



# Flygt 2190, 2201





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# 1 Introduction and Safety

## 1.1 Introduction

### Purpose of the manual

The purpose of this manual is to provide necessary information for installation, operation, and maintenance of 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
<b>DANGER:</b>	A hazardous situation which, if not avoided, will result in death or serious injury
<b>WARNING:</b>	A hazardous situation which, if not avoided, could result in death or serious injury
<b>CAUTION:</b>	A hazardous situation which, if not avoided, could result in minor or moderate injury
<b>NOTICE:</b>	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	Permanent-magnet hazard
 <p data-bbox="583 260 797 289">Electrical Hazard:</p>	 <p data-bbox="1127 260 1260 289">CAUTION:</p>

## 1.3 User safety

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

### The site

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

### Qualified personnel

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

### Protective equipment and safety devices

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

## 1.4 Ex-approved products

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

### Personnel requirements

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

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

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

### Product and product handling requirements

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

- Only use the product in accordance with the approved motor data.
- 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 Ex-approved Xylem representative.
- Only use parts that are provided by an Ex-approved Xylem representative.
- The thermal detectors fitted to the stator windings shall be connected into the motor control circuit in such a manner as to disconnect the supply to the motor in order to prevent the Temperature Class T3.
- The width of flameproof joints is more than the values specified in the tables of the IEC 60079-1 standard.
- The gap of flameproof joints is less than the values specified in Table 1 of the IEC 60079-1 standard.
- The equipment must be submerged during normal operation.

### Guidelines for compliance

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

### Permitted liquid level for ATEX

ATEX-approved products must be fully submerged according to the ATEX approval. 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

### MSHA requirements

According to the United States of America's Code of Federal Regulations, the following requirements must be fulfilled to maintain Mine Safety and Health Administration (MSHA) permissibility of this equipment:

Subject area	Requirements
General safety	<ul style="list-style-type: none"> <li>• Frequent inspections must be made.</li> <li>• All electrical parts, portable cable, and wiring must be kept in a safe condition.</li> <li>• There must not be any openings into the casings of the electrical parts.</li> <li>• The machine frame must be effectively grounded (earthed).</li> <li>• Power wires must not be used for grounding (earthing) .</li> <li>• The operating voltage must match the voltage rating of the motor.</li> </ul>

Subject area	Requirements
Service and repair	<ul style="list-style-type: none"> <li>• Inspections, service, and repairs are only allowed when the portable cable is disconnected from the power supply.</li> <li>• Work must be performed by trained personnel (preferably the manufacturer or agent) to ensure that the pump is restored to its original state of safety in regards to all flame-arresting paths.</li> <li>• Replacement parts must be exactly equal to those provided by the manufacturer.</li> <li>• When cable entries are disturbed on pump or control, they must be reassembled in the approved manner.</li> </ul> <div style="display: flex; align-items: center; margin-top: 10px;">  <div> <p><b>CAUTION: Explosion/Fire Hazard</b></p> <p>Failure to restore the permissible equipment to its original state of safety will void the MSHA approval. The creation of a safety hazard will subject the owner / operator of a mine to citations and penalties under the law.</p> </div> </div>
Fastenings	All bolts, nuts, screws, and threaded covers must be properly tightened and secured.
Cables	A flame-resistant portable cable must be used. It has to bear an MSHA-assigned identification number and be adequately protected by an automatic circuit-interrupting device. Special care must be taken in handling the cable to avoid mechanical damage and wear.
Operation	Poly-Life® equipped products must not be operated dry in hazardous areas.

## 1.5 Special hazards

### Working in temporary installations

Certain industries, such as mining or construction, have a dynamic nature and require temporary installation of equipment. Due to the rugged nature of these applications, normal use of electrical equipment causes wear and tear that can result in insulation breaks, short-circuits, and exposed wires. To maximize safety when using the unit in rugged applications, the following conditions must be met:

- If electrical cables must be located such that they are at risk of being run over by heavy equipment, then provide mechanical protection to prevent physical damage to the cables.
- Visually inspect electrical equipment before use. Remove from service any equipment with exposed wires or visible damage.
- Use ground-fault circuit interrupters on all receptacles, or have an assured equipment grounding conductor program.

### Biological hazards

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

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



**WARNING: Biological Hazard**

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

### Wash the skin and eyes

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

Condition	Action
Chemicals or hazardous fluids in eyes	<ol style="list-style-type: none"> <li>1. Hold your eyelids apart forcibly with your fingers.</li> <li>2. Rinse the eyes with eyewash or running water for at least 15 minutes.</li> <li>3. Seek medical attention.</li> </ol>
Chemicals or hazardous fluids on skin	<ol style="list-style-type: none"> <li>1. Remove contaminated clothing.</li> <li>2. Wash the skin with soap and water for at least 1 minute.</li> <li>3. Seek medical attention, if necessary.</li> </ol>

## 1.6 Protecting the environment

### Emissions and waste disposal

Observe the local regulations and codes regarding:

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

### Exceptional sites




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#### 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.

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## 1.7 Spare parts




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#### 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.

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## 1.8 Warranty

For information about warranty, see the sales contract.

# 2 Transportation and Storage

## 2.1 Inspect the delivery

### 2.1.1 Inspect the package

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

### 2.1.2 Inspect the unit

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

## 2.2 Transportation guidelines

### Precautions



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#### **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.

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### Position and fastening

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

### 2.2.1 Lifting

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



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#### **WARNING: Crush Hazard**

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

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#### **NOTICE:**

Never lift the unit by its cables or hose.

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## 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.

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**NOTICE:**

Never use a naked flame to thaw the unit.

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**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:  $-50^{\circ}\text{C}$  ( $-58^{\circ}\text{F}$ ) 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  $-13^{\circ}\text{C}$  ( $9^{\circ}\text{F}$ ). Below  $-13^{\circ}\text{C}$  ( $9^{\circ}\text{F}$ ), the viscosity increases such that the glycol mixture will lose its flow properties. However, the glycol-water mixture will not solidify completely and thus cannot harm the product.

Follow these guidelines to avoid freezing damage:

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

## 2.4 Storage guidelines

**Storage location**

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

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**NOTICE:**

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

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**NOTICE:**

Do not place heavy weights on the packed product.

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**Long-term storage**

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

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

# 3 Product Description

## 3.1 Products included

Pump model	Standard	EX	MSHA	Drainage	Sludge
2190.010	X			X	
2201.012	X			X	
2201.020	X			X	
2201.320	X			X	
2201.590		X	X	X	
2201.690		X		X	
2201.691		X		X	

## 3.2 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 59). If there is a question regarding the intended use of the equipment, please contact a local sales and service representative before proceeding.



### DANGER: Explosion/Fire Hazard

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

### NOTICE:

Do NOT use the unit in highly corrosive liquids.

For information about pH, see [Application limits](#) (page 59).

### Particle size

The pump can handle liquid containing particles that correspond to the holes in the strainer.

Product version	Number of holes	Hole dimensions
2201.012 HT/SH 2190.010 HT	541	Diameter 12 mm (0.47 in)
2201.012 MT 2201.020 LT	656	Diameter 15 mm (0.59 in)
2201.320 LT/MT 2201.590 LT/MT 2201.690 LT/MT 2201.691 LT/MT	212	10×10 mm (0.4×0.4 in)
2201.320 HT 2201.590 HT 2201.690 HT 2201.691 HT	574	15×45 mm (0.6×1.77 in)



**Pressure class**

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

**Impeller type**

B	Wear resistant
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**Poly-Life**

Version code 2190.010/2201.012/2201.020/2201.320: The pump is available with Poly-Life® polyurethane wear parts for extra resistance.

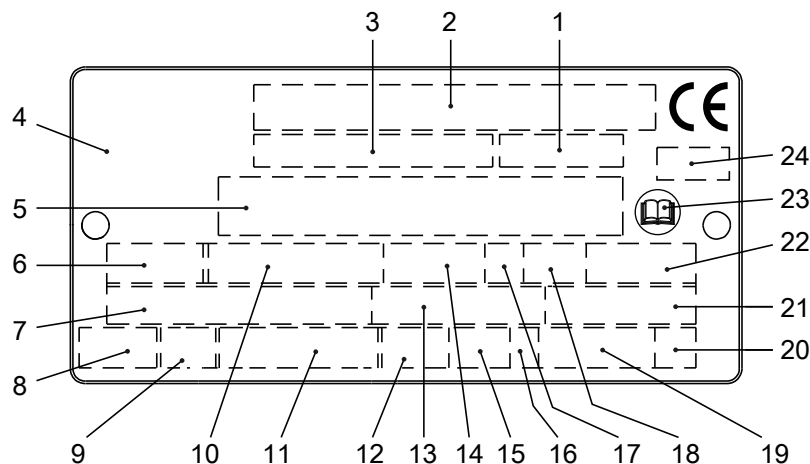
### 3.3 Monitoring equipment

The following applies to the monitoring equipment of the pump:

- The stator incorporates thermal contacts connected in series that activate the alarm at overtemperature.
- • Version code 2190.010: The thermal contacts open at 140°C (284°F) and close at 105°C (221°F).
- Version code 2201.012/2201.020/2201.320: The thermal contacts open at 125°C (257°F) and close at 70°C (160°F).
- Version code 590/690/691: The thermal contacts open at 110°C (230°F) and close at 70°C (160°F).

### 3.4 The data plate

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



1. Curve code or Propeller code
2. Serial number
3. Product number
4. Country of origin
5. Additional information
6. Phase; type of current; frequency
7. Rated voltage
8. Thermal protection
9. Thermal class
10. Rated shaft power
11. International standard
12. Degree of protection
13. Rated current
14. Rated speed
15. Maximum submergence
16. Direction of rotation: L=left, R=right
17. Duty class




WS006257A

18. Duty factor
19. Product weight
20. Locked rotor code letter
21. Power factor
22. Maximum ambient temperature
23. Read installation manual
24. Notified body, only for EN-approved Ex products

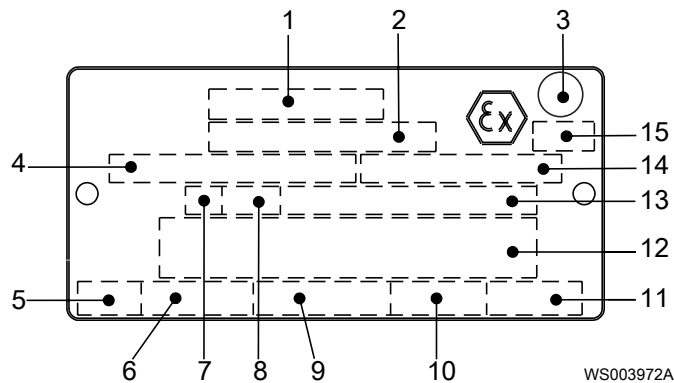
Figure 1: The data plate

### 3.5 Approvals

#### Product approvals for hazardous locations

Pump model	Approvals
2201.590	European Norm (EN) <ul style="list-style-type: none"> <li>• ATEX Directive</li> <li>• EN 1127-1, EN 50014, EN 50018, EN 50019</li> <li>•  II 2G EEx de IIB T3</li> </ul> MSHA: Mine Safety and Health Administration, USA. 30CFR Part 18, Approval number X/P-3400-1
2201.690	European Norm (EN) <ul style="list-style-type: none"> <li>• ATEX Directive</li> <li>• EN 1127-1, EN 50014, EN 50018</li> <li>•  I M2 EEx d I</li> </ul> IEC <ul style="list-style-type: none"> <li>• IECEx scheme</li> <li>• IEC 60079-0, IEC 60079-1</li> <li>• Ex d I</li> </ul>
2201.691	European Norm (EN) <ul style="list-style-type: none"> <li>• ATEX Directive</li> <li>• EN 60079-0:2009, EN 60079-1:2007, EN 13463-1:2009, EN 13463-5:2011</li> <li>•  I M2 c Ex d I Mb</li> </ul> IEC <ul style="list-style-type: none"> <li>• IECEx scheme</li> <li>• IEC 60079-0, IEC 60079-1</li> <li>• Ex d I Mb</li> </ul>

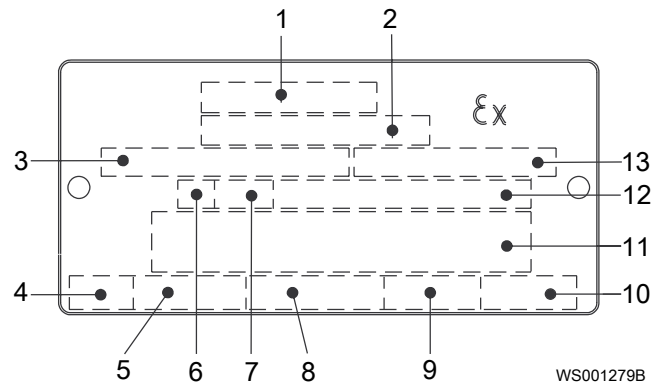
#### The Ex approval plate



1. Approval
2. Approval authority and approval number
3. Approval for Class I
4. Approved drive unit
5. Stall time
6. Starting current/Rated current
7. Duty class

8. Duty factor
9. Input power
10. Rated speed
11. Controller
12. Additional information
13. Maximum ambient temperature
14. Serial number
15. ATEX marking

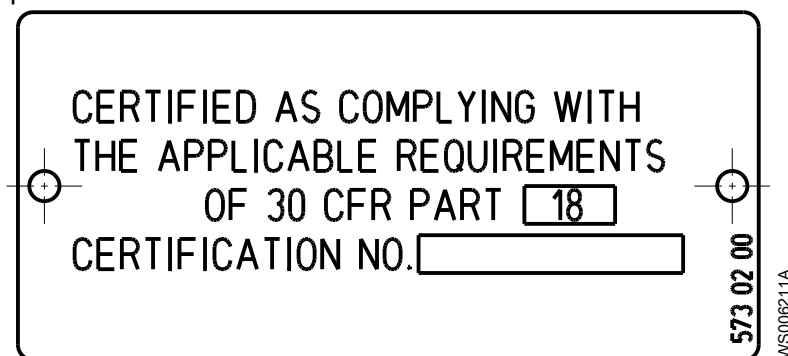
Figure 2: EN



1. Approval
2. Approval authority + approval number
3. Approved for drive unit
4. Stall time
5. Starting current/Rated current
6. Duty class
7. Duty factor
8. Input power
9. Rated speed
10. Controller
11. Additional information
12. Max. ambient temperature
13. Serial number

Figure 3: IEC

The MSHA approval plate



## 3.6 Product denomination

### Reading instruction

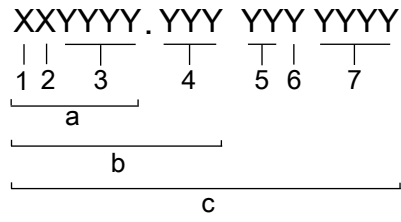
In this section, code characters are illustrated accordingly:

X = letter

Y = digit

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

Codes and parameters



WS006265B

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

# 4 Installation

## 4.1 Install the pump

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




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### 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.

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### DANGER: Inhalation Hazard

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

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### Hazardous atmospheres




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### DANGER: Explosion/Fire Hazard

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

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### WARNING: Explosion/Fire Hazard

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

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### Authority regulation

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

### Sedimentation prevention

In order to avoid sedimentation when the pumped liquid contains solid particles, the velocity of the liquid in the discharge line must exceed a certain value. Choose applicable minimum velocity from the table, and choose proper dimension of the discharge line accordingly.

Mixture	Minimum velocity, meter per second (feet per second)
Water + coarse gravel	4 (13)
Water + gravel	3.5 (11)
Water + sand, particle size <0.6 mm (0.024 in)	2.5 (8.2)
Water + sand, particle size <0.1 mm (0.004 in)	1.5 (4.9)

For more permanent installations with a heavily contaminated pumped liquid, a settling pump-sump is recommended.

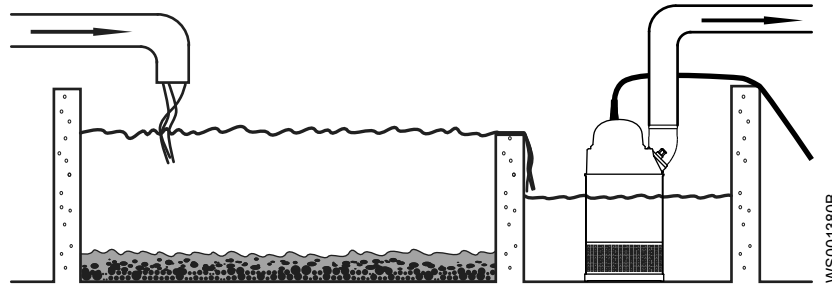
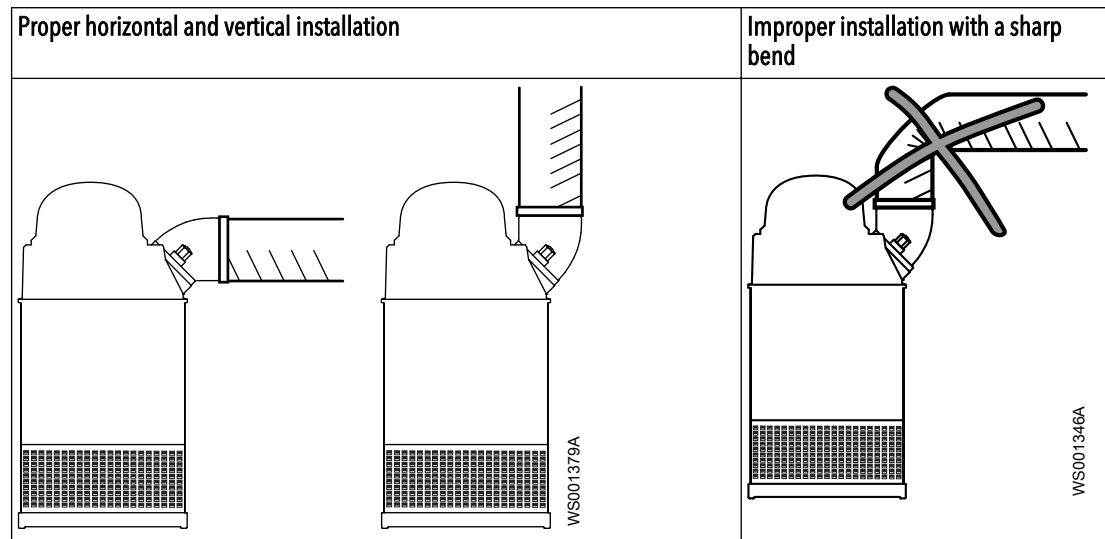


Figure 4: Settling pump-sump

### Discharge line requirements

The discharge line can be run vertically or horizontally, but must be without sharp bends.



