equipment must support weight of the entire assembly and must only be used by authorized personnel.
 - Two sets of lifting equipment must be used to lift the unit for repair work.
 - The lifting equipment must be dimensioned to lift the unit with any remaining pumped media in it.
 - The lifting equipment must not be oversized.
-

NOTICE:

Oversized lifting equipment could cause damage if the unit should stick when being lifted.

Temperature ranges for transportation, handling and storage

Handling at freezing temperature

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

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

NOTICE:

Never use a naked flame to thaw the unit.

Unit in as-delivered condition

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

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

Lifting the unit out of liquid

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

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

Follow these guidelines to avoid freezing damage:

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

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.
 - Do not place heavy weights on the packed product.
-

Long-term storage

If the unit is stored more than 6 months, the following apply:

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

Product Description

Pump design

The pump is submersible, and driven by an electric motor.

Intended use

The product is intended for moving waste water, sludge, raw and clean water. Always follow the limits given in *Application limits* (page 50). If there is a question regarding the intended use of the equipment, please contact an Grindex representative before proceeding.



WARNING:

In explosive or flammable environments, only use Ex- or MSHA-approved pumps.

NOTICE:

Do NOT use the pump in highly corrosive liquids.

Spare parts

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

Pressure class

N	Medium head
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Parts

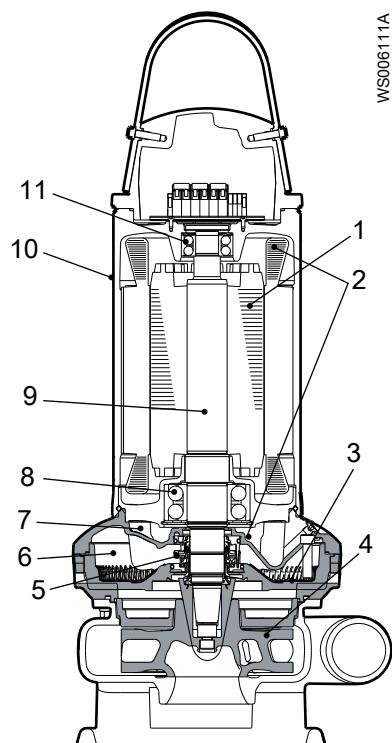


Figure 1: Without cooling jacket

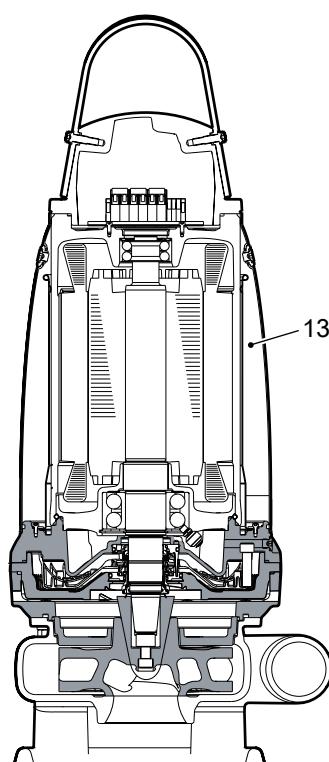
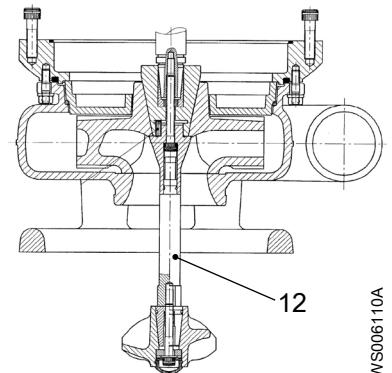


Figure 2: With cooling jacket



Position	Part	Description
1	Motor	For information about the motor, see Motor data (page 50).
2	Monitoring equipment	For more information about the monitoring equipment, see Monitoring equipment (page 14).
3	Flow diffuser	Provides heat transfer from the coolant to the pumped media (liquid).
4	Impeller	The impeller is a shrouded three-channel H-impeller.

Position	Part	Description
5	Mechanical seals	One inner and one outer seal in a combination of materials: <ul style="list-style-type: none">• Tungsten carbide• Silicon carbide RSiC• Aluminium oxide Al₂O₃• Corrosion-resistant cemented carbide WCCR
6	Seal housing	Includes a coolant that lubricates and cools the seals; the housing acts as a buffer between the pumped liquid and the electric motor.
7	Inspection chamber	The inspection chamber is equipped with a FLS10 leakage sensor in order to prevent damages on the motor.
8	Main bearing	The bearing consists of a two row angular contact ball bearing.
9	Shaft	The shaft is stainless steel, with an integrated rotor.
10	Cooling	The pump is cooled by the ambient liquid.
11	Support bearing	The bearing consists of a two-row ball bearing.
12	Agitator	The agitator stirs the slurry in order to prevent deposition of material on the sump bottom. Use of the agitator is optional.
13	Cooling with cooling jacket	The motor is cooled by a closed loop system. An integrated coolant pump circulates the coolant whenever the pump is operated. The cooling jacket can also be used with a external cooling system. For more information, see External cooling (page 14).

External cooling

The following items are required in order to use external cooling:

- Cooling jacket
- Inlet/outlet pipes with M16 threads (replacing the coolant plugs)
- External cooling system (hose, water source, etc.)

Contact your local Grindex representative for more information.

Monitoring equipment

The following applies to the monitoring equipment of the pump:

- The stator incorporates three thermal contacts connected in series that activate the alarm and stops the pump at overtemperature
- The thermal contacts open at 140°C (285°F).
- Ex-approved pumps must have thermal contacts connected to the control panel.
- The sensors and optional sensors must be connected to the monitoring equipment.
- The monitoring equipment must be of a design that makes automatic restart impossible.

- The pump is supplied with an inspection sensor FLS 10 for sensing the presence of any liquid in the inspection chamber.
- Information in the junction box shows if the pump is equipped with optional sensors.

Optional sensors

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

NOTICE:

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

The data plate

Introduction

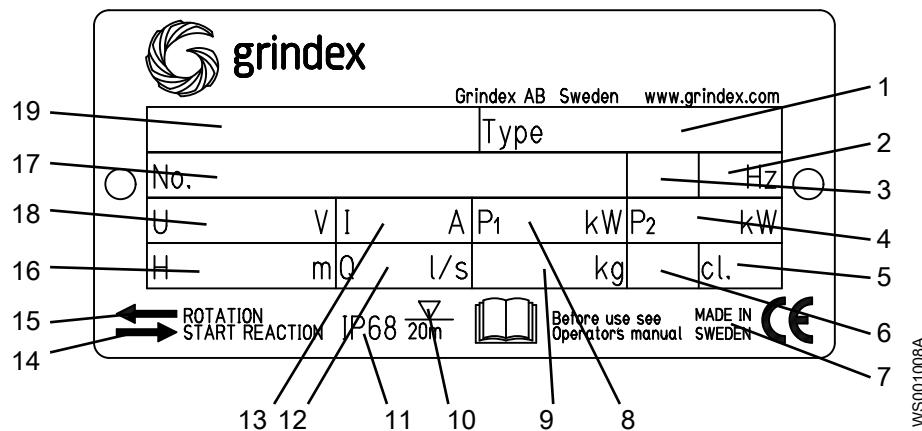
The data plate is a metal label located on the main body of the pump. The data plate lists key product specifications.

The data plate

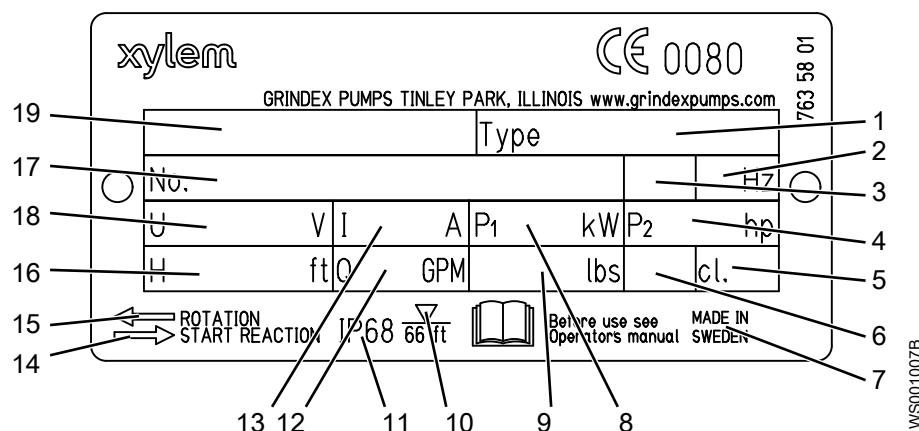
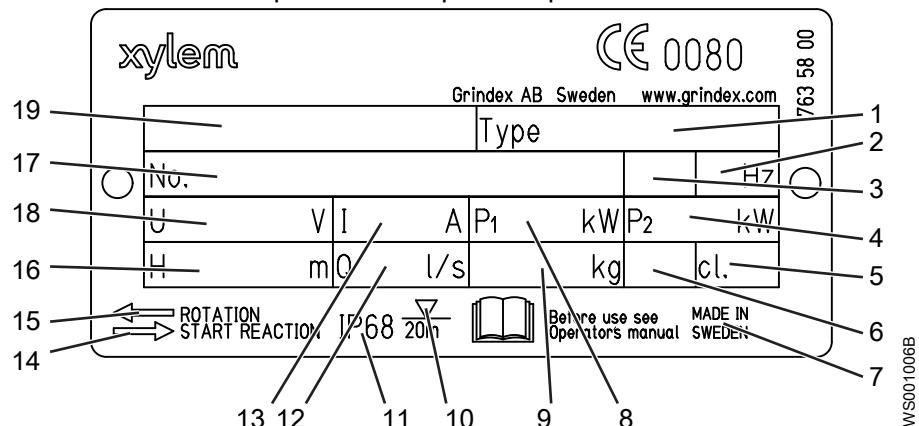
This list of callouts is applicable for all versions of data plates:

