



C3300/6x5, C/R3231, C3240, C3306, C3312,
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C3800

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Introduction and Safety

Introduction

Purpose of this manual

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

- Installation
- Operation
- Maintenance



CAUTION:

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

NOTICE:

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

Product warranty

Coverage

Xylem undertakes to remedy defects in products from Xylem under these conditions:

- The faults are due to defects in design, materials, or workmanship.
- The faults are reported to a local sales and service representative within the warranty period.
- The product is used only under the conditions that are described in this manual.
- The monitoring equipment that is incorporated in the product is correctly connected and in use.
- All service and repair work that is done by Xylem authorized personnel.
- Genuine Xylem parts are used.
- Only Ex-approved spare parts and accessories that are authorized by an Ex-approved Xylem representative are used in Ex-approved products.

Limitations

The warranty does not cover defects that are caused by these situations:

- Deficient maintenance
- Improper installation
- Modifications or changes to the product and installation that are made without consulting a Xylem authorized representative
- Incorrectly executed repair work
- Normal wear and tear

Xylem assumes no liability for these situations:

- Bodily injuries
- Material damages
- Economic losses

Warranty claim

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

Spare parts

Xylem guarantees that spare parts will be available for 20 years after the manufacture of this product has been discontinued.

Safety



WARNING:

- The operator must be aware of safety precautions to prevent physical injury.
- Any pressure-containing device can explode, rupture, or discharge its contents if it is over-pressurized. Take all necessary measures to avoid over-pressurization.
- Operating, installing, or maintaining the unit in any way that is not covered in this manual could cause death, serious personal injury, or damage to the equipment. This includes any modification to the equipment or use of parts not provided by Xylem. If there is a question regarding the intended use of the equipment, please contact a Xylem representative before proceeding.
- Do not change the service application without the approval of an authorized Xylem representative.



CAUTION:

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

Safety message levels

About safety messages

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

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

Definitions

Safety message level	Indication
<p>DANGER:</p>	A hazardous situation which, if not avoided, will result in death or serious injury
<p>WARNING:</p>	A hazardous situation which, if not avoided, could result in death or serious injury
<p>CAUTION:</p>	A hazardous situation which, if not avoided, could result in minor or moderate injury
<p>Electrical Hazard:</p>	The possibility of electrical risks if instructions are not followed in a proper manner

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

User safety

General safety rules

These safety rules apply:

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

Safety equipment

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

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

NOTICE:

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

Electrical connections

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

Hazardous liquids

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

- Make sure that all personnel who work with biologically hazardous liquids are vaccinated against diseases to which they may be exposed.
- Observe strict personal cleanliness.

Wash the skin and eyes

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

Condition	Action
Chemicals or hazardous fluids in eyes	<ol style="list-style-type: none"> 1. Hold your eyelids apart forcibly with your fingers. 2. Rinse the eyes with eyewash or running water for at least 15 minutes. 3. Seek medical attention.

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

Ex-approved products

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

Personnel requirements

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

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

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

Product and product handling requirements

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

- Only use the product in accordance with the approved motor data.
- The Ex-approved product must never run dry during normal operation. Dry running during service and inspection is only permitted outside the classified area.
- Before you start work on the product, make sure that the product and the control panel are isolated from the power supply and the control circuit, so they cannot be energized.
- Do not open the product while it is energized or in an explosive gas atmosphere.
- Make sure that thermal contacts are connected to a protection circuit according to the approval classification of the product, and that they are in use.
- Intrinsically safe circuits are normally required for the automatic level-control system by the level regulator if mounted in zone 0.
- The yield stress of fasteners must be in accordance with the approval drawing and the product specification.
- Do not modify the equipment without approval from an Ex-approved Xylem representative.
- Only use parts that are provided by an Ex-approved Xylem representative.
- Some gap and diametrical clearances could be less than the values specified in table 1 in the standard EN 60079-1. Contact Xylem for any maintenance on flameproof joints.

Guidelines for compliance

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

Minimum permitted liquid level

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

Monitoring equipment

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

- Level indicators
- Temperature detectors

Environmental safety

The work area

Always keep the station clean.

Waste and emissions regulations

Observe these safety regulations regarding waste and emissions:

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



WARNING:

Radiation Hazard. Do NOT send the product to Xylem if it has been exposed to any nuclear radiation.

Electrical installation

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

Transportation and Storage

Inspect the delivery

Inspect the package

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

Inspect the unit

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

Transportation guidelines

Precautions



DANGER:

Disconnect and lock out electrical power before installing or servicing the unit.



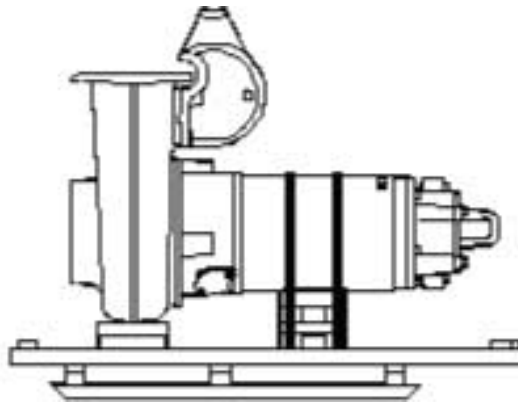
WARNING:

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

Position and fastening

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

Horizontal position



WS001649A

Figure 1: Horizontal position for transport

The impeller/propeller must be locked during transportation, if the unit is transported in the horizontal position.

Vertical position

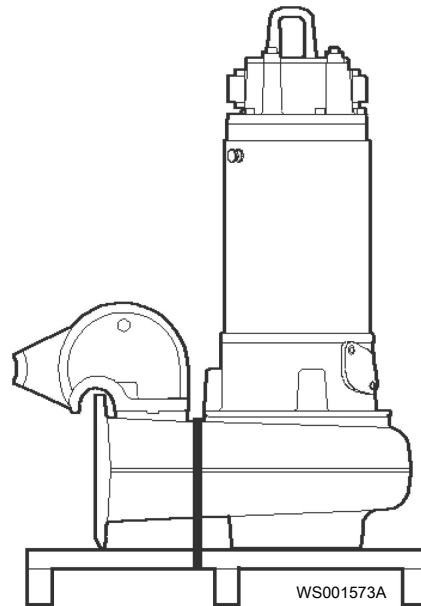


Figure 2: Vertical position for transport

The impeller/propeller must also be locked during transportation.

Lifting



WARNING:

Crush Hazard.

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

Lifting equipment and tackle should always be inspected before starting work.

Lifting equipment

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

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

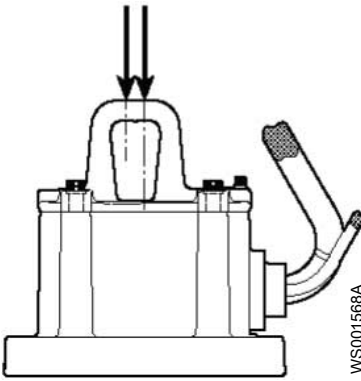
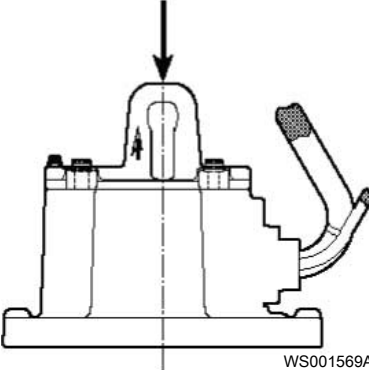
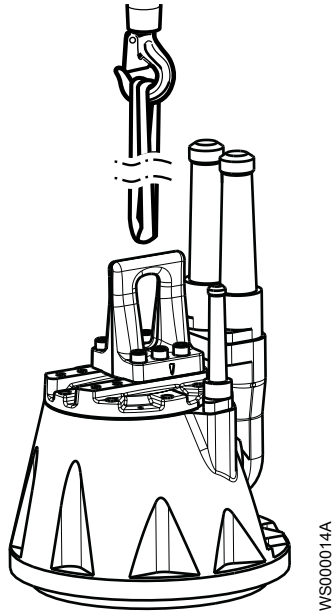
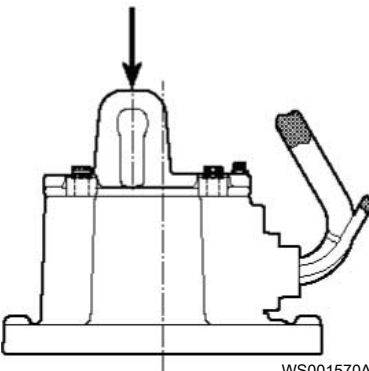
NOTICE:

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

Lifting link placement for vertical lifting

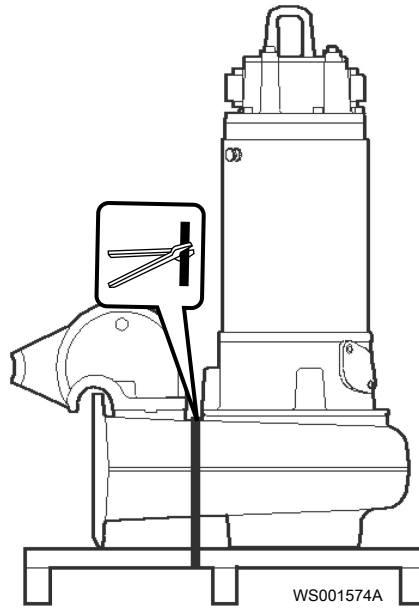
Use the following lifting link configurations to lift the pump in the vertical position.

When lifting only the drive unit for C3400-C3602 units, the lifting cover must be turned 180°.

<p>The left arrow indicates placement of the lifting link when lifting the complete unit with 605-675 drive units. The right arrow indicates placement for lifting the drive unit only.</p>  <p>WS001568A</p> <p>Figure 3: Drive units 605-675</p>	<p>Placement for lifting either the drive unit only, or the complete unit C3231-C3356, with 705-776 drive units.</p>  <p>WS001569A</p> <p>Figure 4: Drive units 705-776</p>
 <p>WS000014A</p> <p>Figure 5: Drive units 805-998</p> <p>For 805-998 drive units, the lifting link must be positioned so that the complete unit hangs forward with an incline of 0-2° in relation to the vertical axis.</p>	<p>Placement for lifting the complete unit C3400-C3602, with 705-776 drive units:</p>  <p>WS001570A</p> <p>Figure 6: Drive units 705-776</p>

Lift pump from vertical position and remove transport pallet

1. Fasten a suitable lifting strap or sling to the lifting eye on the top of the drive unit. See [Lifting](#) (page 9).
2. Cut the transportation strap.



3. Lift the pump using proper lifting equipment.
4. Place the pump upright on a rigid horizontal surface so that it cannot fall over.

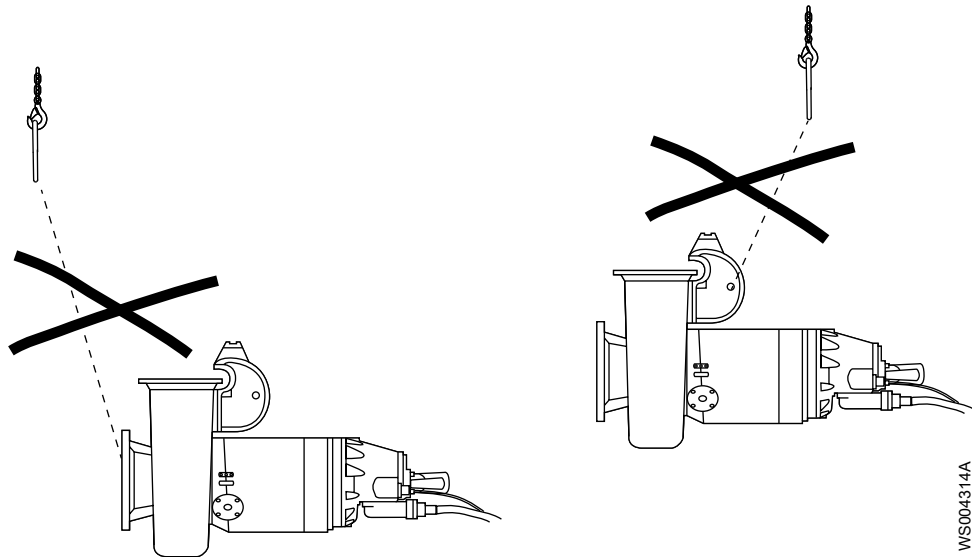
Lift pump from horizontal position and remove transport pallet



WARNING:
Stay clear of suspended loads.



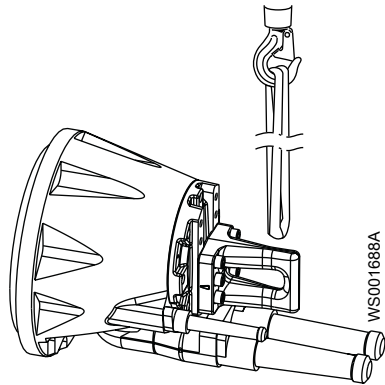
CAUTION:
An assembled pump must never be lifted by the holes in the hydraulic unit.



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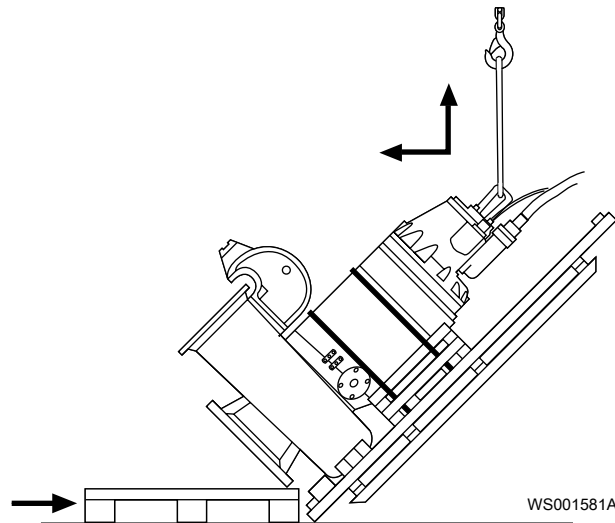
NOTICE:

- When handling the pump to and from horizontal position, the pump should always be lifted by the lifting link. Use a suitable lifting sling/strap.



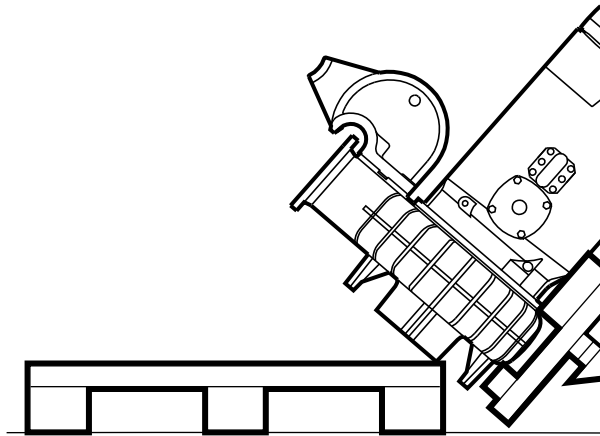
Lift with single-hook equipment

1. Fasten a suitable lifting sling/strap to the lifting eye on the top of the drive unit.
See [Lifting](#) (page 9).
2. Raise the unit approximately halfway to its upright position.
The unit is still attached to the transport pallet.
3. Slide a pallet or similar object under the inlet section.
This will minimize the jolt which may occur later in the lifting, when the unit is almost fully upright.



For C3231: Make sure that the support columns on C3231 are outside the pallet, as they may break if used as support when raising. See the following figure.

WS001592A



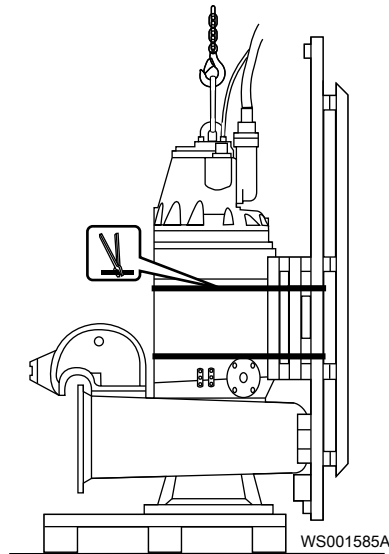
4. Continue raising the unit until it is in an upright position.
The unit may jolt or sway near the end of the lifting operation.



WARNING:

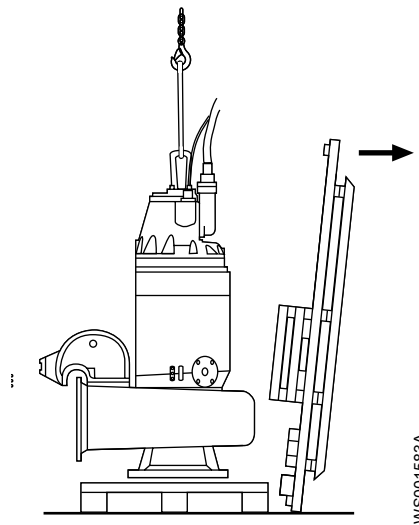
Keep a safe distance while the unit is moving.

5. Remove the straps holding the unit to the transport pallet.

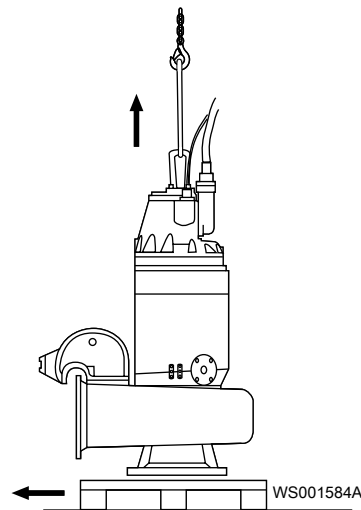


WS001585A

6. Remove the transport pallet.



7. Lift the unit and remove the support pallet.



8. Place the unit upright on a rigid horizontal surface so that it cannot fall over.

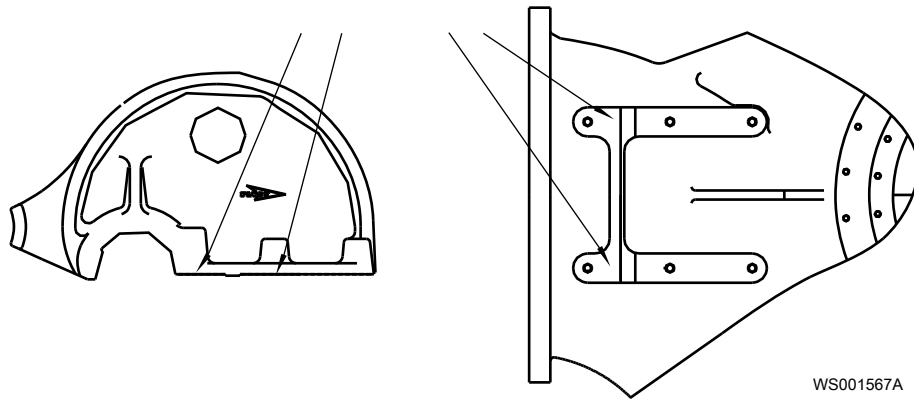
Lift with double-hook equipment (recommended)

1. Fasten a suitable lifting sling/strap to the lifting eye on the top of the drive unit.
See [Lifting](#) (page 9).
2. Fasten a sling around the hydraulic unit.
3. Remove the straps securing the unit to the transport pallet.
4. Lift the unit.
5. Place the unit upright on a rigid horizontal surface so that it cannot fall over.

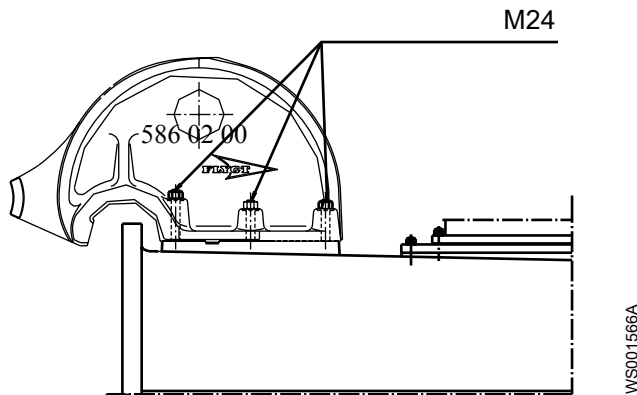
Install the guide claw (3800 only)

The guide claw is delivered detached from the unit.

1. Clean the contact surfaces shown with arrows in the figure below.



2. Tighten the M24 nuts.
Tightening torque: 629 Nm (464 ft-lbs).



Temperature ranges for transportation, handling and storage

Handling at freezing temperature

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

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

NOTICE:

Never use a naked flame to thaw the unit.

Unit in as-delivered condition

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

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

Lifting the unit out of liquid

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

Units equipped with an internal cooling system are filled with a mixture of water and 30% glycol. This mixture remains a flowing liquid at temperatures down to -13°C (9°F). Below -13°C (9°F), the viscosity increases such that the glycol mixture will lose its flow properties.

However, the glycol-water mixture will not solidify completely and thus cannot harm the product.

Follow these guidelines to avoid freezing damage:

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

Storage guidelines

Storage location

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

NOTICE:

- Protect the product against humidity, heat sources, and mechanical damage.
- Do not place heavy weights on the packed product.

Freezing precautions

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

Follow these guidelines to avoid freezing damage:

When	Guideline
Before storage	<ul style="list-style-type: none"> • The unit must be allowed to run for a short time after raising it to discharge remaining pumped liquid. <p>This does not apply to impeller/propeller units.</p> <ul style="list-style-type: none"> • The discharge opening must be covered in a suitable way, or placed facing down so that any still remaining pumped liquid runs out. • If present, the cooling jacket must be drained manually by opening the air vent screws at the top of the cooling jacket.
After storage	<p>If the impeller/propeller is frozen, it must be thawed by immersing the unit in liquid before operating the unit.</p> <hr/> <p>NOTICE: Never use a naked flame to thaw the unit.</p>

Long-term storage

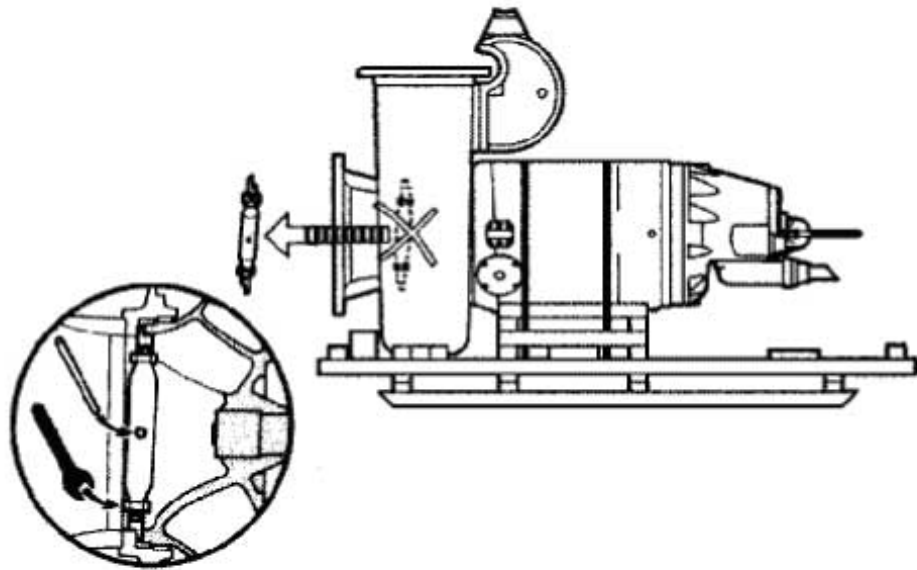
If the unit is stored more than six months, then the following apply:

- 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.

Reinstall the locking device

If the unit will be transported in the horizontal position, then the impeller/propeller must be locked during transport with the locking device.

1. Reinstall the locking device.



WS001582A

2. Clamp the locking device into position by turning and locking it by hand as tightly as possible.
3. Tighten a further 1/8 to 1/3 of a turn according to the torque specified in the cross-sectional drawing in the Part List.

Product Description

Pump design

Intended Use

The product is intended for moving wastewater, sludge, raw and clean water. Always follow the limits that are given in [Application limits](#) (page 115). If there is a question regarding the intended use of the equipment, please contact a Xylem representative before proceeding.



WARNING:

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

NOTICE:

Do NOT use the pump in highly corrosive liquids.

Spare part requirements

The following applies when servicing or repairing the pump:

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

Drive units

C3231

Voltage range	Standard drive units	Explosion-proof drive units	Maximum number of starts per hour
Up to 1 kV	605	615	15
	665	675	15
Up to 1 kV	705	715	15
	735	745	15
	765	775	15
Up to 1 kV	706	716	8
	736	746	8
	766	776	8

C3240

Voltage range	Standard drive units	Explosion-proof drive units	Maximum number of starts per hour
Up to 1 kV	805	815	15
	835	845	15
	865	875	15
	885	895	8
1.2-6.6 kV	862	872	15
	882	892	8

C3300

Voltage range	Standard drive units	Explosion-proof drive units	Maximum number of starts per hour
Up to 1 kV	605	615	15
	665	675	15

C3306

Voltage range	Standard drive units	Explosion-proof drive units	Maximum number of starts per hour
Up to 1 kV	605	615	15
	665	675	15
Up to 1 kV	705	715	15
	735	745	15
	765	775	15
Up to 1 kV	706	716	8
	736	746	8
	766	776	8

C3312

Voltage range	Standard drive units	Explosion-proof drive units	Maximum number of starts per hour
Up to 1 kV	705	715	15
	735	745	15
	765	775	15
Up to 1 kV	706	716	8
	736	746	8
	766	776	8
Up to 1 kV	835	845	15
	865	875	15
	885	895	8
1.2-6.6 kV	862	872	15
	882	892	8

C3351

Voltage range	Standard drive units	Explosion-proof drive units	Maximum number of starts per hour
Up to 1 kV	905	915	8
	935	945	8
	965	975	8
1.2-6.6 kV	950	960	8
	985	995	8
	988	998	8

C3356

Voltage range	Standard drive units	Explosion-proof drive units	Maximum number of starts per hour
Up to 1 kV	605	615	15
	665	675	15
Up to 1 kV	705	715	15
	735	745	15
	765	775	15
Up to 1 kV	706	716	8
	736	746	8
	766	776	8

C3400

Voltage range	Standard drive units	Explosion-proof drive units	Maximum number of starts per hour
Up to 1 kV	705	715	15
	735	745	15
	765	775	15
Up to 1 kV	706	716	8
	736	746	8
	766	776	8
Up to 1 kV	805	815	15
	835	845	15
	865	875	15
	885	895	8
1.2-6.6 kV	862	872	15
	882	892	8

C3501

Voltage range	Standard drive units	Explosion-proof drive units	Maximum number of starts per hour
Up to 1 kV	705	715	15
	735	745	15
	765	775	15
Up to 1 kV	706	716	8
	736	746	8
	766	776	8
Up to 1 kV	805	815	15
	835	845	15
	865	875	15
	885	895	8
1.2-6.6 kV	862	872	15
	882	892	8

C3531

Voltage range	Standard drive units	Explosion-proof drive units	Maximum number of starts per hour
Up to 1 kV	705	715	15
	735	745	15
	765	775	15
Up to 1 kV	706	716	8
	736	746	8
	766	776	8
Up to 1 kV	805	815	15
	835	845	15
	865	875	15
	885	895	8
Up to 1 kV	905	915	8
	935	945	8
	965	975	8
1.2-6.6 kV	862	872	15
	882	892	8
	950	960	8
	985	995	8
	988	998	8

C3602

Voltage range	Standard drive units	Explosion-proof drive units	Maximum number of starts per hour
Up to 1 kV	735	745	15
	765	775	15
Up to 1 kV	736	746	8
	766	776	8
Up to 1 kV	805	815	15
	835	845	15
	865	875	15
	885	895	8
Up to 1 kV	905	915	8
	935	945	8
1.2-6.6 kV	862	872	15
	882	892	8
	950	960	8
	985	995	8
	988	998	8

C3800

Voltage range	Standard drive units	Explosion-proof drive units	Maximum number of starts per hour
Up to 1 kV	905	915	8
	935	945	8
	965	975	8
1.2-6.6 kV	950	960	8
	985	995	8
	988	998	8

Monitoring systems: MAS 711 and CAS

Monitoring system identification

The monitoring system appears on the data plate on the drive unit, in the "Additional Information" field.