### Fasteners

- 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.

#### 4.1.1 Install with S-installation

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

These requirements and instructions only apply when the installation is made according to the dimensional drawing.

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

Make sure that the impeller rotation is correct. For more information, see [Check the impeller rotation](#) (page 27).

## 4.2 Make the electrical connections

### General precautions




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**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.

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**WARNING: Electrical Hazard**

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

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**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.

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**WARNING: Crush Hazard**

Risk of automatic restart.

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**CAUTION: Electrical Hazard**

Prevent cables from becoming sharply bent or damaged.

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**NOTICE:**

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

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### 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.
- The thermal contacts/thermistors must be in use.

### 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 local sales and service representative.
- The voltage drop in long cables must be taken into account. The drive unit's rated voltage is the voltage measured at the cable connection point in the pump.
- For SUBCAB<sup>®</sup> cables, the twisted pair copper foil must be trimmed.
- All unused conductors must be insulated.

### Grounding (earthing)

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




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#### **DANGER: Electrical Hazard**

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

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#### **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.

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#### **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.

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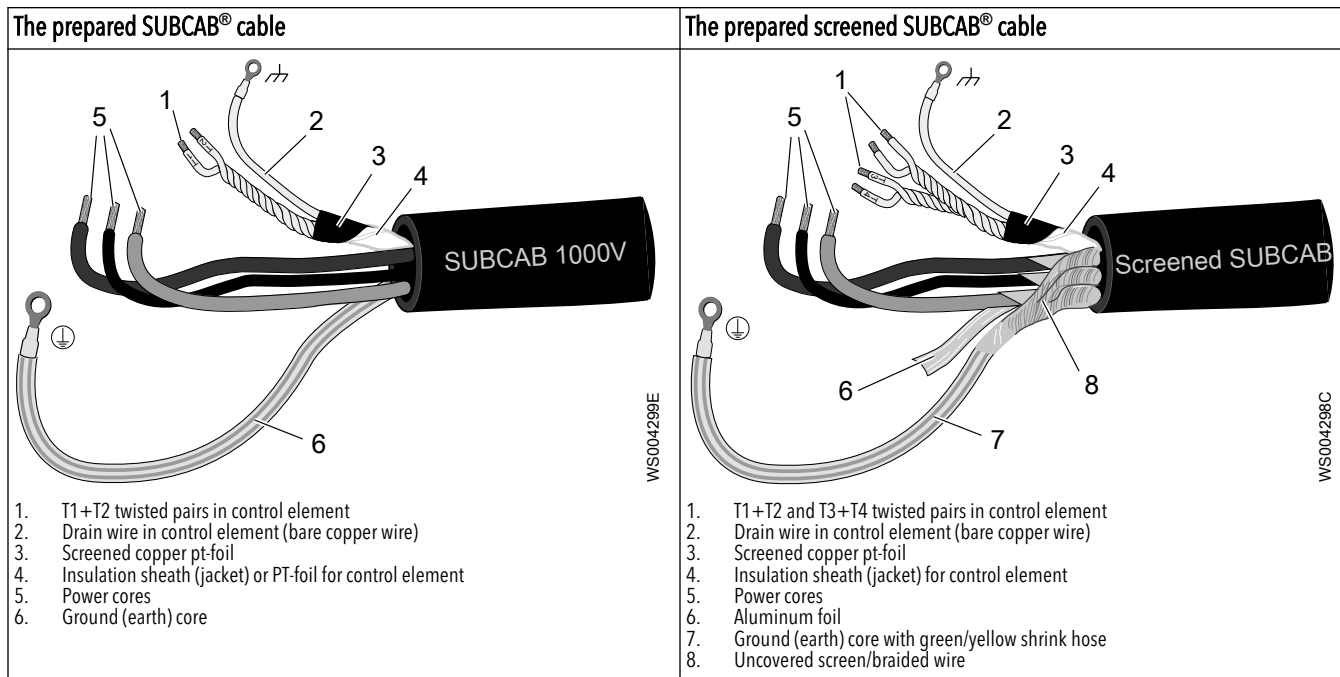
### Ground (earth) conductor length

The ground (earth) conductor must be 100 mm (4.0 in) longer than the phase conductors in the junction box of the unit.

#### 4.2.1 Prepare the SUBCAB cables

This section applies to SUBCAB<sup>®</sup> cables with twisted-pair control cores.





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

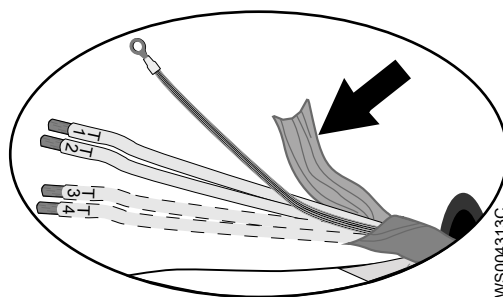


Figure 5: Copper foil on control element.

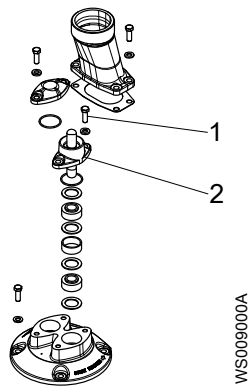
- b) Put a white shrink hose over the drain wire and the cable terminal.
  - c) Fit a cable lug on the drain wire.
  - d) Twist T1+T2 and T3+T4.
  - e) Put a shrink hose over the control element.  
Make sure that the conductive copper foil and drain wire is covered.
3. Prepare the ground (earth) core for SUBCAB™ cable:
  - a) Peel the yellow-green insulation from the ground (earth) core.
  - b) Check that the ground (earth) core is at least 10% longer than the phase cores in the cabinet.
  - c) If applicable, put a cable lug on the ground core.
4. Prepare the ground (earth) core for screened SUBCAB™ cable:
  - a) Untwist the screens around the power cores.
  - b) Put a yellow-green shrink hose over the ground (earth) core.  
Leave a short piece uncovered.
  - c) If applicable, put a cable lug on the screened ground core.

- d) Twist all power core screens together to create a ground (earth) core and fit a cable terminal to the end.
  - e) Check that the ground (earth) core is at least 10% longer than the phase cores in the cabinet.
5. How is the connection to ground (earth) made?
    - Screw: Fit cable terminals to the ground (earth) core and the power cores.
    - Terminal block: Leave the core ends as they are.
  6. Prepare the main leads:
    - a) Remove the aluminum foil around each power core.
    - b) Peel the insulation from each power core.

#### 4.2.2 Connect the motor cable to the pump: Version code 2190.010, 2201.012/020/320

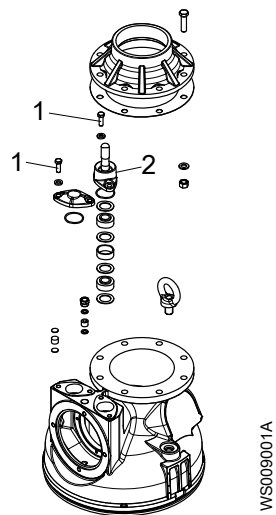
**NOTICE:**

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



Part	Description
1	Screws
2	Entrance flange

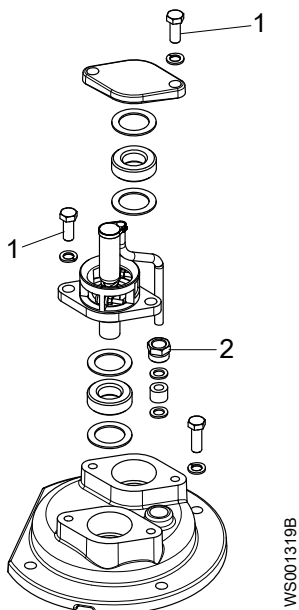
Figure 6: Cable entry for version code 2190.010 HT and 2201.012 HT



Part	Description
1	Screws

Part	Description
2	Entrance flange

Figure 7: Cable entry for version code 2201.012 MT and 2201.020 LT



Part	Description
1	Screws
2	Gland nut

Figure 8: Cable entry for version code 2201.320

- Check the data plate to see which connections are required for the power supply:
  - Y
  - D
  - Y serial
  - Y parallel
  - Y/D
- Arrange the connections on the terminal board in accordance with the required power supply.  
Do not use links (jumper strips) with the Y/D start.  
Do not use links (jumper strips) with the 9 stator leads tandem-coupling.
- Connect the motor conductors (U1, V1, W1) to the terminal board. Connect the ground (earth) lead.
- Make sure that the pump is correctly connected to ground (earth).
- Make sure that any thermal contacts incorporated in the pump are properly connected to the terminal board.
- Install the cover.
- Version code 2190.010, 2201.012/020: Fasten the screws on the entrance flange so that the cable insertion assembly bottoms out.
- Version code 2201.320: Fasten the screws and the gland nut on the entrance flange so that the cable insertion assembly bottoms out.

After you have connected the motor cable to the pump, connect the motor cable and the control cable to the starter equipment.

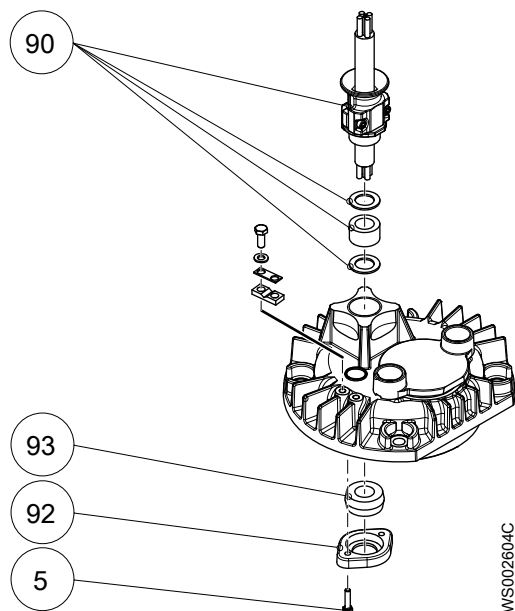


**DANGER: Explosion/Fire Hazard**

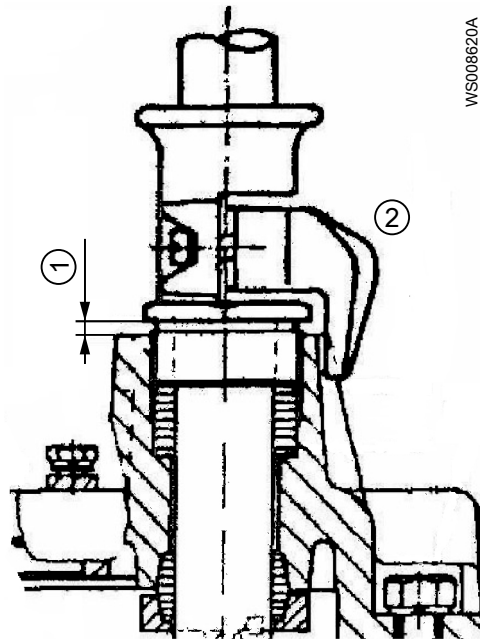
Special rules apply to installations in explosive or flammable atmospheres. Do not install the product or any auxiliary equipment in an explosive zone unless it is rated explosion-proof or intrinsically-safe. If the product is EN/ATEX-, MSHA- or FM-approved, then see the specific EX information in the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

Three thermal contacts are incorporated in the stator. They are normally closed. Thermal contacts must never be exposed to voltages higher than 250 V, breaking current maximum 6 A at a power factor 0.6. It is recommended that the thermal contacts are connected to 24 V over a separate fuse to protect any other automatic equipment.

**4.2.3 Connect the motor cable to the pump: Version code 590/690/691**



Position number	Description
5	Hexagon head screw
90	Cable entry
92	Gland flange
93	Seal sleeve



Position number	Description
1	Minimum clearance 3.2 mm (0.13 in)
2	Cable strain relief

Figure 9: Cable entry

Figure 10: Cable strain relief

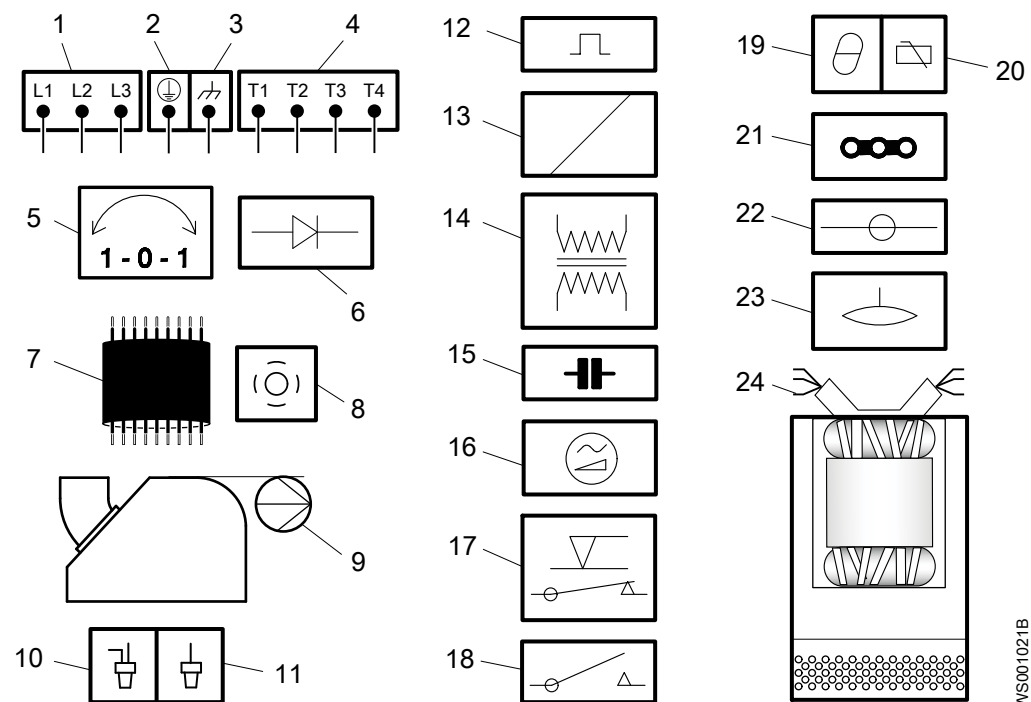
1. Insert the motor cable.  
25-30 mm (0.9-1.2 in) of the jacket must be on the inside of the cover.
2. Check that the seal sleeves and washers conform to the outside diameter of the cable.
3. Tighten the cable entry so that the seal sleeve is compressed and seals between the motor cable and the cover.  
Leave a clearance between the cover and the flange on the cable entry. See [Figure 10: Cable strain relief](#) (page 22).  
The cable entry is threaded with Pg29/Pr37, Pg36/Pr47, and Pg42/Pr54.
4. Twist together the ground (earth) leads into a bundle and slip an insulating tube over the intertwined leads.  
The ground (earth) leads are located concentrically around each phase lead.
5. Fit the gland flange:

- a) Fit it with the largest diameter of the hole facing the inside of the cover.
  - b) Tighten the screws, but leave 1 mm (0.04 in) of clearance between the cover and the gland flange.
6. Fit the O-ring on the cover.
  7. Connect the leads.
  8. Connect the control cable between the terminal board (H1 and H2) and the control circuit of the starter.
  9. Fit and tighten the cover.
 

Check, through the inspection hole, that no leads are pinched.
  10. Fit the O-ring on the inspection cover.
  11. Fit and tighten the inspection cover.
  12. Fit and tighten the cable strain relief on the cable entry.
  13. Connect the pump to ground (earth) with an external ground (earth) lead on the top of the cover.