1. Pump type number
2. Frequency
3. Phases, type of current
4. Rated shaft power
5. Thermal class
6. Locked rotor code-letter
7. Country of origin
8. Maximum power consumption
9. Product weight
10. Maximum submersion depth
11. Degree of protection
12. Maximum capacity
13. Rated current
14. Direction of the start reaction
15. Direction of the impeller rotation
16. Maximum head
17. Serial number
18. Rated voltage
19. Pump model

This is the data plate for non explosion-proof version .020:



These are the data plates for explosion-proof version .190:



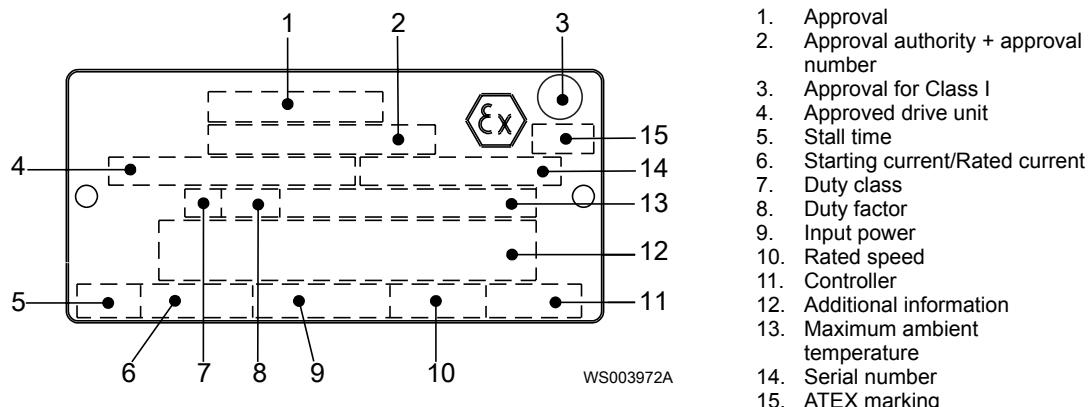
Approvals

Product approvals for hazardous locations

Pump	Approval
8150.190	European Norm (EN) <ul style="list-style-type: none"> • ATEX Directive • EN 60079-0, EN 60079-1, EN 1127-1 • Ex I M2 Ex d I • Ex II 2 G Ex d IIB T3
	EN approval for cable entry: <ul style="list-style-type: none"> • Certificate number: INERIS 02ATEX9008 U • Ex II 2 G Ex d IIC or I M2 Ex d I
	Factory Mutual (FM) <ul style="list-style-type: none"> • Class I. Div 1. Group C and D • Dust ignition proof for use in Class II. Div 1. Group E, F and G • Suitable for use in Class III. Div 1. Hazardous Locations

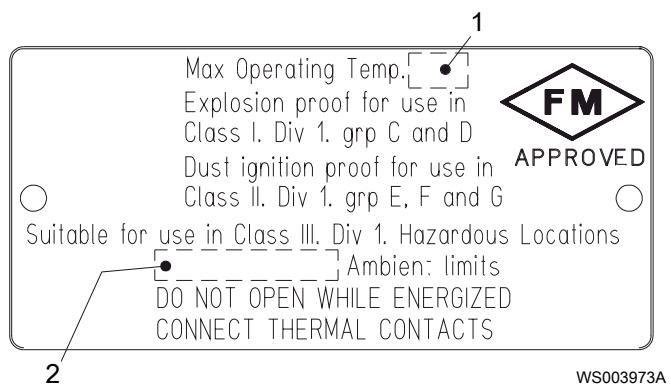
EN approval plate

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



FM approval plate

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



2

1. Temperature class
2. Maximum ambient temperature

WS003973A

Installation

Install the pump



WARNING:

- Electrical shock hazard. Check that the cable and cable entry have not been damaged during transport before installing the pump.
- Note that special rules apply to installation in explosive atmospheres.
- Make sure that the unit cannot roll or fall over and injure people or damage property.
- Do not install CSA-approved products in locations that are classified as hazardous in the national electric code, ANSI/NFPA 70-2005.
- Do not install the starter equipment in an explosive zone unless it is explosion-proof rated.

NOTICE:

- Do not run the pump dry.
- Never force piping to make a connection with a pump.
- Always remove all debris and waste material from the sump, inlet piping, and discharge connection, before you install the pump.

These requirements apply:

- Use the pump dimensional drawing in order to ensure proper installation.
- Provide a suitable barrier around the work area, for example, a guard rail.
- Check the explosion risk before you weld or use electric hand tools.
- Always check the impeller rotation before lowering the pump into the pumped liquid.

Authority regulation

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

Fasteners



WARNING:

- Only use fasteners of the proper size and material.
- Replace all corroded fasteners.
- Make sure that all fasteners are properly tightened and that there are no missing fasteners.

Make the electrical connections

General precautions



Electrical Hazard:

- A certified electrician must supervise all electrical work. Comply with all local codes and regulations.
- 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.
- Leakage into the electrical parts can cause damaged equipment or a blown fuse. Keep the end of the motor cable above the liquid level.
- Make sure that all unused conductors are insulated.
- 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.



WARNING:

Do not install the starter equipment in an explosive zone unless it is explosion-proof rated.



CAUTION:

If the pump is equipped with automatic level control and/or internal contactor, there is a risk of sudden restart.

Requirements

These general requirements apply for electrical installation:

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

Cables

These are the requirements to follow when you install cables:

- The cables must be in good condition, not have any sharp bends, and not be pinched.
- The sheathing must not be damaged and must not have indentations or be embossed (with markings, etc.) at the cable entry.
- The cable entry seal sleeve and washers must conform to the outside diameter of the cable.
- The minimum bending radius must not be below the accepted value.
- If using a cable which has been used before, a short piece must be peeled off when refitting it so that the cable entry seal sleeve does not close around the cable at the same point again. If the outer sheath of the cable is damaged, then replace the cable. Contact a Grindex service shop.
- The voltage drop in long cables must be taken into account. The drive unit's rated voltage is the voltage measured at the cable connection point in the pump.
- The screened cable must be used according to the European CE requirements if a Variable Frequency Drive (VFD) is used. For more information, contact your Grindex representative (VFD-supplier).

Earthing (Grounding)



Electrical Hazard:

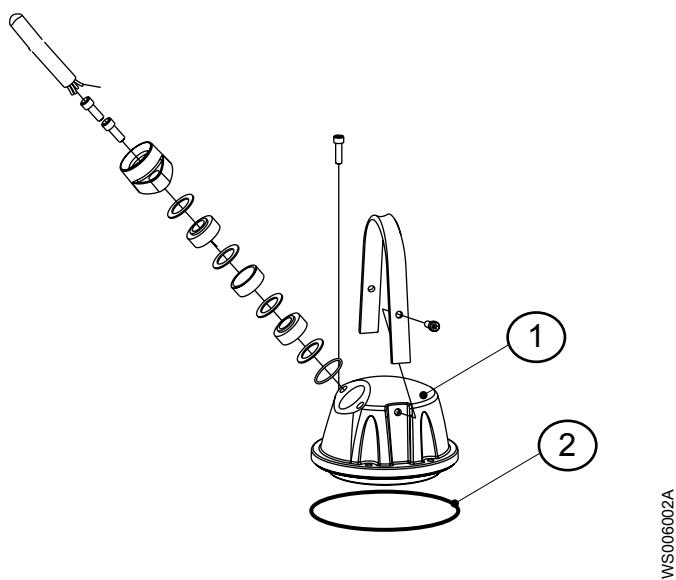
- You must earth (ground) all electrical equipment. This applies to the pump equipment, the driver, and any monitoring equipment. Test the earth (ground) lead to verify that it is connected correctly.
- If the motor cable is jerked loose by mistake, the earth (ground) conductor should be the last conductor to come loose from its terminal. Make sure that the earth (ground) conductor is longer than the phase conductors. This applies to both ends of the motor cable.
- Risk of electrical shock or burn. You must connect an additional earth-(ground-) fault protection device to the earthed (grounded) connectors if persons are likely to come into physical contact with the pump or pumped liquids.