MAS 711 system

MAS 711 is the standard monitoring equipment.

Pumps with the standard MAS 711 equipment with a 12-lead auxiliary cable are mounted with the following items:

- Thermal switches for stator temperature monitoring (3 in series) or PTC-thermistors
- Leakage sensor in the stator housing
- Leakage sensor in the junction box
- Analogue temperature sensor (Pt100) for main bearing temperature monitoring
- Analogue temperature sensor (Pt100) for stator winding temperature in one phase
- Pump memory

Pumps with the optional MAS equipment with a 24-lead auxiliary cable are mounted with the following possible options:

- Vibration sensor VIS10
- Analogue temperature sensor (Pt100) for stator winding temperature in phases 2 and 3
- Leakage sensor in the oil housing (CLS)
- Analogue temperature sensor (Pt100) for support bearing temperature monitoring

CAS system

Older pumps may be installed with the CAS system.

Pumps with the standard CAS equipment 12-lead auxiliary cable are mounted with the following items:

- Thermal switches for stator temperature monitoring (3 in series) or PTC-thermistors
- Leakage sensor in the stator housing
- Leakage sensor in the junction box
- Analogue temperature sensor (Pt100) for main bearing temperature monitoring

Pumps with the optional CAS equipment with a 12-lead auxiliary cable are mounted with the following possible options:

- Leakage sensor in the oil housing (CLS)
- Analogue temperature sensor (Pt100) for support bearing temperature monitoring. (Requires separate Pt100 relay.)

Pumps with the optional CAS equipment 24-lead auxiliary cable have the same options as for the 12-lead cable, and two additional analogue temperature sensors (Pt100) for stator winding temperature in 3 phases. (Requires additional Pt100 relays.)

The CAS system has been replaced by the MAS system. CAS is no longer available as a spare part, but if necessary CAS may be replaced by the MAS 711 together with the MRM-01 relay.

Pt100 resistance

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

T, °C	R, ohms	T, °C	R, ohms	T, °C	R, ohms	T, °C	R, ohms	T, °C	R, ohms
0	100.00	33	112.83	66	125.54	99	138.12	132	150.57
1	100.39	34	113.22	67	125.92	100	138.50	133	150.95
2	100.78	35	113.61	68	126.31	101	138.88	134	151.33
3	101.17	36	113.99	69	126.69	102	139.26	135	151.70
4	101.56	37	114.38	70	127.07	103	139.64	136	152.08
5	101.95	38	114.77	71	127.45	104	140.02	137	152.45
6	102.34	39	115.15	72	127.84	105	140.39	138	152.83
7	102.73	40	115.54	73	128.22	106	140.77	139	153.20
8	103.12	41	115.93	74	128.60	107	141.15	140	153.58
9	103.51	42	116.31	75	128.98	108	141.53	141	153.95
10	103.90	43	116.70	76	129.37	109	141.91	142	154.32
11	104.29	44	117.08	77	129.75	110	142.29	143	154.70
12	104.68	45	117.47	78	130.13	111	142.66	144	155.07
13	105.07	46	117.85	79	130.51	112	143.04	145	155.45
14	105.46	47	118.24	80	130.89	113	143.42	146	155.82
15	105.85	48	118.62	81	131.27	114	143.80	147	156.19
16	106.24	49	119.01	82	131.66	115	144.17	148	156.57
17	106.63	50	119.40	83	132.04	116	144.55	149	156.94
18	107.02	51	119.78	84	132.42	117	144.93	150	157.31
19	107.40	52	120.16	85	132.80	118	145.31	151	157.69
20	107.79	53	120.55	86	133.18	119	145.68	152	158.06
21	108.18	54	120.93	87	133.56	120	146.06	153	158.43
22	108.57	55	121.32	88	133.94	121	146.44	154	158.81
23	108.96	56	121.70	89	134.32	122	146.81	155	159.18
24	109.35	57	122.09	90	134.70	123	147.19	156	159.55
25	109.73	58	122.47	91	135.08	124	147.57	157	159.93
26	110.12	59	122.86	92	135.46	125	147.94	158	160.30
27	110.51	60	123.24	93	135.84	126	148.32	159	160.67
28	110.90	61	123.62	94	136.22	127	148.70	160	161.04
29	111.28	62	124.01	95	136.60	128	149.07		
30	111.67	63	124.39	96	136.98	129	149.45		
31	111.94	64	124.77	97	137.36	130	149.82		
32	112.45	65	125.16	98	137.74	131	150.20		

The MAS 711 monitoring equipment

The MAS 711 system

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

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

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

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

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

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

- Temperature:
 - Main bearing
 - Support bearing
 - Stator winding
- Vibration
- Leakage:
 - In the stator housing or inspection chamber
 - In the junction box
 - Water in the oil chamber (not applicable for 7X6 drive units)
- Power monitoring

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

Pump current

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

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

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

Sensors, drive units up to 1 kV

The drive units in this voltage range are shown in [Drive units](#) (page 18).

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

Parameter Monitored	Sensor	Signal Cable, Number of Leads Required	Standard or Optional
Vibration	VIS 10	24	Optional
Leakage in the junction box	Float Switch Leakage Sensor (FLS)	12	Standard
Stator winding temperature in one phase	Pt100 analogue temperature sensor in 1 stator winding	12	Standard
Stator winding temperature	Thermal switches (3), or	12	Standard
	PTC-thermistors (3)	24	Optional
Stator winding temperature in phases 2 and 3	Pt100 analogue temperature sensors in 2 additional stator windings	24	Optional
Main bearing temperature	Pt100 analogue temperature sensor	12	Standard
Leakage in the stator housing or inspection chamber	Float Switch Leakage Sensor (FLS)	12	Standard
Water in oil: standard drive units only. (Not applicable for 7X6 drive units.)	Capacitive Leakage Sensor (CLS)	24	Optional
Support bearing temperature	Pt100 analogue temperature sensor	24	Optional

Parameter Monitored	Sensor	Signal Cable, Number of Leads Required	Standard or Optional
Pump memory	Printed circuit board for pump memory includes a temperature sensor.	12	Standard
Pump current	A current transformer in the control cabinet is required.		
Power monitoring	Separate electronic instrument using three current transformers.		Optional

For more information on the stator temperature monitoring, see [Stator temperature monitoring methods](#) (page 31).

Sensors, drive units 1.2 - 6.6 kV

The drive units in this voltage range are shown in [Drive units](#) (page 18).

Table 2: Sensors for pumps using 1.2 - 6.6 kV drive units

Description	Sensor	Signal Cable, Number of Leads Required	Standard or Optional
Vibration	VIS 10	24	Optional
Leakage in the junction box	Float Switch Leakage Sensor (FLS)	24	Standard
Stator winding temperature	PTC-thermistors (3+3)	24	Standard
Stator winding temperature in phases 1, 2 and 3	Pt100 analogue temperature sensors in each stator winding (3+3) ¹	24	Standard
Main bearing temperature	Pt100 analogue temperature sensor	24	Standard
Leakage in the stator housing	Float Switch Leakage Sensor (FLS)	24	Standard
Water in oil: standard drive units only	Capacitive Leakage Sensor (CLS)	24	Optional
Support bearing temperature	Pt100 analogue temperature sensor	24	Optional
Pump memory	Printed circuit board for pump memory includes a temperature sensor.	24	Standard
Pump current	A current transformer in the control cabinet is required.		
Power monitoring	Separate electronic instrument using three current transformers.		Optional

For more information on the stator temperature monitoring, see [Stator temperature monitoring methods](#) (page 31).

Signal cables

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

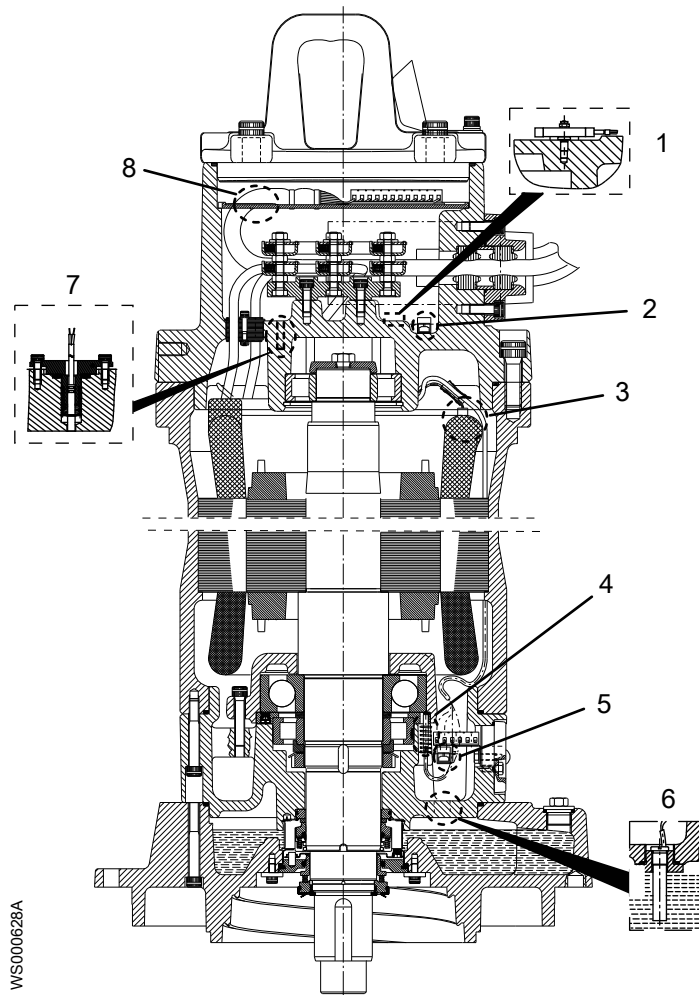
- 12x1.5 mm² (unscreened, also known as unshielded). Conductors 1-12.
- 24x1.5 mm² (unscreened, also known as unshielded). Conductors 1-24.
- S12x1.5 mm² (screened, also known as shielded). Conductors 1-12.
- S24x1.5 mm² (screened, also known as shielded). Conductors 1-24.

The number of conductors required to connect the sensors to the monitoring system depends on the number and type of sensors being used. Medium-voltage (1.2-6.6 kV) drive units always have 24 signal cable leads.

¹ 6 total: 3 sensors are connected and 3 are built-in spares.

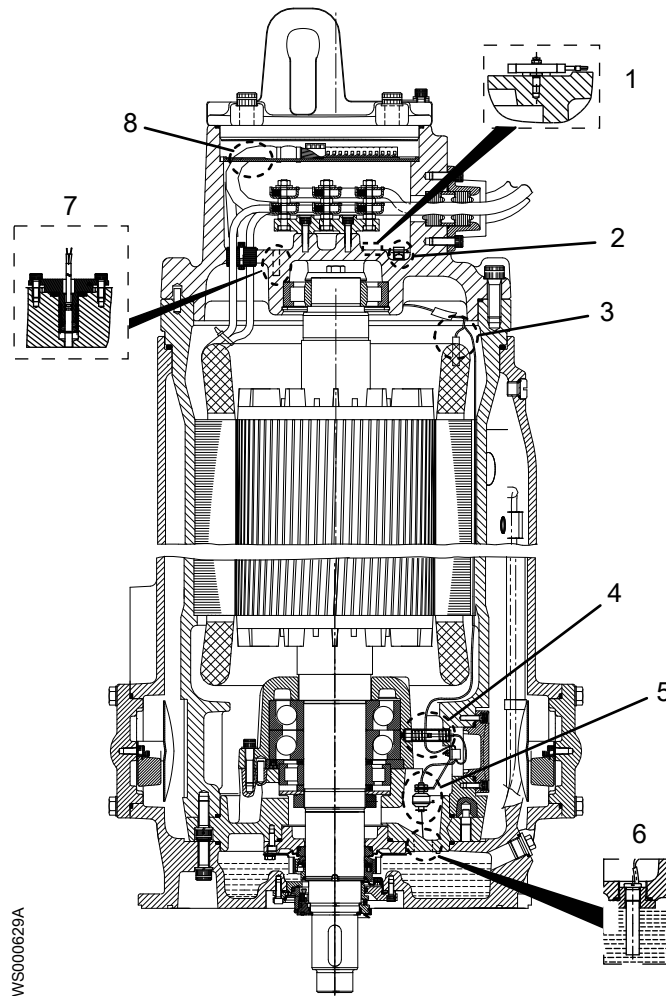
Sensors

6X5 drive units



1. Vibration - VIS 10
2. Leakage in the junction box - FLS, Float Switch Leakage Sensor
3. Stator winding temperature
4. Main bearing temperature - Pt100 analogue temperature sensor
5. Leakage in the stator housing - FLS
6. Water in oil (*not available in explosion-proof drive units*) - CLS, Capacitive Leakage Sensor
7. Support bearing temperature - Pt100 analogue temperature sensor
8. Pump memory

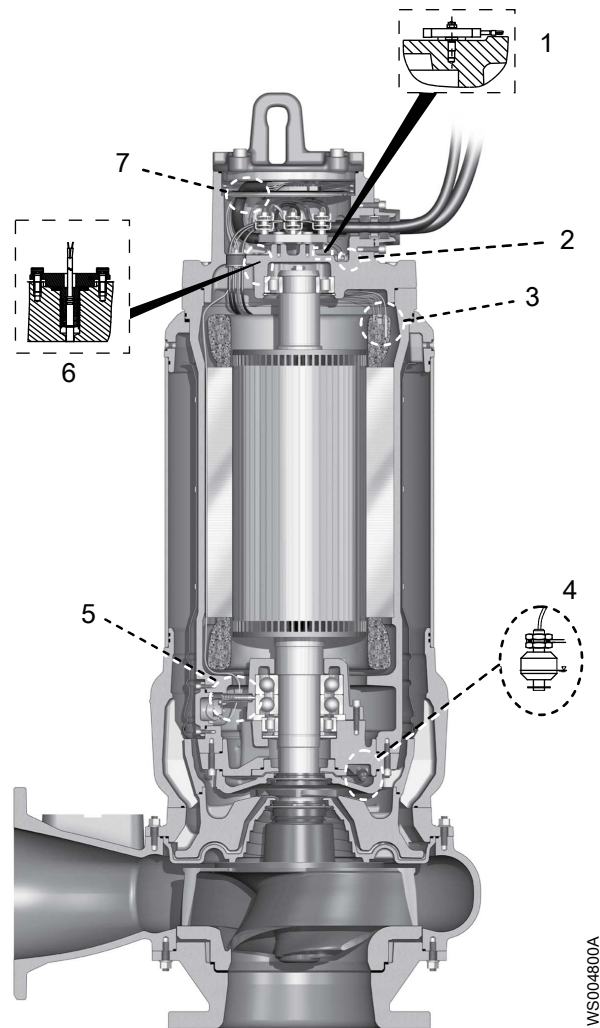
7X5 drive units



WS000629A

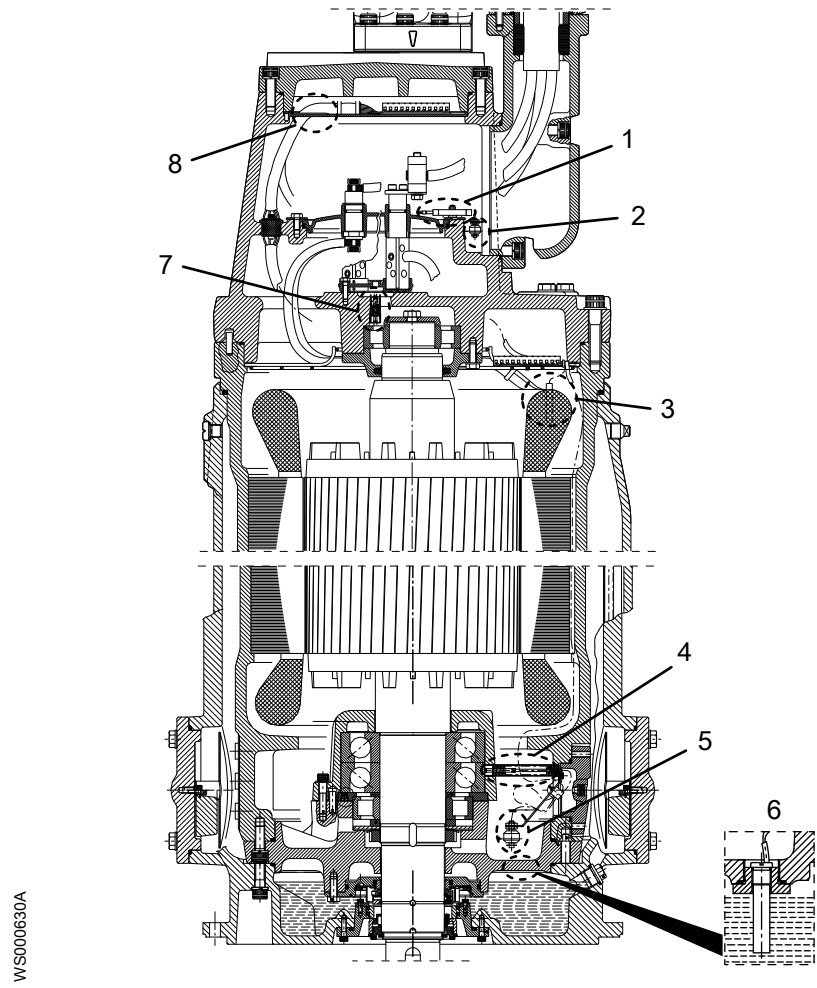
1. Vibration - VIS 10
2. Leakage in the junction box - FLS, Float Switch Leakage Sensor
3. Stator winding temperature
4. Main bearing temperature - Pt100 analogue temperature sensor
5. Leakage in the stator housing - FLS
6. Water in oil (*standard drive units only*) - CLS, Capacitive Leakage Sensor
7. Support bearing temperature - Pt100 analogue temperature sensor
8. Pump memory

7X6 drive units



1. Vibration - VIS 10
2. Leakage in the junction box - FLS, Float Switch Leakage Sensor
3. Stator winding temperature
4. Leakage in the inspection chamber (with cooling jacket) or stator housing (without cooling jacket) - FLS
5. Main bearing temperature - Pt100 analogue temperature sensor
6. Support bearing temperature - Pt100 analogue temperature sensor
7. Pump memory

8X5 and 9X5 drive units



- 1. Vibration - VIS 10
- 2. Leakage in the junction box - FLS, Float Switch Leakage Sensor
- 3. Stator winding temperature
- 4. Main bearing temperature - Pt100 analogue temperature sensor
- 5. Leakage in the stator housing - FLS
- 6. Water in oil (*standard drive units only*) - CLS, Capacitive Leakage Sensor
- 7. Support bearing temperature - Pt100 analogue temperature sensor
- 8. Pump memory

Temperature sensors

Table 3: Thermal switch

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

Table 4: PTC-thermistor

Description	Measured value	Fault values
The PTC-thermistor is a semiconductor device.	Resistance at normal temperature: <ul style="list-style-type: none"> • 50-100 ohm (150-300 ohm for three in series). 	<ul style="list-style-type: none"> • Above the tripping point, T_{Ref}, the resistance increases dramatically to several kohm. • An infinite value (open circuit) indicates a fault (a wire is broken or there is a bad contact in a connector). • A value close to zero indicates a short circuit in the wiring.

Table 5: Pt100 sensor

Description	Measured value	Fault values
The Pt100 sensor is a resistor changing value almost linearly with temperature.	Resistance: <ul style="list-style-type: none"> • 100 ohm at 0°C (32°F) • 107.79 ohm at room temperature (20°C, 68°F) • 138.5 ohm at 100°C (212°F) For resistance data between 0–160 0°C (32–212°F), see Pt100 resistance (page 23). Never connect the Pt100 sensor to a voltage higher than 2.5 V.	> 200 ohm (approx.) can indicate the following situations: <ul style="list-style-type: none"> • Broken sensor • Bad contact • Broken lead < 70 ohm (approx) indicates: <ul style="list-style-type: none"> • Short circuit.

For information on the various configurations of switches, thermistors and sensors used to monitor stator winding temperature, see [Stator temperature monitoring methods](#) (page 31).

FLS

Table 6: Float switch sensor (FLS)

Description	Measured value	Fault values
The float switches are leakage sensors. 6X5, 7X5, 8X5, 9X5 drive units: The float switches are located in the lower part of the stator housing and in the junction box. 7X6 drive units: The float switches are leakage sensors located in the inspection chamber and in the junction box.	Resistance. 2 sensor variants: FLS: <ul style="list-style-type: none"> • Normal: 1530 ohm • Alarm: 330 ohm FLS 10: <ul style="list-style-type: none"> • Normal: 1200 ohm • Alarm: 430 ohm 	> 10% (approx.) deviation from rated ohm values indicates sensor fault, or fault in the wiring.

VIS10

Table 7: Vibration sensor (VIS10)

Description	Measured value	Fault values
The vibration sensor located in the junction box measures vibrations in one direction. The output is a 4-20 mA signal proportional to the vibration level.	Current, 4-20 mA	<ul style="list-style-type: none"> • >> 20 mA indicates a short circuit. • << 4 mA indicates a fault. • A zero value indicates a broken wire or bad contact in a connector.

CLS

This section does not apply to 7X6 drive units.

Table 8: Water-in-oil sensor (CLS)

Description	Measured value	Fault values
Capacitive leakage sensor located in the oil housing. This sensor issues an alarm if the water content reaches a concentration of approximately 30% or more.	Standard drive unit only. CLS must be connected to 12 V DC with correct polarity (+/-).	See table below.

CLS alarm is not a cause for stopping the pump. It is merely an indicator to check the oil and outer seal at the next planned service.

Table 9: CLS current measurements

Measuring result	Explanation
0 mA	Can indicate one of the following conditions: <ul style="list-style-type: none"> The sensor has the wrong polarity. Check by changing plus and minus. The cable/lead is broken.
4.0 to 8.0 mA	OK
27 to 33 mA	Alarm current
> 33 mA	Short circuit

Stator temperature monitoring methods

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

By using an analogue sensor, two adjustable alarm limits can be used, one for warning ("B"-alarm) and one for pump stop ("A"-alarm). The configurations which may be used for monitoring the stator-winding temperature depend upon the voltage range of the drive unit. See [Drive units](#) (page 18) for the voltage range for each drive unit.

Up to 1 kV drive units

Table 10: Stator temperature monitoring configuration, up to 1 kV

Standard / Optional	Monitoring configuration description
Standard	<ul style="list-style-type: none"> Three thermal switches, connected in series, are incorporated in the coil ends of the stator winding. The switches are normally closed, and open at 140°C (285°F). One Pt100 sensor is incorporated in one of the windings.
	Or:
Optional	<ul style="list-style-type: none"> Three thermistors, connected in series, are incorporated in the coil ends of the stator windings. $T_{Ref}=140^{\circ}C$ (285°F). One Pt100 sensor is incorporated in one of the windings.
	Or:
	<ul style="list-style-type: none"> Three thermal switches, connected in series, are incorporated in the coil ends of the stator winding. The switches are normally closed, and open at 140°C (285°F). Three Pt100 sensors, one for each phase, are incorporated in the windings.
	Or:
	<ul style="list-style-type: none"> Three thermistors, connected in series, are incorporated in the coil ends of the stator windings. $T_{Ref}=140^{\circ}C$ (285°F). Three Pt100 sensors, one for each phase, are incorporated in the windings.

1.2-6.6 kV drive units

Table 11: Stator temperature monitoring configuration, 1.2-6.6 kV

Standard / Optional	Monitoring configuration description
Standard	This configuration uses the following: <ul style="list-style-type: none"> • Three thermistors, connected in series, are incorporated in the coil ends of the stator windings. $T_{Ref}=155^{\circ}\text{C}$ (310°F) for medium-voltage drive units. • Three Pt100 sensors, one for each phase, are incorporated in the windings. There are three additional thermistors, and 3 additional Pt100 sensors, already in place in the stator windings as reserves. See below for sensor markings.

Stators used in the 1.2-6.6 kV drive units are equipped with 3 Pt100 sensors marked 19:20, 21:22, and 23:24. These are connected at the plinth on the terminal plate. The stator is also equipped with a duplicate set of 3 Pt100 sensors, marked 19s:20s, 21s:22s, and 23s:24s. This duplicate set is not connected to the terminal plate as long as the first set of 3 Pt100 sensors are functioning; it is kept in reserve as a back-up set. The ends of the reserve sensor leads are isolated, and leads bundled among the other cables, until the back-up Pt100 sensors are needed.

Pump memory

The pump memory is located inside the pump's junction box. The memory is loaded with data from the factory, which is then uploaded to the MAS system at first startup.