## 4.2.4 Cable charts

### Connection locations



1	Starter equipment and main leads (L1, L2, L3)	13	Coil
2	Ground (earth)	14	Transformer
3	Functional ground	15	Capacitor
4	Control leads (T1, T2, T3, T4)	16	Softstarter
5	Phase shifter	17	Level regulator
6	Diode	18	Contactors, start relay or thermal relay
7	Motor cable	19	Thermal detector in stator
8	Screen	20	Thermal detector in main bearing
9	Pump	21	Jumper
10	Crimp connection	22	Terminal board, terminal plate
11	Crimp isolation	23	Leakage sensor

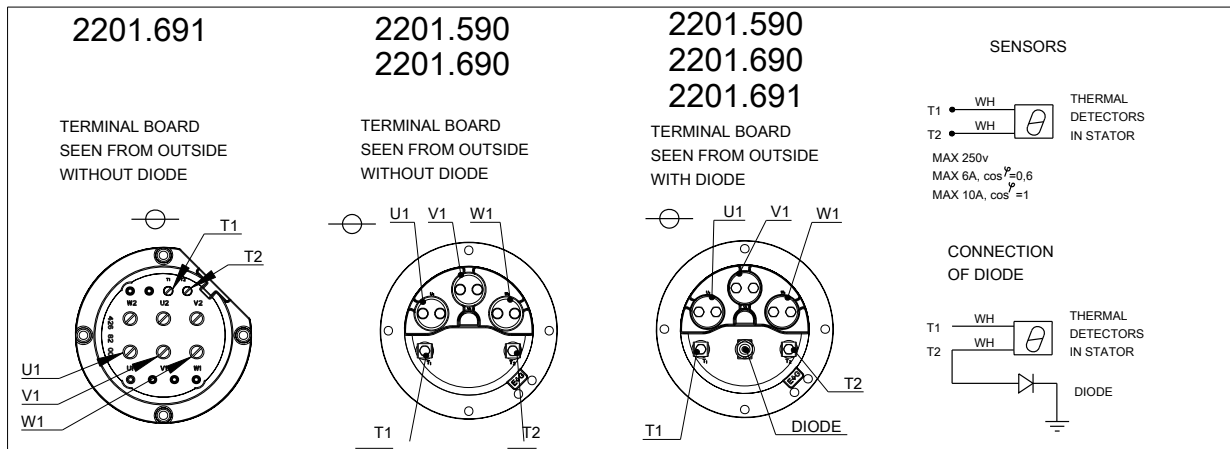
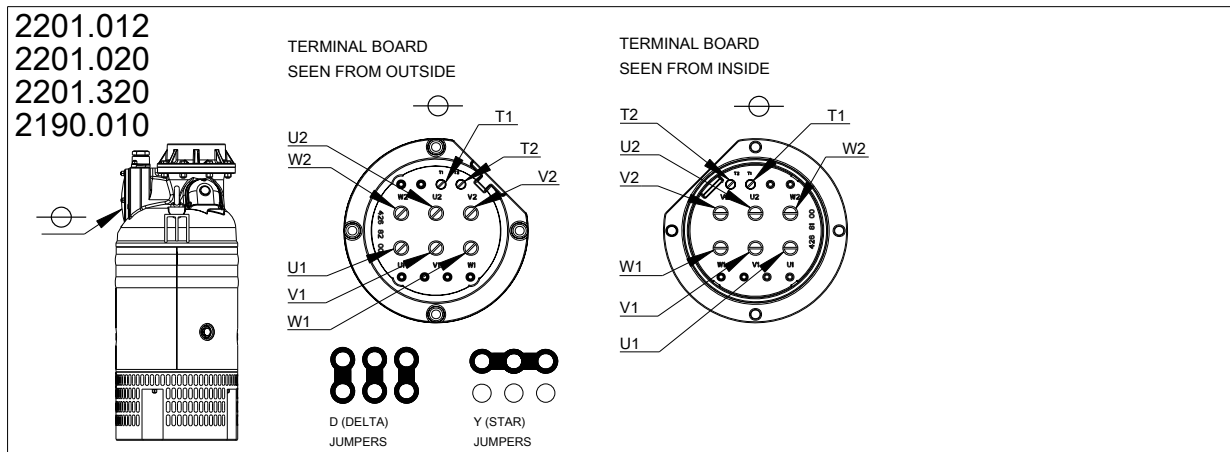
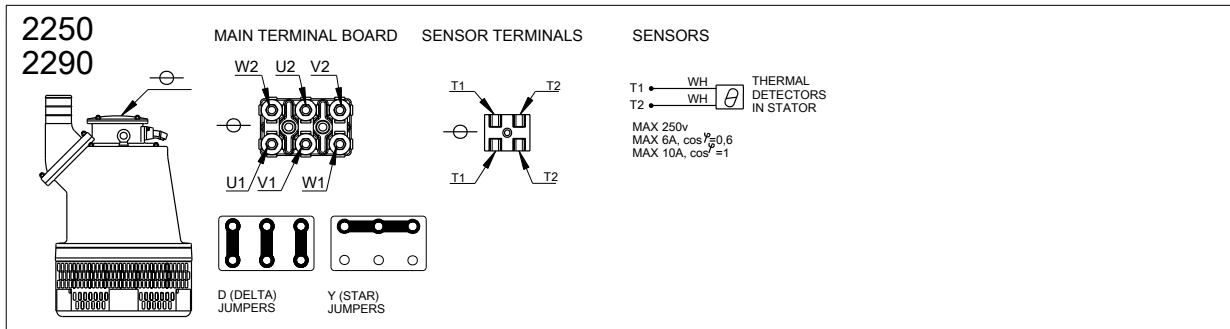
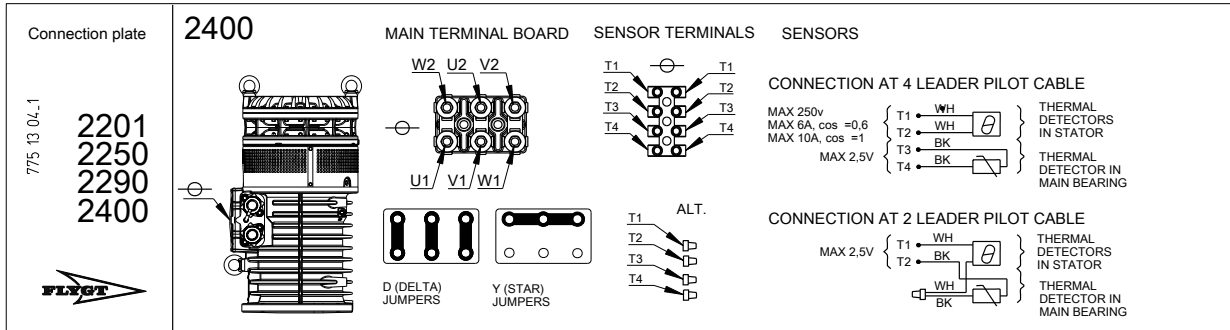
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12	Motor protector	24	Stator leads (U1, U2, U5, U6, V1, V2, V5, V6, W1, W2, W5, W6, Z1, Z5, Z6)
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## Color code standard

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

View of terminal board and sensor connections



WS008889A

Motor cable, stator leads and thermal contacts connection to terminal board

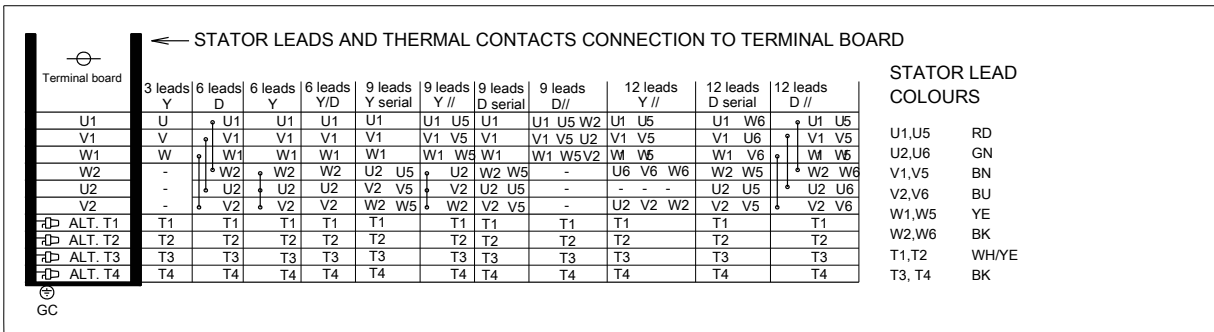
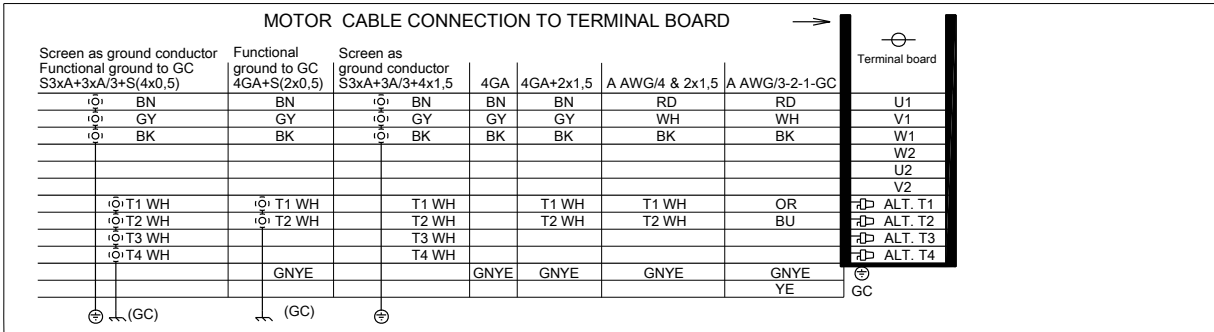
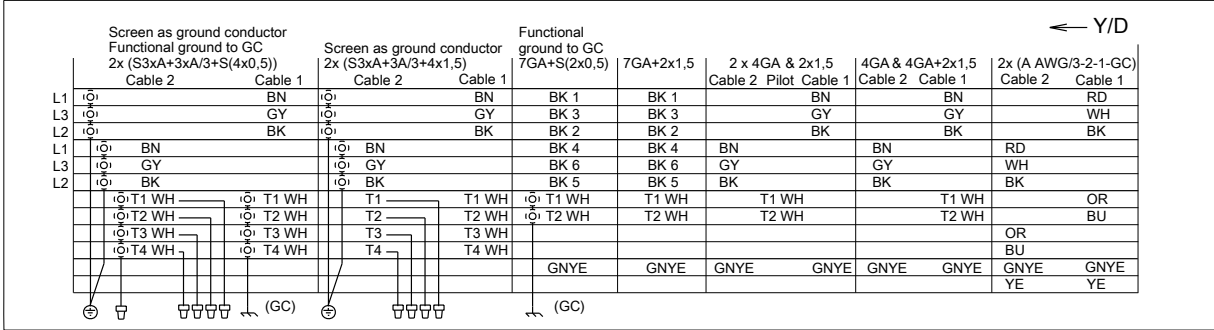
7/5 13 04.1

**2201**  
**2250**  
**2290**  
**2400**

**SYMBOLS AND DENOMINATIONS**

BN=Brown	⊖=Terminal board
BK=Black	⊖=Screen
WH=White	⊖=Ground
OG=Orange	⊖=Functional ground
GN=Green	⊖=Crimp connection
GNYE=Green-Yellow	⊖=Crimp isolation
RD=Red	
GY=Grey	
BU=Blue	
YE=Yellow	

GC= Ground check  
A = Cable dimension in cable specification  
Use ⊖ on cables not in use



WS008990A



## 4.3 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.

Check the direction of rotation each time the cable has been re-connected and after phase or total supply failure.

1. Start the motor.
2. Stop the motor.
3. Check that the impeller rotates in the correct direction.

The correct direction of impeller rotation is clockwise when you look at the pump from above. When started, the pump will react in the opposite direction to the impeller rotation.

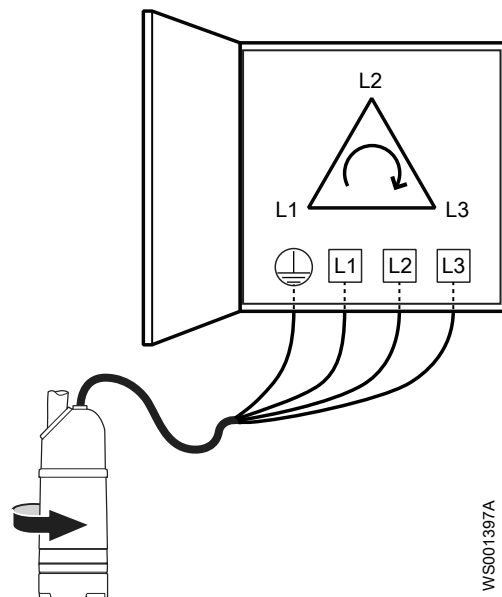


Figure 11: Start reaction

4. If the impeller rotates in the wrong direction, then do the following:
  - If the motor has a 3-phase connection, then transpose two phase conductors and repeat this procedure from step 1.

For 3-phase pumps with external starters or without built-in motor protection, the phases must be shifted on the output terminal of the starter.

# 5 Operation

## 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.

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### WARNING: Crush Hazard

Risk of automatic restart.

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## Distance to wet areas




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### 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.

---




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### 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.

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## Noise level

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### NOTICE:

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

---

## 5.1 Start the pump




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### WARNING: Explosion/Fire Hazard

During operation the Ex-approved product must be fully submerged, to avoid overheating.

---




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### CAUTION: Crush Hazard

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

---



---

### NOTICE:

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

---

1. Inspect the pump. Check that there is no physical damage to the pump or cables.
2. Check the oil level in the oil housing.
3. 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.

---

4. Check that the monitoring equipment (if any) works.
5. Check that the impeller rotation is correct.
6. Start the pump.

## 5.2 Clean the pump

The pump must be cleaned if it has been running in very dirty water. If clay, cement or other similar dirt is left in the pump it may clog the impeller and seal, preventing the pump from working.

Let the pump run for a while in clean water, or flush it through the discharge connection.

# 6 Maintenance

## Precautions

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




---

### DANGER: Crush Hazard

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

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### WARNING: Biological Hazard

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

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### CAUTION: Crush Hazard

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

---

Make sure that you follow these requirements:

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

## Ground continuity verification

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

## Maintenance guidelines

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

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

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

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

## 6.1 Torque values

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

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

## Screws and nuts

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

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

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

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

### Hexagon screws with countersunk heads

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

## 6.2 Service

Regular inspection and service of the pump ensures more reliable operation.

Type of service	Purpose	Inspection interval
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.	Twice a year
Major overhaul	To secure a long operating lifetime for the product. It includes replacement of key components and the measures taken during an inspection.	Every year, under normal operating conditions

### 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

Regular inspection and service of the pump ensures more reliable operation.

Service item	Action
Visible parts on the pump and installation	<ol style="list-style-type: none"> <li>1. Check that all screws, bolts, and nuts are properly tightened.</li> <li>2. Check the condition of the pump casing, strainer, cover, lifting handles, eye bolts, ropes, chains, and wires.</li> <li>3. Check for worn or damaged parts.</li> <li>4. Adjust and/or replace if necessary.</li> </ol>
Pipes, valves, and other peripheral equipment	<ol style="list-style-type: none"> <li>1. Check for worn or damaged parts.</li> <li>2. Adjust and/or replace if necessary.</li> </ol>

Service item	Action
Impeller	<ol style="list-style-type: none"> <li>1. Check for worn or damaged parts.</li> <li>2. Adjust and/or replace if necessary.</li> </ol> <p>Wear on the impeller or surrounding parts necessitates fine adjustments of the impeller or replacement of worn parts.</p>
Oil	<p>Check the oil:</p> <ol style="list-style-type: none"> <li>1. Take an oil sample.</li> <li>2. If the oil contains particles, then replace the mechanical seal. Contact an authorized service shop.</li> </ol> <p>Make sure that the volume is filled to the correct level. A smaller amount of water is not harmful for the mechanical seal.</p>
Cable entry	<ol style="list-style-type: none"> <li>1. Check that the following requirements are met: <ul style="list-style-type: none"> <li>• The cable clamps must be properly tightened.</li> <li>• The cable entry must be firmly tightened into its bottom-most position.</li> <li>• The seal sleeve and the washers must conform to the outside diameter of the cables.</li> </ul> </li> <li>2. Cut off a piece of the cable so that the seal sleeve closes around a new position on the cable.</li> <li>3. Replace the seal sleeve, if necessary.</li> </ol>
Inspection volume <sup>1</sup>	<ol style="list-style-type: none"> <li>1. Check that the inspection screw is properly tightened.</li> <li>2. Remove the inspection screw.</li> <li>3. Drain all liquid, if any.</li> <li>4. If there is oil in the inspection volume, then empty the oil and check again after one week. If there is oil in the inspection volume again, then replace the mechanical seal. Contact an authorized service shop.</li> <li>5. If there is water in the inspection volume, then check that the inspection screw O-ring is not damaged.</li> </ol>
Cable	<ol style="list-style-type: none"> <li>1. If the outer jacket is damaged, replace the cable.</li> <li>2. Check that the cables do not have any sharp bends and are not pinched.</li> </ol>
Cooling system	If the flow through the system has been partly restricted, then rinse and clean.
Level sensors or other sensor equipment	<ol style="list-style-type: none"> <li>1. Check the functionality.</li> <li>2. Repair or replace any damaged equipment.</li> <li>3. Clean and adjust the equipment.</li> </ol>
Starter equipment	<ol style="list-style-type: none"> <li>1. Check the condition and functionality.</li> <li>2. Contact an electrician, if necessary.</li> </ol>
Insulation resistance in the stator	<ol style="list-style-type: none"> <li>1. Check the insulation between: <ul style="list-style-type: none"> <li>• Phase-phase on the stator</li> <li>• Phase-ground (earth)</li> </ul> <p>The insulation should be &gt; 1 megaohm. Use a 1000-VDC megger to test the insulation.</p> </li> <li>2. If the resulting value is &lt; 1 megaohm, then contact an authorized service shop.</li> </ol>

### 6.2.2 Major overhaul

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

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

<sup>1</sup> Regardless of individual applications, the inspection volume should not be inspected less frequently than the intervals for normal applications and operating conditions at media (liquid) temperatures <40°C (104°F).