Connect the motor cable to the pump



CAUTION:

Leakage into the electrical parts can cause damaged equipment or a blown fuse. Keep the end of the motor cable above the liquid level.



1. Entrance cover
2. O-ring

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

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

Connect the motor cable to the starter and monitoring equipment



WARNING:

Do not install the starter equipment in an explosive zone unless it is explosion-proof rated.

NOTICE:

- Thermal contacts are incorporated in the pump.
- Thermal contacts must never be exposed to voltages higher than 250 V, breaking current maximum 4 A. It is recommended that they are connected to 24 V over separate fuses to protect other automatic equipment.

1. Connect the T1 and T2 control conductors to the monitoring equipment.

Do not connect the T1 and T2 leads to thermal contacts if the temperature of the pumped liquid is above 40°C (104°F).

NOTICE:

Ex-approved products must always have the thermal contacts connected irrespective of the ambient temperature.

2. Connect the mains leads (L1, L2, L3, and earth [ground]) to the starter equipment.
For information about the phase sequence and the color codes of the leads, see [Cable charts](#) (page 23).
3. Check the functionality of the monitoring equipment:
 - a) Check that the signals and the tripping function work properly.
 - b) Check that the relays, lamps, fuses, and connections are intact.
 Replace any defective equipment.

Cable charts

Description

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

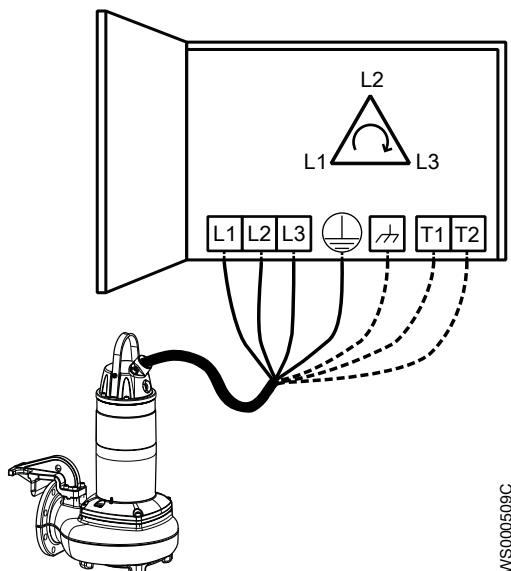
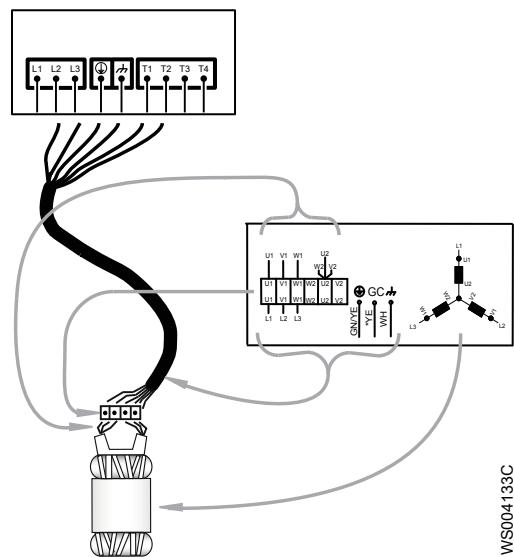


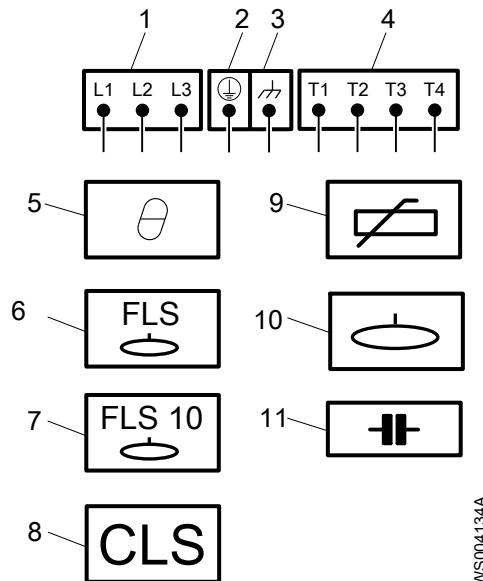
Figure 3: Phase sequence

Connection locations

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



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



1. Starter equipment and mains leads (L1, L2, L3)
2. Earth (ground)
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

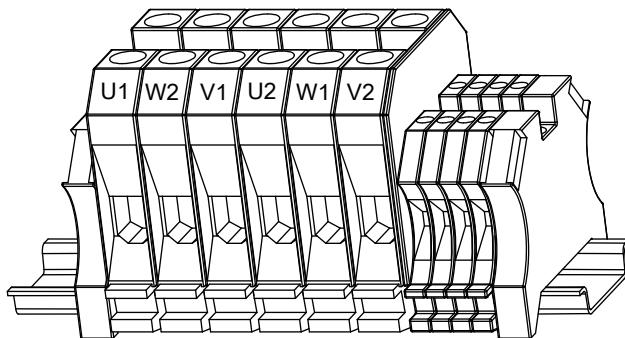
Color code standard

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

Colors and markings of leads

Motor Connection		Colors and marking of the main leads				
COLOR STANDARD	STATOR LEADS	Mains 3 ~	SUBCAB 7GX Screenflex 7GX	SUBCAB 4GX Screenflex 4GX	SUBCAB AWG	SUBCAB Screened
BN = Brown BK = Black WH = White OG = Orange GN = Green GN/YE = Green-Yellow RD = Red GY = Grey BU = Blue YE = Yellow 773 29 01/1	U1,U5 = RD U2 = GN V1,V5 = BN V2 = BU W1,W5 = YE W2 = BK T1,T2 = WH or YE *SUBCAB AWG * * Ground conductor is stranded around core GC=Ground check	L1 L2 L3 L1 L2 L3  	BK 1 BK 2 BK 3 BK 4 BK 5 BK 6 GN/YE Screen (WH)	BN BK GY - - - GN/YE Screen (WH)	RD BK WH - - - GN/YE -	BN BK GY - - - **Screen/PE from cores Screen (WH) - -
	51 680 01	GC	-	-	YE	-