The data that is uploaded contains the following features:

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

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

The cooling system

The cooling system removes the heat that is generated by the motor. Most of the heat is transferred to the surrounding media through the stator housing. The following table gives an overview of the various cooling systems.

Drive units	Cooling system type	Cooling jacket	Description
6X5, 7X5, 8X5, 9X5 7X6	Direct cooling	No	The pump is fully submerged and directly cooled by the surrounding water.
6X5, 7X5, 8X5, 9X5	Integrated cooling	Yes	A portion of the pumped liquid is circulated from the pump housing through the cooling jacket. The pump can work continuously at output regardless of whether the pump is above or below the surface of the liquid.
6X5, 7X5, 8X5, 9X5 7X6	External cooling	Yes	The cooling jacket is connected to a separate, external cooling system.
7X6	Internal cooling	Yes	The motor is cooled by a closed-loop system. An integrated coolant pump circulates the water-glycol coolant whenever the pump is operated.

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

NOTICE:

Always operate the pump with the drive unit completely submerged in the pumped liquid, if the pump is delivered without the integral drive unit cooling jacket. When emptying the sump, the lowest liquid level must not be lower than the top of the pump housing. Contact your local Xylem representative for more information.

Direct cooling

In direct cooling, the pump is submerged in the liquid being pumped.

For direct cooling to be used, the pump must be completely submerged during normal operation.

On certain occasions, for example when emptying a sump, partial submersion is allowed. The allowable time for this is limited by several factors, such as ambient temperature, size of the sump, inflow, outflow and so on.

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

Internal cooling

Overview

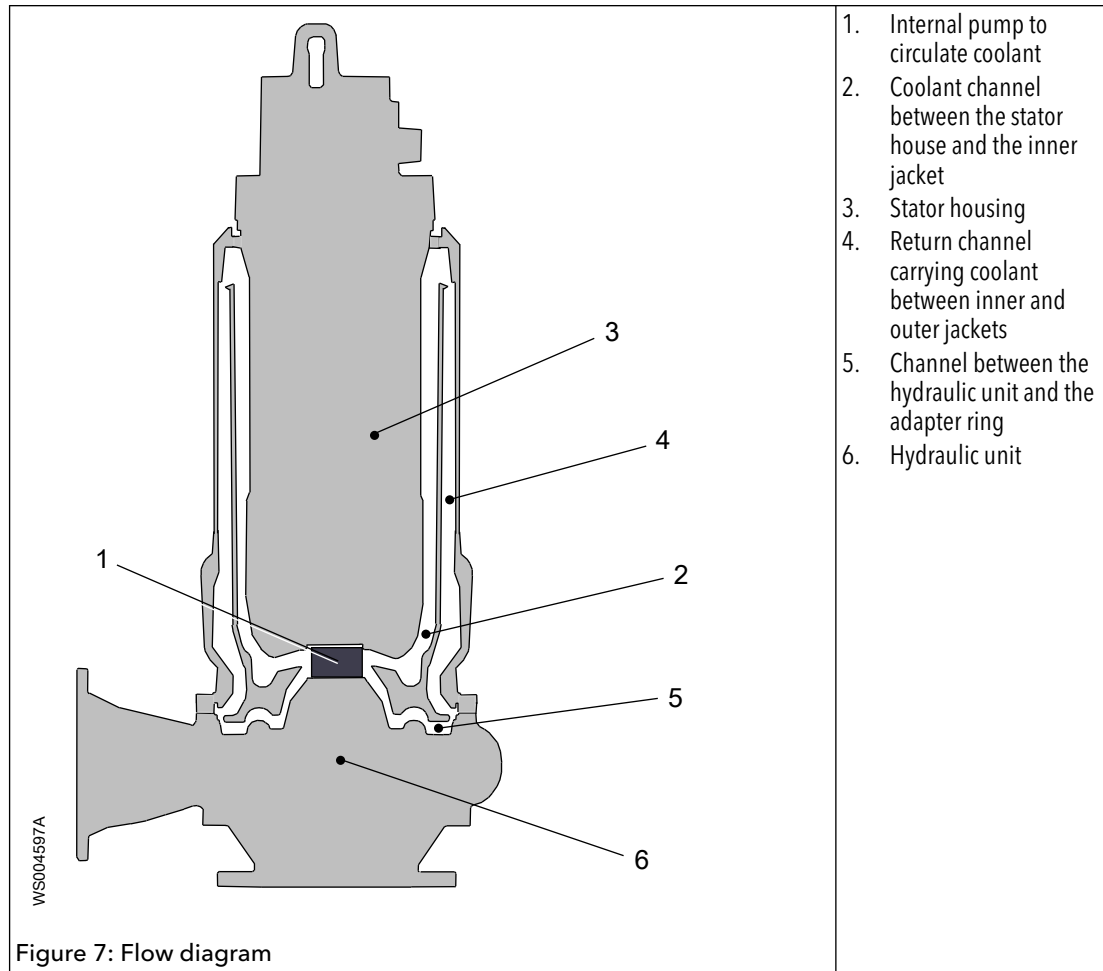
Internal cooling removes heat from the motor by circulating coolant in a closed loop within the cooling jacket. The coolant circuit is self-contained within the drive unit; no external equipment is needed. The coolant is isolated from the pumped media.

Applications where internal cooling (closed-loop cooling with cooling jacket) can be used include the following:

- When extreme amounts of concentrated sewage where grease or fats are present, is combined with operating close to the limits of the cooling system.
- When the pumped media contains abrasive or corrosive components.

Principle

The following figure shows the principle of the closed-loop cooling system.



The drive unit is equipped with an inner and an outer cooling jacket. An internal pump (1 in the flow diagram) in the shaft seal unit pumps the coolant through the channel between the stator housing and the inner cooling jacket (2). In this channel the coolant removes heat from the stator (3). The coolant then moves to the outer channel between the inner and outer cooling jackets (4), and flows back down to the bottom. It continues through the narrow slot (5) between the flow diffuser, which is mounted in the seal housing, and the seal housing cover, then back to the internal pump in the mechanical seal. The seal housing cover works as a heat exchanger, with the pumped fluid in the hydraulic unit cooling the water-glycol in the cooling system (6).

Combined lubrication and cooling

The purpose of the coolant is to cool and lubricate the seals, and to cool the motor.

Coolant

The coolant is a mixture of 70% water and 30% monopropylene glycol.

Z-installation orientation

Z-installations using internal cooling require a specific orientation. The drive unit must be oriented such that the inspection chamber leakage sensor functions properly. The inspection plug on the adapter must be oriented downwards.

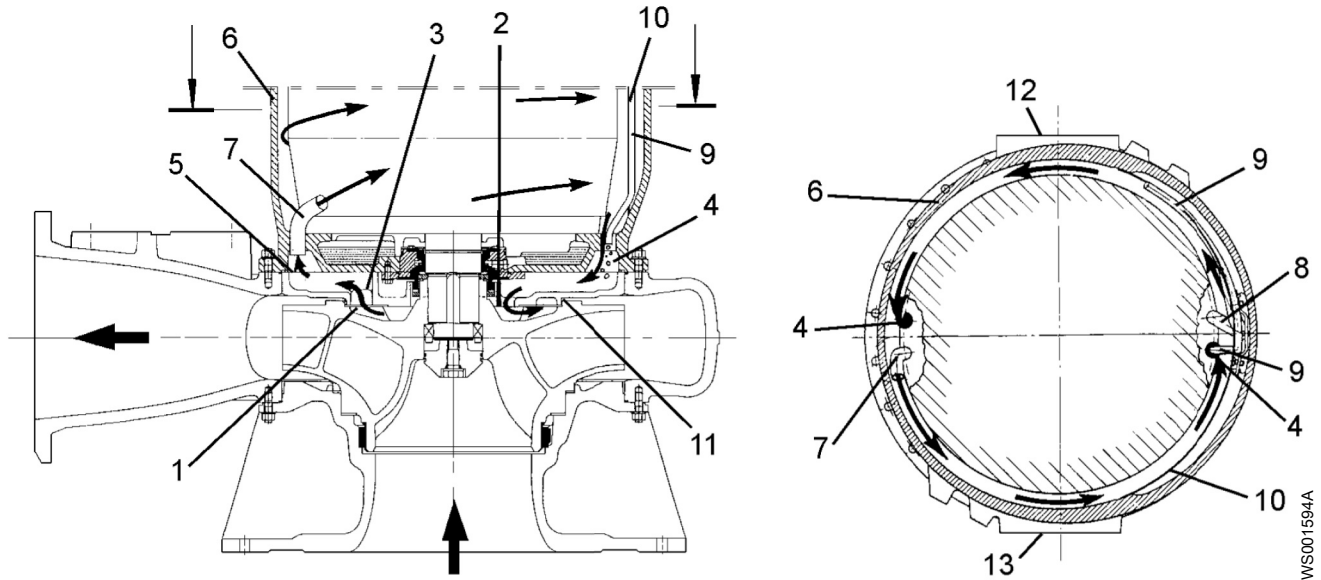
Integrated cooling

With integrated cooling, a portion of the pumped liquid is circulated from the pump housing through the cooling jacket. The pumped media removes the heat from the motor, and then returns to the pump housing, where it re-joins the main stream of liquid being pumped.

This cooling system is designed to tolerate a range of water qualities, up to and including municipal sewage. Larger particles and other contaminants in the pumped liquid are kept out of the cooling jacket by a narrow gap between the guide ring and the impeller.

System

The following figure shows the various parts of the integrated cooling system.



1. Back-vane on impeller
2. Coolant outlet, to pump housing
3. Coolant inlet, from pump housing
4. Air evacuation
5. Coolant entry
6. Cooling jacket
7. Coolant supply pipe, lower
8. Coolant supply pipe, upper
9. Air evacuation pipe
10. Metal shield
11. Anti-contamination gap
12. Inspection cover
13. Inspection cover

A separate circulation pump is not needed for integrated cooling. Circulation through the cooling jacket is provided by back-vanes on the impeller.

Ports and fittings

With integrated cooling, the cooling jacket is equipped with the following ports:

Port	Quantity	Description
Inlet pipes	2	Diametrically opposed one at bottom and one approximately 2/3 up. Not external ports - no inlet connection required during pump installation.
Outlet ports	2	Diametrically opposed at bottom of jacket. Not external ports - no outlet connection required during pump installation.
Air vent	1	Automatic. Situated at top of jacket.
Drain	1	Situated at lower part of jacket. ISO G 3/4 threaded connection.

For information regarding the fittings required to drain the cooling jacket, see [Fittings needed to drain 6X5, 7X5, 8X5, 9X5 cooling jackets](#) (page 38).

Filling and draining

With integrated cooling, the cooling jacket fills automatically at pump start-up.

For instructions on draining the cooling jacket, see [Empty the coolant \(integrated cooling\)](#) (page 90).

Z-installation orientation

Z-installations using integrated cooling require a specific orientation. The drive unit must be oriented such that the air evacuation system and the stator housing leakage sensor function properly. The cooling jacket inspection cover marked "SENSORS" must be oriented downwards.

External Cooling

With external cooling, the drive unit is equipped with a cooling jacket. Water circulates through the jacket, cooling the motor. The cooling water circuit can be open or closed. In both cases, it is isolated from the pumped media.

This figure shows the principle of the external cooling system. The figure is only a representative sketch of the principle of external cooling.

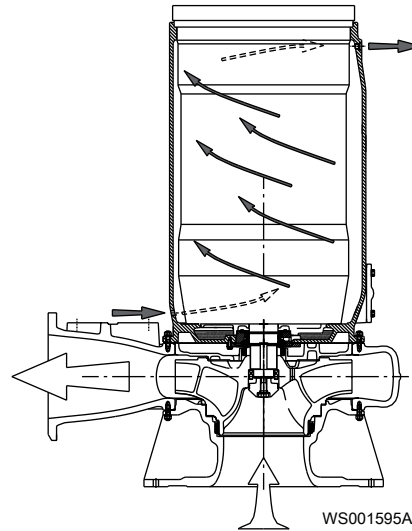


Figure 8: Representative image of the external cooling principle.

Applications where external cooling can be used include the following:

- When the temperature of the pumped media exceeds 40°.
- When extreme amounts of concentrated sewage where grease or fats are present, is combined with operating close to the limits of the cooling system. This is not applicable for 7X6 drive units.
- When the pumped media contains abrasive or corrosive components. This is not applicable for 7X6 drive units.
- In variable speed applications, where the lowest speed falls below the speed limit for the integrated cooling system during longer periods of operation.

With external cooling, the cooling jacket is equipped with the following ports:

Table 12: 6X5, 7X5, 8X5, 9X5 drive units

Port	Quantity	Description
Inlet port	1	At the bottom of the jacket. Threaded ISO G 3/4.
Outlet port	1	At the top of the jacket. Threaded ISO G 3/4. Also used to drain the jacket.
Air vent	1	At the top of the jacket.

Table 13: 7X6 drive units

Port	Quantity	Description
Drain plug	1	M16. At the bottom of the jacket. Used to drain the cooling jacket.
Fill plugs	2	M16. At the top of the jacket. Used as inlet and outlet plugs when externally cooled.

Port	Quantity	Description
Air vent	-	No air vent on 7X6 drives.

For information regarding the fittings required to drain the cooling jacket, see [Fittings needed to drain 6X5, 7X5, 8X5, 9X5 cooling jackets](#) (page 38).

For instructions on draining the cooling jacket, see [Empty the coolant \(external cooling\)](#) (page 91).

Supply water flow

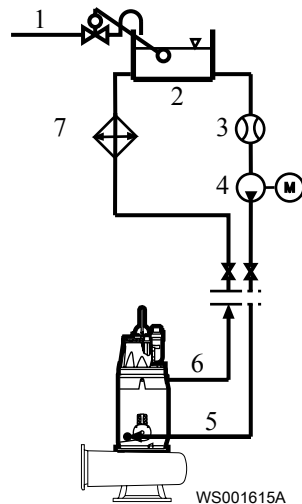
For information about dimensioning the water supply for external cooling, contact your local sales and service representative.

External cooling, closed loop

NOTICE:

It is extremely important that the cooling water flow is maintained at or above the desired minimum level while the pump is running.

For a closed loop system, the cooling water supply should be arranged as shown in the figure below.



1. Cooling water supply
2. Expansion tank
3. Flow meter
4. Circulation pump
5. Coolant in
6. Coolant out
7. Heat exchanger

Item	Notes
Cooling water supply	Incoming supply should be equipped with a vacuum valve. It should also be separated from the cooling circuit with a non-return (check) valve.
Expansion tank	Equipped with a level regulator. The tank is used to fill up the system at start-up, and then acts as an expansion tank.
Circulation pump	The pump must be able to deliver at least the minimum required flow (including pressure drop in supply and return line) at all times.
Flow meter or flow switch	Used to monitor that the required flow of coolant is maintained during pump operation. The flow meter should have an electric output that can be wired into the pump power supply circuit in such a way, that the pump is stopped if the flow of coolant is interrupted.

Item	Notes
Coolant in	Supply line (coolant in) and return line (coolant out) should both be fitted with valves so that the pump can be isolated from the cooling circuit during service.
	The supply line should also be fitted with a three-way connection and valving so that the cooling jacket can be drained before service work. See Fittings needed to drain 6X5, 7X5, 8X5, 9X5 cooling jackets (page 38).

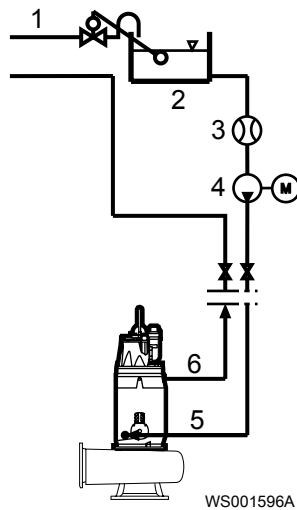
For P- and S-installations, two 1-inch inner diameter reinforced water hoses are needed. To avoid movement in the sump, they should be fixed with cable ties to the cables.

For T- and Z-installation, pipes should be used instead of hoses to minimize the risk of accidental leakage. Flexible connections (for example, reinforced hose) from the pipe to the pump are advised, to avoid transmitting vibrations from the pump to the pipes.

External cooling, open loop

It is extremely important that the cooling water flow is maintained at or above the desired minimum level while the pump is running.

For an open loop system, the cooling water supply should be arranged as shown in the figure below.



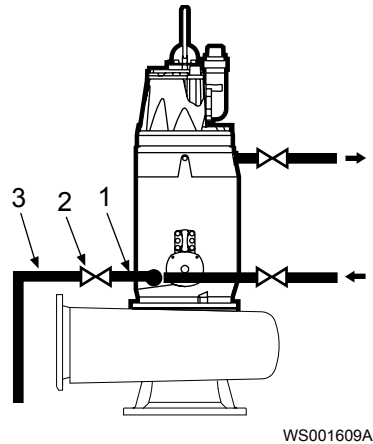
1. Cooling water supply
2. Supply tank
3. Flow meter
4. Circulation pump
5. Coolant in
6. Coolant out

Item	Notes
Cooling water supply	Incoming supply should be equipped with a vacuum valve. It should also be separated from the cooling circuit with a non-return (check) valve.
Supply tank	Local regulations may require that the supply line (especially in sewage applications) is totally separated from the cooling circuit.
Circulation pump	The pump must be able to deliver at least the minimum required flow (including pressure drop in supply and return line).
Flow meter or flow switch	Used to monitor that the required flow of coolant is maintained during pump operation. The flow meter should have an electric output that can be wired into the pump power supply circuit in such a way, that the pump is stopped if the flow of coolant is interrupted.

Fittings needed to drain 6X5, 7X5, 8X5, 9X5 cooling jackets

This section describes the fittings needed to drain the cooling jacket. It is applicable to both integrated cooling and external cooling systems.

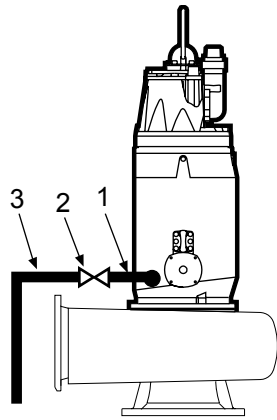
The cooling jacket on T and Z installations with integrated cooling, and P, S and T installations with external cooling, should be fitted with a nipple, a stop-cock, and a pipe or hose leading to a suitable sump. If external cooling is used, then a tee will be needed.



WS001609A

1. Tee, nipple (if needed)
2. Shutoff valve
3. Pipe to drain coolant

Figure 9: P, S, and T installations with external cooling



WS001611A

1. Nipple
2. Shutoff valve
3. Pipe to drain coolant

Figure 10: T and Z installations with integrated cooling

Seal flushing

Seal flushing is not available for 7X6 drive units.

External cooling required

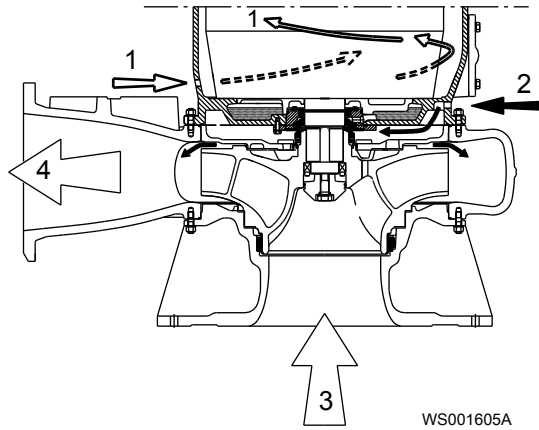
Seal flushing requires external cooling.

Description

Seal flushing is sometimes used when pumping demanding fluids which could cause fouling of the outer mechanical seal. The seal is continuously flushed with a supply of clean water. This keeps the mechanical shaft seal in clean water and isolated from the aggressive or abrasive fluid being pumped.

After circulating around the seal, the flush water continues out into the pump housing, where it combines with the fluid being pumped.

The following figure shows the flows of seal flush water, coolant, and fluid being pumped.



1. Coolant
2. Seal flushing, inlet
3. Pumped fluid, inlet
4. Pumped fluid and seal flush water, outlet

Applications for seal flushing

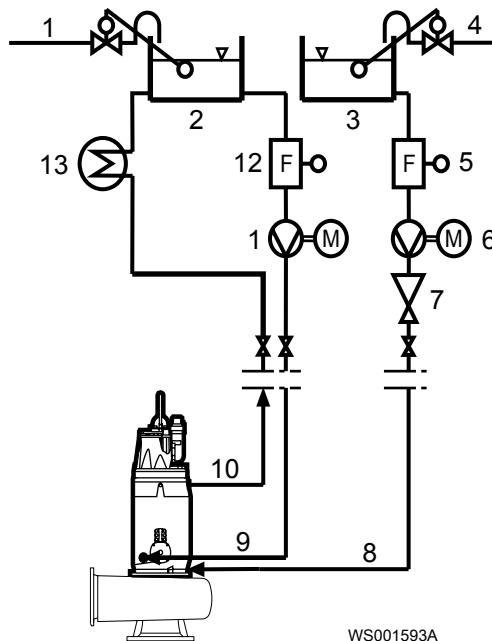
Examples of demanding applications where seal flushing might be used include the following:

- Corrosive liquids
- Water containing excessive amounts of sand, fine sediment or other abrasive material
- Water containing calcium deposits
- Water containing excessive amounts of fibers or other materials with a tendency to clog together.

For more information regarding seal flushing applications please contact your local sales and service representative.

Circuit diagram for seal flushing

The supply of incoming flushing water should be arranged as described in the circuit diagram below. As all slushing water is lost into the hydraulic end, this is always an open circuit solution.



1. Cooling water supply
2. Expansion tank
3. Supply tank
4. Seal flushing water supply
5. Flow meter

- 6. Booster pump
- 7. Constant flow valve
- 8. Seal flushing inlet to pump
- 9. Coolant inlet to motor
- 10. Coolant outlet
- 11. Circulation pump
- 12. Flow meter
- 13. Heat exchanger

It is recommended that a constant flow valve is installed in the supply line. This should be chosen to give a flow of at least 15 liters/min (4 US gal/min). If the valve is exposed to a sufficient pressure difference between its input and output connection, then the output flow will remain constant even if the pressure at the output connection varies. This feature is important if the pump operates at different duty points.

Connections for seal flushing

P- and S-installations	T- and Z-installations
A 3/4" I.D. reinforced water hose is needed for the seal flushing. The supply line for the seal flushing water should be equipped with a stop-cock for service work. In order to avoid movement of the hose in the sump, it should be fixed to the cables with cable ties.	Pipes instead of hoses should be used to minimize risk of accidental leakage. However, flexible cables to the pump (for example, a piece of reinforced hose) are advised, to avoid transmitting vibrations from the pump to the pipes.

Inlet port and outlet control

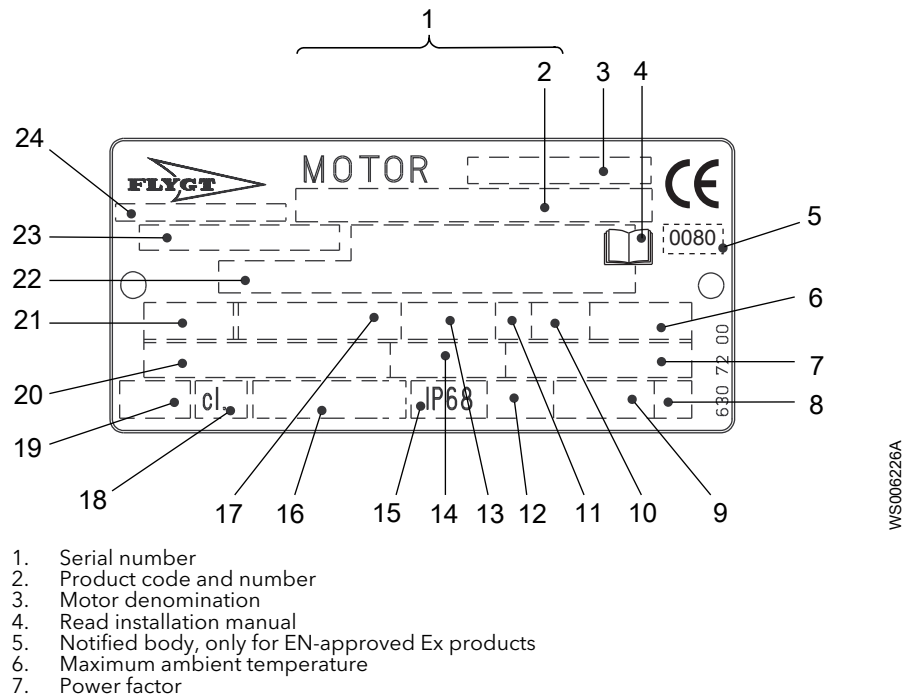
Table 14:

Item	Description	
Flush water inlet	Location	At the lower part of the cooling jacket.
	Connection	Threaded ISO G 3/4.
Outlet control	Flushing water outlet is controlled by a lip seal, which acts as a check valve between the guide ring and the impeller hub to protect the mechanical seal.	

The data plates

The data plates include key product specifications.