Service item	Action
Mechanical seal	Replace with new seal units.

## 6.3 Change the oil

A paraffin oil with viscosity close to ISO VG32 is recommended. The pump is delivered from the factory with this type of oil. In applications where poisonous properties are of less concern, a mineral oil with viscosity up to ISO VG32 can be used.

### Empty the oil

1. Lay the pump on its side.

Lock the pump with supports to prevent it from rolling over.

2. Remove the oil plug.
3. Remove the oil screw.

There are two oil screws. Either screw can be used for drainage, but it is easier to drain the oil if both oil screws are removed.



#### CAUTION: Compressed Gas Hazard

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

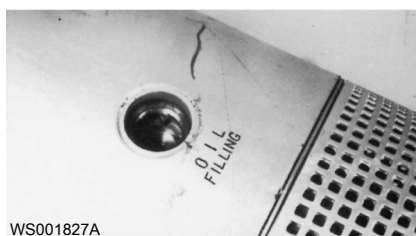
4. Fit the oil drainage tube (optional).  
The tube is included with the pump at delivery.
5. Turn the pump so that the oil hole faces downwards and let the oil run out into a container.



### Fill with oil

1. Replace the oil screw O-ring.
2. Put one of the oil screws back and tighten it.
3. Put the corresponding oil plug back.
4. Turn the pump so that the oil hole faces upwards and fill with new oil.

Quantity: 5 L (5.3 qt)



5. Put the oil screw back and tighten it.  
Tightening torque: 10-20 Nm (7.4-15 ft-lbs)
6. Put the oil plug back.

## 6.4 Replace the impeller

Before you replace the impeller, you must drain the oil in the oil housing. See applicable steps in [Change the oil](#) (page 33).

### 6.4.1 Remove the impeller, alternative 1



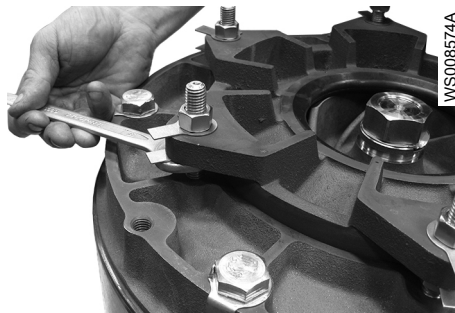
**CAUTION: Cutting Hazard**

Worn parts can have sharp edges. Wear protective clothing.

Table 3: Applicability

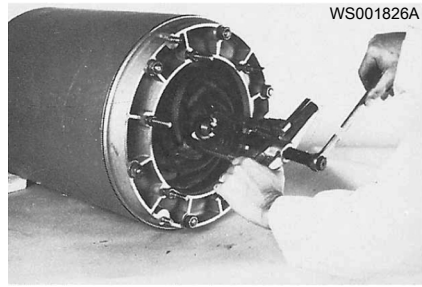
Product code	Pressure class	Open or closed impeller
2201.020	LT	Open
2201.320	MT, HT	Open
2201.590	MT, HT	Open
2201.690	MT, HT	Open
2201.691	MT, HT	Open

1. Lay the pump on its side or turn it upside down.
2. Remove the strainer:
  - a) Remove the nuts.
  - b) Remove the strainer.
3. Remove the suction cover:
  - a) Remove the nuts.
  - b) Remove the washers.
  - c) Remove the suction cover.



- d) Remove the O-ring.
4. Remove the impeller:
  - a) Remove the impeller nut.
  - b) Remove the washer.
  - c) Pull off the impeller.  
Use an impeller puller or pry off carefully with two strong screwdrivers or bars.





## 6.4.2 Remove the impeller, alternative 2



### CAUTION: Cutting Hazard

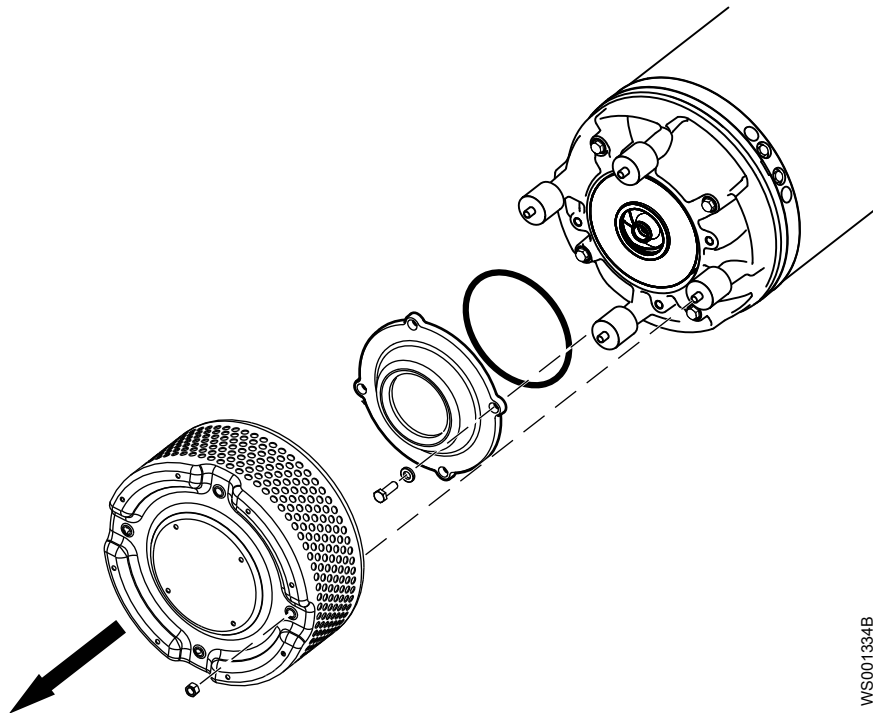
Worn parts can have sharp edges. Wear protective clothing.

Table 4: Applicability

Product code	Pressure class	Open or closed impeller
2190.010	HT	Closed
2201.012	HT	Closed

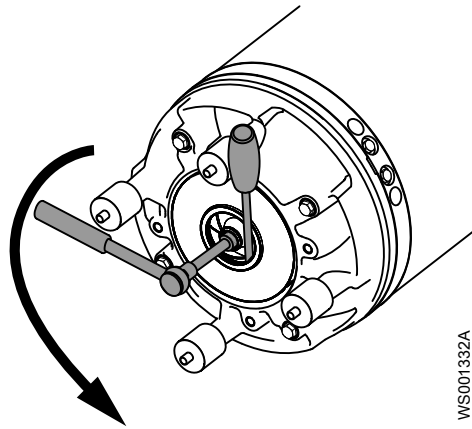
The illustrations are generic.

1. Remove the strainer.

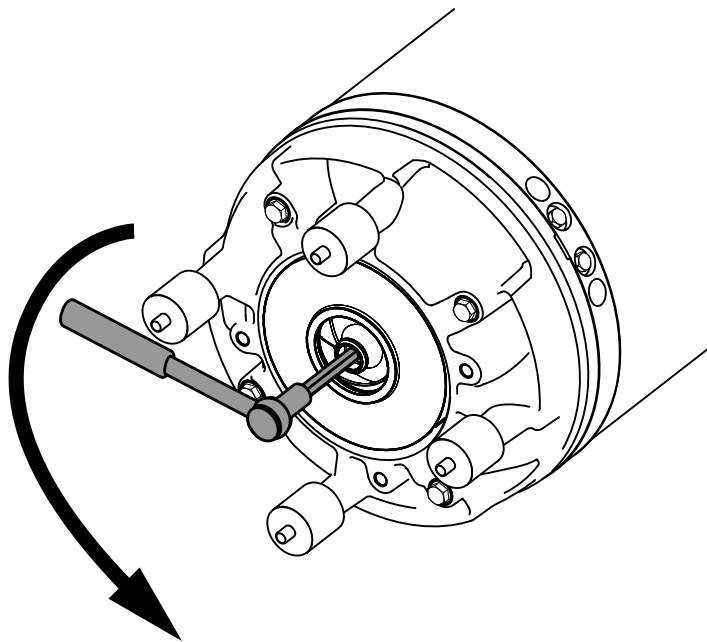


WS001334B

2. Remove the suction cover.
3. Remove the O-ring.
4. Loosen the impeller:
  - a) Lock the impeller to prevent rotation.  
Use pliers, a screwdriver, or similar.
  - b) Remove the impeller screw and the washer.



5. Remove the impeller:
  - a) Lock the impeller to prevent rotation.  
Use pliers, a screwdriver, or similar.
  - b) Turn the adjustment screw counterclockwise until the impeller breaks free from the shaft.  
Use a 12 mm hexagon bit adapter (Allen socket) with a 100 mm (4 in) extension.



- c) Pull off the impeller.

### 6.4.3 Remove the impeller, alternative 3



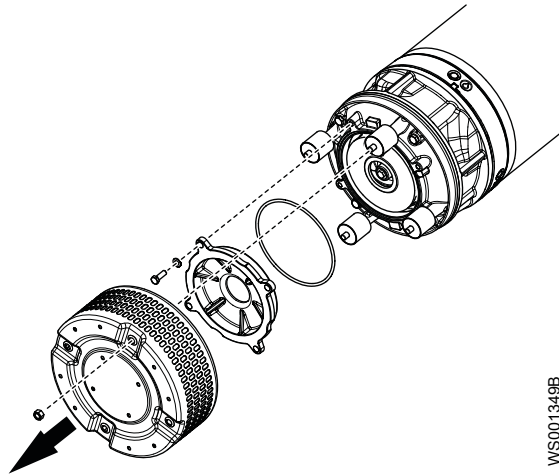
**CAUTION: Cutting Hazard**

Worn parts can have sharp edges. Wear protective clothing.

Table 5: Applicability

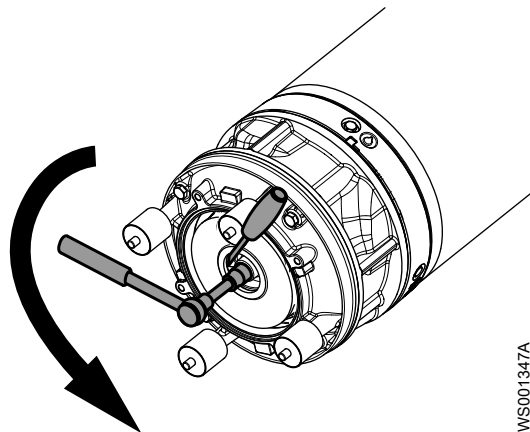
Product code	Pressure class	Open or closed impeller
2201.012	SH	Closed

1. Remove the strainer.



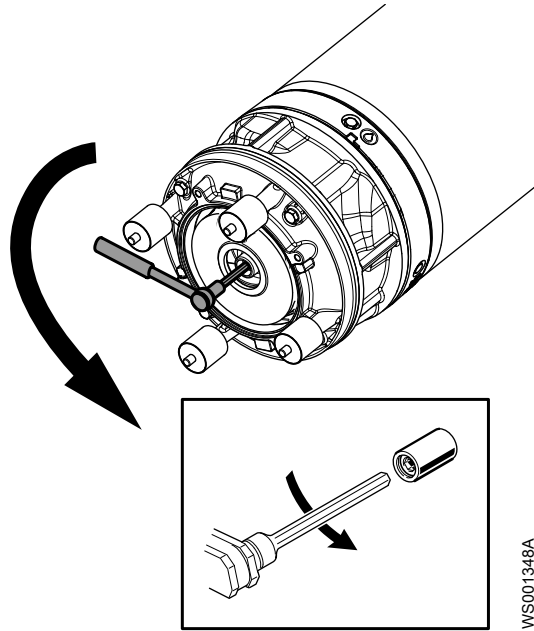
WS001349B

2. Remove the suction cover.
3. Remove the O-ring.
4. Loosen the impeller:
  - a) Lock the impeller to prevent rotation.  
Use pliers, a screwdriver, or similar.
  - b) Remove the impeller screw and the washer.



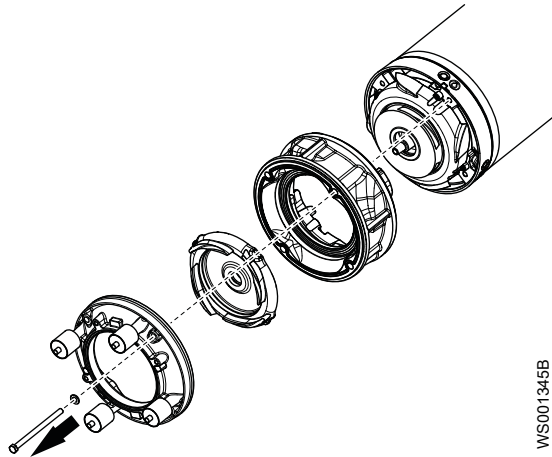
WS001347A

5. Remove the impeller:
  - a) Lock the impeller to prevent rotation.  
Use pliers, a screwdriver, or similar.
  - b) Turn the adjustment screw counterclockwise until the impeller breaks free from the shaft.  
Use a 12 mm hexagon bit adapter (Allen socket) with a 100 mm (4 in) extension.



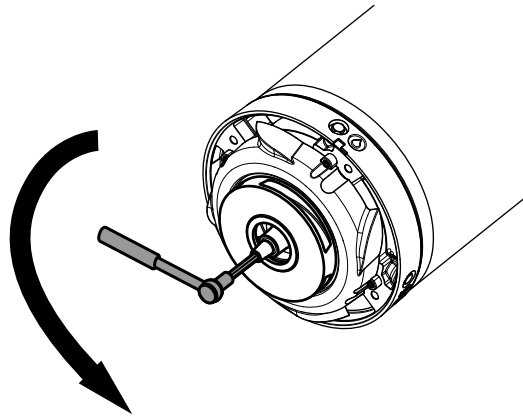
WS001348A

- c) Pull off the impeller.
6. Remove the lower diffuser.



WS001345B

7. Remove the inner diffuser.
8. Remove the upper diffuser.
9. Remove the impeller:
  - a) Lock the impeller to prevent rotation.  
Use pliers, a screwdriver, or similar.
  - b) Turn the adjustment screw counterclockwise until the impeller breaks free from the shaft.  
Use a 12 mm hexagon bit adapter (Allen socket) with a 100 mm (4 in) extension.



WS001351A

c) Pull off the impeller.

#### 6.4.4 Remove the impeller, alternative 4



**CAUTION: Cutting Hazard**

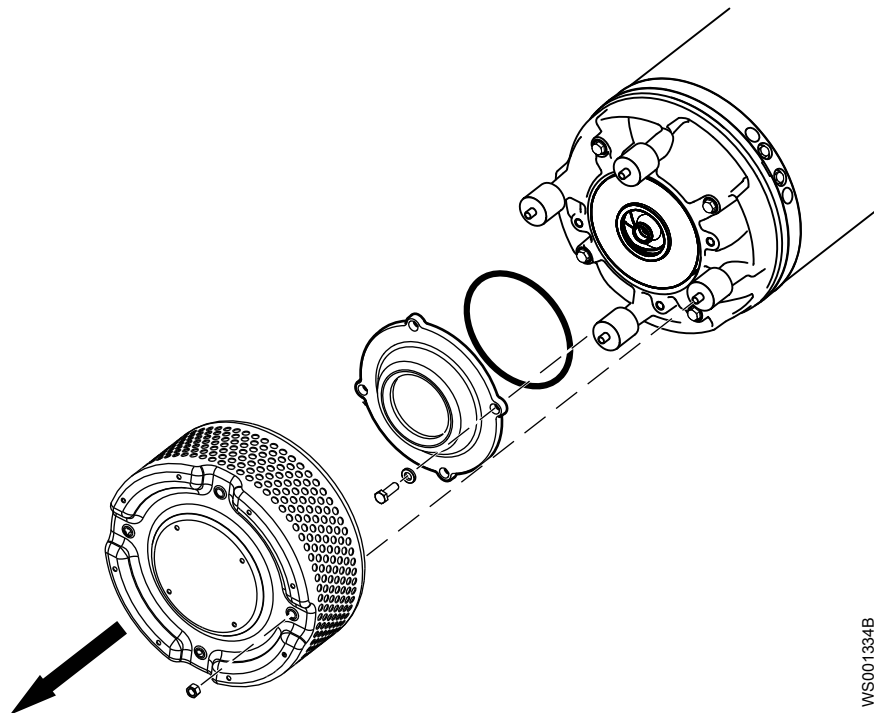
Worn parts can have sharp edges. Wear protective clothing.

Table 6: Applicability

Product code	Pressure class	Open or closed impeller
2190.010	HT	Open
2201.012	MT, HT	Open

The illustrations are generic.