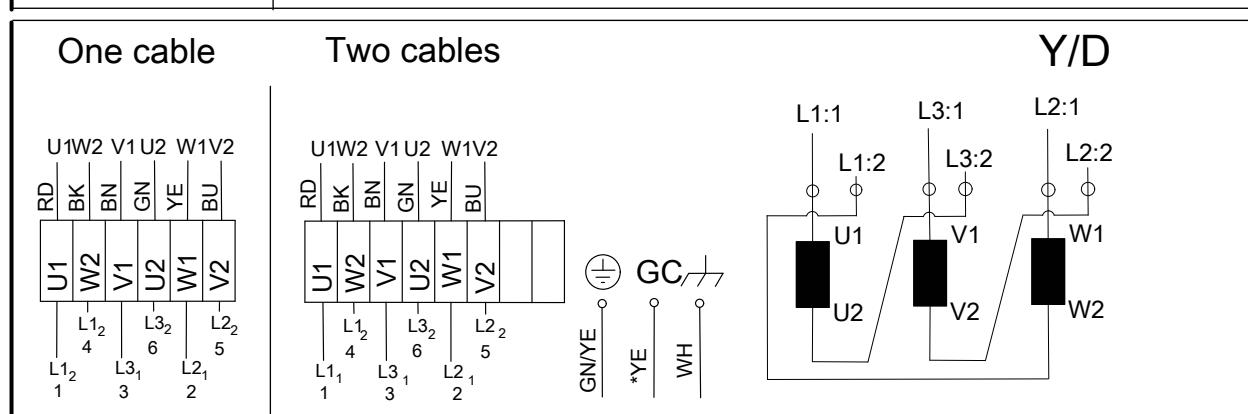
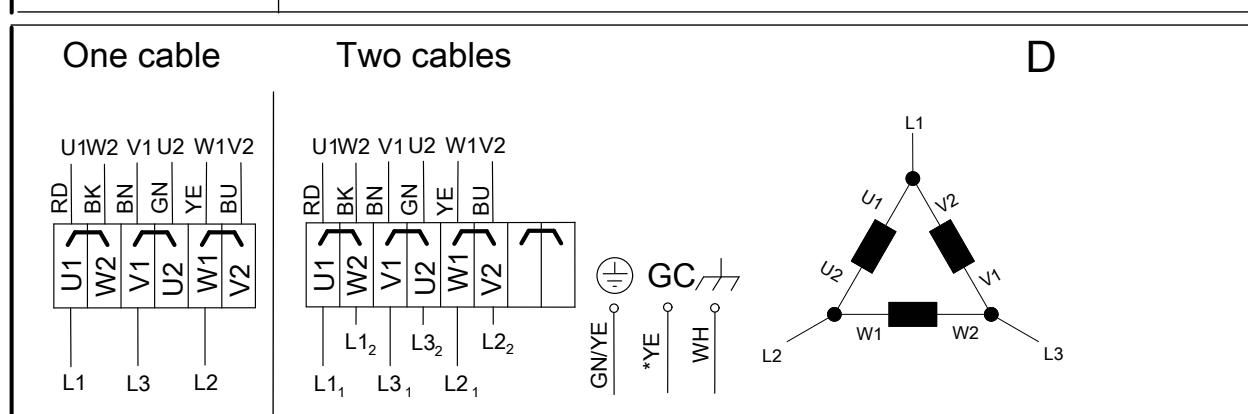
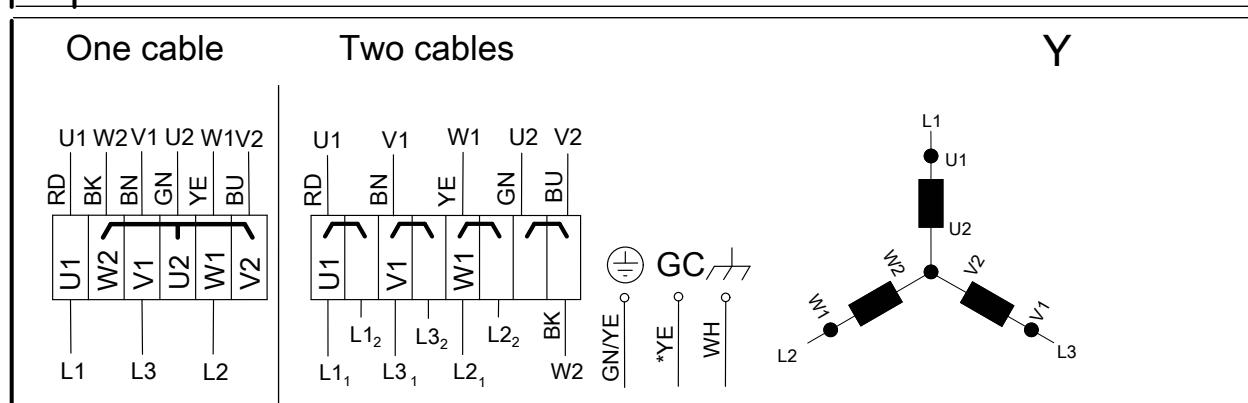
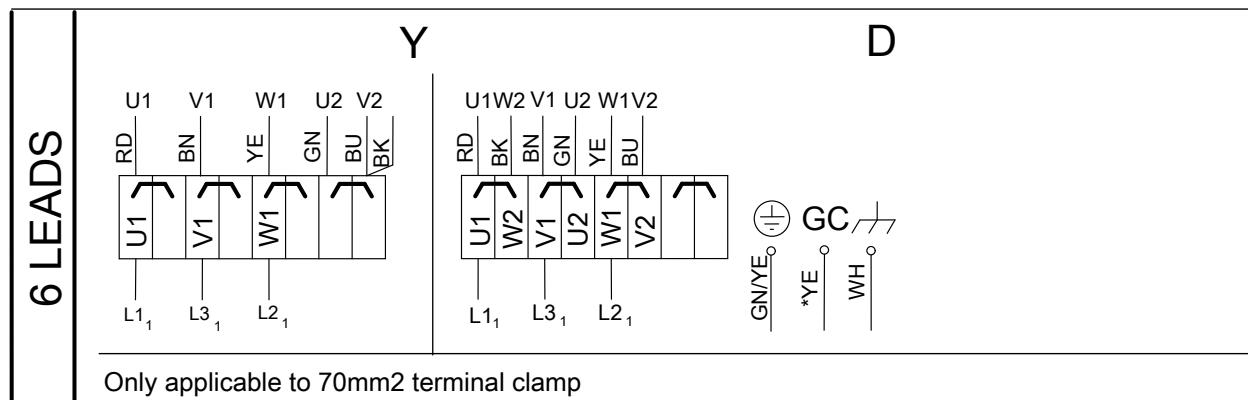
Terminal clamps 6 stator leads



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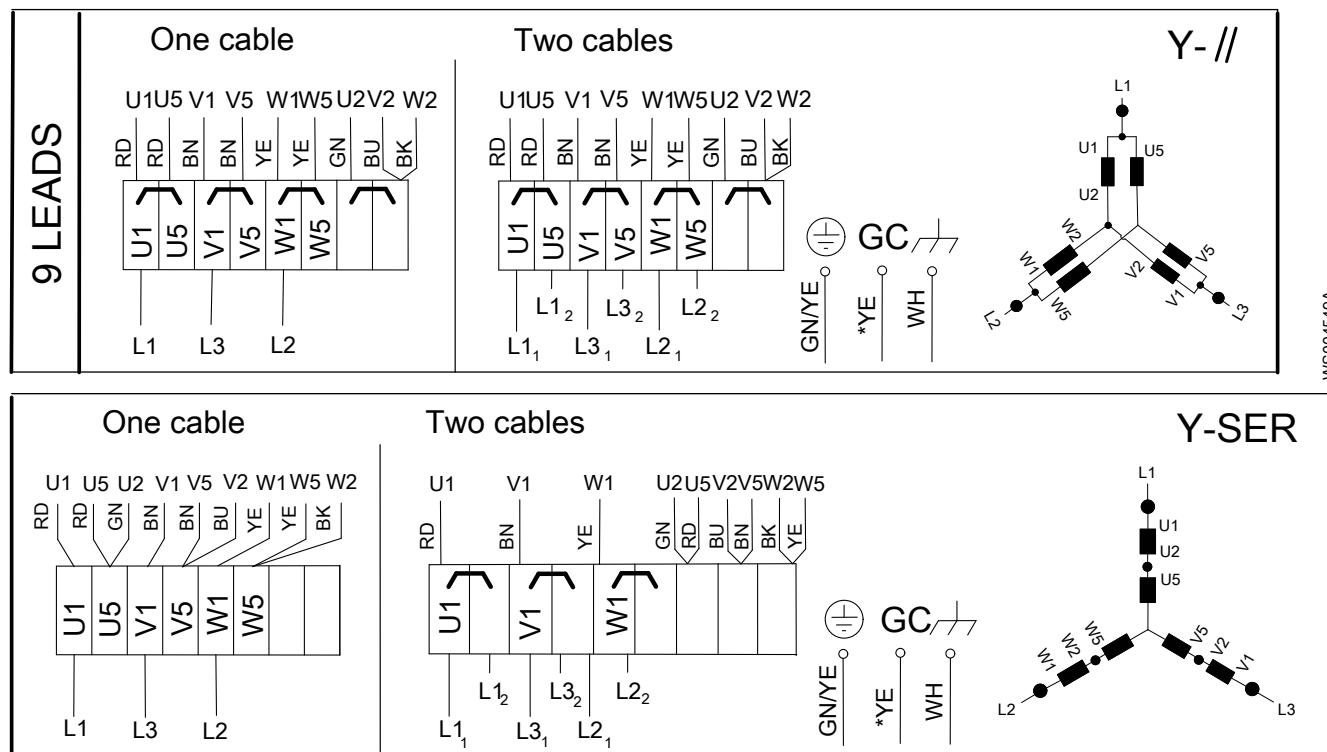
6-leads connection

If a separate control cable is used, then the control cores in the motor cable are never used.



9-leads connection

If a separate control cable is used, then the control cores in the motor cable are never used.



Screened cable connection

Cable without separate ground conductor. Screen as ground conductor.