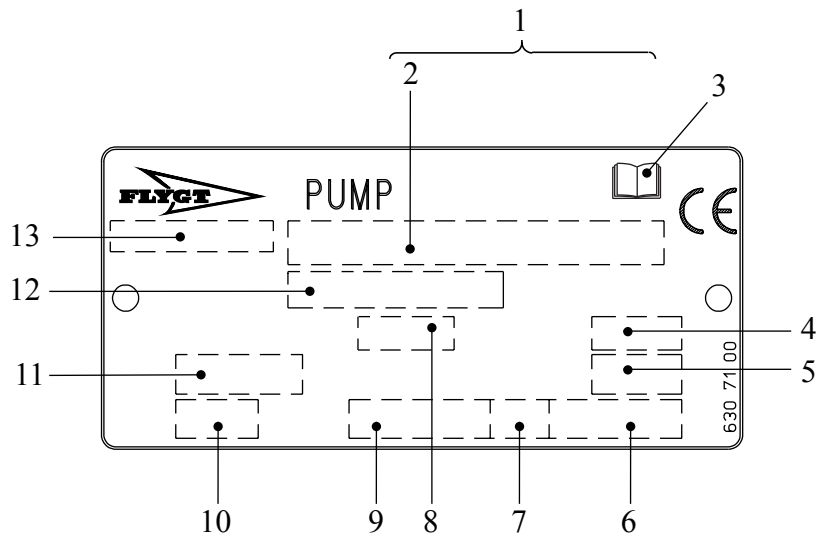
Drive unit



8. Locked rotor code letter
9. Product weight
10. Duty factor
11. Duty class
12. Maximum submergence
13. Rated speed
14. Rated current
15. Degree of protection
16. International standard
17. Rated shaft power
18. Thermal class
19. Thermal protection
20. Rated voltage
21. Phase; Type of current; Frequency
22. Additional information
23. Product number
24. Country of origin

Figure 11: The drive unit plate valid from 990101

Hydraulic unit









WS006230A





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

Figure 12: The hydraulic unit plate

Approvals

Product approvals for hazardous locations

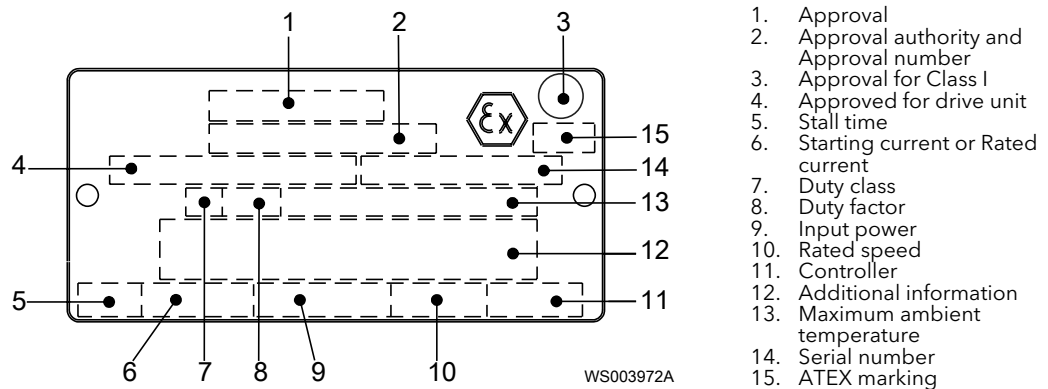
Drive Unit	Approval
615, 675	European Norm (EN) <ul style="list-style-type: none"> • ATEX Directive • EN 60079-0:2009, EN 60079-1:2007, EN 13463-1:2009, EN 13463-5:2011 •  II 2 G c Ex d IIB T3 Gb •  II 2 G c Ex d IIB T4 Gb
	IEC <ul style="list-style-type: none"> • IECEx scheme • IEC 60079-0, IEC 60079-1 • Ex d IIB T3 • Ex d IIB T4
	EN approval for cable entry: <ul style="list-style-type: none"> • Certificate number: INERIS 02ATEX9008 U •  II 2 G Ex d IIC Gb or I M2 Ex d I Mb
	FM (FM Approvals) <ul style="list-style-type: none"> • Explosionproof for use in Class I, Div. 1, Group C and D • Dust ignition proof for use in Class II, Div. 1, Group E, F and G • Suitable for use in Class III, Div. 1, Hazardous Locations
715, 745, 775	European Norm (EN) <ul style="list-style-type: none"> • ATEX Directive • EN 60079-0:2009, EN 60079-1:2007, EN 13463-1:2009, EN 13463-5:2011 •  II 2 G c Ex d IIB T3 Gb •  II 2 G c Ex d IIB T4 Gb
	IEC <ul style="list-style-type: none"> • IECEx scheme • IEC 60079-0, IEC 60079-1 • Ex d IIB T3 • Ex d IIB T4
	EN approval for cable entry: <ul style="list-style-type: none"> • Certificate number: INERIS 02ATEX9008 U •  II 2 G Ex d IIC Gb or I M2 Ex d I Mb
	FM (FM Approvals) <ul style="list-style-type: none"> • Explosionproof for use in Class I, Div. 1, Group C and D • Dust ignition proof for use in Class II, Div. 1, Group E, F and G • Suitable for use in Class III, Div. 1, Hazardous Locations

Drive Unit	Approval
716, 746, 776	European Norm (EN) <ul style="list-style-type: none"> • ATEX Directive • EN 60079-0:2009, EN 60079-1:2007, EN 13463-1:2009, EN 13463-5:2011 •  II 2 G c Ex d IIB T3 Gb
	IEC <ul style="list-style-type: none"> • IECEx scheme • IEC 60079-0, IEC 60079-1 • Ex d IIB T3
	EN approval for cable entry: <ul style="list-style-type: none"> • Certificate number: INERIS 02ATEX9008 U •  II 2 G Ex d IIC Gb or I M2 Ex d I Mb
	FM (FM Approvals) <ul style="list-style-type: none"> • Explosionproof for use in Class I, Div. 1, Group C and D • Dust ignition proof for use in Class II, Div. 1, Group E, F and G • Suitable for use in Class III, Div. 1, Hazardous Locations
815, 845, 875, 895 872, 892	European Norm (EN) <ul style="list-style-type: none"> • ATEX Directive • EN 60079-0:2009, EN 60079-1:2007, EN 13463-1:2009, EN 13463-5:2011 •  II 2 G c Ex d IIB T3 Gb
	IEC <ul style="list-style-type: none"> • IECEx scheme • IEC 60079-0, IEC 60079-1 • Ex d IIB T3
	EN approval for cable entry: <ul style="list-style-type: none"> • Certificate number: INERIS 02ATEX9008 U •  II 2 G Ex d IIC Gb or I M2 Ex d I Mb
	FM (FM Approvals) <ul style="list-style-type: none"> • Explosionproof for use in Class I, Div. 1, Group C and D • Dust ignition proof for use in Class II, Div. 1, Group E, F and G • Suitable for use in Class III, Div. 1, Hazardous Locations

Drive Unit	Approval
915, 945, 975 960, 995, 998	<p>European Norm (EN)</p> <ul style="list-style-type: none"> • ATEX Directive • EN 60079-0:2009, EN 60079-1:2007, EN 13463-1:2009, EN 13463-5:2011 • Ex I M2 c Ex d I Mb • Ex II 2 G c Ex d IIB T3 Gb • Ex II 2 G c Ex d IIB T4 Gb <p>(For T4, $T_{amb} = 25^{\circ}\text{C}$.)</p>
	<p>IEC</p> <ul style="list-style-type: none"> • IECEx scheme • IEC 60079-0, IEC 60079-1 • Ex d I • Ex d IIB T3 • Ex d IIB T4 <p>(For T4, $T_{amb} = 25^{\circ}\text{C}$.)</p>
	<p>EN approval for cable entry:</p> <ul style="list-style-type: none"> • Certificate number: INERIS 02ATEX9008 U • Ex II 2 G Ex d IIC Gb or I M2 Ex d I Mb
	<p>FM (FM Approvals)</p> <ul style="list-style-type: none"> • Explosionproof for use in Class I, Div. 1, Group C and D • Dust ignition proof for use in Class II, Div. 1, Group E, F and G • Suitable for use in Class III, Div. 1, Hazardous Locations

EN approval plate

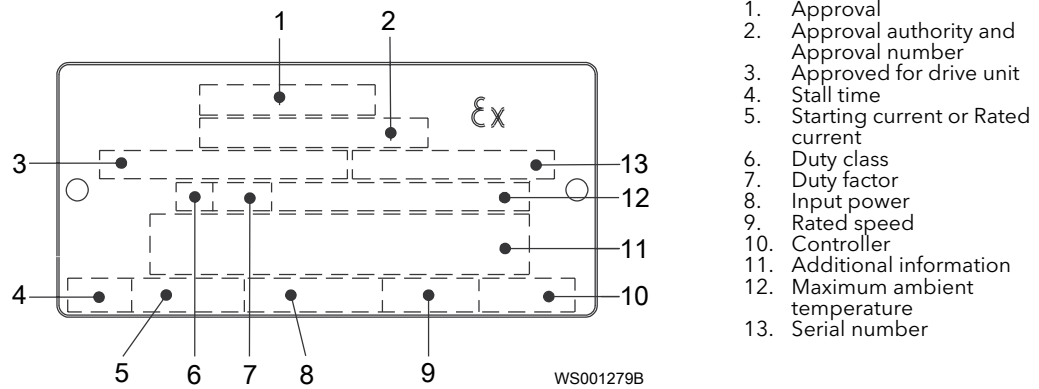
This illustration describes the EN approval plate and the information that is contained in its fields.



IEC approval plate

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

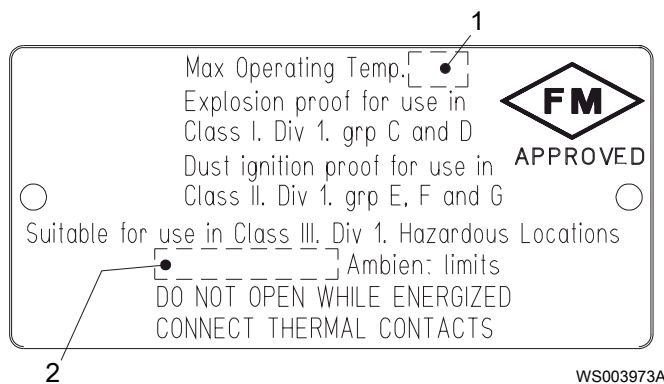
International Norm; not for EU member countries.



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

FM approval plate

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



1. Temperature class
2. Maximum ambient temperature

Product denomination

Reading instruction

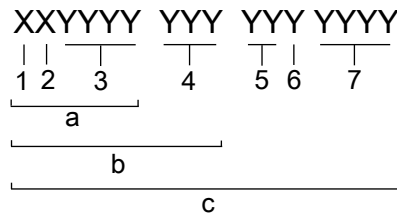
In this section, code characters are illustrated accordingly:

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



WS004060B

Type of Callout	Number	Indication
Type of code	a	Sales denomination
	b	Product code
	c	Serial number

Type of Callout	Number	Indication
Parameter	1	Hydraulic end
	2	Type of installation
	3	Sales code
	4	Drive unit
	5	Production year
	6	Production cycle
	7	Running number

Installation

Install the pump



DANGER:

Disconnect and lock out electrical power before installing or servicing the unit.



WARNING:

- Note that special rules apply to installation in explosive atmospheres.
 - Do not install the starter equipment in an explosive zone unless it is explosion-proof rated.
 - Do not install CSA-approved products in locations that are classified as hazardous in the national electric code, ANSI/NFPA 70-2005.
 - Vent the tank of a sewage station in accordance with local plumbing codes.
 - Make sure that the unit cannot roll or fall over and injure people or damage property.
-



WARNING:

Electrical shock hazard. Check that the cable and cable entry have not been damaged during transport before installing the pump.

NOTICE:

- Do not run the pump dry.
 - Never force piping to make a connection with a pump.
-

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

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

These requirements apply:

- Use the pump dimensional drawing in order to ensure proper installation.
 - Provide a suitable barrier around the work area, for example, a guard rail.
 - Check the explosion risk before you weld or use electric hand tools.
 - Remove all debris from the inlet piping system before you install the pump.
 - Remove all debris from the pump sump before you install the pump.
-

Fasteners

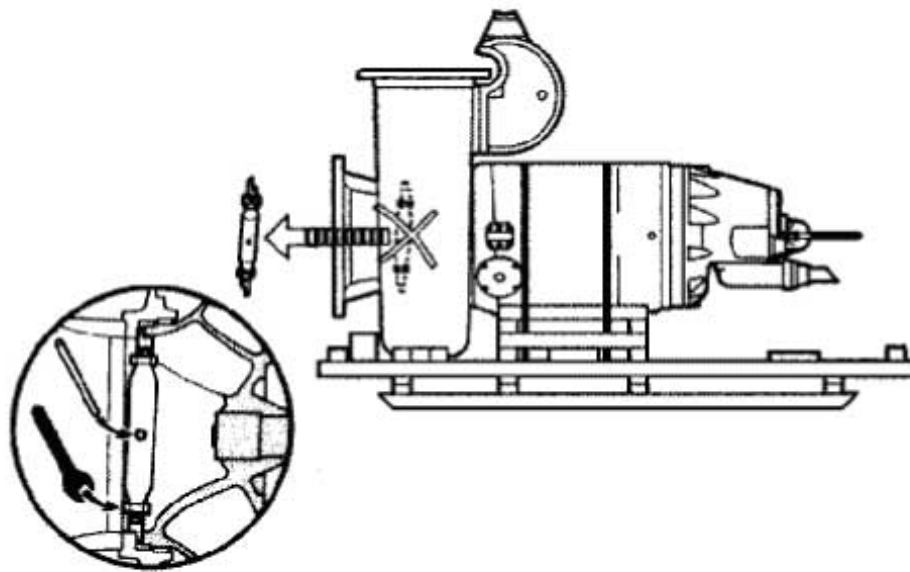


WARNING:

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

The locking device

Pumps delivered in the horizontal position have a locking device for the impeller/propeller. Before you install the pump, you must remove this locking device.



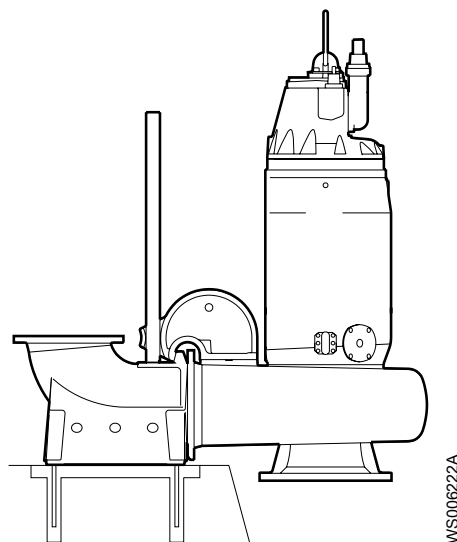
WS001582A

Install with P-installation

In the P-installation, the pump is installed on a stationary discharge connection, and operates either completely or partially submerged in the pumped liquid.

The following items are required:

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



WS006222A

Figure 13: P-installation

1. Provide a barrier around the pump pit; for example, a guardrail.
Make sure the sump is dry.
2. Place the discharge connection in the correct position.
3. Mount the anchor bolts.
4. Level the discharge connection, using a leveller and if necessary, shims.
5. Place the discharge connection in position, and tighten the nuts.
6. Connect the discharge pipe to the discharge connection.
7. Install the guide bars:
 - a) Secure the guide bars in the bracket.
 - b) Check that the guide bars are placed vertical by using a level or a plumb line.
8. Lower the pump along the guide bars.
On reaching the bottom position, the pump will automatically connect to the discharge connection.
9. Check that the pump is seated correctly at the discharge connection.
10. Secure the cables:
 - a) Make sure that the cables cannot be sucked into the inlet of the pump. Support straps are required for deep installations.
 - b) Run the cables up to the electrical panel or junction box and connect them according to the separate instructions.
11. Clean all debris from the sump, before filling the sump.

Install with S-installation

In the S-installation, the pump is transportable and intended to operate either completely or partially submerged in the pumped liquid. The pump is equipped with a connection for hose or pipe and stands on a base stand. For more detailed information about the different installation types, see the Parts List document.

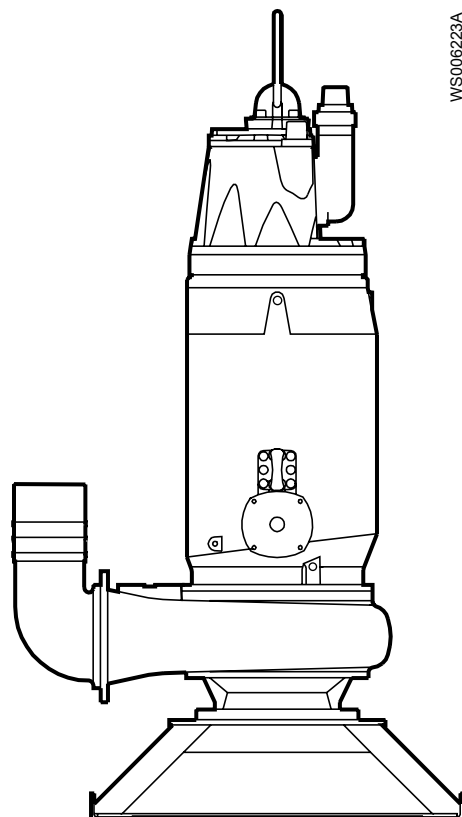


Figure 14: S-installation

1. Connect the discharge line.
2. Lower the pump into the sump.
3. Run the cables up to the electrical panel or junction box, and connect them according to the instructions in [Connect the cables](#) (page 53).
4. Place the pump on the base and make sure it cannot fall over or sink.
 Alternatively, the pump can be suspended by its lifting eye just above the sump bottom.
5. Secure the cables.
 Make sure that the cables cannot be sucked into the inlet of the pump. Support straps are required for deep installations.
6. Secure the discharge hose or pipe in a safe manner.

Install with T/Z-installation

- In the T-installation the pump is installed in a stationary vertical position in a dry well next to the wet sump.
- In the Z-installation, the pump is installed in a horizontal position on a support stand, and a bellmouth is connected to the inlet pipe.

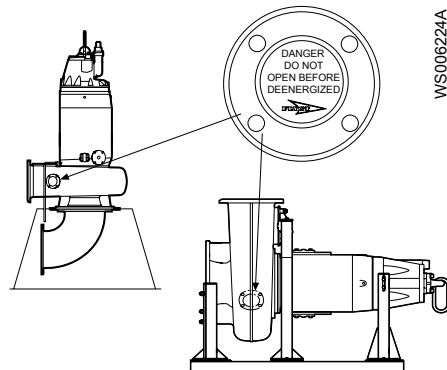


Figure 15: T-installation (left) and Z-installation

Z-installations using integrated cooling require a specific orientation. The drive unit must be oriented such that the air evacuation system and the stator housing leakage sensor function properly. The cooling jacket inspection cover marked "SENSORS" must be oriented downwards.

For 7X6 drive units only: Z-installations using internal cooling require a specific orientation. The drive unit must be oriented such that the inspection chamber leakage sensor functions properly. The inspection plug on the adapter must be oriented downwards.

The following items are required:

- Support stand for anchoring the pump to a base
- Plate or base stand with anchor bolts for anchoring the pump to a concrete base
- Inlet elbow for connecting the suction line and discharge line
- Shutoff valves to permit removal of the pump for service
- Air vent on the discharge side between the pump and the check valve



WARNING:

Never remove the inspection cover during service or internal cleaning of the pump housing until the pump has been de-energized and drained.

1. For Z-installations: Check that the drive unit is oriented such that the cooling jacket inspection cover marked "SENSORS" is facing downwards.

For 7X6 drive units, check that the inspection plug on the adapter is facing downwards.

2. Fasten the pump:
 - a) Use the anchor bolts to bolt the base stand to the concrete base.
 - b) Bolt the pump to the base stand and the suction connection.
3. Make sure that the pump is vertical (T-installation) or horizontal (Z-installation).
4. Connect the suction line and discharge line.
5. Run the cables up to the electrical panel or junction box, and connect them according to the separate instructions. For information about electrical connections, see [Connect the cables](#) (page 53).
6. Make sure that the weight of the pump does not put strain on the piping.

Make the electrical connections

General precautions



Electrical Hazard:

- A certified electrician must supervise all electrical work. Comply with all local codes and regulations.
 - Before starting work on the unit, make sure that the unit and the control panel are isolated from the power supply and cannot be energized. This applies to the control circuit as well.
 - Leakage into the electrical parts can cause damaged equipment or a blown fuse. Keep the end of the motor cable above the liquid level.
 - Make sure that all unused conductors are insulated.
 - There is a risk of electrical shock or explosion if the electrical connections are not correctly carried out or if there is fault or damage on the product.
-
-



WARNING:

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



CAUTION:

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

Requirements

These general requirements apply for electrical installation:

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

- The thermal contacts must be connected to a protection circuit in accordance with the product approvals.
- The thermal contacts/thermistors must be in use.
- For FM-approved pumps, a leakage sensor must be connected and in use in order to meet approval requirements.
- The environment must be appropriate for medium-voltage (1.2-10 kV) cables and electrical work.

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. For more information, see [Cable charts](#) (page 61).
- The correct entrance flange must be used with the existing cable according to the table in [Cable charts](#) (page 61).
- The minimum bending radius must not be below the accepted value.
- If using a cable which has been used before, a short piece must be peeled off when refitting it so that the cable entry seal sleeve does not close around the cable at the same point again. If the outer sheath of the cable is damaged, then replace the cable. Contact a local sales and service representative.
- The voltage drop in long cables must be taken into account. The drive unit's rated voltage is the voltage measured at the cable connection point in the pump.
- The screened cable must be used according to the European CE requirements if a Variable Frequency Drive (VFD) is used. For more information, contact your local sales and service representative (VFD-supplier).
- For SUBCAB™ cables, the twisted pair copper foil must be trimmed.

Earthing (Grounding)



Electrical Hazard:

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

Connect the cables

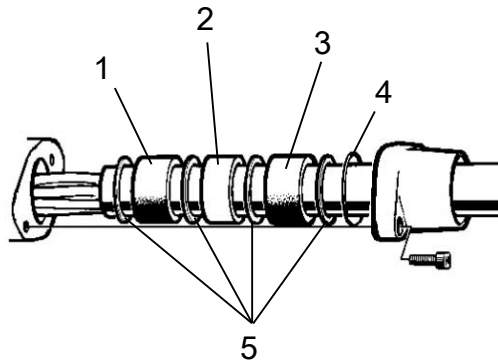
1. Connect the monitoring equipment.
2. Connect the cable to the terminal board:
 - If you have the MAS system, connect the cable to its terminal board according to the illustration and table in [MAS 711 sensor connections](#) (page 56).

NOTICE:

As the cable ends are sealed to eliminate moisture entrainment during transport and storage, no wire markings for the sensors at the outlet end of the cable are made at the factory. Markings must therefore be carried out during installation of the pump.

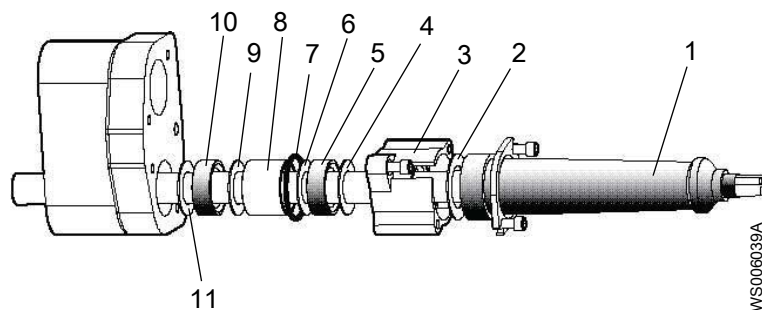
At the first installation, the MAS base unit and the pump memory should be synchronized. To synchronize the units do the following:

1. Check that the communication between the pump and the MAS base unit is activated.
2. Upload the factory settings of sensors and associated parameters by choosing the command "copy all from pump memory to MAS". For more information about the MAS installation, see the Installation and User Manual for the MAS-711 monitoring equipment.
3. Connect the power cable:
 - a) Check the data plate to determine which connection, Y or D, is valid for the voltage supply.
 - b) Arrange the connection on the terminal board in accordance with Y or D.
 - c) Connect the power cable leads to the terminal board connection U1, U2, V1, V2, W1, W2, and earth (ground) according to the cable chart.
 See [Cable charts](#) (page 61).
 - d) If control elements are present and not used, then cut and cap them.
4. Install the entrance flange:
 - a) Mount the entrance-flange parts according to the illustration for the correct drive unit.



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

Figure 16: Drive units 605-776



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

- 10. Seal sleeve
- 11. Washer

Figure 17: Drive unit 805-998

- b) Mount the protective rubber sleeve onto the cable where it leaves the junction box (connection housing).
The rubber sleeve must have the correct size to give the correct compression around the cable.
 - c) Fasten the connection flange to the entrance flange.
Make sure that the seal sleeve is not misaligned with the rubber sleeve and that the entrance flange supports the cable so that it cannot be excessively bent.
5. Connect the starter equipment:
- a) Connect the power cable to the starter equipment according to the diagram in [Power cable phase sequence](#) (page 55).
 - b) Connect the auxiliary cable to the starter equipment.

Power cable phase sequence

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

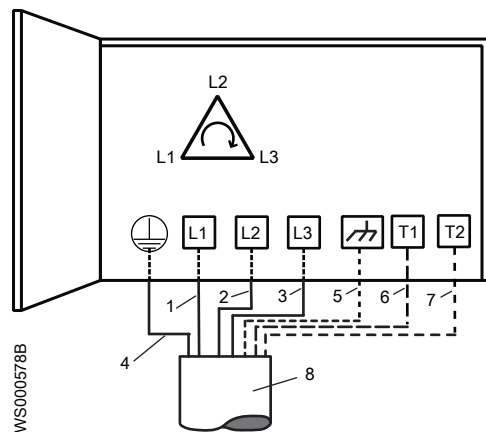


Figure 18: Correct phase sequence

For colors of cable leads, see [Colors and markings of power leads](#) (page 69).