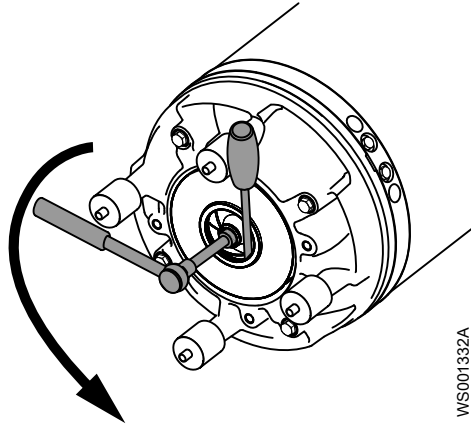
1. Remove the strainer.



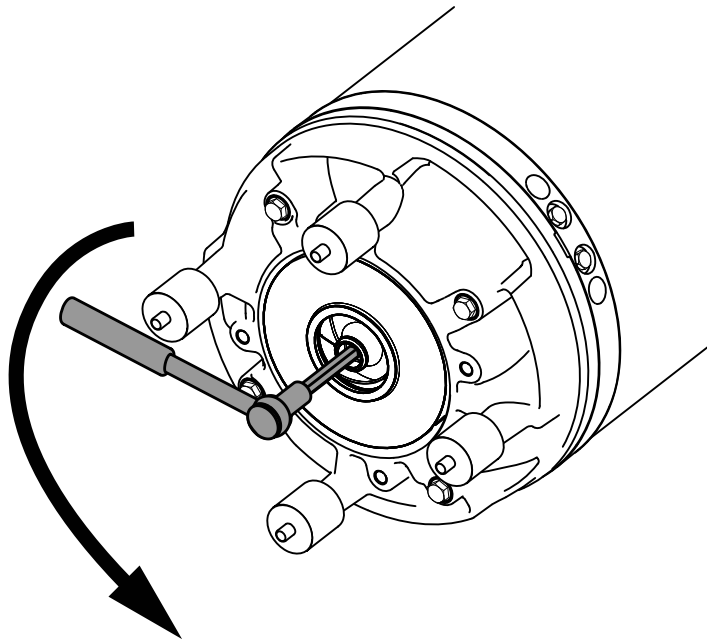
WS001334B

2. Loosen the impeller:  
a) Lock the impeller to prevent rotation.

- Use pliers, a screwdriver, or similar.
- b) Remove the impeller screw and the washer.



- 3. Remove the impeller:
  - a) Lock the impeller to prevent rotation.  
Use pliers, a screwdriver, or similar.
  - b) Turn the adjustment screw counterclockwise until the impeller breaks free from the shaft.  
Use a 12 mm hexagon bit adapter (Allen socket) with a 100 mm (4 in) extension.
  - c) Remove the suction cover.
  - d) Remove the O-ring.
  - e) Pull off the impeller.



### 6.4.5 Install the impeller, alternative 1

Table 7: Applicability

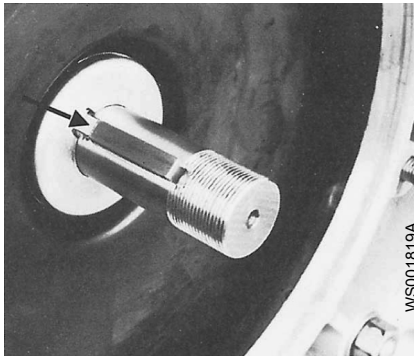
Product code	Pressure class	Open or closed impeller
2201.020	LT	Open
2201.320	MT, HT	Open
2201.590	MT, HT	Open
2201.690	MT, HT	Open

Product code	Pressure class	Open or closed impeller
2201.691	MT, HT	Open

1. Prepare the shaft:
  - a) Polish off any flaws with a fine emery cloth.  
The end of the shaft must be clean and free from burrs.
  - b) Clean and grease all sealing surfaces and O-rings.  
Do not use molybdenum disulphide (MoS<sub>2</sub>).
  - c) Grease the end of the shaft and the impeller hub.
  - d) Insert the key in the keyway of the shaft.
  - e) Fit an appropriate number of adjusting washers on the shaft.



2. Check that the driving pin on the outer seal aligns with the key.
3. Without turning the shaft in relation to the driving ring, push the impeller carefully so that the pin fits into the impeller keyway.



4. Fit the washer and the nut.
5. Tighten the impeller nut.  
Tightening torque: 200 Nm (150 ft-lb)
6. Secure with washer.
7. Check that the impeller can rotate freely.

#### 6.4.6 Install the impeller, alternative 2

Table 8: Applicability

Product code	Pressure class	Open or closed impeller
2190.010	HT	Closed
2201.012	HT	Closed

1. Prepare the shaft:
  - a) Polish off any flaws with a fine emery cloth.

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

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

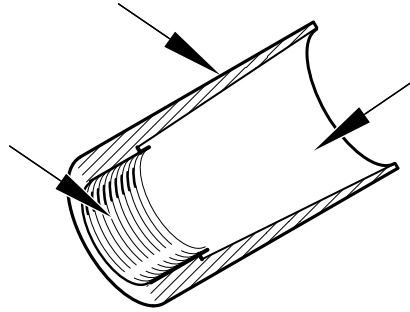
The proper lubrication is grease for bearings, for example Exxon Mobil Unirex N3, Mobil Mobilith SHC 220 or equivalent.

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**NOTICE:**

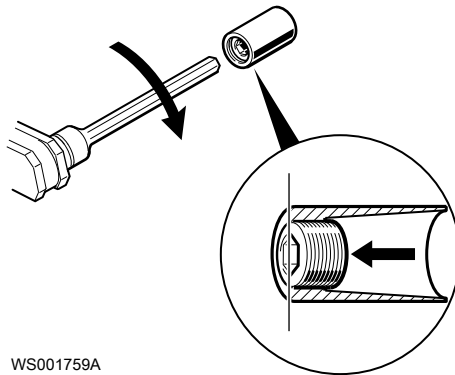
Surplus grease can cause the impeller to become loose. Remove surplus grease from conical and/or cylindrical surfaces of shafts and/or sleeves.

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WS006895A

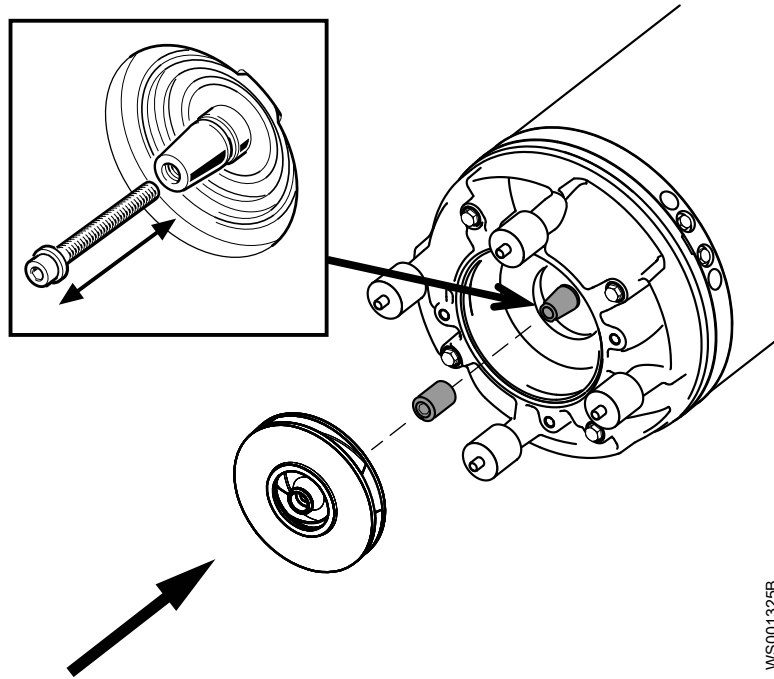
2. Align the edge of the adjustment screw with the edge of the conical sleeve so that they are flush.



WS001759A

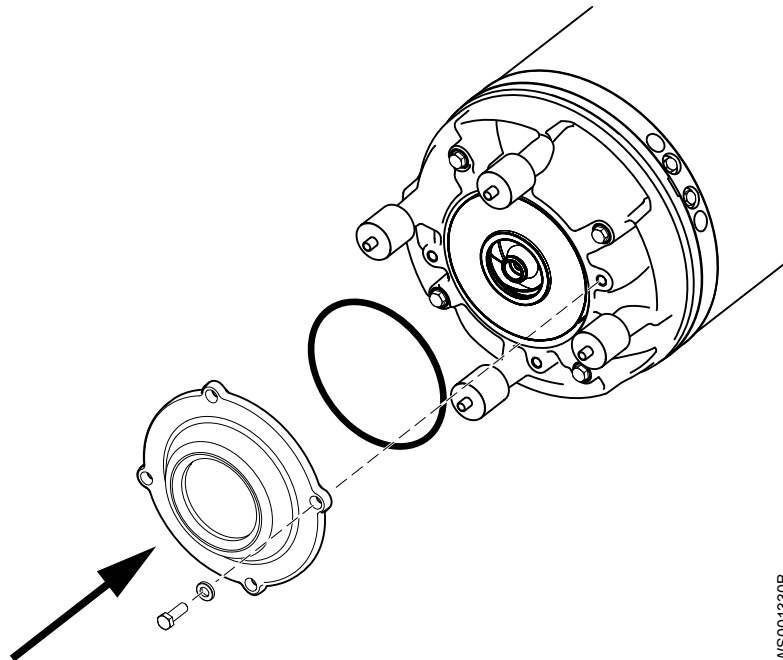
3. Grease the threads of the impeller screw and the washer.  
The proper lubrication of the screw and washer is lubricating grease for assembly of bolts etc., for example, Kluber ALTEMP Q NB 50 or equivalent.
4. Check that the impeller screw is clean and easy to screw into the shaft end.  
This is to prevent the shaft from rotating with the impeller screw.
5. Assemble the conical sleeve in the impeller.  
Make sure that the conical sleeve bottoms in the impeller.





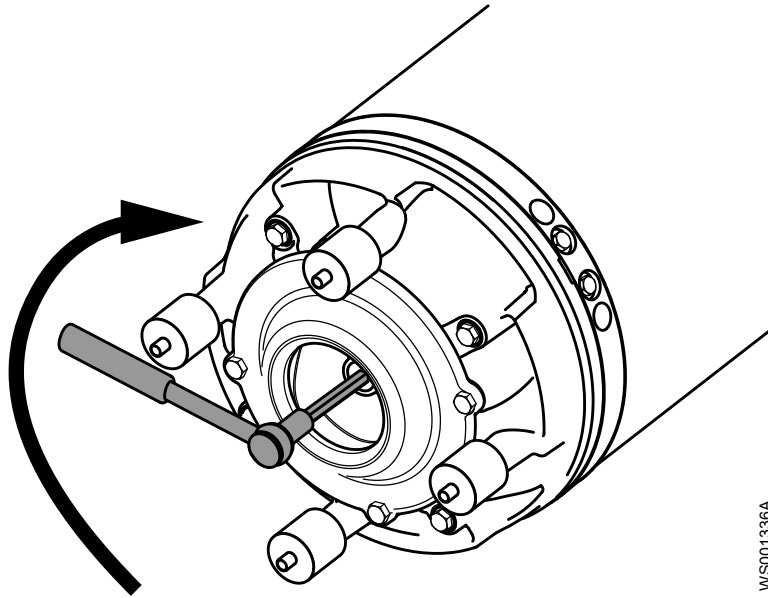
WS001325B

6. Assemble the impeller with the conical sleeve onto the shaft. Make sure that the conical sleeve bottoms in the impeller.
7. Mount the suction cover with its O-ring and tighten. Tightening torque: 76 Nm (57 ft-lb)



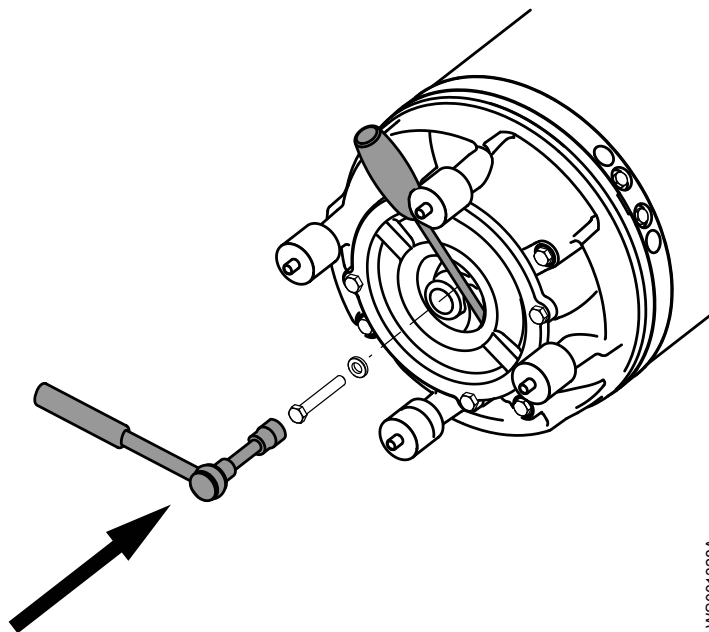
WS001330B

8. Turn the adjustment screw clockwise until the impeller makes contact with the suction cover. Tighten a further 1/8 turn, 45°. This will ensure the correct clearance between the impeller and the suction cover in the next step. Use a 12 mm hexagon bit adapter (Allen socket).



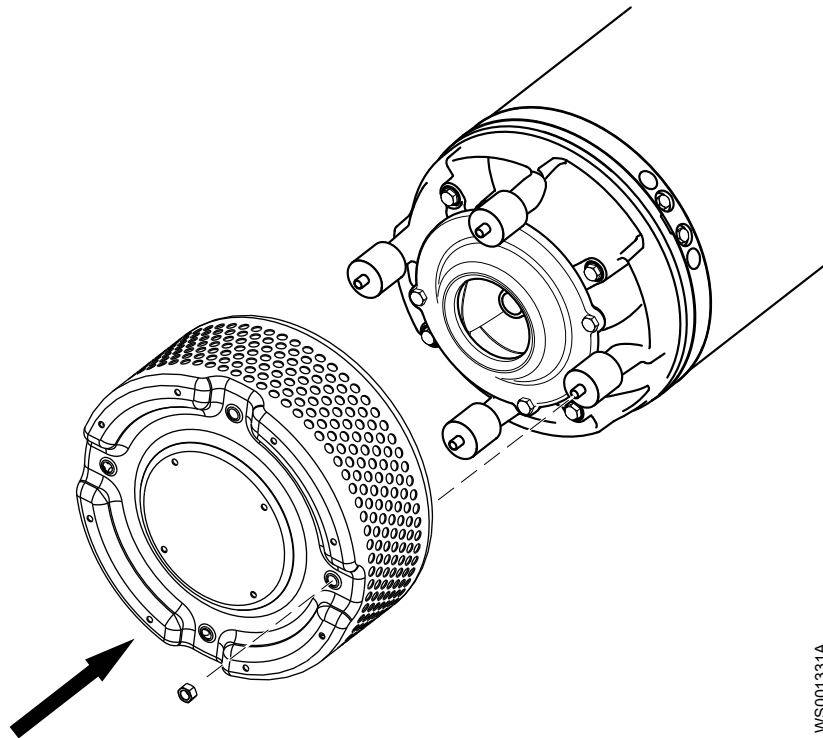
WS001336A

9. Fasten the impeller:
  - a) Place the washer on the impeller screw.
  - b) Lock the impeller to prevent rotation.  
Use pliers, a screwdriver, or similar.
  - c) Tighten the impeller screw.  
Tightening torque: 76 Nm (57 ft-lb)
  - d) Tighten a further 1/8 turn, 45°.  
The screw will be loaded to its yield point and the load capacity of the joint will be higher.
  - e) Check that the impeller can rotate freely.