Screened SUBCAB & FGB Screened

Cable without sep. ground conductor
Screen as ground conductor

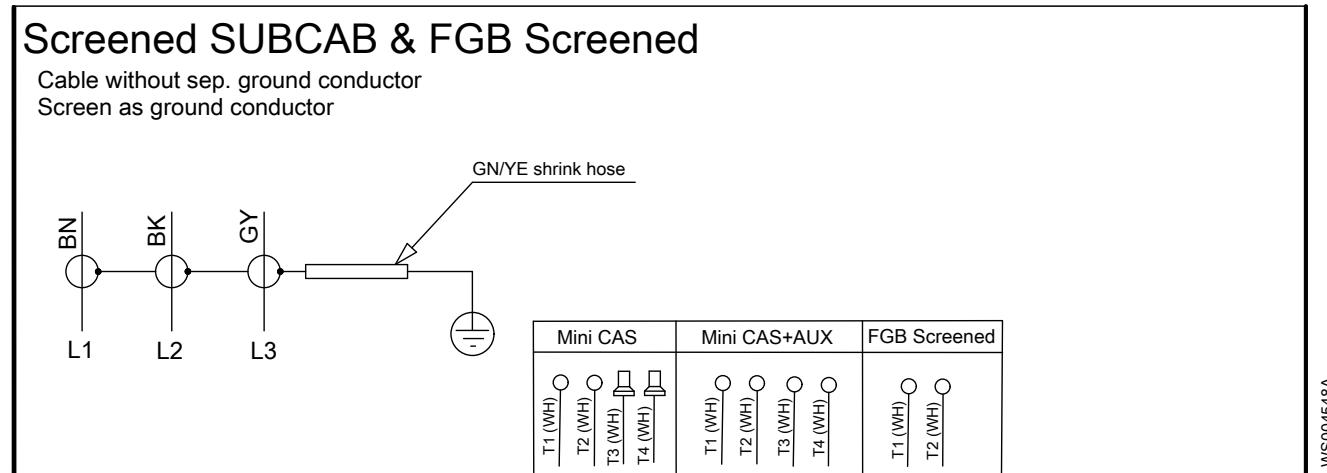


Figure 4: Screened SUBCAB and FGB screened

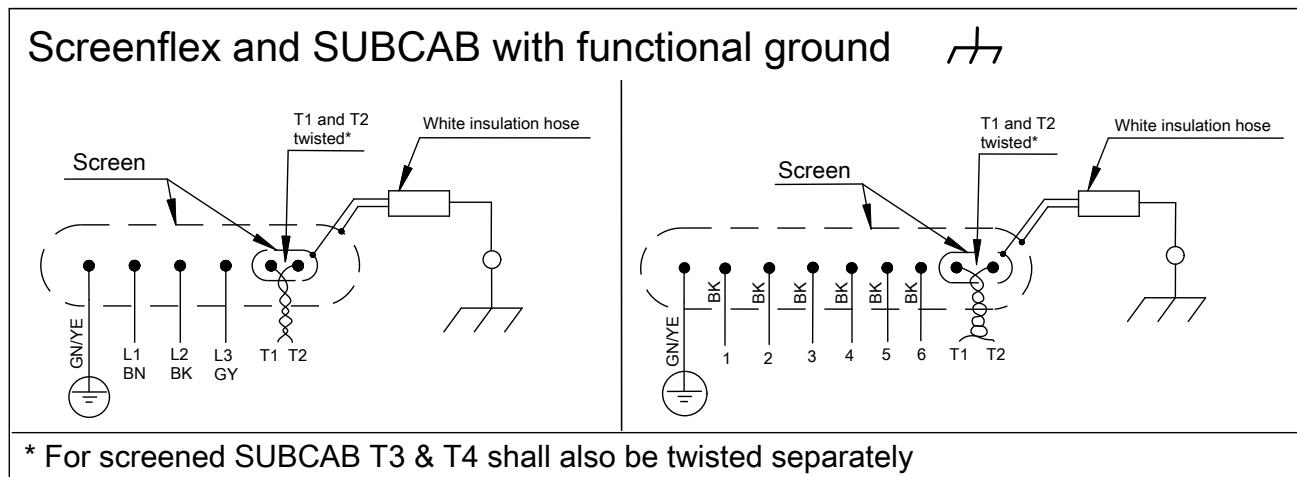


Figure 5: Screenflex and SUBCAB with functional ground

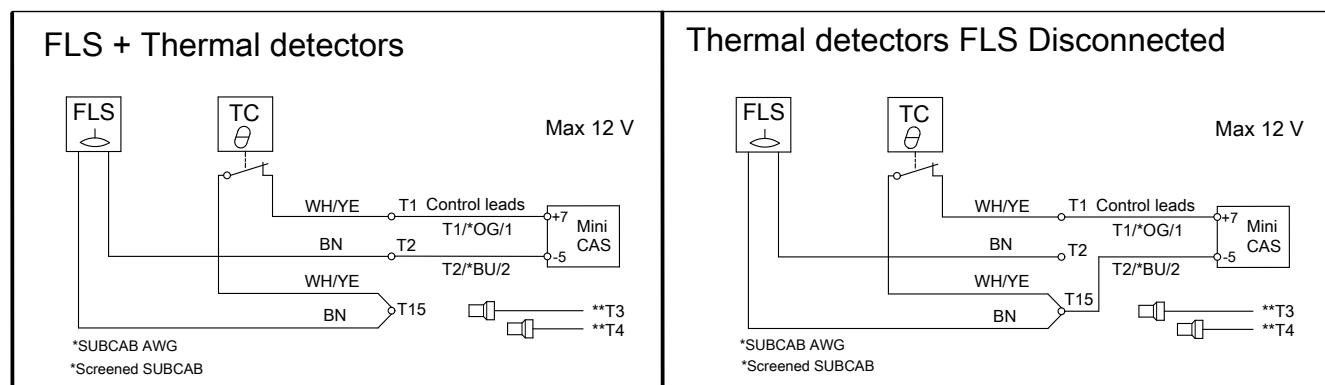
*For screened SUBCAB T3 and T4 shall also be twisted separately.

Sensor-connection

Connection to the pump

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

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**∞ Ohm****1200 Ohm****430 Ohm**

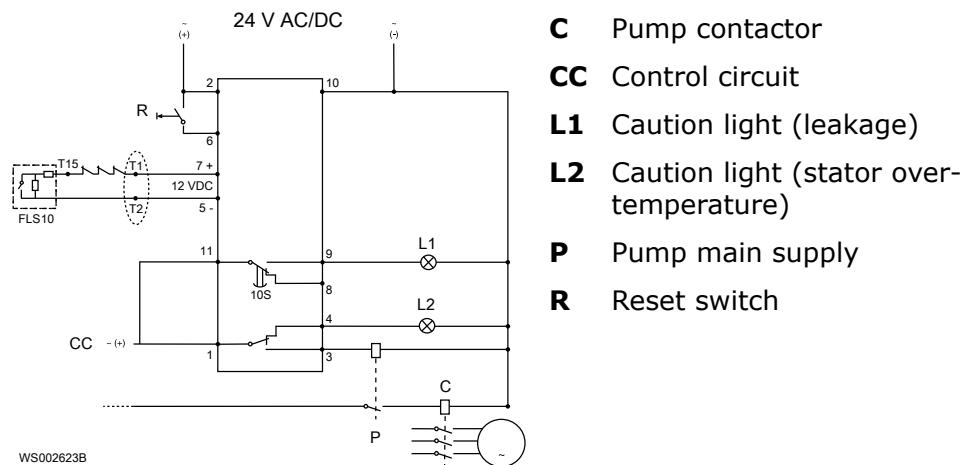
Overtemperature

OK

Leakage

Connection to the monitoring equipment

MiniCAS II



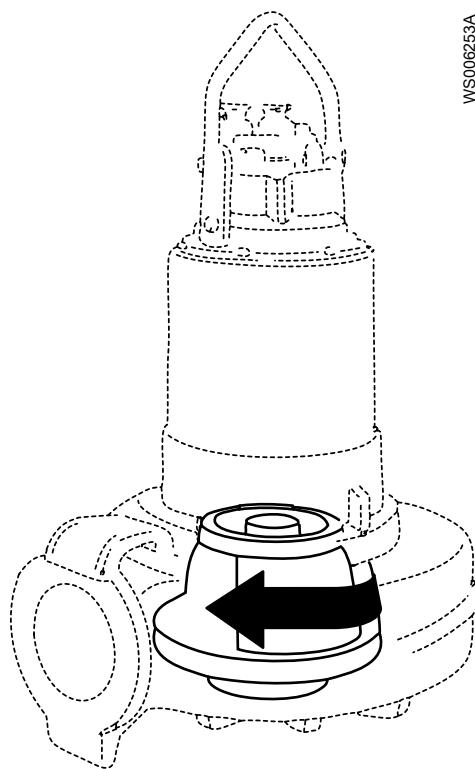
Check the impeller rotation



WARNING:

The starting jerk can be powerful.

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



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

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

Operation

Precautions



WARNING:

- Never operate the pump without safety devices installed.
- Never operate the pump with the discharge valve closed.
- Make sure you have a clear path of retreat.
- Never work alone.



CAUTION:

If the pump is equipped with automatic level control and/or internal contactor, there is a risk of sudden restart.

Distance to wet areas



Electrical Hazard:

Risk of electrical shock. Make sure no one gets closer than 20 m (65 ft.) to the unit when being in contact with the pumped or mixed liquid.

Noise level

NOTICE:

The noise level of the product is lower than 70 dB. However, the noise level of 70 dB may be exceeded in some installations and at certain operating points on the performance curve. Make sure that you understand the noise level requirements in the environment where the pump is installed. Failure to do so may result in hearing loss or violation of local laws.

Start the pump



WARNING:

- If you need to work on the pump, make sure that it is isolated from the power supply and cannot be energized.
- Make sure that the unit cannot roll or fall over and injure people or damage property.
- In some installations, the pump and the surrounding liquid may be hot. Bear in mind the risk of burn injuries.
- Make sure nobody is close to the unit when it is started. The unit will jerk in the opposite direction of the impeller rotation.

NOTICE:

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

1. Check the coolant level in the seal housing.
2. Remove the fuses or open the circuit breaker, and check that the impeller can be rotated freely.

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

Maintenance

Precautions



WARNING:

- Always follow safety guidelines when working on the product. See *Introduction and Safety* (page 3).
- Disconnect and lock out electrical power before installing or servicing the pump.
- Make sure that the unit cannot roll or fall over and injure people or damage property.
- Rinse the unit thoroughly with clean water before working on the unit.
- Rinse the components in water after dismantling.

Make sure that you follow these requirements:

- Check the explosion risk before you weld or use electrical hand tools.
- Allow all system and pump components to cool before you handle them.
- Make sure that the product and its components have been thoroughly cleaned.
- 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.