Item	Description	
1	L1 cable lead	
2	L2 cable lead	
3	L3 cable lead	
4	Earth PE or ground cable lead	
5	Functional ground	In cables with both power cores and control element.
6	T1 cable lead (control element)	In cables with both power cores and control element.
7	T2 cable lead (control element)	In cables with both power cores and control element.
8	Power cable to pump	

MAS 711 sensor connections

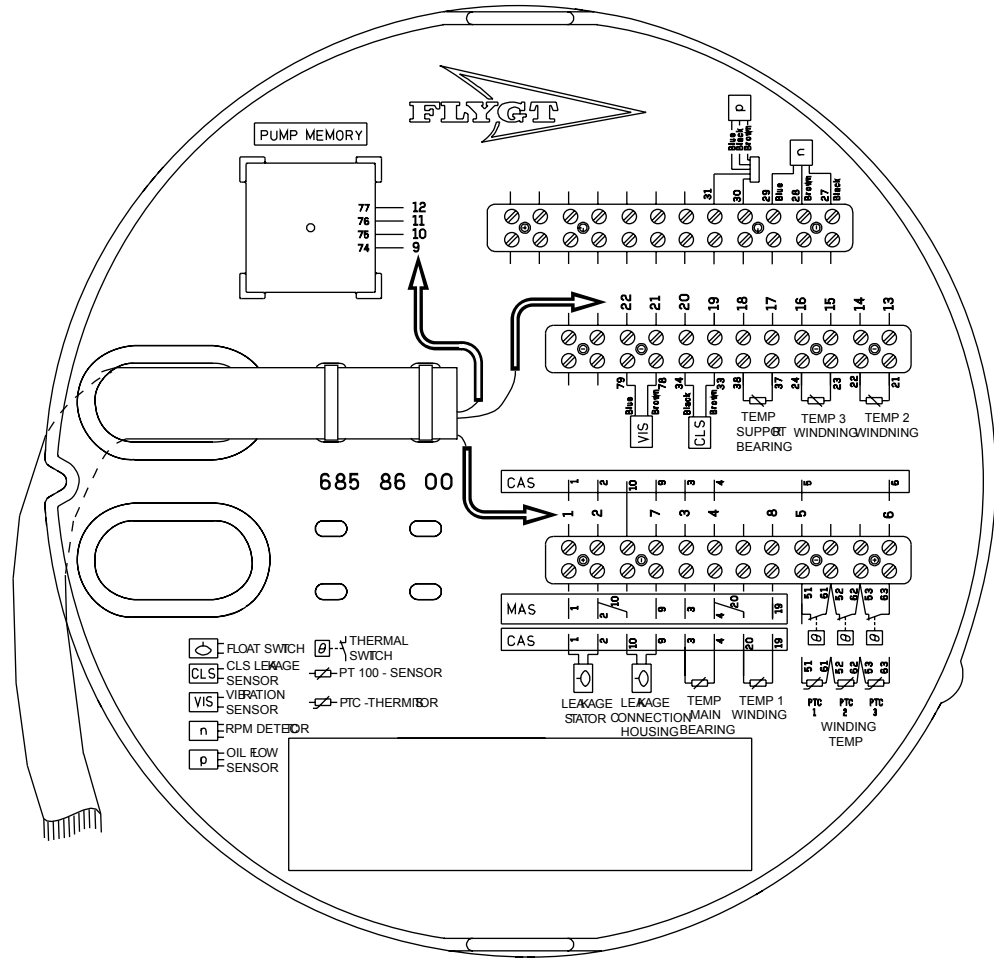


Figure 19: Connections at the pump. Arrows indicate SUBCAB cable lead numbers.

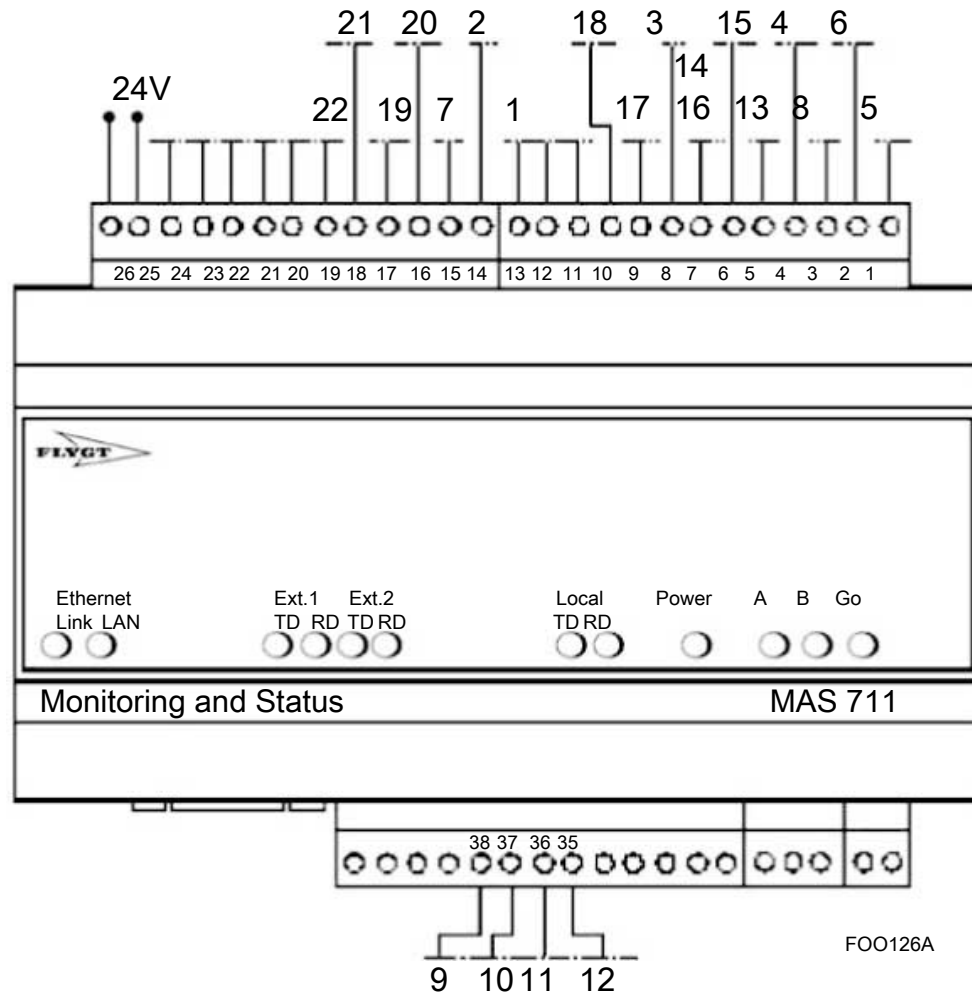


Figure 20: Connections at the MAS 711 base unit

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

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

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

³ The Pt100 sensor in the main bearing and the support bearing use the same terminal (terminal 4) on the terminal block

Sensor	Terminal block	Conductor number for 12-lead cable	Conductor for 24-lead cable
Pt100 in the stator winding 1	19	8	8
	4	–	–
Pt100 in the stator winding 2	21	–	13
	22	–	14
Pt100 in the stator winding 3	23	–	15
	24	–	16
Pump memory RS-485 B	74	9	9
Pump memory RS-485 A	75	10	10
Pump memory supply, earth (ground)	76	11	11
Pump memory supply, 12 V DC+	77	12	12
Vibration sensor VIS10	+ 78	–	21
	- 79	–	22

CAS or MAS 711 + MRM-01 sensor connections

The CAS monitoring system has been replaced by the MAS 711. This section provides information for connecting CAS to 6X5, 7X5, 8X5 and 9X5 drive units in the following situations:

- A replacement pump is being installed at an older pump station, where the CAS system is still functioning.
- A replacement monitoring system is needed at an older pump station, where the pump is still working but the CAS system must be replaced.

The CAS monitoring system is no longer available as a spare part. If a replacement for CAS is needed at an older pump station, then the MAS 711 plus the MRM-01 relay may be used.

Connection plate in pump housing

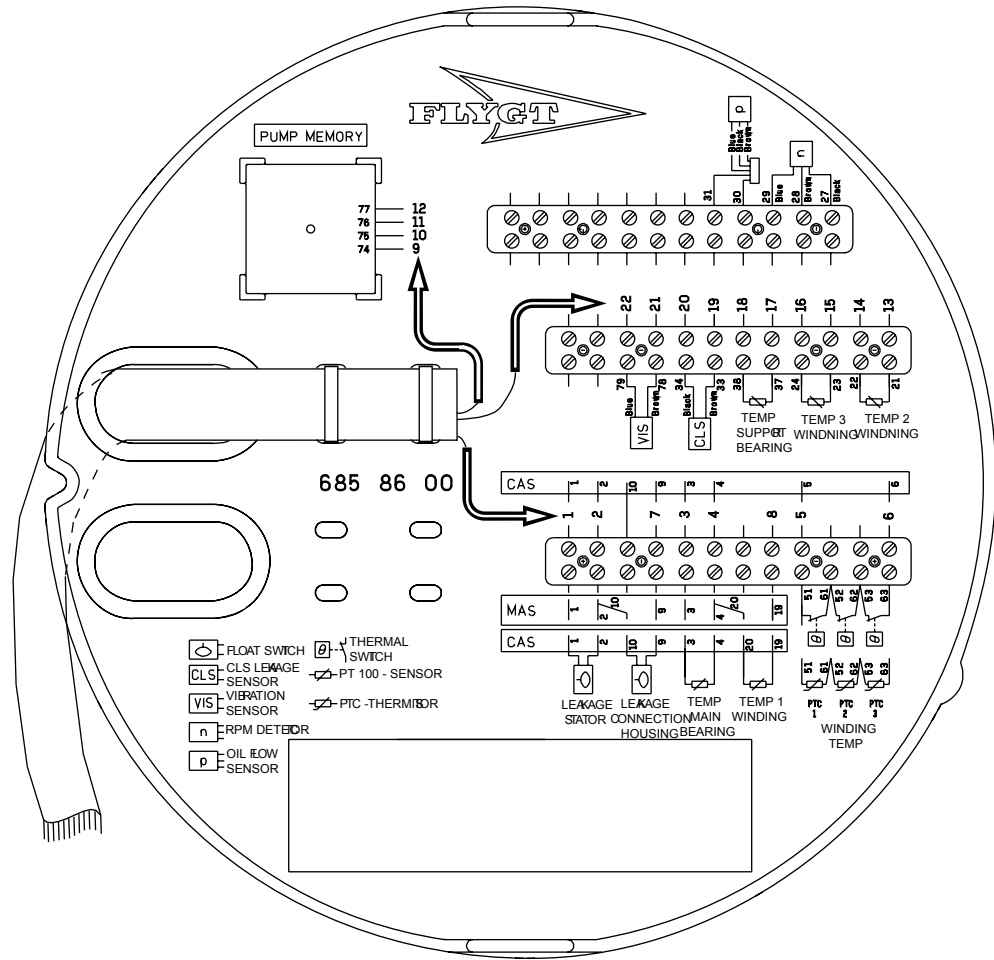


Figure 21: Connections at the pump. Arrows indicate SUBCAB® cable lead numbers.

MAS 711 + MRM-01

This section provides connection diagrams for replacing the CAS monitoring system with the MAS 711 together with the MRM-01 relay.

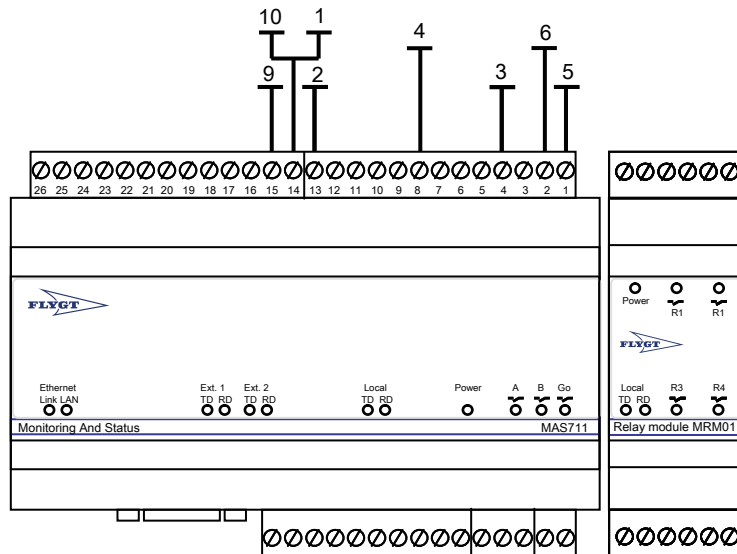


Figure 22: Connections at the MAS 711 + MRM-01 base units

Description	Part number
Unit, MAS 711 and MRM-01	40 50 15 45
MAS 711	40 50 11 41
MRM-01	40 50 15 36

CAS-connected pumps

The CAS system is no longer available as a spare part.

This section provides connection diagrams for replacement pumps at stations equipped with a functioning CAS monitoring system.

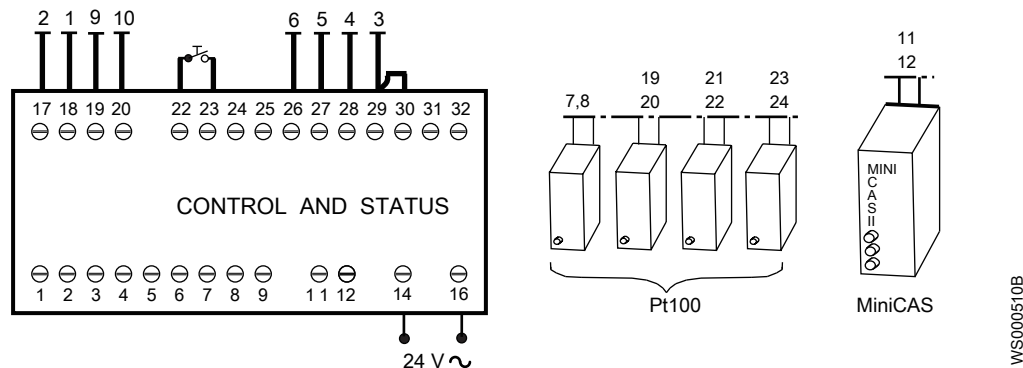


Figure 23: Connections at the CAS base unit

For more information about the CAS system, see [CAS system](#) (page 22).

Connection table

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

Sensor	Terminal block	Conductor number for 12-lead cable	Conductor for 24-lead cable
Float switch in the stator housing	1	1	1
	2	2	2
Pt100 in the main bearing	3	3	3
	4	4	4
Thermal switches or thermistors in the stator	5	5	5
	6	6	6
Pt100 in the support bearing	37	7	7
	38	8	8
Float switch in the junction box	9	9	9
	10	10	10
CLS sensor in the oil housing	+	33	11
	-	34	12
Pt100 in the stator winding 1	19	-	19
	20	-	20
Pt100 in the stator winding 2	21	-	21
	22	-	22
Pt100 in the stator winding 3	23	-	23
	24	-	24

Cable charts



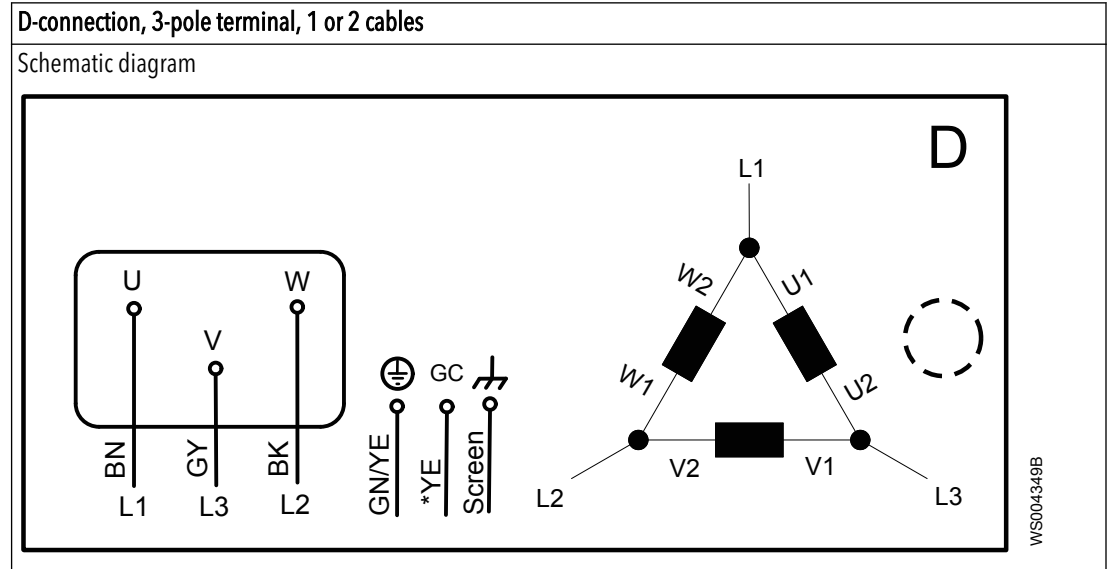
Electrical Hazard:

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

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

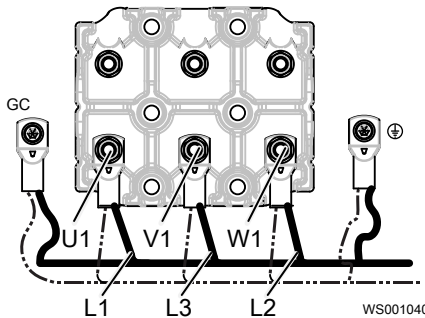
Drive units up to 1.1 kV



D-connection, 3-pole terminal, 1 or 2 cables

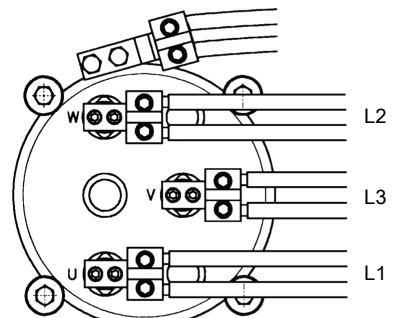
Drive units:

- 605/615, 665/675
- 705/715, 735/745, 765/775 with small connection housing
- 706/716, 736/746, 766/776 with small connection housing



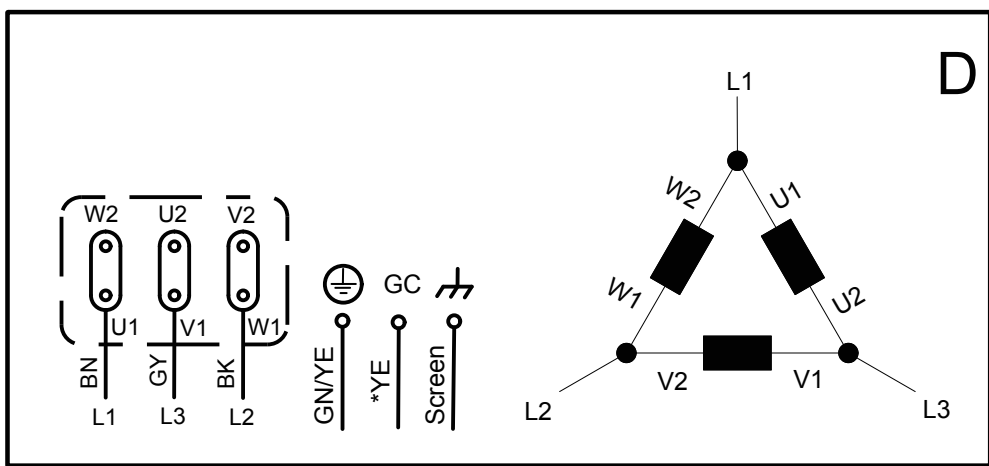
Drive units:

- 805/815, 835/845, 865/875, 885/895
- 905/915, 935/945, 965/975
- 705/715, 735/745, 765/775 with large connection housing
- 706/716, 736/746, 766/776 with large connection housing



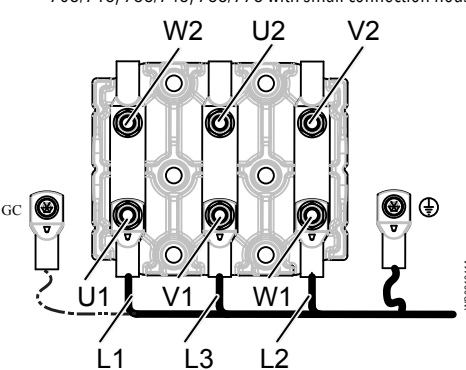
D-connection, 6-pole terminal, 1 cable; 6X5, 7X5 and 7X6 series

Schematic diagram



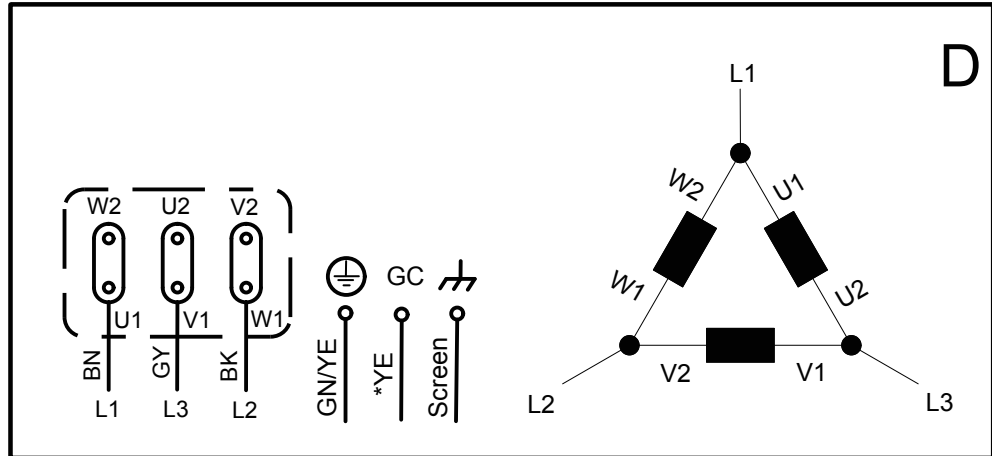
Drive units:

- 605/615, 665/675
- 705/715, 735/745, 765/775 with small connection housing
- 706/716, 736/746, 766/776 with small connection housing



D-connection, 6-pole terminal; 2 cables

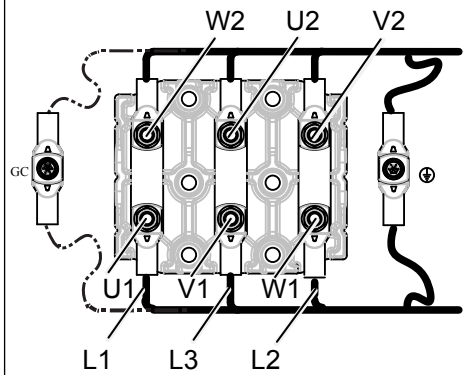
Schematic diagram



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Drive units:

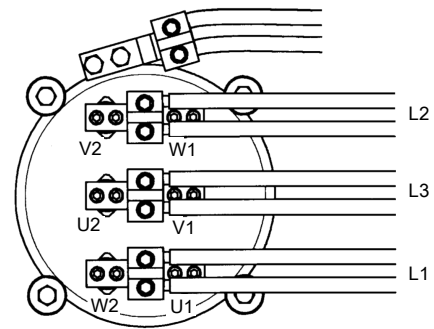
- 605/615, 665/675
- 705/715, 735/745, 765/775 with small connection housing
- 706/716, 736/746, 766/776 with small connection housing



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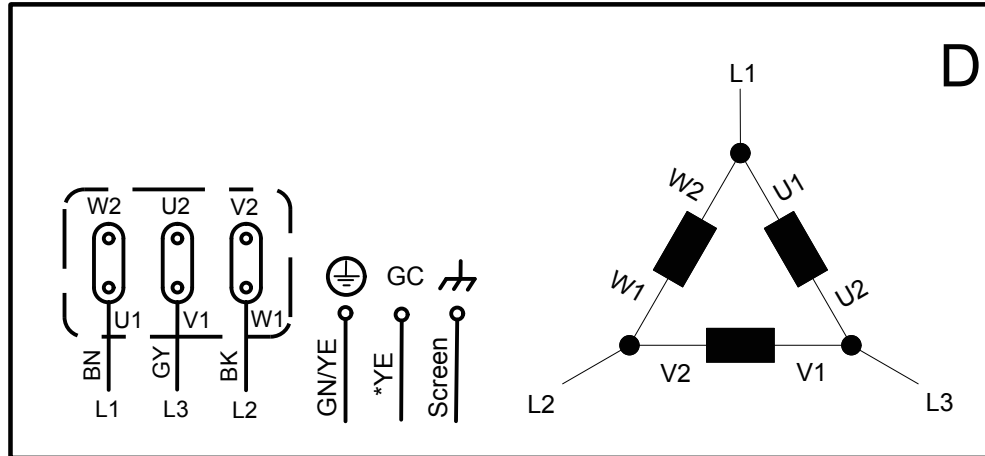
Drive units:

- 805/815, 835/845, 865/875, 885/895
- 905/915, 935/945, 965/975
- 705/715, 735/745, 765/775 with large connection housing
- 706/716, 736/746, 766/776 with large connection housing



D-connection, 6-pole terminal; 3 cables

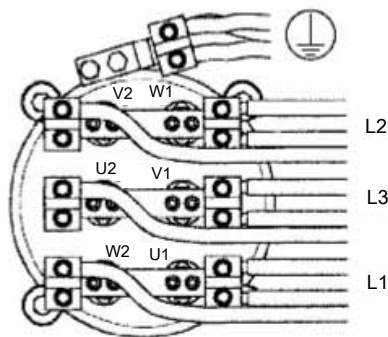
Schematic diagram



WS003911A

Drive units:

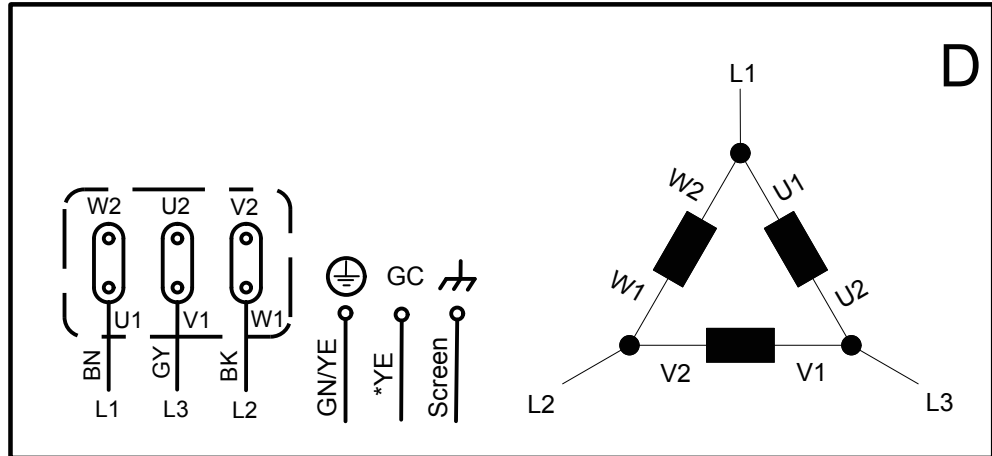
- 705/715, 735/745, 765/775 with large connection housing
- 805/815, 835/845, 865/875, 885/895
- 905/915, 935/945, 965/975



WS001729A

D-connection, 6-pole terminal; 4 cables

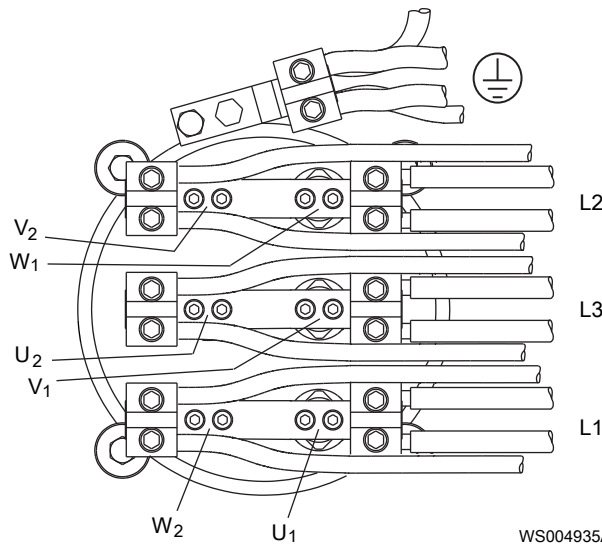
Schematic diagram



WS003911A

Drive units:

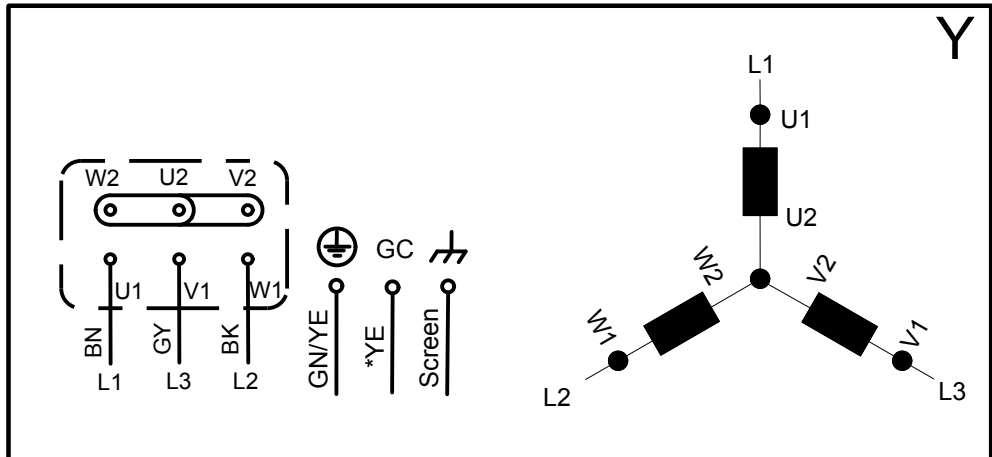
- 965/975



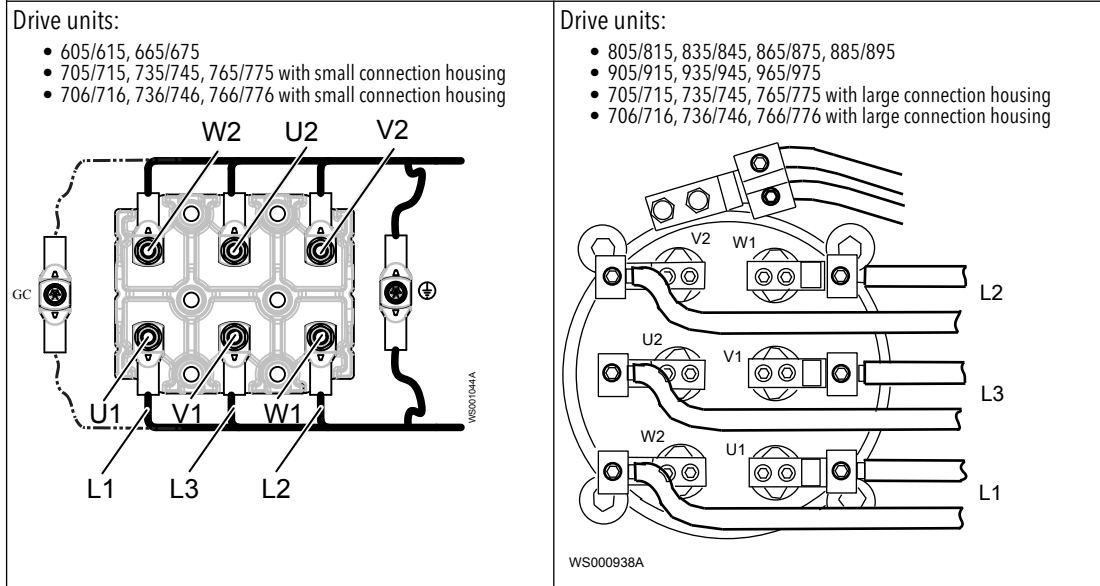
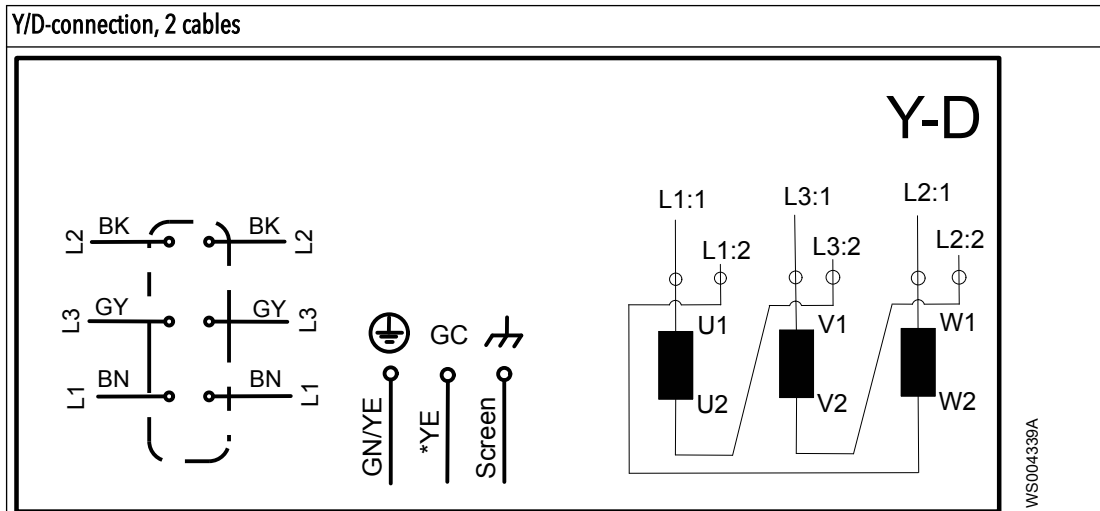
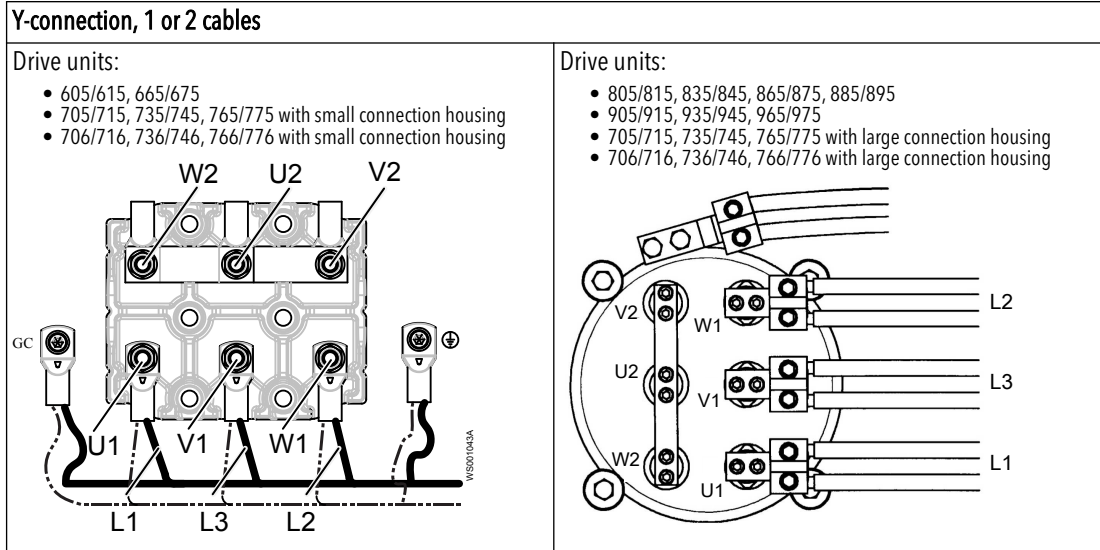
WS004935A

Y-connection, 1 or 2 cables

Schematic diagram

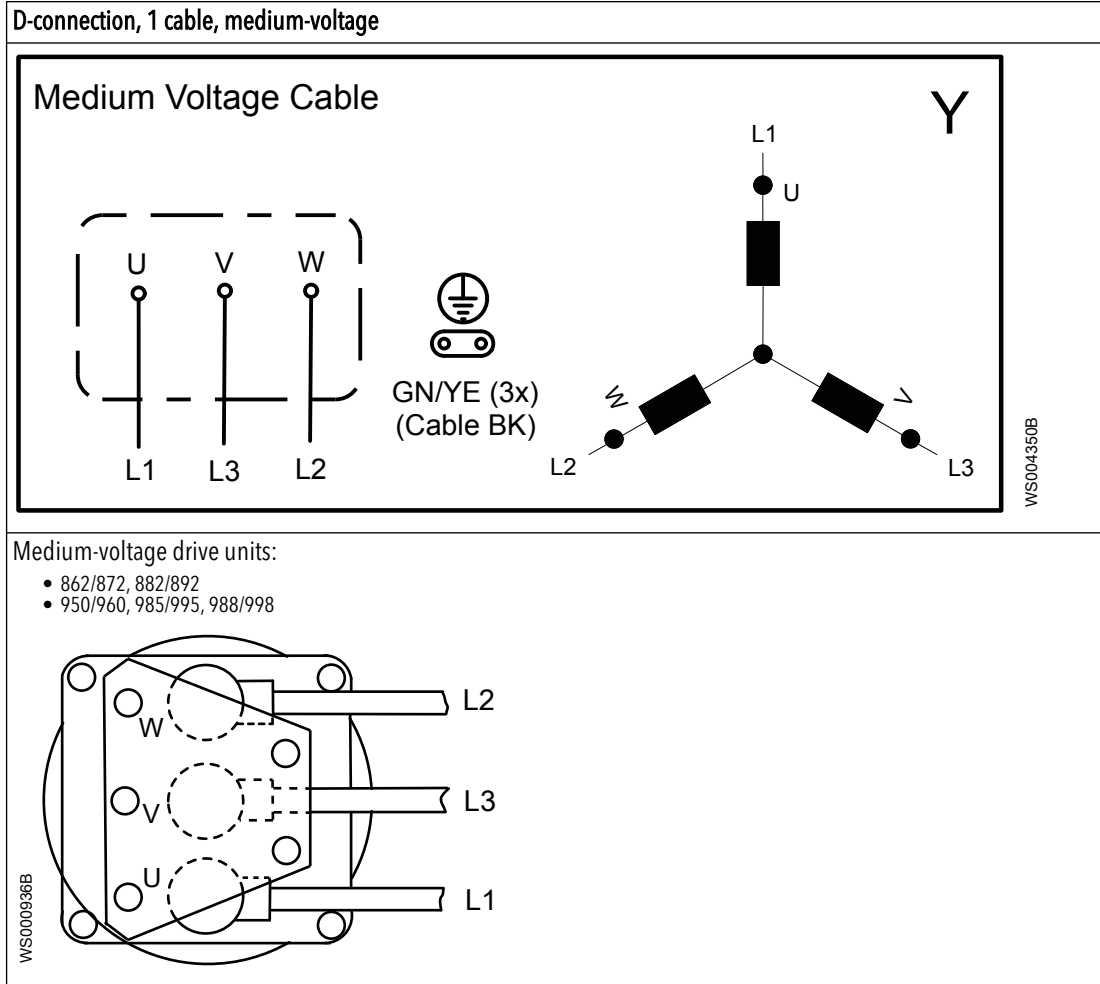


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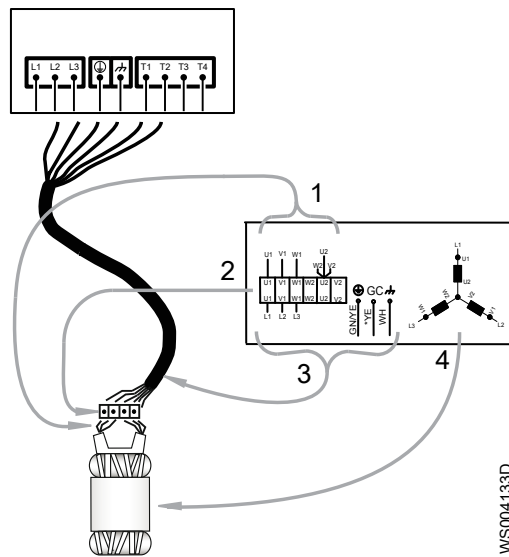
Drive units 1.2-6.6 kV

The connection diagrams for medium-voltage (1.2-6.6 kV) drive units are shown in the table below.

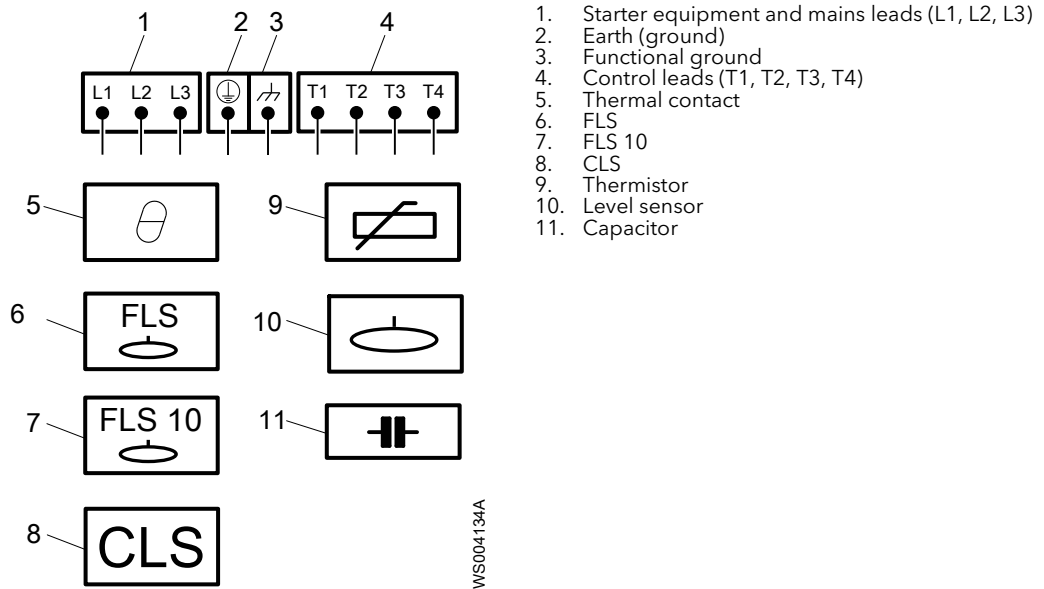


Connection locations

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



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



3-phase connection, screened

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

The following figure shows screened SUBCAB cable without separate ground conductor. The ground conductor is made of stranded ground cores.

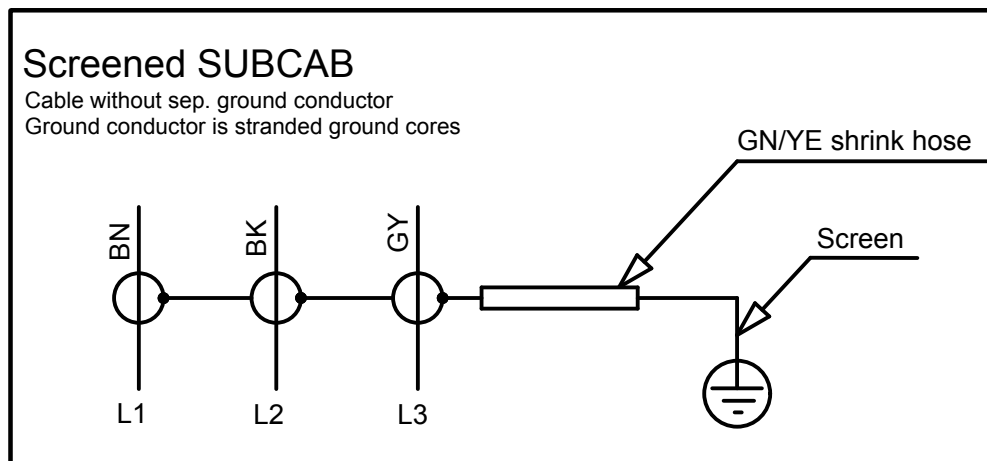
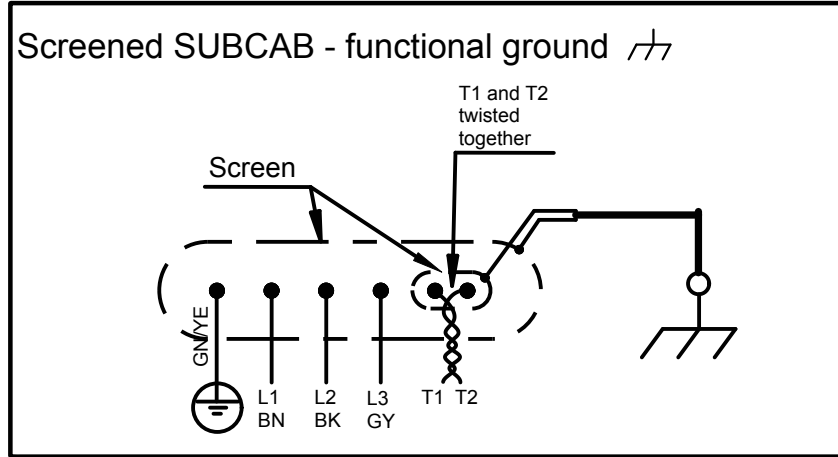


Figure 24: Without separate ground conductor

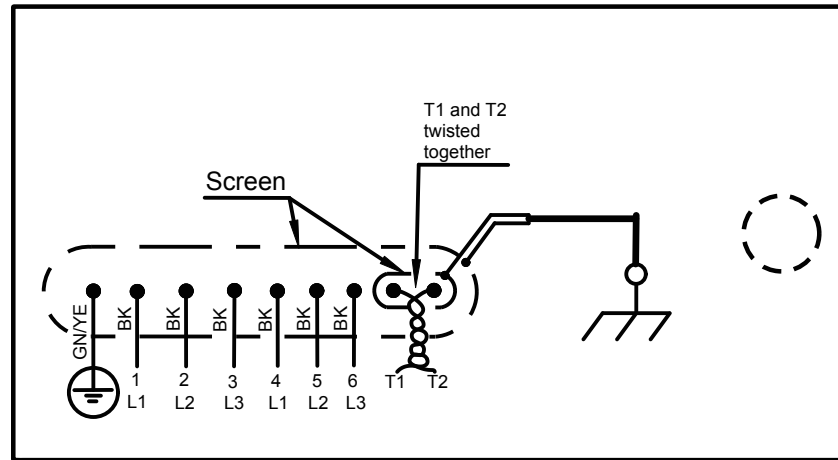
The following figure shows screened SUBCAB with functional ground. T1 and T2 are twisted together.



WS004341A

Figure 25: With functional ground

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



WS004351B

Figure 26: With functional ground

Colors and markings of power leads

Table 15: Colors or markings on the main leads

Mains	Color of cable lead		
	SUBCAB	SUBCAB AWG	NTSCGEWTOEUS – marking
L1 cable lead	Brown (BN)	Red (RD)	Black (BK) – L1
L2 cable lead	Black (BK)	Black (BK)	Black (BK) – L2
L3 cable lead	Grey (GY)	White (WH)	Black (BK) – L3
Earth PE or ground cable lead	Green/Yellow (GNYE)	Green/Yellow (GNYE)	Green/Yellow (GNYE)
Ground check GC cable lead	–	Yellow (YE)	–

Table 16: Color of stator leads. (Cables up to 1.1 kV. Not valid for 1.2–6.6 kV.)

Stator leads	Color
U1	Red (RD)

Stator leads	Color
V1	Brown (BN)
W1	Yellow (YE)
U2	Green (GN)
V2	Blue (BU)
W2	Black (BK)

Cable bending radius, weight and diameter

Control cables

Table 17: SUBCAB® control cables

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

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

Power cables with power cores and control element

Table 18: Screened SUBCAB

Cable	Minimum bending radius in mm	Weight in kg/m	Outer diameter, minimum-maximum in mm
S3x16 + 3x16/3 + S(4x0.5)	240	1.1	Ø 24-26
S3x25 + 3x16/3 + S(4x0.5)	290	1.4	Ø 29-31
S3x35 + 3x16/3 + S(4x0.5)	320	2.0	Ø 32-34
S3x50 + 3x25/3 + S(4x0.5)	380	3.0	Ø 38-40
S3x70 + 3x35/3 + 2 S(2x0.5)	420	3.5	Ø 42-44
S3x95 + 3x50/3 + 2S(2x0.5)	440	4.6	Ø 44-47
S3x120 + 3x70/3 + 2S(2x0.5)	500	5.5	Ø 50-52
S6x95 + 95 + S(4x0.5)	570	7.6	Ø 57-60

Table 19: SUBCAB

Cable	Minimum bending radius in mm	Weight in kg/m	Outer diameter, minimum-maximum in mm
4 G 16 + S(2x0.5)	260	1.13	Ø 26-28
4 G 25 + S(2x0.5)	320	1.7	Ø 32-34
4 G 35 + S(2x0.5)	350	2.24	Ø 35-37
3x50 + 2G35/2 + S(2x0.5)	350	2.6	Ø 35-37
3x70 + 2G35/2 + S(2x0.5)	380	3.3	Ø 38-41
3x95 + 2G50/2 + S(2x0.5)	470	4.5	Ø 47-50
3x120 + 2G70/2 + S(2x0.5)	540	5.7	Ø 54-56

Power cables, 1.2-10 kV

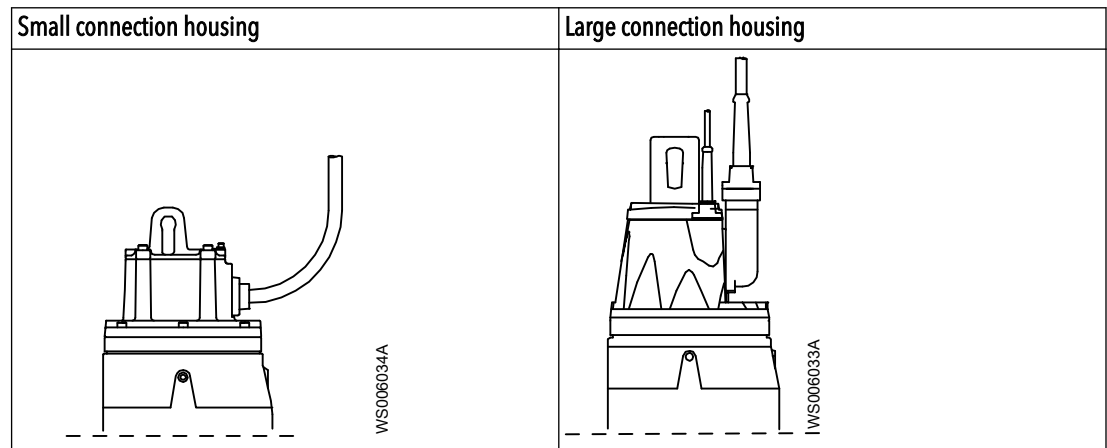
Table 20: NTSCGEWTOEUS 1.2-10 kV

This table shows the minimum bending radius, weight and outer diameter for NTSCGEWTOEUS 1.2-10 kV cables.

Cable	Minimum bending radius in mm	Weight in kg/m	Outer diameter, minimum-maximum in mm
3x25+3x25/3	385	3.32	Ø 46.4-49.4
3x50+3x25/3	450	4.78	Ø 54.0-58.0

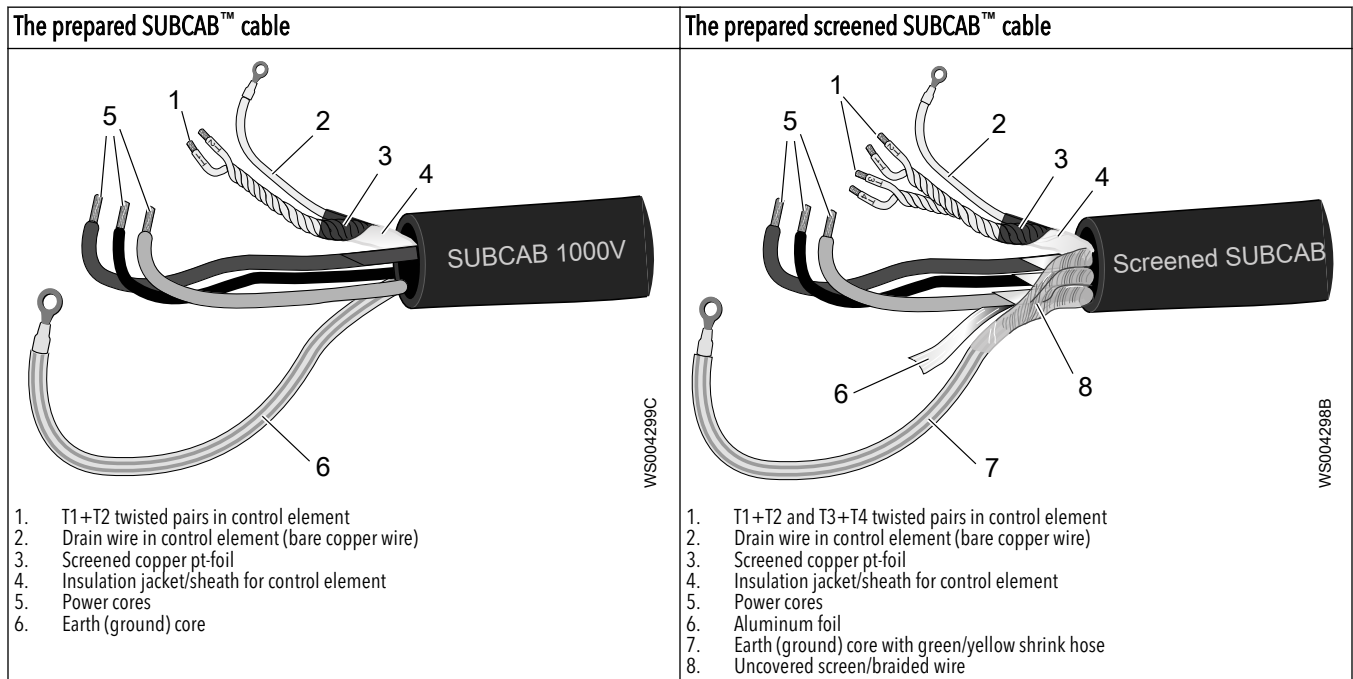
Connection housing (junction box) in 7X5 and 7X6 drive units

This table shows the large and small connection housings (junction boxes) for 7X5 and 7X6 drive units.