WS001328A

10. Mount the strainer and the nuts.  
Tightening torque: 76 Nm (57 ft-lb)



### 6.4.7 Install the impeller, alternative 3

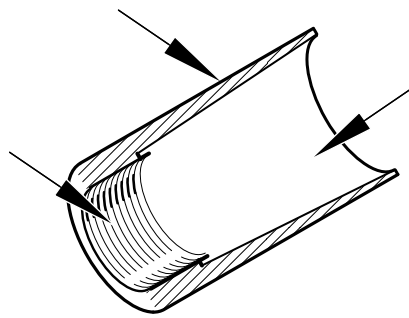
Table 9: Applicability

Product code	Pressure class	Open or closed impeller
2201.012	SH	Closed

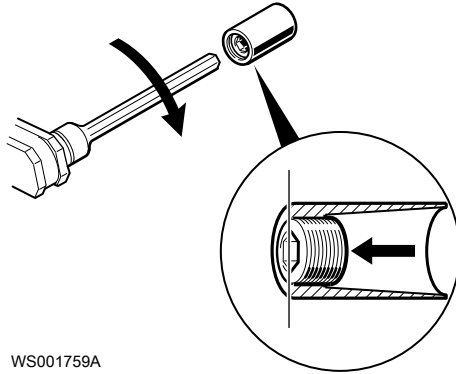
1. Prepare the shaft:
  - a) Polish off any flaws with a fine emery cloth.  
The end of the shaft must be clean and free from burrs.
  - b) Coat the inner conic, the outer cylindrical surfaces, and the thread of the conical sleeve with a thin layer of grease.  
The proper lubrication is grease for bearings,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

**NOTICE:**

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

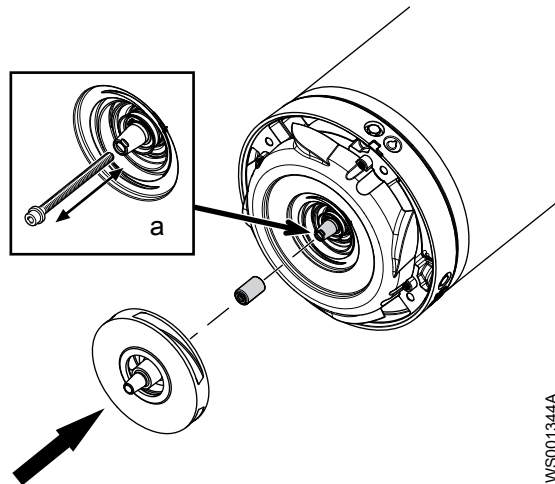


2. Align the edge of the upper adjustment screw with the edge of the upper conical sleeve so that they are flush.



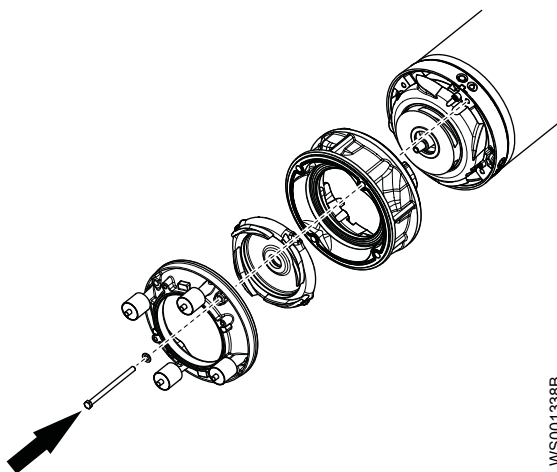
WS001759A

3. Grease the threads of the impeller screw and the washer.  
The proper lubrication of the screw and washer is lubricating grease for assembly of bolts etc., for example, Kluber ALTEMP Q NB 50 or equivalent.
4. Check that the impeller screw is clean and easy to screw into the shaft end.  
This is to prevent the shaft from rotating with the impeller screw.



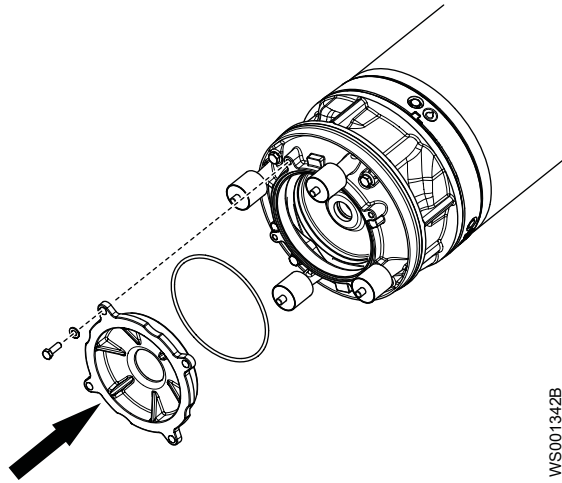
WS001344A

5. Assemble the upper conical sleeve and the upper impeller onto the shaft.
6. Mount the diffuser parts and tighten.



WS001338B

7. Mount the suction cover with its O-ring and tighten.  
Tightening torque: 76 Nm (57 ft-lb)

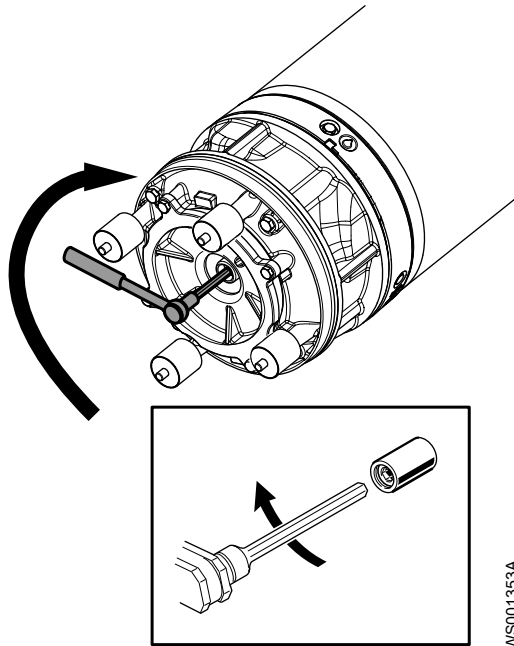


WS001342B

8. Turn the adjustment screw clockwise until the impeller makes contact with the suction cover.

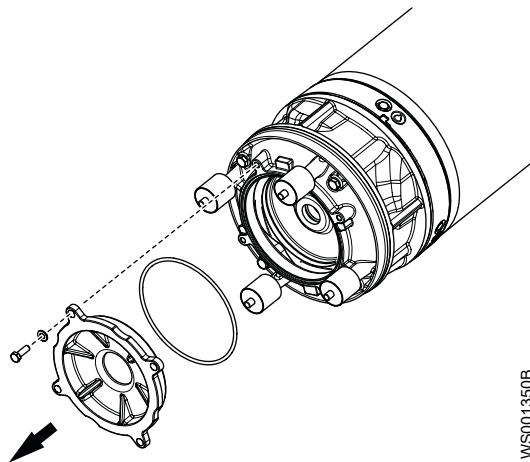
This will ensure the correct clearance between the impeller and the suction cover in the next step.

Use a 12 mm hexagon bit adapter (Allen socket) with a 100 mm (4 in) extension.



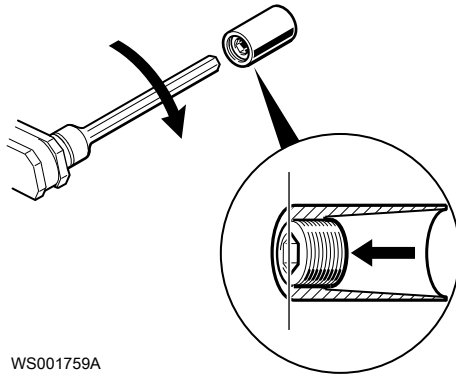
WS001353A

9. Remove the suction cover.



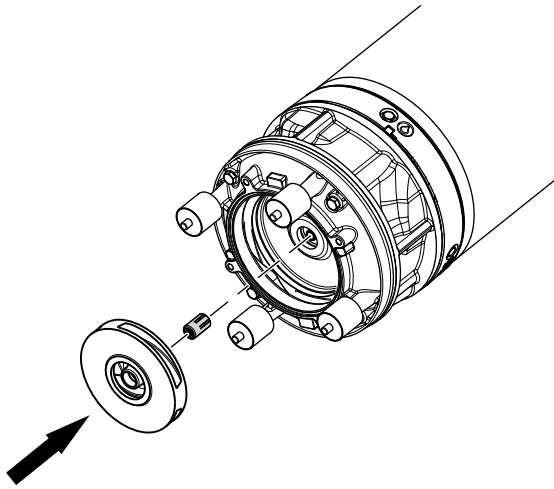
WS001350B

10. Remove the O-ring.
11. Align the edge of the lower adjustment screw with the edge of the lower conical sleeve so that they are flush.

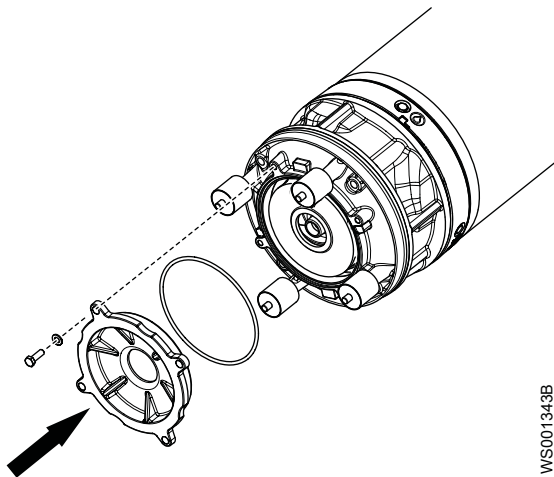


WS001759A

12. Assemble the lower conical sleeve and the lower impeller onto the shaft end of the upper impeller.



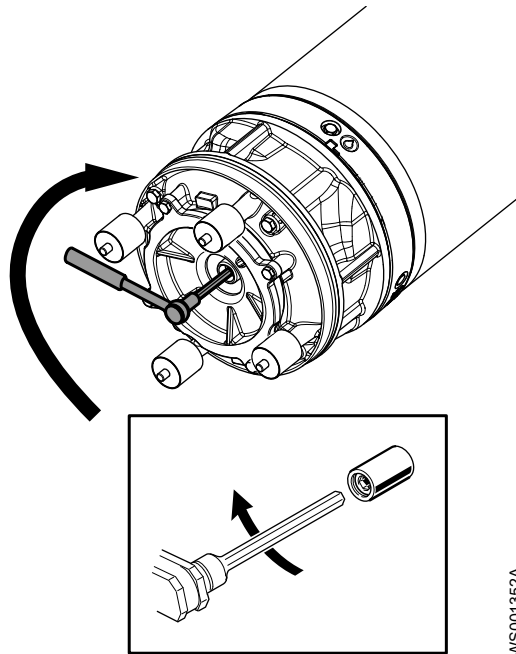
13. Mount the suction cover with its O-ring and tighten.  
Tightening torque: 76 Nm (57 ft-lb)



WS001343B

14. Turn the lower adjustment screw clockwise until the lower impeller makes contact with the suction cover. Tighten a further 1/6 turn, 60°.  
This will ensure the correct clearance between the lower impeller and the suction cover in the next step.

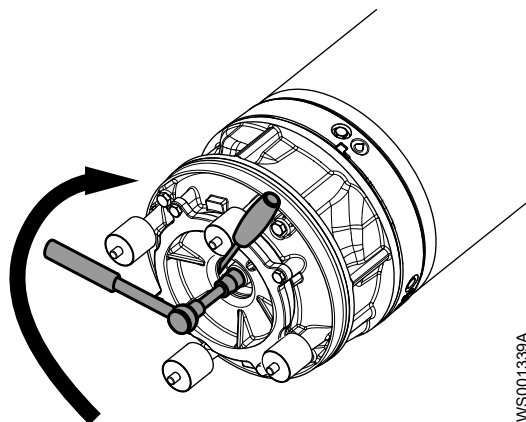
Use a 12 mm hexagon bit adapter (Allen socket) with a 100 mm (4 in) extension.



WS001352A

15. Fasten the impeller:

- a) Place the washer on the impeller screw.
- b) Lock the impeller to prevent rotation.  
Use pliers, a screwdriver, or similar.
- c) Tighten the impeller screw.  
Tightening torque: 76 Nm (57 ft-lb)
- d) Tighten a further 1/8 turn, 45°.  
The screw will be loaded to its yield point and the load capacity of the joint will be higher.
- e) Check that both the upper and lower impeller can rotate easily.



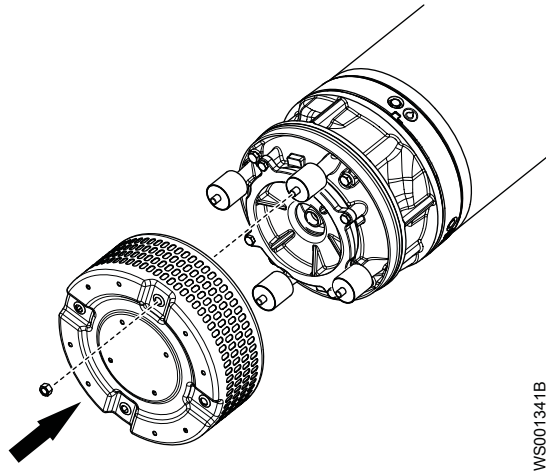
WS001339A

16. Check that the impeller can rotate freely.

If not, then the adjustment screw and the conical sleeve have not been aligned, and the shaft may have been displaced relative to the main bearing.

17. Mount the strainer and the nuts.

Tightening torque: 76 Nm (57 ft-lb)



### 6.4.8 Install the impeller, alternative 4

Table 10: Applicability

Product code	Pressure class	Open or closed impeller
2190.010	HT	Open
2201.012	MT, HT	Open

1. Prepare the shaft:

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

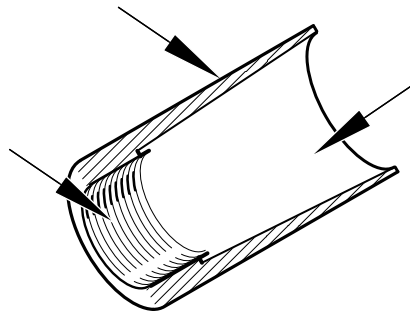
The end of the shaft must be clean and free from burrs.

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

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

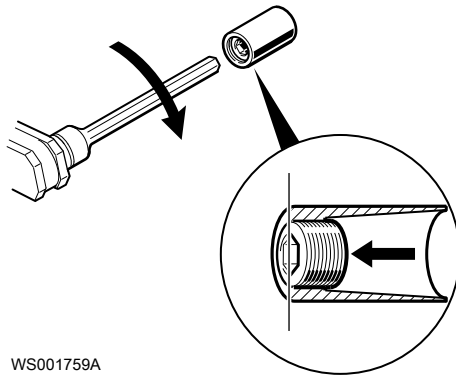
**NOTICE:**

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



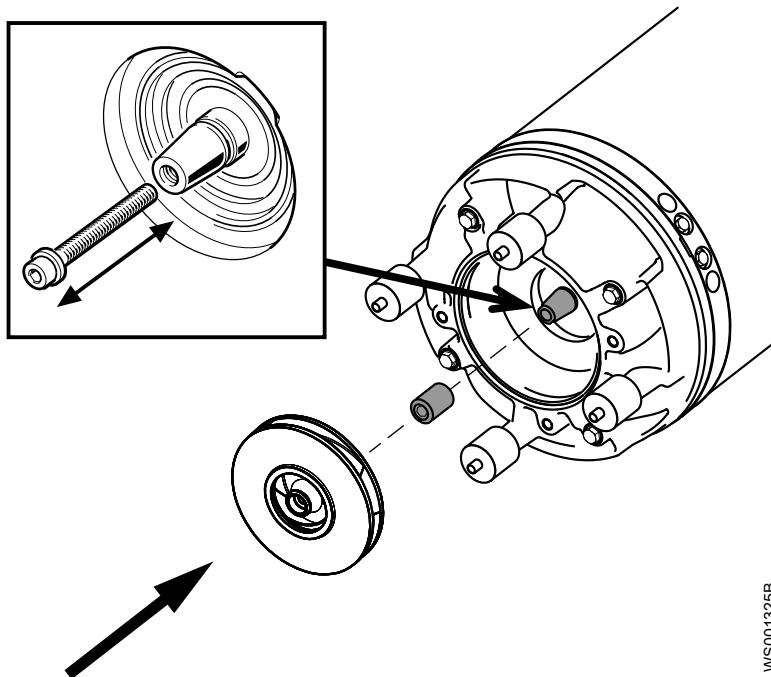
2. Align the edge of the adjustment screw with the edge of the conical sleeve so that they are flush.





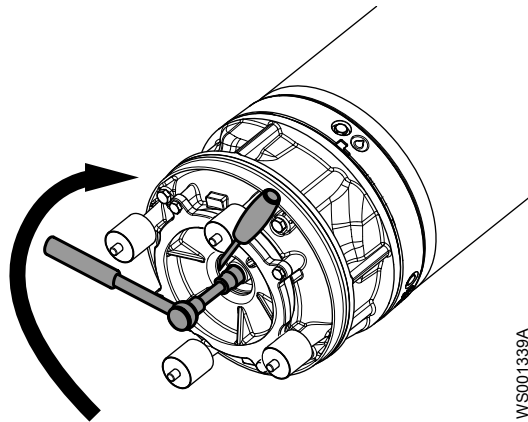
WS001759A

3. Grease the threads of the impeller screw and the washer.  
The proper lubrication of the screw and washer is lubricating grease for assembly of bolts etc., for example, Kluber ALTEMP Q NB 50 or equivalent.
4. Check that the impeller screw is clean and easy to screw into the shaft end.  
This is to prevent the shaft from rotating with the impeller screw.
5. Assemble the conical sleeve in the impeller.  
Make sure that the conical sleeve bottoms in the impeller.



WS001325B

6. Assemble the impeller with the conical sleeve onto the shaft.
7. Press the impeller against the seal housing cover. Turn the adjustment screw clockwise until the clearance between the impeller and the seal housing cover is 0.5-0.7 mm (0.02-0.03 in).
8. Fasten the impeller:
  - a) Place the washer on the impeller screw.
  - b) Lock the impeller to prevent rotation.  
Use pliers, a screwdriver, or similar.
  - c) Tighten the impeller screw.  
Tightening torque: 76 Nm (57 ft-lb)
  - d) Tighten a further 1/8 turn, 45°.  
The screw will be loaded to its yield point and the load capacity of the joint will be higher.