Maintenance guidelines

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

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

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

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

Torque values

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

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

Screws and nuts

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

Property class	M4	M5	M6	M8	M10	M12	M16	M20	M24	M30
50	1.0 (0.74)	2.0 (1.5)	3.0 (2.2)	8.0 (5.9)	15 (11)	27 (20)	65 (48)	127 (93.7)	220 (162)	434 (320)
70, 80	2.7 (2)	5.4 (4)	9.0 (6.6)	22 (16)	44 (32)	76 (56)	187 (138)	364 (268)	629 (464)	1240 (915)

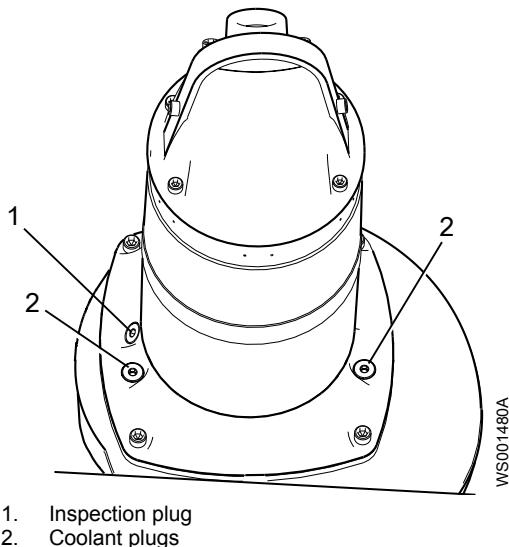
Property class	M4	M5	M6	M8	M10	M12	M16	M20	M24	M30
100	4.1 (3)	8.1 (6)	14 (10)	34 (25)	66 (49)	115 (84.8)	248 (183)	481 (355)	—	—

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

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

Hexagon screws with countersunk heads

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

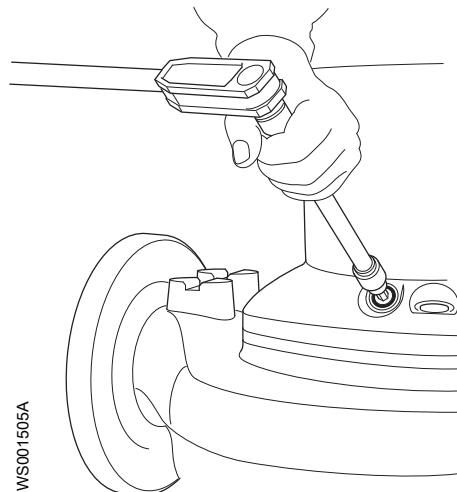
Change the coolant

1. Inspection plug
2. Coolant plugs

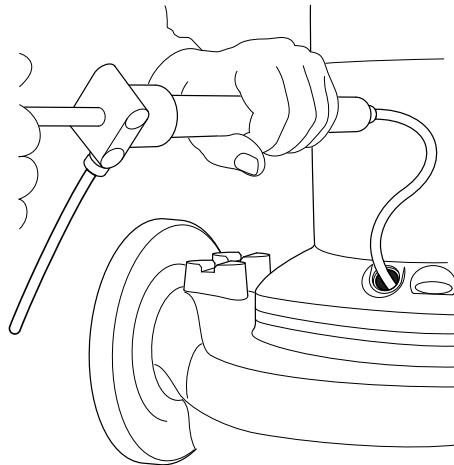
Empty the coolant**WARNING:**

The seal housing may be pressurized. Hold a rag over the inspection/ filling plugs to prevent splatter.

1. Empty the coolant in the inspection chamber:
 - a) Remove the inspection plug.



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



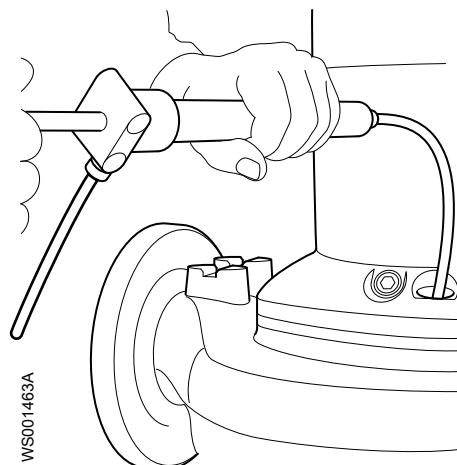
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c) Replace the inspection plug and O-ring and tighten.

Tightening torque: 44 Nm (33 ft-lbs)

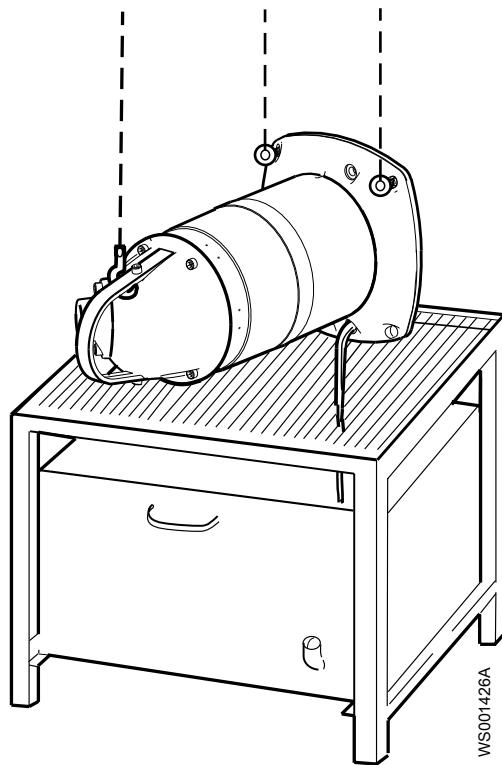
2. Empty the coolant:

a) Place the pump in a horizontal position, or leave it upright to use a pump to empty the coolant.



b) If the pump is laid in a horizontal position, place a container under the pump.

c) Remove the coolant plugs and empty the coolant.



Fill with coolant

Use a coolant that is a mixture of 70% water and 30% monopropylene glycol. The coolant should prevent corrosion and be nonpoisonous (generally recognized as safe by the FDA as food additives under part 184 and 182).

NOTICE:

Clean water with an anti-corrosive is an acceptable coolant when there is no risk of freezing.

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

Quantity: approximately

- 4.6 L (4.9 qt.) without cooling jacket
- 16.7 L (17.6 qt.) with cooling jacket

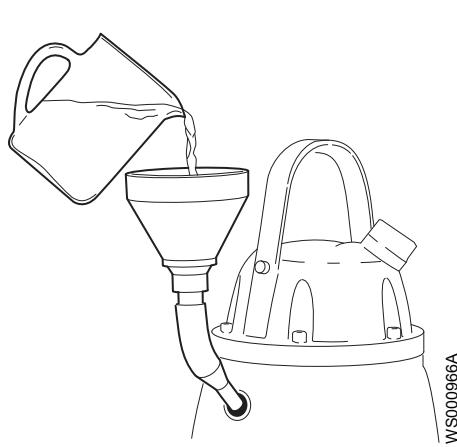


Figure 6: With cooling jacket

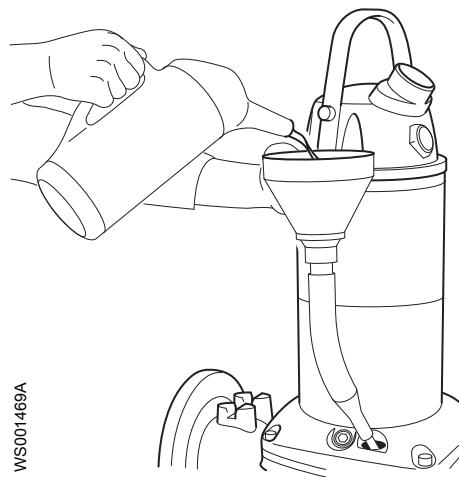
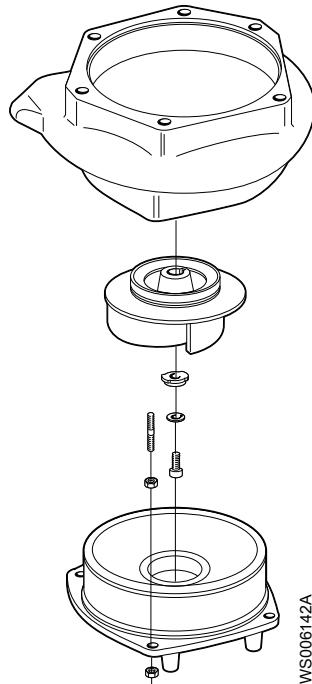


Figure 7: Without cooling jacket

2. Replace the O-rings.

3. Tighten the coolant plugs.
Tightening torque: 44 Nm (33 ft-lbs)

Replace the impeller



Required tools:

- 17 mm hexagon bit adapter with an extension of at least 125 mm (4.92 in.)
- Impeller puller
- If applicable, contact your local Grindex representative for correct type and size.
- Chain
- Rod (wooden or copper) for locking the impeller in place, if applicable.
- Two crowbars, if applicable



WARNING:

- If you fail with the impeller installation, you must redo the installation procedure from the beginning.
- A worn impeller and/or pump housing can have very sharp edges. Wear protective gloves.
- When laying the pump on its side, do not allow the weight of the pump to rest on any portion of the impeller. The impeller must not be allowed to make contact with the concrete floor or other hard and rough surfaces.