Prepare the SUBCAB™ cables

This section applies to SUBCAB 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.

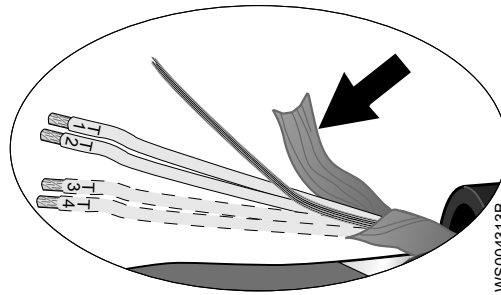


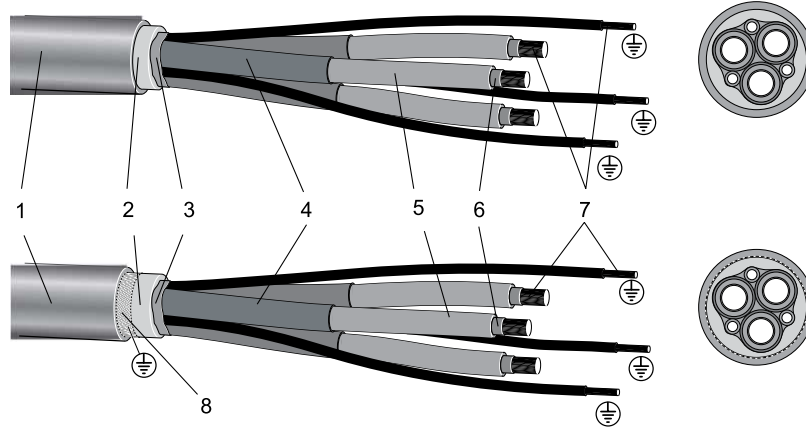
Figure 27: Copper foil on control element.

- 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 an insulating hose and insulating tape over the control element.
Make sure that the copper foil is covered.
3. Prepare the earth (ground) core for SUBCAB™ cable:
 - a) Peel the yellow-green insulation from the earth (ground) core.
 - b) Check that the earth (ground) core is at least 10% longer than the phase cores in the cabinet.
 4. Prepare the earth (ground) core for screened SUBCAB™ cable:
 - a) Untwist the screens around the power cores.
 - b) Put a yellow-green shrink hose over the earth (ground) core.
Leave a short piece uncovered.
 - c) Twist all power core screens together to create a earth (ground) core and fit a cable terminal to the end.
 - d) Check that the earth (ground) core is at least 10% longer than the phase cores in the cabinet.
 5. How is the connection to earth (ground) made?
 - Screw: Fit cable terminals to the earth (ground) 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.

Prepare the medium-voltage cable

This instruction is for preparing medium voltage (1.2-10 kV) power cables prior to connecting them at the pump.

The upper illustration shows a cable without screen. The lower illustration shows a screened cable.

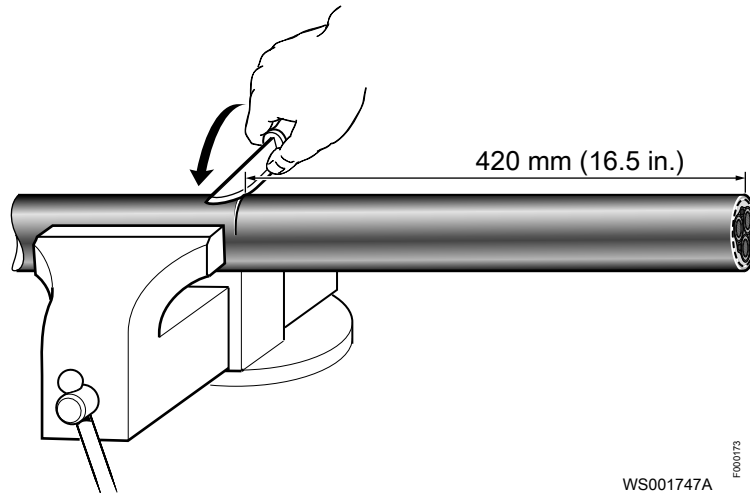


WS001742B

1. Outer cable sheath
2. Inner sheath
3. Conductive foil
4. Conductive layer
5. Conductor insulation
6. Conductive foil
7. Copper conductor
8. Shield wires

1. Peel off 420 mm of the cable casing at the connection end of the cable.

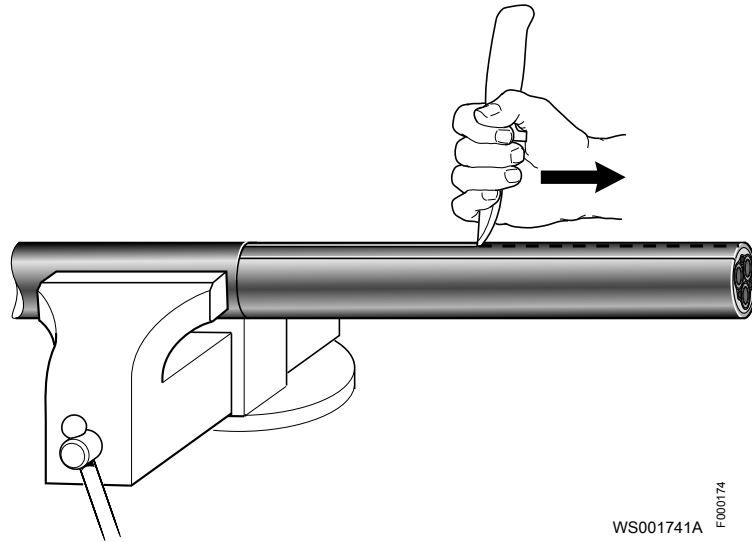
a) Make the vertical cut.



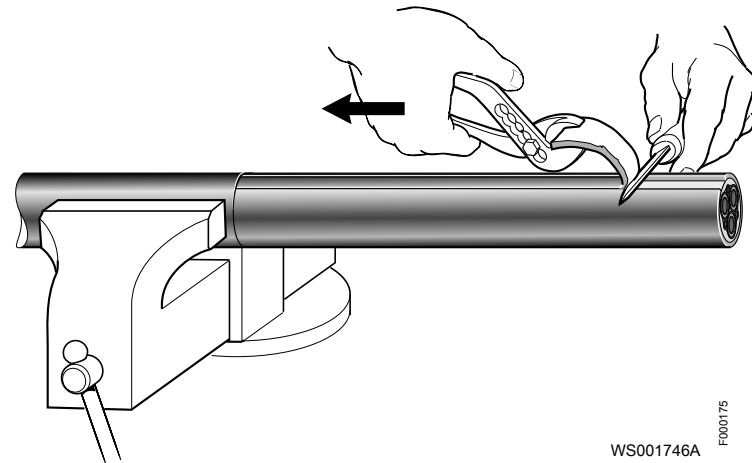
WS001747A

F000173

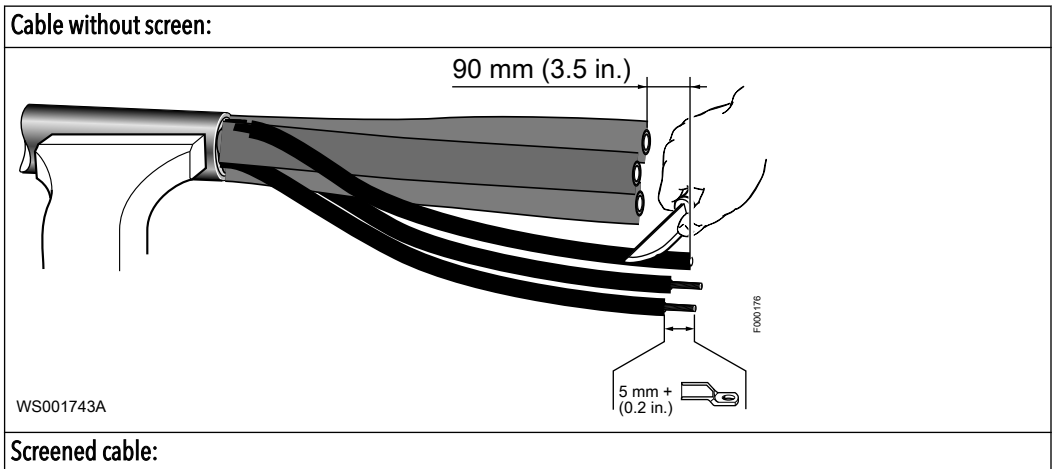
b) Make the horizontal cut.

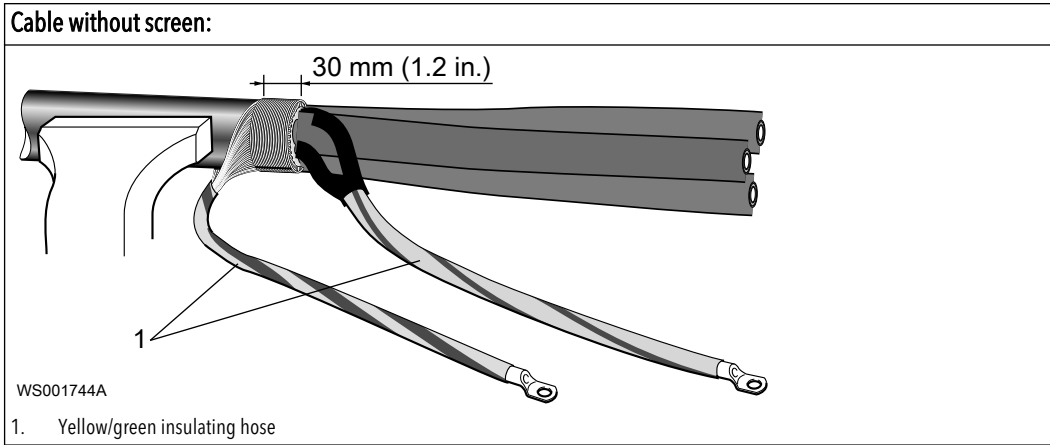


c) Remove the cable casing.

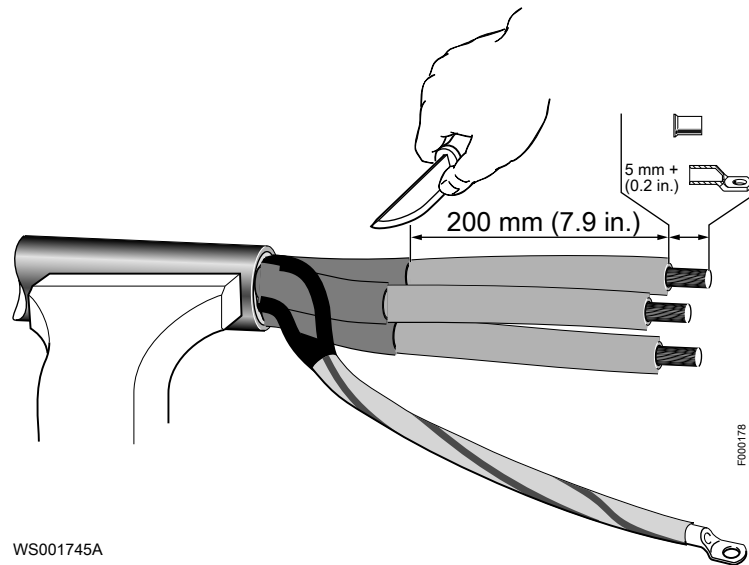


2. Peel off the casing from the leads.

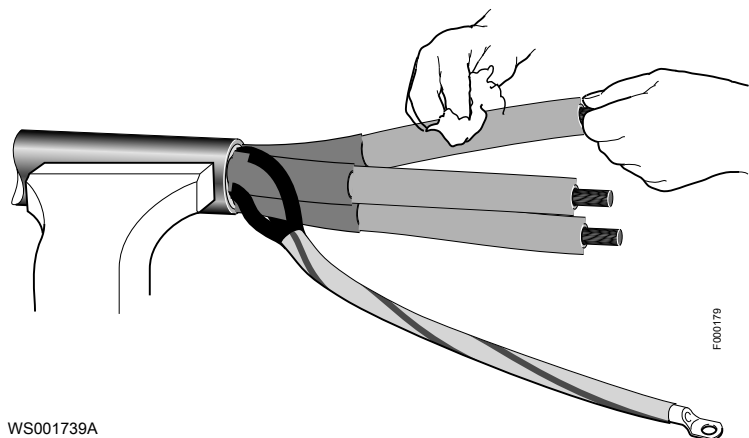




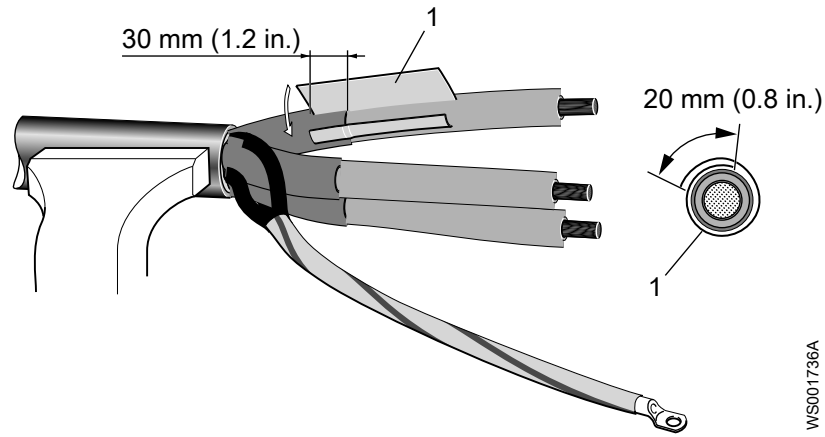
3. Peel off the conductive layer.



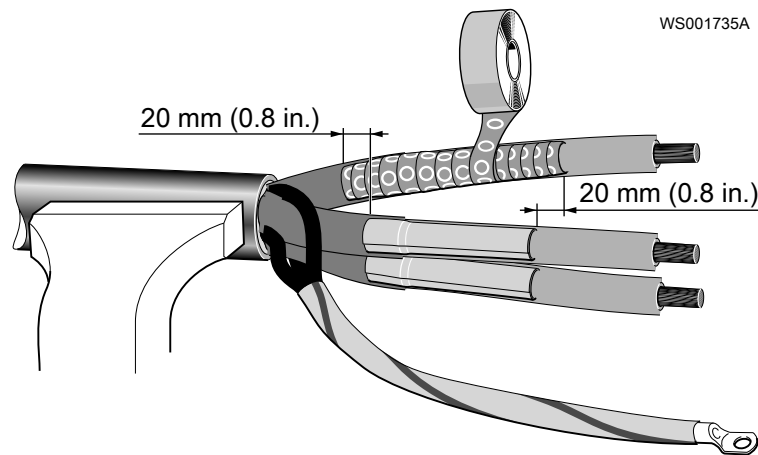
4. Clean the power leads with chemically pure petrol.



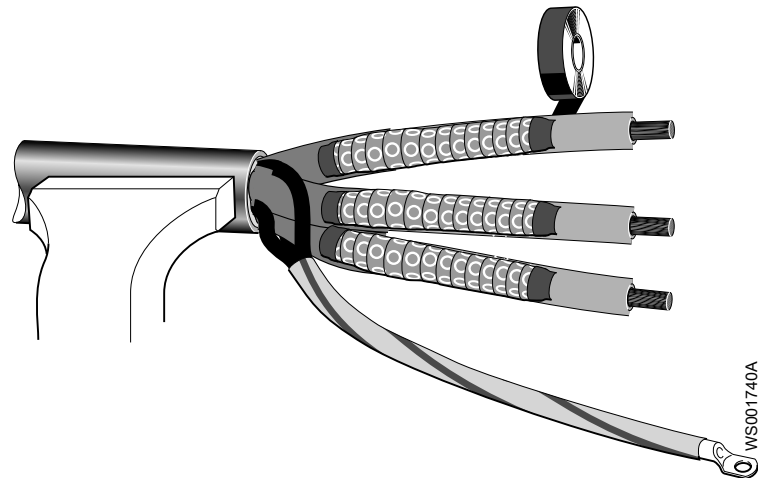
5. Attach the FSD (stress-grading pad) to the leads.



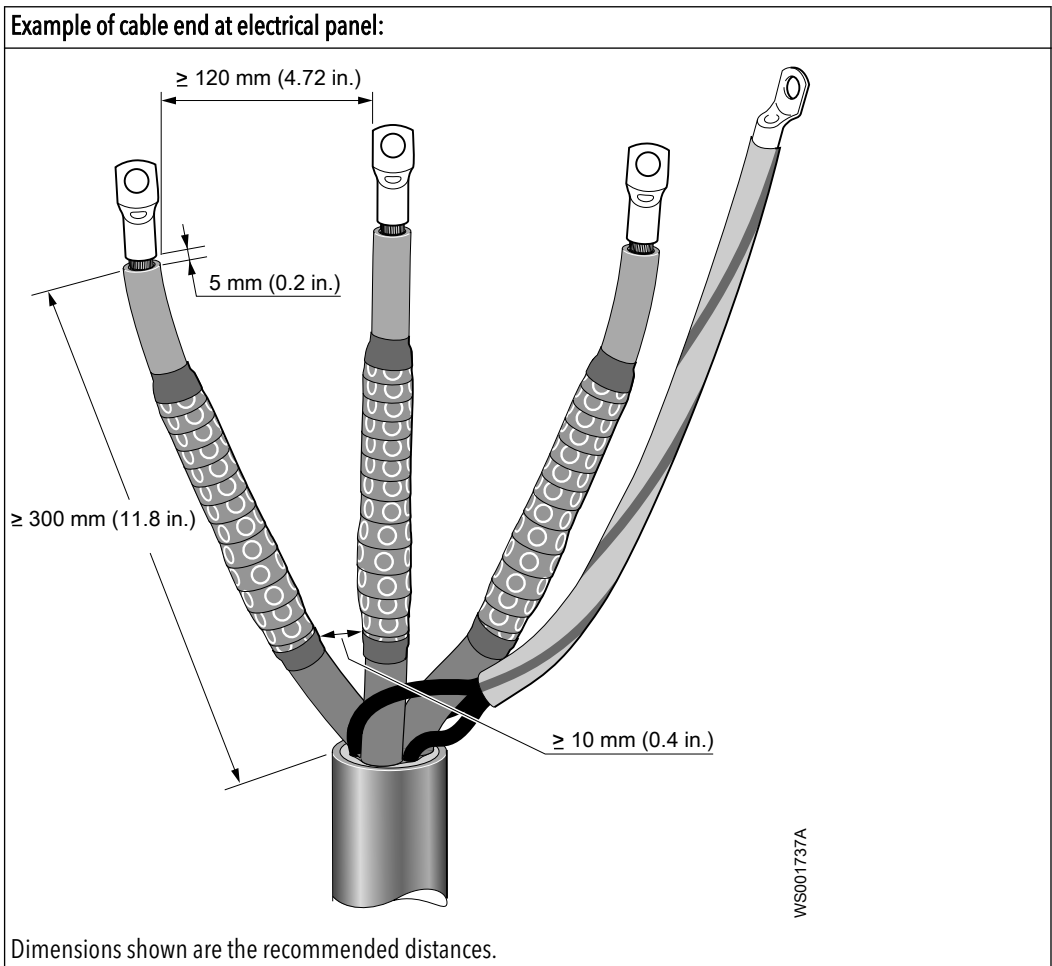
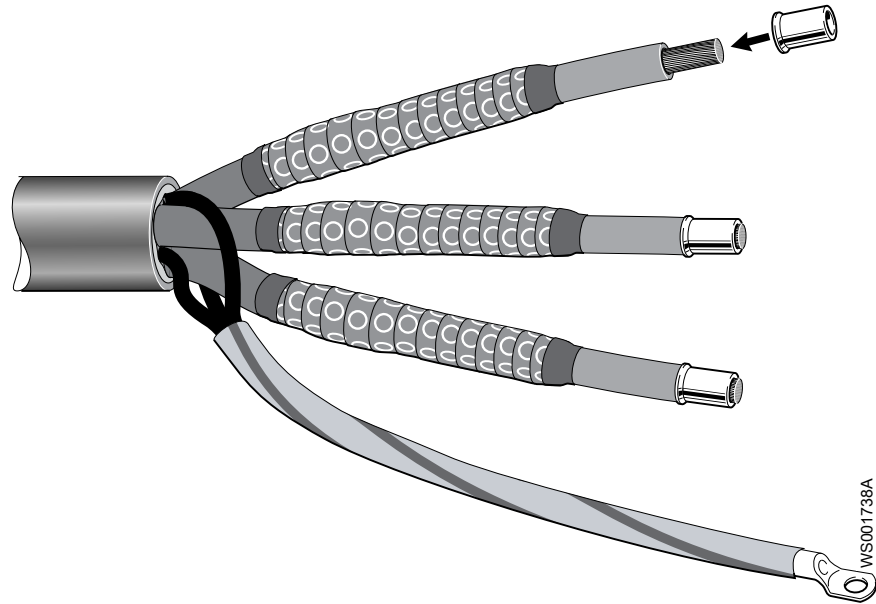
1. FSD, stress-grading pad
6. Apply four turns of IV (insulating self-bonding) tape with half overlap. Stretch the tape until the markings are circular.



7. Fasten the IV tape ends with electrical tape.



8. Fasten the connection shoes and connection eyes to the leads.



Connect the coolant

This instruction applies to pumps with the following drive units:

- 605, 615, 665, 675
- 705, 715, 735, 745, 765, 775
- 706, 716, 736, 746, 766, 776 with external cooling

- 805, 815, 835, 845, 865, 875, 885, 895
- 862, 872, 882, 892
- 905, 915, 935, 945, 965, 975
- 950, 960, 985, 995, 988, 998

These instructions do not apply to the 7X6 drive units with internal cooling.

Connect the integrated cooling system

This instruction is for connecting a drainage pipe to the bottom of the cooling jacket for pumps using integrated cooling. The pumped fluid is used as coolant in these systems. When integrated cooling is used, coolant supply and return lines are not required.

This instruction does not apply to 7X6 drive units.

Connect the fittings to drain the coolant as shown in [Fittings needed to drain 6X5, 7X5, 8X5, 9X5 cooling jackets](#) (page 38).

Connect the external cooling system

This instruction is for connecting external cooling systems to the pump.

1. Connect the coolant supply line to the pump inlet.

For location of the inlet connection on the drive unit, see [Coolant supply and return connections](#) (page 80).

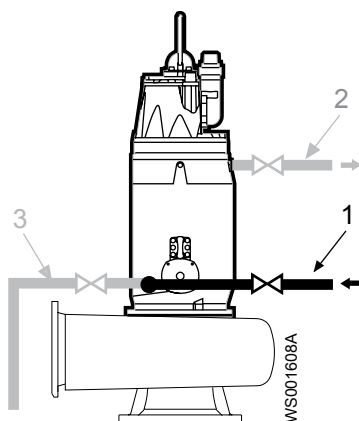


Figure 28: Connecting coolant supply

2. Connect the coolant return line to the outlet on the pump.

For location of the return line connection on the drive unit, see [Coolant supply and return connections](#) (page 80).

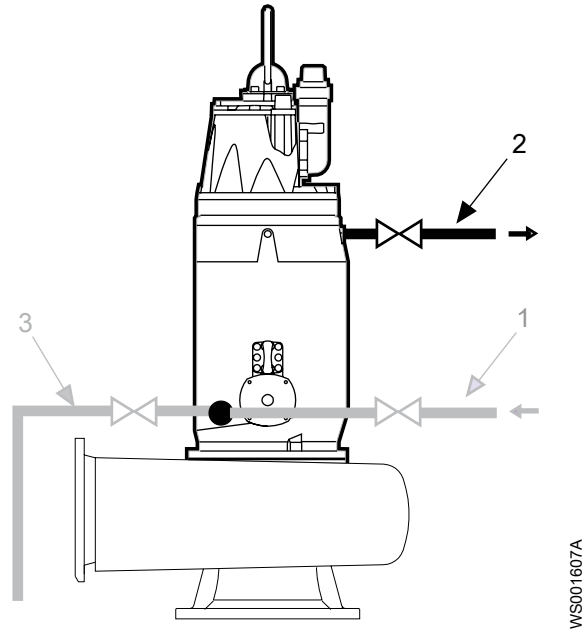


Figure 29: Connecting coolant return line

3. Connect the fittings to drain the coolant, see [Fittings needed to drain 6X5, 7X5, 8X5, 9X5 cooling jackets](#) (page 38).

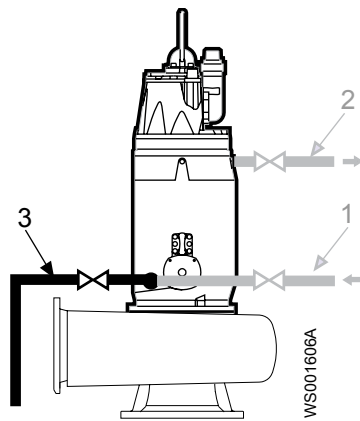


Figure 30: Connecting fittings to drain coolant

Coolant supply and return connections

Drive units: 6X5

This section applies to the following drive units:

- 605, 615, 665, 675

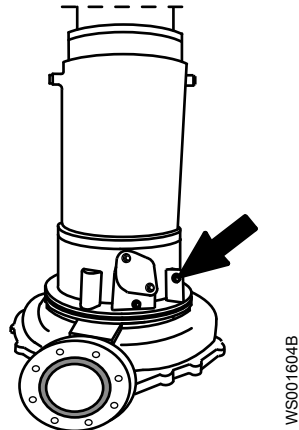


Figure 31: Inlet for coolant supply line

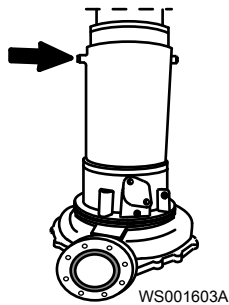


Figure 32: Coolant return line

Drive units: 7X5, 8X5, 9X5

This section applies to the following drive units:

- 705, 715, 735, 745, 765, 775
- 805, 815, 835, 845, 862, 865, 872, 875, 882, 885, 892, 895
- 905, 915, 935, 945, 950, 960, 965, 975, 985, 995, 988, 998

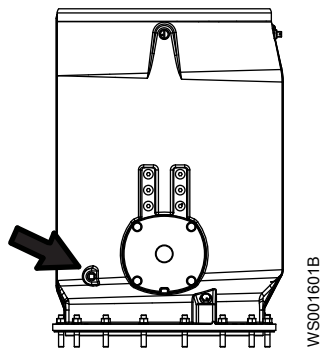


Figure 33: Inlet for coolant supply line

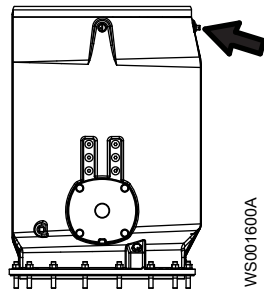


Figure 34: Coolant return line

Drive units: 7X6

This section applies to the following drive units:

- 706, 716, 736, 746, 766, 776

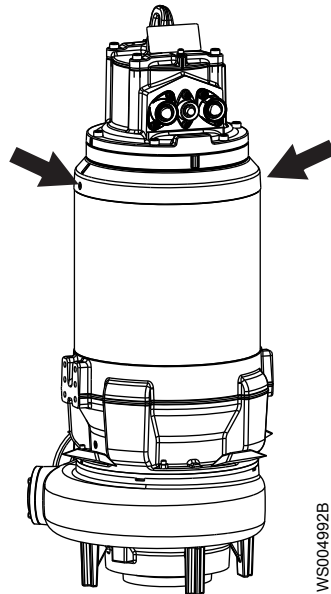


Figure 35: Connections for coolant supply and return lines

Connect the seal flushing

This instruction is for connecting the seal flushing water to the pump, in applications where seal flushing is used.