WS001339A

### 6.4.9 Adjust the impeller

Table 11: Applicability

Product code	Pressure class	Open or closed impeller
2190.010	HT	Open
2201.012	MT, HT	Open
2201.020	LT	Open
2201.320	MT, HT	Open
2201.590	MT, HT	Open
2201.690	MT, HT	Open
2201.691	MT, HT	Open

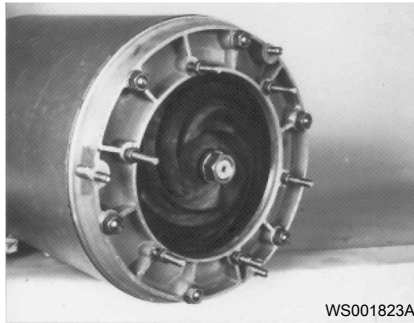
In order for the pump to perform at maximum capacity, the impeller must be adjusted regularly. The impeller clearance should be minimal when the impeller is tightened. Use the adjusting washers to adjust the clearance.

Pumps that are equipped with polyurethane covering are extremely resistant to wear. If the impeller does not rotate freely, then the friction generates a lot of heat. This can result in deformed wear parts, a stuck impeller, or damage to the pump. The impeller clearance should be 0.2-0.3 mm (0.008-0.012 in) when the impeller is tightened.

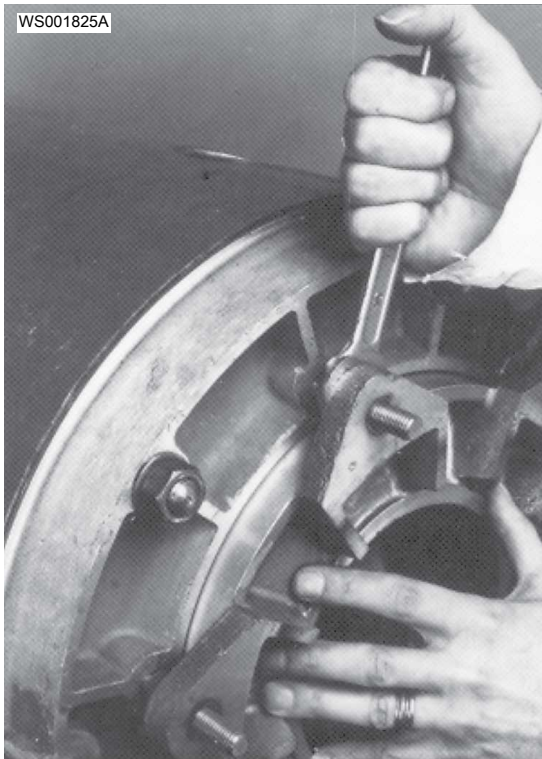


WS001821A

1. Check that the impeller can rotate freely.
2. Turn the adjusting nuts down to the bottom of the studs.  
MT: Check that the spacers are seated on the studs.



3. Fit the O-ring.  
Fit the washers also.
4. Press the suction cover against the impeller.
5. Tighten the adjusting nuts so that they lie flush against the suction cover.



6. Back off all adjusting nuts another half turn (counter-clockwise).
7. Place washers and nuts on the studs. Tighten the nuts evenly all around.
8. Check that the impeller can rotate freely.  
The impeller clearance should be 0.2-0.3 mm (0.008-0.012 in) when the impeller is tightened.
9. Version code 590, 690 and 691: Lock the nuts with tab washers.
10. Install the strainer.

#### 6.4.10 Replace the diffuser

1. Remove the diffuser:
  - a) Remove the impeller, see previous instructions.
  - b) Remove the screws and washers.



c) Remove the diffuser.



2. Install the diffuser:
  - a) Fasten the diffuser in place with the screws and washers.  
Tightening torque: 160-200 Nm (120-150 ft-lb)
  - b) For further instructions, see previous instructions.

# 7 Troubleshooting

## Introduction



### DANGER: Electrical Hazard

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

Follow these guidelines when troubleshooting:

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

## 7.1 The pump does not start



### DANGER: Crush Hazard

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

### 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: <ul style="list-style-type: none"> <li>• The impeller rotates freely.</li> <li>• The sensor indicators do not indicate an alarm.</li> <li>• The overload protection is not tripped.</li> </ul> If the problem still persists: Contact the local sales and service representative.
The pump does not start automatically, but can be started manually.	Check that: <ul style="list-style-type: none"> <li>• The start level regulator is functioning. Clean or replace if necessary.</li> <li>• All connections are intact.</li> <li>• The relay and contactor coils are intact.</li> <li>• The control switch (Man/Auto) makes contact in both positions.</li> </ul> Check the control circuit and functions.
The installation is not receiving voltage.	Check that: <ul style="list-style-type: none"> <li>• The main power switch is on.</li> <li>• There is control voltage to the start equipment.</li> <li>• The fuses are intact.</li> <li>• There is voltage in all phases of the supply line.</li> <li>• All fuses have power and that they are securely fastened to the fuse holders.</li> <li>• The overload protection is not tripped.</li> <li>• The motor cable is not damaged.</li> </ul>

Cause	Remedy
The impeller is stuck.	Clean: <ul style="list-style-type: none"> <li>• The impeller</li> <li>• The sump in order to prevent the impeller from clogging again.</li> </ul>

If the problem persists, contact the local sales and service representative. Always state the serial number of your product, see [Product Description](#) (page 10).

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



### DANGER: Crush Hazard

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

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

If the problem persists, contact the local sales and service representative. Always state the serial number of your product, see [Product Description](#) (page 10).

## 7.3 The pump starts-stops-starts in rapid sequence

Cause	Remedy
The pump starts due to back-flow which fills the sump to the start level again.	Check that: <ul style="list-style-type: none"> <li>• The distance between the start and stop levels is sufficient.</li> <li>• The non-return valve(s) work(s) properly.</li> <li>• The length of the discharge pipe between the pump and the first non-return valve is sufficiently short.</li> </ul>
The self-holding function of the contactor malfunctions.	Check: <ul style="list-style-type: none"> <li>• The contactor connections.</li> <li>• The voltage in the control circuit in relation to the rated voltages on the coil.</li> <li>• The functioning of the stop-level regulator.</li> <li>• Whether the voltage drop in the line at the starting surge causes the contactor's self-holding malfunction.</li> </ul>

If the problem persists, contact the local sales and service representative. Always state the serial number of your product, see [Product Description](#) (page 10).

## 7.4 The pump runs but the motor protection trips



### DANGER: Crush Hazard

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

### 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"> <li>• Clean the impeller.</li> <li>• Clean out the sump.</li> <li>• Check that the impeller is properly trimmed.</li> </ul>
The drive unit is not receiving full voltage on all three phases.	<ul style="list-style-type: none"> <li>• Check the fuses. Replace fuses that have tripped.</li> <li>• If the fuses are intact, then notify a certified electrician.</li> </ul>
The phase currents vary, or they are too high.	Contact the local sales and service representative.
The insulation between the phases and ground in the stator is defective.	<ol style="list-style-type: none"> <li>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 &gt; 5 megaohms.</li> <li>2. If the insulation is less, then do the following: Contact the local sales and service representative.</li> </ol>
The density of the pumped fluid is too high.	Make sure that the maximum density is 1100 kg/m <sup>3</sup> (9.2 lb/US gal) <ul style="list-style-type: none"> <li>• Change the impeller, or</li> <li>• Change to a more suitable pump</li> <li>• Contact the local sales and service representative.</li> </ul>
The ambient temperature exceeds the maximum ambient temperature.	The pump must not be used for such an application.
There is a malfunction in the overload protection.	Replace the overload protection.

If the problem persists, contact the local sales and service representative. Always state the serial number of your product, see [Product Description](#) (page 10).

## 7.5 The pump delivers too little or no water



### DANGER: Crush Hazard

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

### 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"> <li>• If it is a 3-phase pump, then transpose two phase leads.</li> <li>• If it is a 1-phase pump, then do the following: Contact the local sales and service representative.</li> </ul>

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

If the problem persists, contact the local sales and service representative. Always state the serial number of your product, see [Product Description](#) (page 10).



# 8 Technical Reference

## 8.1 Application limits

Data	Description
Media (liquid) temperature	Maximum temperature 40°C (104°F)
pH of the pumped media (liquid)	Version code 2190.010, 2201.012/020: 5-8 Version code 2201.320/590/690/691: 6-11
Media (liquid) density	Maximum density: 1100 kg/m <sup>3</sup> (9.2 lb. per US gal.)
Depth of immersion	20 m (65 ft.)
Other	For specific weight, current, voltage, power rating, and speed of the pump, see the data plate on the pump. For starting current, see <a href="#">Motor data</a> (page 59). For other applications, contact the local sales and service representative for information.

### Motor data

Feature	Description
Motor type	Squirrel-cage induction motor
Frequency	50 or 60 Hz
Supply	3-phase
Starting method	Direct on-line Star-delta
Maximum starts per hour	30 evenly spaced starts per hour
Code compliance	IEC 60034-1
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])

## 8.2 Specific motor data: Version code 2190.010, 2201.012/020

2201.012, 3-phase, 50 Hz, MT, HT

Motor type:

- 2,940 rpm
- 37 kW (50 hp)

Voltage, V	Connection	Rated current, A	Starting current, A
220	D	117	700
230	D	112	740
380	Y	67	405
380	D	67	405
400	Y	65	430
400	D	65	430
415	D	62	350
440	D	59	375
500	D	51	271

Voltage, V	Connection	Rated current, A	Starting current, A
525	D	49	296
550	D	47	310
660	Y	39	231
690	Y	37	246
1000	Y	26	184

## 2190.010, 3-phase, 50 Hz, HT

Motor type:

- 2,910 rpm
- 25 kW (34 hp)

Voltage, V	Connection	Rated current, A	Starting current, A
220	D	79	460
230	D	76	485
380	Y	46	265
380	D	46	258
400	Y	44	280
400	D	43	269
415	D	42	286
440	D	41	305
500	D	35	227
525	D	33	198
550	D	32	209
660	Y	26	150
690	Y	25	158
1000	Y	18	128

## 2201.020, 3-phase, 50 Hz, LT

Motor type:

- 1,465 rpm
- 30 kW (40 hp)

Voltage, V	Connection	Rated current, A	Starting current, A
220	D	108	895
230	D	110	945
380	Y	62	515
380	D	61	485
400	Y	64	550
400	D	61	520
415	D	54	415
440	D	54	450
500	D	45	335
525	D	44	355
550	D	45	375
660	Y	35	281
690	Y	35	297

**2201.012, 3-phase, 60 Hz, MT, HT**

Motor type:

- 3,540 rpm
- 43 kW (58 hp)

Voltage, V	Connection	Rated current, A	Starting current, A
200	D	152	725
208	D	144	760
220	D	136	810
220	D//	134	710
230	D	133	895
230	D//	127	750
380	Y	78	465
380	Y//	77	410
400	Y	76	520
400	Y//	73	435
440	DSER	67	355
440	D	68	405
460	DSER	64	375
460	D	65	480
480	D	65	470
575	D	52	249
600	D	50	284

**2190.010, 3-phase, 60 Hz, HT**

Motor type:

- 3,510 rpm
- 29 kW (39 hp)

Voltage, V	Connection	Rated current, A	Starting current, A
220	D//	91	555
230	D//	87	585
380	Y//	53	320
400	Y//	50	340
440	DSER	46	277
440	D	46	260
460	DSER	43	292
460	D	44	274
480	D	42	287
575	D	35	227
600	D	33	238

**2201.020, 3-phase, 60 Hz, LT**

Motor type:

- 1,760 rpm
- 37 kW (50 hp)

Voltage, V	Connection	Rated current, A	Starting current, A
200	D	138	885

Voltage, V	Connection	Rated current, A	Starting current, A
208	D	130	940
220	D//	123	865
230	D//	119	915
400	D	72	605
380	D	73	565
460	DSER	59	455
400	Y//	68	530
440	DSER	61	430
380	Y//	71	495
440	D	65	495
460	D	64	480
480	D	63	520
575	D	48	305
600	D	46	360

### 8.3 Specific motor data: Version code 2201.320/590/690/691

3-phase, 50 Hz

Motor type:

- 2,900 rpm
- 37 kW (50 hp)

Voltage (V)	Rated current (A)	Starting current (A)
380 D	67	375
400 D	64	310
415 D	61	325
440 D	58	350
500 D	51	305
550 D	46	285
1,000 D	25	132
1,100 D	23	145

3-phase, 60 Hz

Motor type:

- 3,400 rpm
- 42.7 kW (57.2 hp)

Voltage (V)	Rated current (A)	Starting current (A)
440 D	68	375
460 D	65	395
575	52	305

## 8.4 Dimensions and weights

Version code 2190.010 2201.012 2201.020

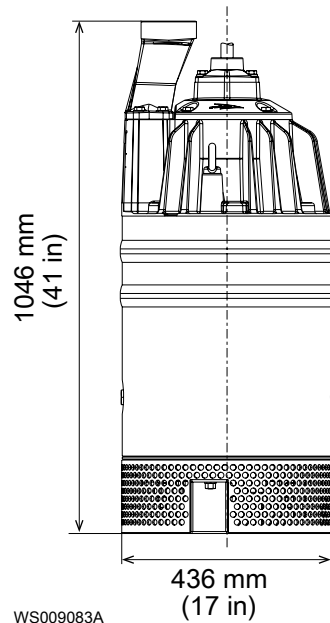


Figure 12: HT

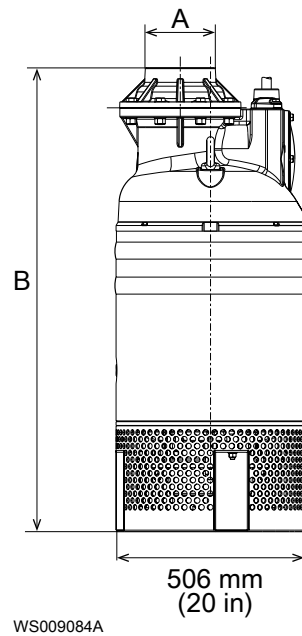


Figure 13: LT, MT

Table 12: Dimensions LT, MT

A	B
6 in (152 mm) (hose)	1332 mm (52.4 in)
8 in (203 mm) (hose)	1302 mm (51.3 in)
ISO-G6, NPT 6	1227 mm (48.3 in)
ISO-G8, NPT 8	1217 mm (47.9 in)

Table 13: Weight without motor cable

MT	280 kg (618 lbs)
2201 HT	240 kg (530 lbs)
2190 HT	210 kg (463 lbs)
SH	270 kg (595 lbs)
LT	285 kg (628 lbs)

Version code 320/590/690/691

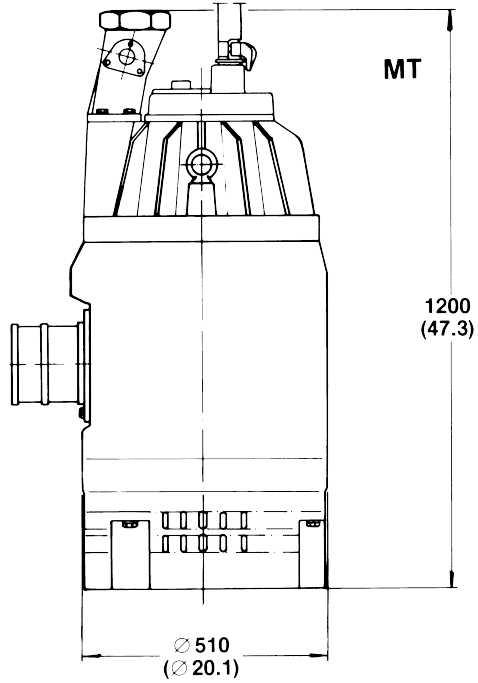


Figure 14: MT

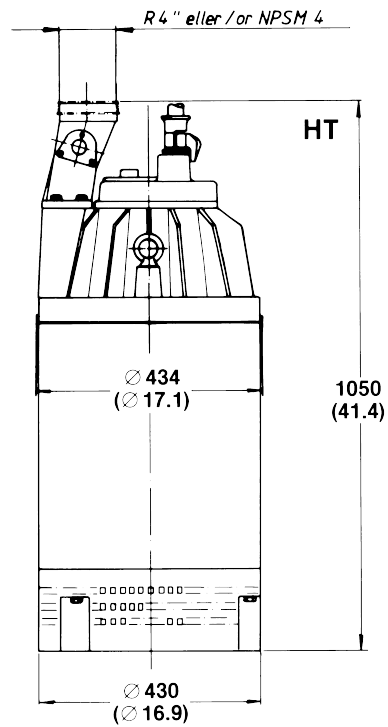


Figure 15: HT

Table 14: Weight without motor cable

MT	445 kg (980 lbs)
HT	350 kg (770 lbs)

## 8.5 Performance curves

### Test standard

Pumps are tested in accordance with ISO 9906:2012, HI 11.6:2012.