Remove the impeller

1. Lock the impeller:
 - a) Place the pump in a horizontal position.
Do not remove the round sling.
 - b) Thread a chain through the impeller and pump housing outlet.
 - c) Lock the chain so the impeller cannot rotate.



2. Remove the impeller from the shaft:
 - a) Remove the wear protection/plug.
 - b) Remove the impeller screw.
 - c) Turn the adjustment screw counterclockwise until the impeller breaks free from the shaft.
 - d) Hand-tighten the impeller screw to prevent it from falling off.



3. Remove the drive unit from the pump housing:
 - a) Remove the chain from the impeller and pump housing.
 - b) Raise the pump.
 - c) Remove the pump housing screws.
 - d) Remove the drive unit from the pump housing.
 - e) Remove the O-rings.



4. Secure the wearing cover:
 - a) Place the drive unit horizontally.

**WARNING:**

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

- b) Prevent the wearing cover from falling off when removing the impeller by attaching a round sling.



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5. Remove the impeller:
 - a) Remove the impeller screw.
 - b) Remove the impeller and the conical sleeve.



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- c) Remove the wearing cover.



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Install the impeller



WARNING:

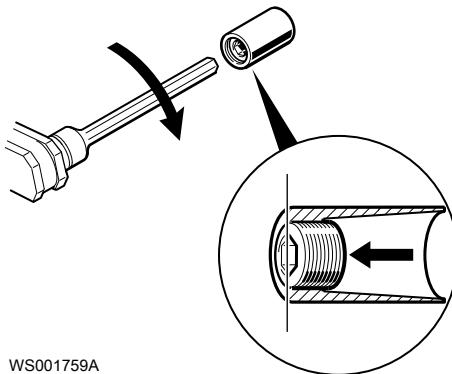
If you fail with the impeller installation, you must redo the installation procedure from the beginning.

1. Prepare the sleeve:
 - a) Make sure that the end of the shaft is free from burrs.
Polish off any flaws with a fine emery cloth.
 - b) Grease the shaft end.
 - c) Grease the conical sleeve, the threads of the adjustment screw, the washer, and the impeller screw.
Always use a new impeller screw.

NOTICE:

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

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



- e) Fit the sleeve and impeller to the shaft.
f) Hand-tighten the impeller screw to prevent it from falling off.

2. Mount the impeller:

- Assemble the wearing cover to the drive unit and secure it with a round sling.
- Fit the sleeve and the impeller to the shaft
- Fit the washer and impeller screw onto the shaft.
- Hand-tighten the impeller screw to prevent it from falling off.
- Remove the sling and fit new O-rings to the wearing cover.



3. Mount the pump housing:

- Grease the pump housing screws.
- Place the drive unit in the pump housing.
- Tighten the screws in a diagonal sequence.

For tightening torque, see [Torque values](#) (page 33).



4. Lock the impeller:

- Place the pump in a horizontal position.
- Thread a chain through the impeller and pump housing outlet.
- Lock the chain so the impeller cannot rotate.



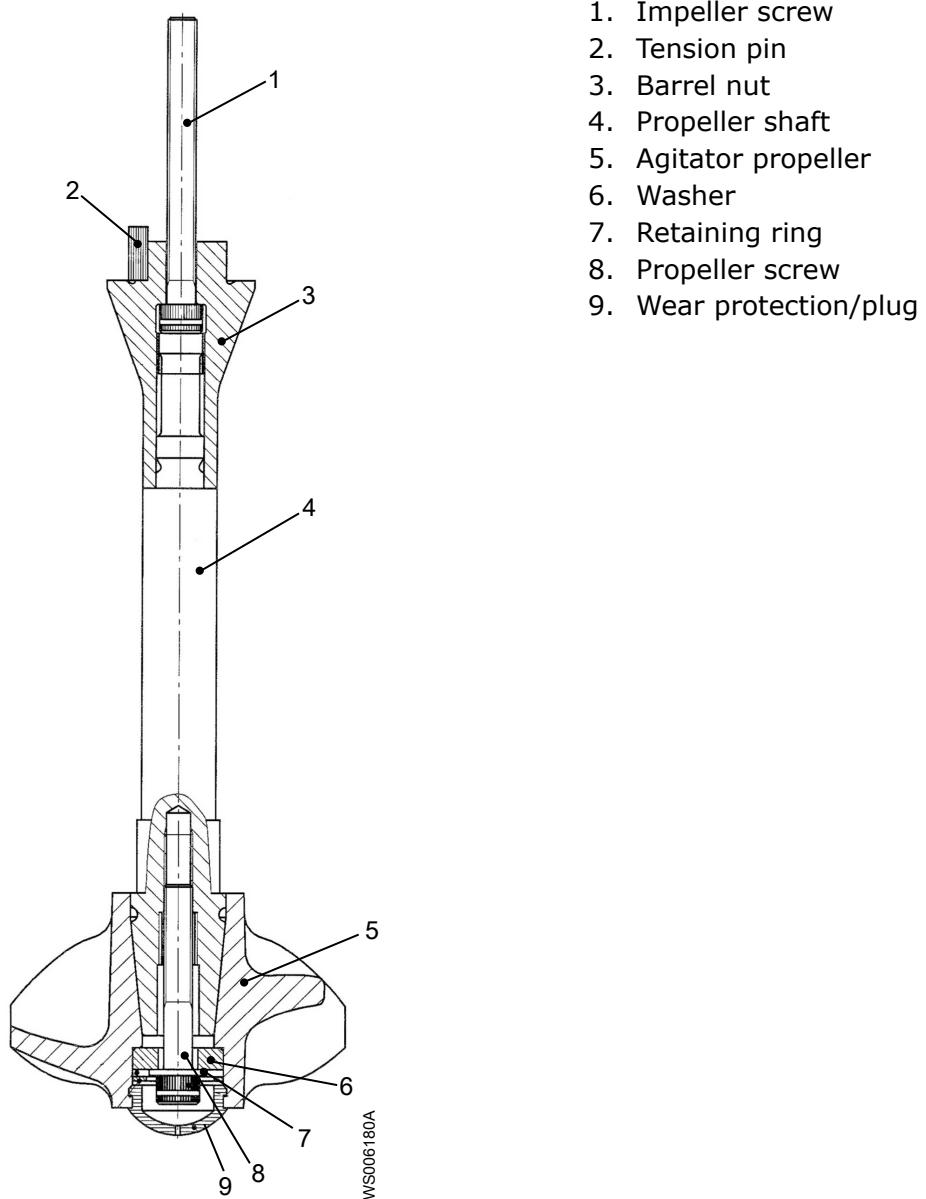
5. Adjust the impeller:
 - a) Remove the impeller screw.
 - b) Using a hexagon-bit adapter, turn the adjustment screw clockwise until the impeller makes contact with the pump housing.
 - c) Tighten it a further 1/8 turn (45°).



6. Fasten the impeller:
 - a) Fit the greased washer and impeller screw.
 - b) Tighten the impeller screw.
For tightening torque, see *Torque values* (page 33).
 - c) Tighten it a further 1/8 turn (45°).
 - d) Fit the wear protection/plug.
 - e) Remove the chain from the impeller and pump housing.
7. Check that the impeller can rotate freely.

The clearance between the impeller and the pump housing should be 0.1 – 0.7 mm (0.004– 0.03 in.).

Replace the agitator



Remove the agitator unit

Remove the necessary pump parts to make the agitator area accessible.

1. Lock the impeller:

If applicable use a rod (wooden or plastic) or a chain to lock the impeller in place.

2. Remove the wear protection/plug.

3. Remove the propeller screw.

4. Remove the retaining ring and the washer.

5. Remove the propeller from the propeller shaft:

- a) Put the propeller screw in its hole.

- b) Place the washer on the top of the propeller screw, and insert the retaining ring into the groove in the propeller.

- c) Undo the propeller screw.
This causes the head of the propeller screw to press the propeller outward.
6. Remove the strainer, if any.
 7. Remove the propeller shaft.
 8. Remove the impeller screw, the barrel nut, and the parallel key.

Install the agitator unit

Remove the necessary pump parts to make the agitator area accessible.

1. Lock the impeller:
If applicable use a rod (wooden or plastic) or a chain to lock the impeller in place.
2. Install the propeller shaft:
 - a) Fit the barrel nut and the impeller screw and tighten.
Always use a new impeller screw.
For tightening torque, see *Torque values* (page 33).
 - b) Tighten it a further 1/8 turn (45°).
 - c) Apply grease to the contact surfaces between the propeller shaft and the barrel nut.
 - d) Fit the propeller shaft into the barrel nut and tighten, using the key handle on the propeller shaft.
Tightening torque: 250 Nm (184 ft-lbs)
 - e) Check that the impeller can rotate freely.
3. Fit the strainer, if any.
4. Apply a small amount of grease into the taped hole in the agitator propeller.
5. Fit the propeller, the retaining ring, washer, the propeller screw into the propeller shaft and tighten.
Tightening torque: 57 Nm (42 ft-lbs)
6. Fit the wear/protective plug into the propeller.
7. Check that the impeller can rotate freely.