2190.010

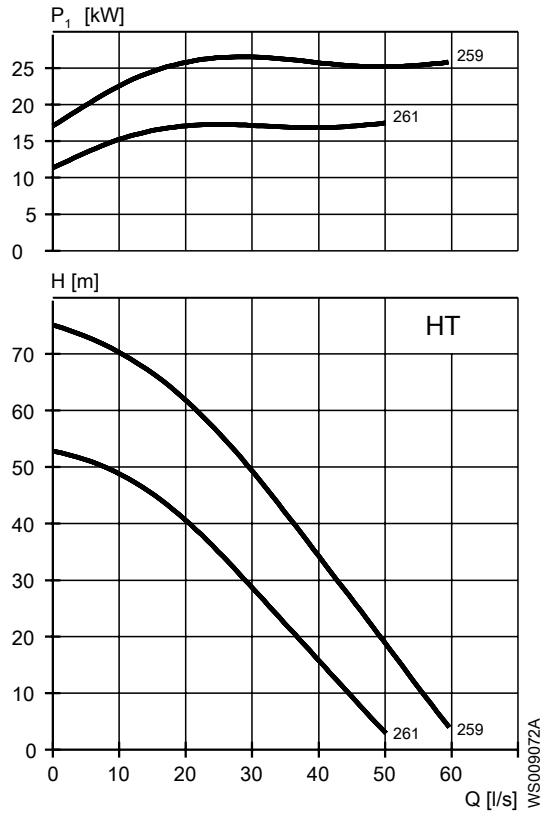


Figure 16: 50 Hz, HT

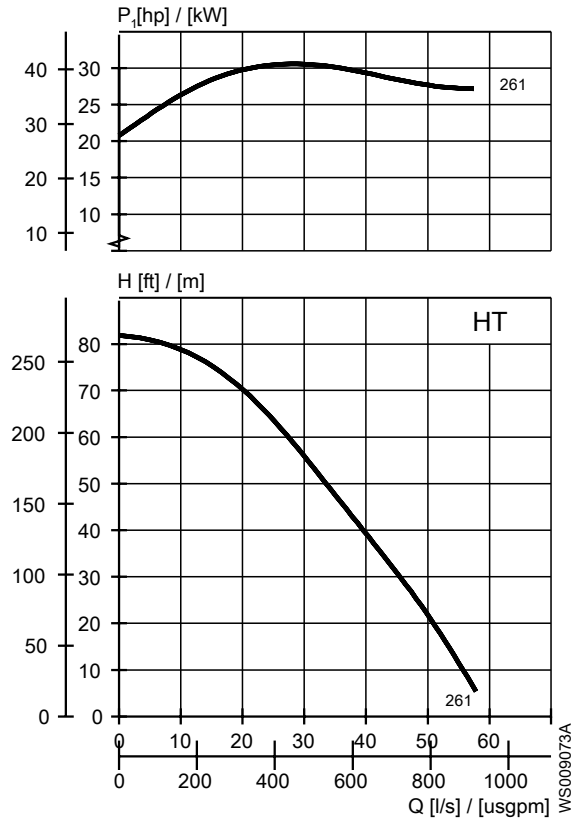


Figure 17: 60 Hz, HT



2201.012

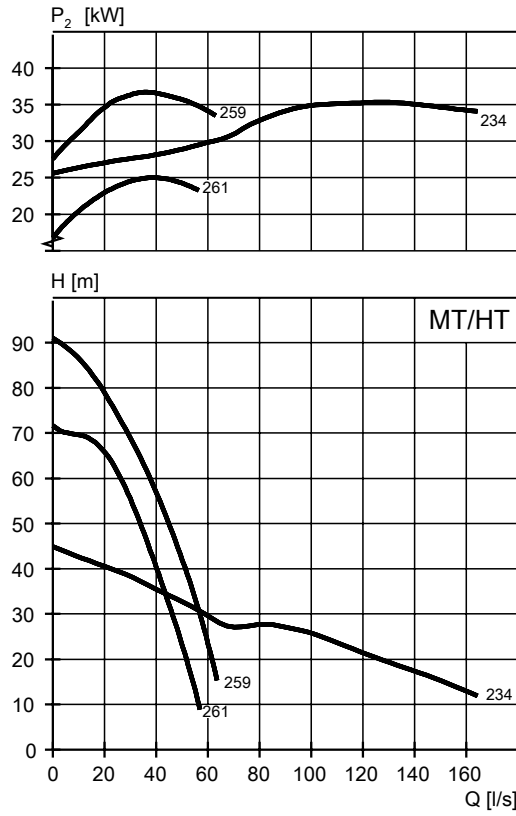


Figure 18: 50 Hz, MT, HT

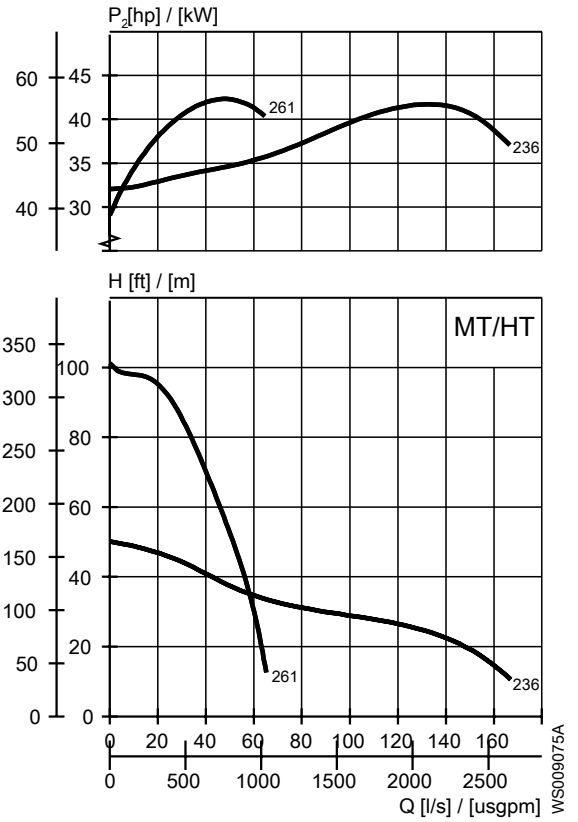


Figure 19: 60 Hz, MT, HT

2201.020

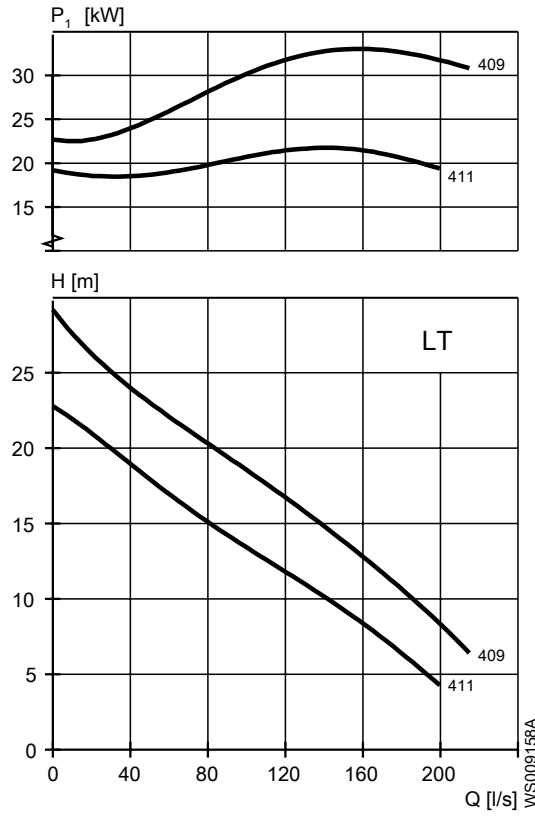


Figure 20: 50 Hz, LT

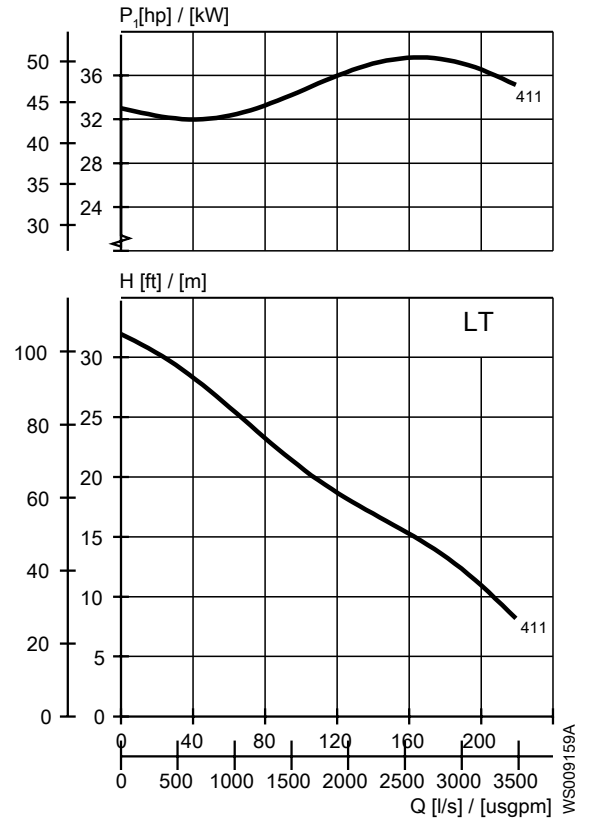


Figure 21: 60 Hz, LT

2201.320

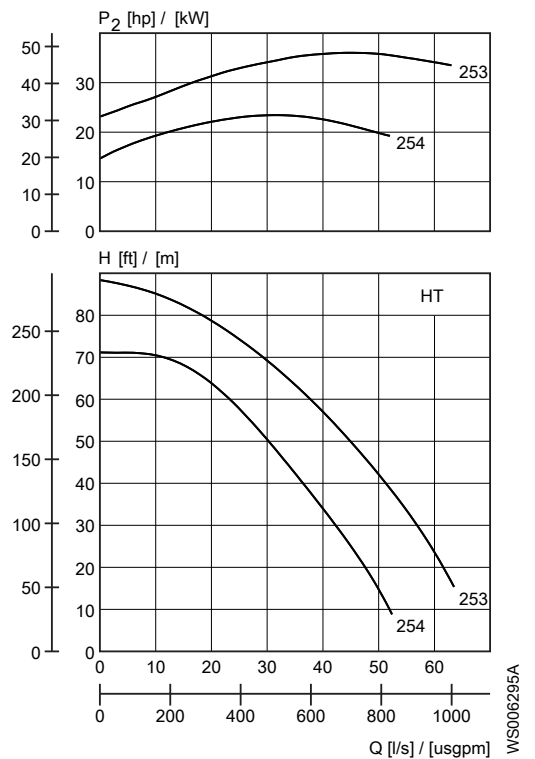


Figure 22: 50 Hz, HT

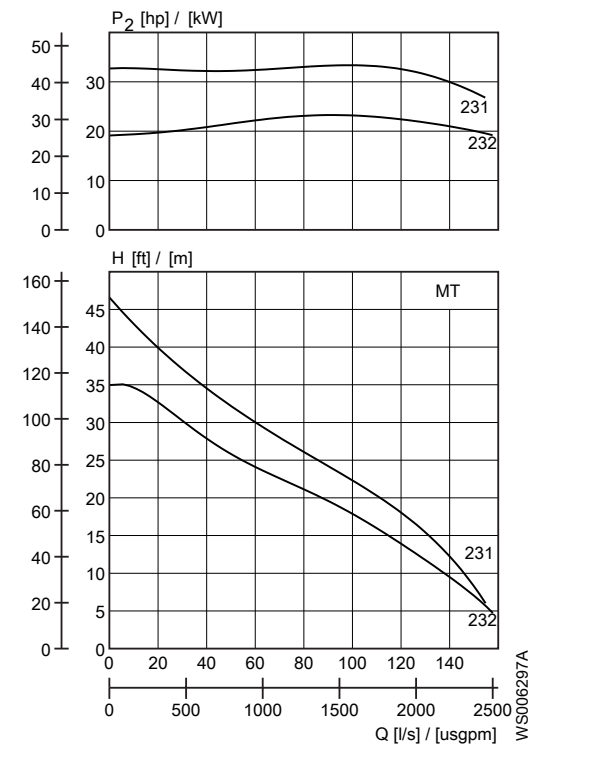


Figure 23: 50 Hz, MT

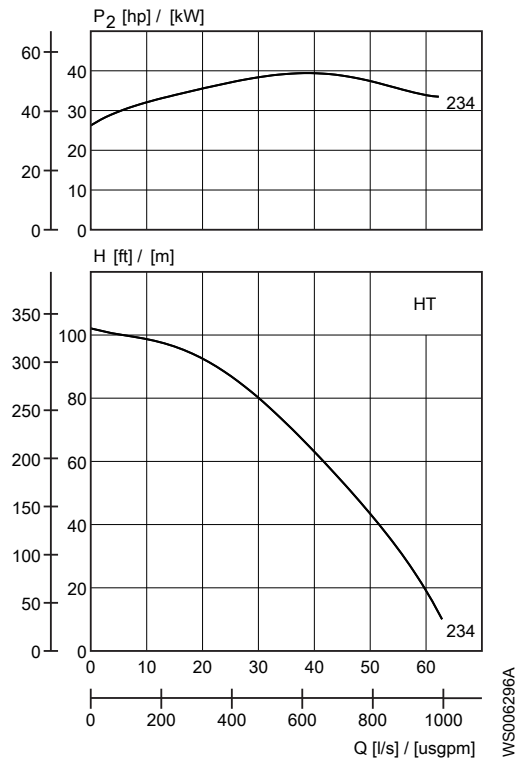


Figure 24: 60 Hz, HT

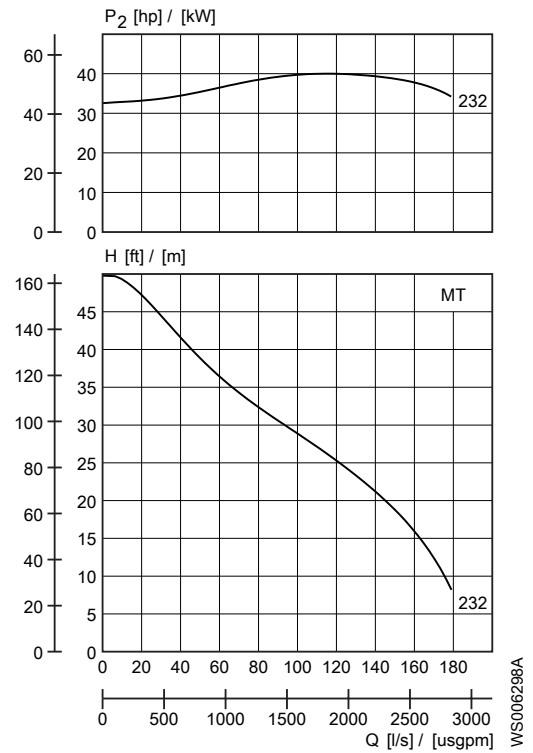


Figure 25: 60 Hz, MT

2201.590, 2201.690, 2201.691

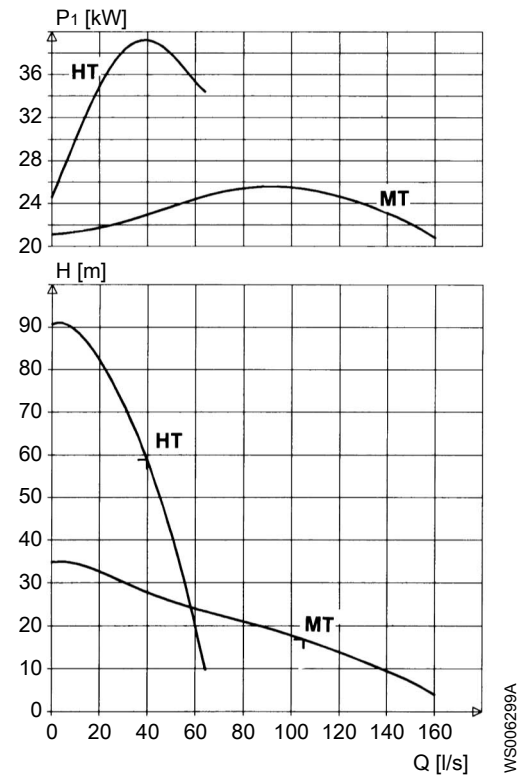


Figure 26: 50 Hz, 37 kW

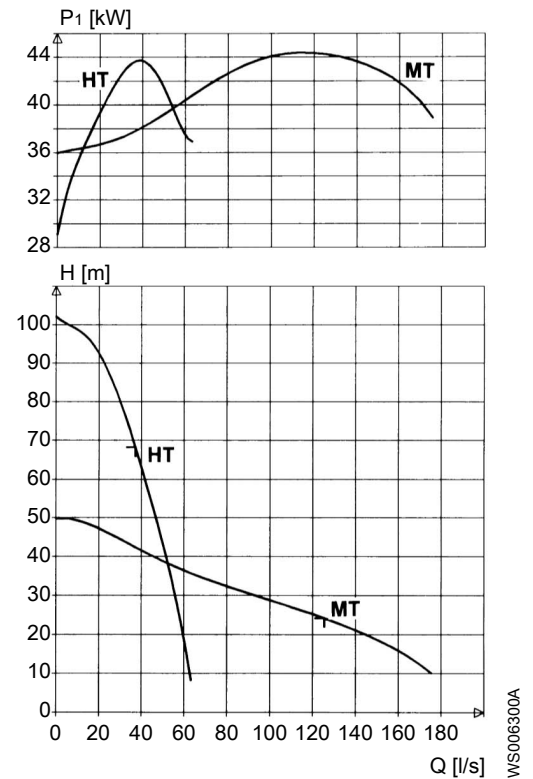


Figure 27: 60 Hz, 42.7 kW (58 hp)

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