Service the pump

Type of service	Purpose	Inspection interval
Initial inspection	To make a check up of the pump condition by an authorized Grindex 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.	Within the first year of operation.
Periodical inspection	To prevent operational interruptions and machine breakdown. Measures to secure performance and pump 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.	Up to 4,000 hours or 1 year, whichever comes first. Applies to normal applications and operating conditions at media (liquid) temperatures <40°C.

Type of service	Purpose	Inspection interval
Major overhaul	To secure a long operating lifetime for the product. It includes replacement of key components and the measures taken during an inspection.	Up to 8,000 hours or 3 years, whichever comes first. These intervals apply to normal applications and operating conditions at media (liquid) temperatures <40°C.

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).

Inspection

Service item	Action
Cable	<ol style="list-style-type: none"> If the outer jacket is damaged, replace the cable. Check that the cables do not have any sharp bends and are not pinched.
Connection to power	Check that the connections are properly tightened.
Electrical cabinets	Check that they are clean and dry.
Impeller	<ol style="list-style-type: none"> Check the impeller clearance. Adjust the impeller, if necessary.
Inspection chamber	<ol style="list-style-type: none"> Drain all liquid, if any. Check the resistance of the leakage sensor. Normal value approx. 1200 ohms, alarm approx. 430 ohms.
Insulation	<p>Use a megger maximum 1000 V.</p> <ol style="list-style-type: none"> Check that the resistance between the earth (ground) and phase lead is more than 5 megohms. Conduct a phase-to-phase resistance check.
Junction box	Check that it is clean and dry.
Level regulators	Check the condition and functionality.
Lifting device	Check that local safety regulations are followed.
Lifting handle	<ol style="list-style-type: none"> Check the screws. Check the condition of the lifting handle. Replace if necessary.
O-rings	<ol style="list-style-type: none"> Replace the oil plug O-rings. Replace the O-rings at the entrance or junction cover. Grease the new O-rings.
Overload protection and other protections	Check the correct settings.
Personnel safety devices	Check the guard rails, covers, and other protections.

Service item	Action
Rotation direction	Check the impeller rotation.
Seal housing	1. Fill with new coolant, if necessary. 2. Check that the freezing point is lower than -13°C (9°F).
Terminal board	Check that the connections are properly tightened.
Thermal contacts	Normally closed circuit; interval 0–1 ohm.
Thermistor	Check the resistance is between 20–250 ohms and the measured voltage is maximum 2 V DC.
Voltage and amperage	Check the running values.

Major overhaul

For a major overhaul, take this action in addition to the tasks listed under Inspection.

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

Service in case of alarm

For information about indication values for sensors, see [Sensor-connection](#) (page 28).

Alarm source	Action
FLS10	<ol style="list-style-type: none"> 1. Drain the fluid in the inspection chamber. Fill with new coolant if necessary. 2. Check the freezing point (lower than -13°C or 9°F). Check the inspection chamber again after one week of operation. If leakage has occurred: <ol style="list-style-type: none"> 1. Drain the fluid. 2. Change the mechanical seal unit. 3. Replace with new coolant.
The thermistor/Thermal contact	<ol style="list-style-type: none"> 1. Check the coolant level. 2. Check the start and stop levels.
The overload protection	Check that the impeller can rotate freely.

Troubleshooting

Introduction

Follow these guidelines when troubleshooting the pump:

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

The pump does not start



WARNING:

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.	<p>Check that:</p> <ul style="list-style-type: none"> • The impeller rotates freely. • The sensor indicators do not indicate an alarm. • The overload protection is not tripped. <p>If the problem still persists: Contact the local Grindex service shop.</p>
The pump does not start automatically, but can be started manually.	<p>Check that:</p> <ul style="list-style-type: none"> • 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. <p>Check the control circuit and functions.</p>
The installation is not receiving voltage.	<p>Check that:</p> <ul style="list-style-type: none"> • 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.

Cause	Remedy
	<ul style="list-style-type: none"> The overload protection is not tripped. The motor cable is not damaged.
The impeller is stuck.	<p>Clean:</p> <ul style="list-style-type: none"> The impeller The sump in order to prevent the impeller from clogging again.

If the problem persists, contact the local Grindex service shop. Always state the product number and the serial number of your pump when you contact Grindex, see *Product Description* (page 12).

The pump does not stop when a level sensor is used



WARNING:

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.	<p>Check that:</p> <ul style="list-style-type: none"> There are no leaks from the piping and/or discharge connection. The impeller is not clogged. The non-return valve(s) are functioning properly. The pump has adequate capacity. For information: Contact the local Grindex service shop.
There is a malfunction in the level-sensing equipment.	<ul style="list-style-type: none"> Clean the level regulators. Check the functioning of the level regulators. Check the contactor and the control circuit. Replace all defective items.
The stop level is set too low.	Raise the stop level.

If the problem persists, contact the local Grindex service shop. Always state the product number and the serial number of your pump when you contact Grindex, see *Product Description* (page 12).

The pump starts-stops-starts in rapid sequence

Cause	Remedy
The pump starts due to back-flow which fills the sump to the start level again.	<p>Check that:</p> <ul style="list-style-type: none"> The distance between the start and stop levels is sufficient. The non-return valve(s) work(s) properly. The length of the discharge pipe between the pump and the first non-return valve is sufficiently short.

Cause	Remedy
The self-holding function of the contactor malfunctions.	<p>Check:</p> <ul style="list-style-type: none"> • The contactor connections. • The voltage in the control circuit in relation to the rated voltages on the coil. • The functioning of the stop-level regulator. • Whether the voltage drop in the line at the starting surge causes the contactor's self-holding malfunction.

If the problem persists, contact the local Grindex service shop. Always state the product number and the serial number of your pump when you contact Grindex, see *Product Description* (page 12).

The pump runs but the motor protection trips



WARNING:

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.	<ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • Check the fuses. Replace fuses that have tripped. • If the fuses are intact, notify a certified electrician.
The phase currents vary, or they are too high.	Contact the local Grindex service shop.
The insulation between the phases and ground in the stator is defective.	<ol style="list-style-type: none"> 1. Use an insulation tester. With a 1000 V DC megger, check that the insulation between the phases and between any phase and ground is > 5 megohms. 2. If the insulation is less: Contact the local Grindex service shop.
The density of the pumped fluid is too high.	<p>Make sure that the maximum density is 1100 kg/m³ (9.2 lb/US gal)</p> <ul style="list-style-type: none"> • Change to a more suitable pump. • Contact the local Grindex service shop.
There is a malfunction in the overload protection.	Replace the overload protection.

If the problem persists, contact the local Grindex service shop. Always state the product number and the serial number of your pump when you contact Grindex, see *Product Description* (page 12).

The pump delivers too little or no water



WARNING:

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NOTICE:

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

Cause	Remedy
The impeller rotates in the wrong direction.	<ul style="list-style-type: none"> If it is a 3-phase pump, transpose two phase leads. If it is a 1-phase pump: Contact the local Grindex service shop.
One or more of the valves are set in the wrong positions.	<ul style="list-style-type: none"> Reset the valves that are set in the wrong position. Replace the valves, if necessary. Check that all valves are correctly installed according to media flow. Check that all valves open correctly.
The impeller is difficult to rotate by hand.	<ul style="list-style-type: none"> Clean the impeller. Clean out the sump. Check that the impeller is properly trimmed.
The pipes are obstructed.	Clean out the pipes to ensure a free flow.
The pipes and joints leak.	Find the leaks and seal them.
There are signs of wear on the impeller, pump, and casing.	Replace the worn parts.
The liquid level is too low.	<ul style="list-style-type: none"> Check that the level sensor is set correctly. Depending on the installation type, add a means for priming the pump, such as a foot valve.

If the problem persists, contact the local Grindex service shop. Always state the product number and the serial number of your pump when you contact Grindex, see *Product Description* (page 12).

Technical Reference

Application limits

Data	Description
Liquid temperature	40°C (104°F) maximum Ex-approved pumps: 40°C (104°F) maximum
Liquid density	Contact the local Grindex representative
pH of the pumped media (liquid)	5.5–14
Depth of immersion	20 m (65 ft) maximum
Other	For the specific weight, current, voltage, power ratings, and speed of the pump, see the data plate of the pump.

Motor data

Feature	Description
Motor type	Squirrel-cage induction motor
Frequency	50 or 60 Hz
Supply	3-phase
Starting method	<ul style="list-style-type: none"> • Direct on-line • Star-delta
Maximum starts per hour	30 evenly spaced starts per hour
Code compliance	IEC 60034-1
Rated output variation	±10%
Voltage variation without overheating	±10%, provided that it does not run continuously at full load
Voltage imbalance tolerance	2%
Stator insulation class	H (180°C [360°F])



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