1. Check that the supply of incoming seal flushing water has been arranged as shown in [Circuit diagram for seal flushing](#) (page 40).
2. Connect the seal flushing supply water to the pump.
See [Connections for seal flushing](#) (page 41).

Check the impeller rotation

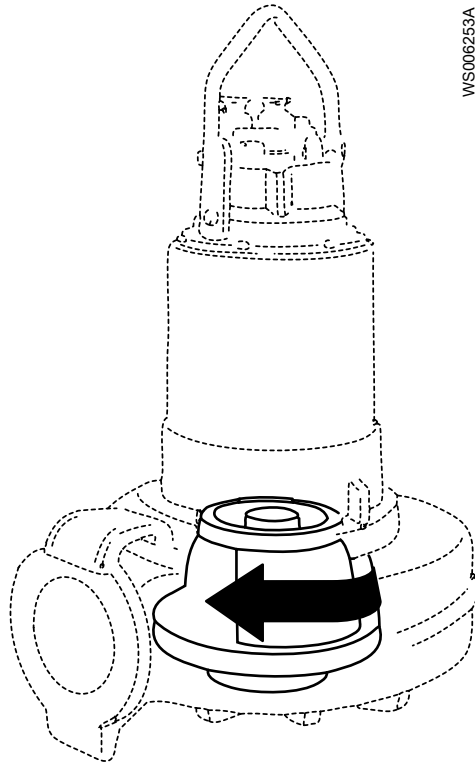


WARNING:

The starting jerk can be powerful.

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

The figure shows a generic impeller pump.



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

4. If the impeller/propeller rotates in the wrong direction, check that the phase leads are correctly connected. See [Power cable phase sequence](#) (page 55).
After re-connecting phase leads, do this procedure again.

Operation

Precautions



WARNING:

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



CAUTION:

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

Noise level

In certain installations and at certain operating points on the pump performance curve, the noise level can be greater than 70 dB.

Pumps with power output greater than 30 kW, as shown in the diagram below, may have a noise level between 70 dB and maximum 85 dB at the best efficiency point.

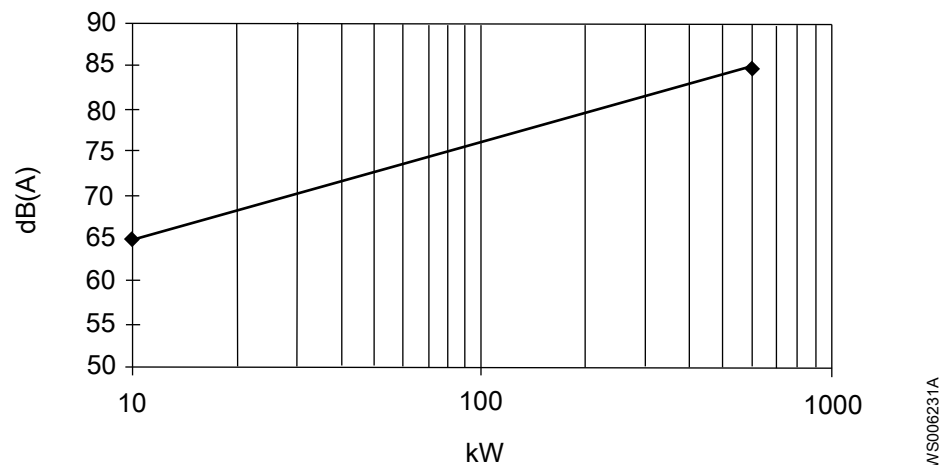


Figure 36: Sound pressure

Estimate zinc anode replacement intervals

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

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

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

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

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

Start the pump



WARNING:

- Make sure that the unit cannot roll or fall over and injure people or damage property.
 - Make sure nobody is close to the unit when it is started. The unit will jerk in the opposite direction of the impeller rotation.
-

1. Check that:
 - a) The monitoring equipment works.
 - b) The starter equipment is installed according to the manufacturer's instructions.
 - c) All the alarms are functioning.
 - d) The lubricant is at the correct level.
2. Remove the fuses or open the circuit breaker, and check that the impeller can be rotated freely.
Make sure the locking device has been removed. See [The locking device](#) (page 48).
Make sure that the propeller rotates in the correct direction. See [Check the impeller rotation](#) (page 81).
3. Conduct insulation test phase to ground. To pass, value must exceed five Megohms.
4. Start the pump.

Check that:

- the machine is working without noise or vibration.
- all electrical values are correct.
- all accessories are working properly.

Note any abnormalities.

Modifications for freezing conditions

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

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

Maintenance

Precautions



WARNING:

- Always follow safety guidelines when working on the product. See [Introduction and Safety](#) (page 3).
- If you need to work on the pump, make sure that it is isolated from the power supply and cannot be energized.



WARNING:

- Rinse the unit thoroughly with clean water before working on the unit.
- Rinse the components in water after dismantling.
- Make sure that the unit cannot roll or fall over and injure people or damage property.
- In some installations, the pump and the surrounding liquid may be hot. Bear in mind the risk of burn injuries.
- Make sure nobody is close to the unit when it is started. The unit will jerk in the opposite direction of the impeller rotation.

The following requirements apply:

- Make sure that all safety guards are in place and secure.
- Make sure that you have a clear path of retreat.
- Never work alone.
- Check the explosion risk before starting work.
- Allow all system and pump components to cool before you handle them.
- Do not open any vent or drain valves or remove any plugs while the system is pressurized. Make sure that the pump is isolated from the system and that pressure is relieved before you disassemble the pump, remove plugs, or disconnect piping.
- Depressurize and empty the coolant system for T and Z installations, and all installations with external cooling.
- Make sure electrical power is disconnected, locked and tagged.

Earth continuity verification

An earth continuity test must always be performed after service.

Service

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

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

Table 21: Service intervals

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

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

NOTICE:

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

Inspection



CAUTION:

The inside may be pressurized. Be careful when opening the inspection covers.

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

Do the following to service the pump:

Part to service	Action
Pump exterior	Check the entire pump and the cables for external mechanical damage.
Cable	<ol style="list-style-type: none"> 1. If the outer jacket is damaged, replace the cable. 2. Check that the cables do not have any sharp bends and are not pinched. 3. Check that the leads and cable entry screws are correctly connected and tightened to the correct torque.
Lifting handle	Check the lifting handle for corrosion or other damage.
Junction box	<ol style="list-style-type: none"> 1. General: Check that it is clean and dry. If it is wet: <ol style="list-style-type: none"> a. Check the cable entry. b. Replace the O-rings. (New O-rings should be fitted to all O-ring seal joints opened during inspection.) 2. Terminal board: Check that the connections are properly tightened.
Junction box insulation, drive units up to 1.1 kV	Check the condition and function. See Check the junction box insulation, up to 1 kV drives (page 88).
Junction box insulation, drive units 1.2 - 6.6 kV	Check the condition and function. See Check the junction box insulation, 1.2-6.6 kV drives (page 89).

Part to service	Action
Stator housing: 6X5, 7X5, 8X5, 9X5 drive units.	<ol style="list-style-type: none"> Check that it is clean and dry: <ul style="list-style-type: none"> If there is oil in the stator housing, then drain and clean it. After one week of operation, check again. If there is still oil in the stator housing, then change the seals. If there is water in the stator housing and there was water in the oil, change the seals immediately. If there is water in the stator housing, but there was no water in the oil, check all other connections. Replace the O-rings.
Oil housing: 6X5, 7X5, 8X5, 9X5 drive units.	<ol style="list-style-type: none"> Check the oil quality: <ul style="list-style-type: none"> If there is water in the oil, then drain the oil and replace with new oil. After one week of operation, check the oil quality again. If the oil is free from water, then fill the oil to the correct level, if necessary. Replace the filling plug O-rings.
Stator housing: 7X6 drive units with cooling jacket.	<ol style="list-style-type: none"> Check that it is clean and dry. If there is any fluid, then drain and clean it. Replace the O-rings.
Stator housing: 7X6 drive units without cooling jacket.	<ol style="list-style-type: none"> Check that it is clean and dry: <ul style="list-style-type: none"> If there is fluid in the stator housing, then drain and clean it. After one week of operation, check again. If there is still fluid in the stator housing, then change the seals. Replace the O-rings.
Inspection chamber: 7X6 drive units with cooling jacket.	<ol style="list-style-type: none"> Check that it is clean and dry: <ul style="list-style-type: none"> If there is fluid in the inspection chamber, then drain and clean it. After one week of operation, check again. If there is still fluid in the inspection chamber, then change the seals. Replace the O-rings.
Seal lubricant: 7X6 drive units.	Check the level. Fill to the correct level, if necessary.
Hydraulic parts	<ol style="list-style-type: none"> Check the general condition of the impeller/propeller and the wear ring. Replace if necessary. If applicable, check the O-ring.
Zinc anodes	Check and change if necessary.
Screw joints	Check all externally accessible screw joints, and tighten if necessary to correct torque. See Torque values (page 111).
Electrical cabinets	Check that they are clean and dry.
Connection to power	Check that the connections are properly tightened.
Level regulators	Check the condition and function. See Check the leakage sensors (page 89).
Temperature sensors	Check the condition and function. See Check the temperature sensors (page 89).

After any service involving the power connections, always check the rotation before operating the pump. See [Check the impeller rotation](#) (page 81).

Major overhaul

- Perform a complete inspection service. See [Inspection](#) (page 86).
- Do these additional steps:

Part to service	Action
Isolation check, drive units up to 1.1 kV	Check that the resistance between earth and phase lead is more than 5 MΩ.

Part to service	Action
Isolation check, 1.2 – 6.6 kV drive units	<ol style="list-style-type: none"> 1. Check that the resistance between earth and phase lead is above the minimum for the motor voltage. Recommended test voltage: 500 V DC (max. 1000 V DC). The resistance value is related to motor voltage and should have minimum value of 5 MΩ/kV at a temperature of 25°C (77°F). For example, for a 6 kV motor the resistance between earth and phase lead should be more than 30 MΩ.
Cable	Check that the rubber sheathing (jacket) is undamaged. Change if necessary.
Oil housing	6X5, 7X5, 8X5, 9X5 drive units: Change the oil. 7X6 drive units: Change the water-glycol mixture.
General dismantling and cleaning	<ol style="list-style-type: none"> 1. Dismantle the pump completely. 2. Clean all the parts. 3. Re-assemble after replacing bearings, O-rings and seals.
Bearings	Replace the bearings with new bearings.
O-rings and other rubber sealing parts	Replace O-rings and other rubber sealing parts.
Seals	Replace with new seals.
Sensors	<p>Check the following:</p> <ol style="list-style-type: none"> 1. Stator temperature sensors. 2. Bearing temperature sensors. 3. FLS and CLS sensors. <p>See Check the temperature sensors (page 89) and Check the leakage sensors (page 89).</p>
Impeller/propeller	Check the general status of the impeller/propeller and wear ring. Change if necessary.
Zinc anodes	Check their condition. Replace if necessary.
Screw joints	Check all externally accessible screw joints and tighten if necessary to correct torque. See torque table and Parts List.
Lifting handle	Check its condition. Replace if necessary.
Painting	Touch up any painting if necessary.
Rotational direction	Check impeller/propeller rotation direction. See Check the impeller rotation (page 81).
Voltage and amperage	Check the running values.
Electrical cabinets/panels	Check that they are clean and dry.
Connection to power	Check the cable connections. Tighten if necessary.
Overload and other protections	Check settings
Level regulators	Check condition and function.

After any service involving the power connections, you must check the rotation before operating the pump. See [Check the impeller rotation](#) (page 81).

Check the junction box insulation, up to 1 kV drives

1. Check that the resistance between the earth (ground) and phase lead is more than 5 megohms.
Use a 1000 V DC megger.
The resistance should preferably be more than 50 MΩ.
2. Keep a record of the results.

Check the junction box insulation, 1.2-6.6 kV drives

1. Check that the resistance value is a minimum of 5 megohms/kV at a temperature of 25°C (77°F).
Use a 1000 V DC megger. Recommended test voltage: 500 V DC, max. 1000 V DC.
The resistance should preferably be more than 300 megohms.
The resistance value is related to the motor voltage. For example, with a 6 kV motor, the resistance between earth (ground) and phase lead should be more than 30 megohms.
2. Keep a record of the results.

Check the temperature sensors

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

The different types of temperature sensors are:

- Thermal switches
- PTC-thermistors
- Pt100

NOTICE:

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

1. Disconnect the sensor wires.
2. Measure the resistance to check the status of the sensor and wiring according to the values in [Sensors](#) (page 26).
3. Measure between each sensor lead to earth (ground) to establish that the resistance is infinite (or at least several Megaohm).

Check the leakage sensors

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

1. Check the float switch (FLS) in the stator housing, according to the values in [Sensors](#) (page 26).
In 7X6 drive units with cooling jackets, the FLS is located in the inspection chamber.
Measure ohms by using a multimeter to establish either of the conditions below (or both if the sensor is accessible).
2. Check the float switch (FLS) in the junction box (connection housing).
3. Check the water-in-oil sensor (CLS) in the oil housing by following this procedure.
Not applicable for 7X6 drive units.
 - a) Connect the CLS to a 12 V DC supply.
The sensor must have the correct polarity in order to be checked. However, it will not be damaged if plus and minus are switched.
 - b) Use a multimeter as an ammeter, and connect it in series with the sensor.
 - c) If the sensor is accessible, check: the alarm function by gripping the sensor in your hand.
Skin and blood tissue contain a high content of water.For interpretation of the CLS measurement results, see [Sensors](#) (page 26).

Lubricants and coolants used in the drive units

Drive units	Coolant, if cooling jacket is used	Seal lubricant
605, 615, 665, 675	Water.	Oil
705, 715, 735, 745, 765, 775	For instructions about emptying the coolant, see Empty the cooling jacket: 6X5, 7X5, 8X5, 9X5 drive units (page 90).	For instructions about changing the oil, see Oil change: 6X5, 7X5, 8X5, 9X5 drive units (page 91).
805, 815, 835, 845, 865, 875, 885, 895		
862, 872, 882, 892		
905, 915, 935, 945, 965, 975		
950, 960, 985, 995, 988, 998	Water-glycol mixture For instructions about emptying the coolant, see Change the water-glycol mixture: 7X6 drive units (page 92).	Water-glycol mixture For instructions about emptying the lubricant, see Change the water-glycol mixture: 7X6 drive units (page 92).
706, 716, 736, 746, 766, 776		

Empty the cooling jacket: 6X5, 7X5, 8X5, 9X5 drive units

This section applies to drive units using one of the following:

- Integrated cooling
- External cooling

To check whether these instructions apply to a specific drive unit, see [Lubricants and coolants used in the drive units](#) (page 90).

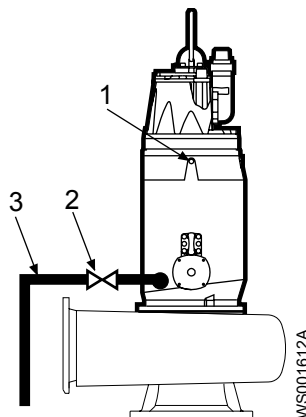
Empty the coolant (integrated cooling)



WARNING:

The cooling jacket must be drained before service.

1. Remove the vent plug marked "1" in the figure below.
2. Depressurize the cooling system by opening the stop-cock marked "2" in the figure below (if applicable).
3. Remove the coolant filling plug and empty the coolant through the drainage pipe, marked "3" in the figure below.
4. After you empty the cooling jacket on P and S installations, run the pump run dry for no more than 30 seconds to expel all water from the impeller area.



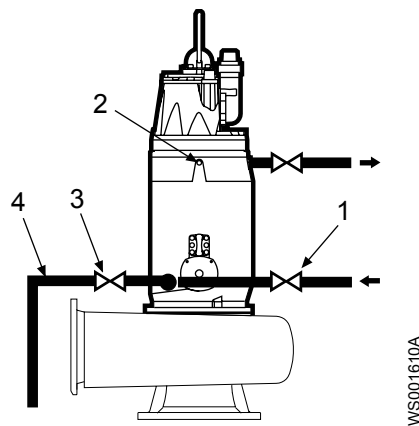
1. Vent plug
2. Stop-cock
3. Drainage pipe

Figure 37: T and Z installations with integrated cooling

Empty the coolant (external cooling)

Before starting work, check that the cooling jacket has been drained.

1. Turn off the supply of coolant to the pump, see "1" in the figure below.
2. Remove the vent plug marked "2" in the figure below.
3. Depressurize the cooling system by opening the stop-cock marked "3" in the figure below (if applicable).
4. Remove the coolant filling plug and empty the coolant through the drainage pipe, marked "4" in the figure below.
5. After you empty the cooling jacket on P and S installations, run the pump dry for no more than 30 seconds to expel all water from the impeller area.



1. Coolant inlet
2. Vent plug
3. Stop-cock
4. Drainage pipe

Figure 38: P, S, and T installations with external cooling

Oil change: 6X5, 7X5, 8X5, 9X5 drive units

To check which drive units use oil as lubricant, see [Lubricants and coolants used in the drive units](#) (page 90).

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

The replacement oil must have a viscosity class of ISO VG 15-35. Examples of suitable oil types are the following:

- Mobile Whiterex
- Shell Ondina

The amount of oil required is given below. Fill up the oil to the bottom thread.

Table 22: Pumps with cooling jacket

Drive unit	Volume of oil
6X5	5.5 liters (5.8 quarts)
7X5	5.5 liters (5.8 quarts)

Drive unit	Volume of oil
8X5	11 liters (11.6 quarts)
9X5	9 liters (9.5 quarts)

Table 23: Pumps without cooling jacket

Drive unit	Hydraulic unit	Volume of oil
6X5, 7X5	C3300, C3231, C3306, C3356	5.2 liters (5.5 quarts)
7X5, 8X5	C3240, C3312, C3400	11.5 liters (12.1 quarts)
8X5	C3501, C3531, C3602	8.4 liters (8.9 quarts)
9X5	C3351, C3531, C3602, C3800	9 liters (9.5 quarts)

Empty the oil

1. Unscrew the oil plugs.



WARNING:

The oil housing may be pressurized. Hold a rag over the oil plug to prevent oil from spraying out.

2. Pump out the oil.

Use oil drainage pump 83 95 42. Make sure that the plastic tube goes all the way to the bottom of the oil housing.



Fill with oil

1. Fill the housing with new oil.
Make sure that the oil reaches the oil holes when standing vertically.
2. Insert and tighten plugs with the new O-rings and plugs.
Tightening torque: 80 Nm (60 ft-lbs)
3. Check the paint; if damaged, repaint.

Change the water-glycol mixture: 7X6 drive units

This section is applicable for the drive units shown in the following table.

Table 24: 7X6 drive units

Standard drive units	Explosion-proof drive units
706	716
736	746
766	776

In 7X6 drive units, the same glycol-water mixture is used for cooling the motor, and for lubricating the seals.

Water-glycol amounts

Glycol-water mixture

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

NOTICE:

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

Volume of water-glycol mixture

Hydraulic unit	With cooling jacket, liter (qt.)			Without cooling jacket, liter (qt.)
	706 / 716	736 / 746	766 / 776	
C3231	71 (75)	87 (92)	100 (106)	5.2 (5.5)
C3306	71 (75)	87 (92)	100 (106)	5.2 (5.5)
C3312	76 (80)	92 (97)	105 (111)	11.5 (12.1)
C3356	71 (75)	87 (92)	100 (106)	5.2 (5.5)
C3400	76 (80)	92 (97)	105 (111)	11.5 (12.1)
C3501	77 (81)	93 (98)	106 (112)	8.4 (8.9)
C3531	77 (81)	93 (98)	106 (112)	8.4 (8.9)
C3602	77 (81)	93 (98)	106 (112)	9 (9.5)

Lubricant and coolant plugs

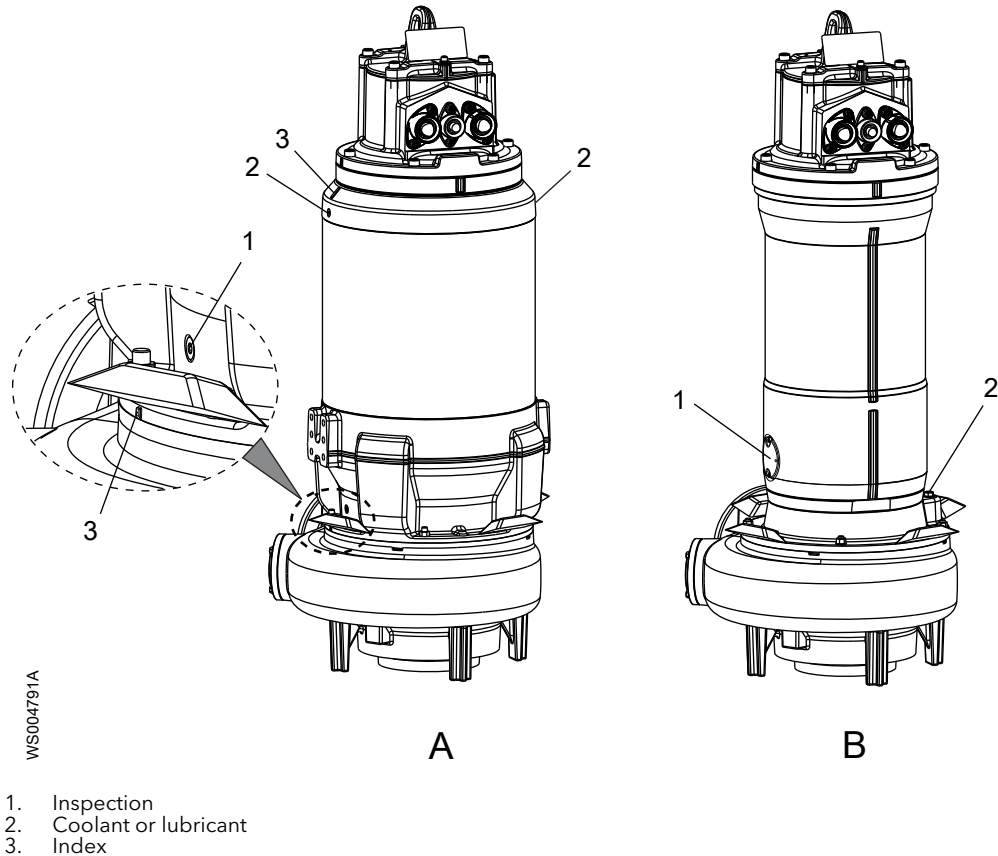


Figure 39: A: Drive unit with cooling jacket. B: Drive unit without cooling jacket.

7X6 drive units with cooling jacket

This section provides instructions for changing the coolant and lubrication fluid in 7X6 drive units with cooling jackets.

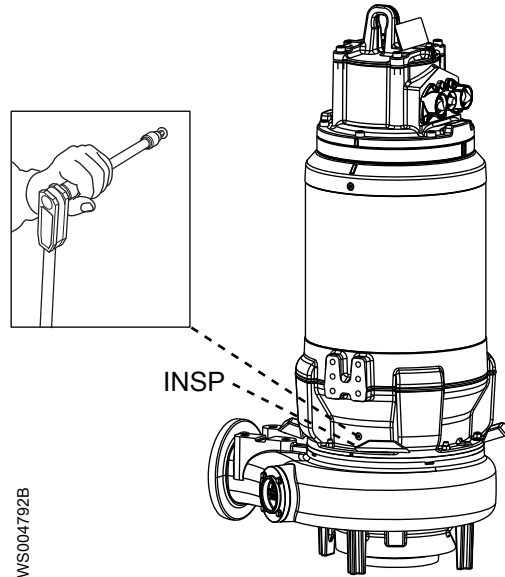
Empty the water-glycol mixture



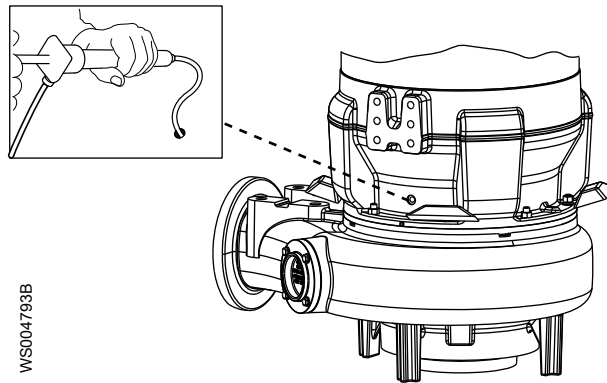
WARNING:

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

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



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

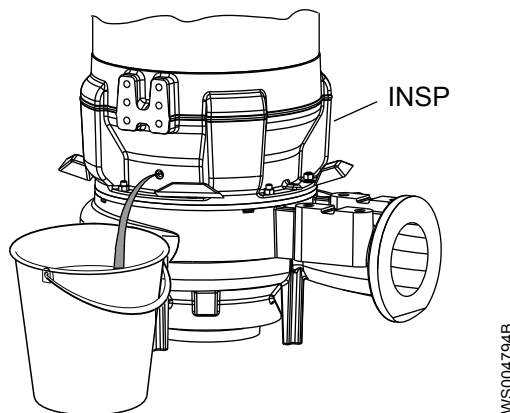


c) Replace the inspection plug and O-ring and tighten.

Tightening torque: 44 Nm (33 ft-lbs)

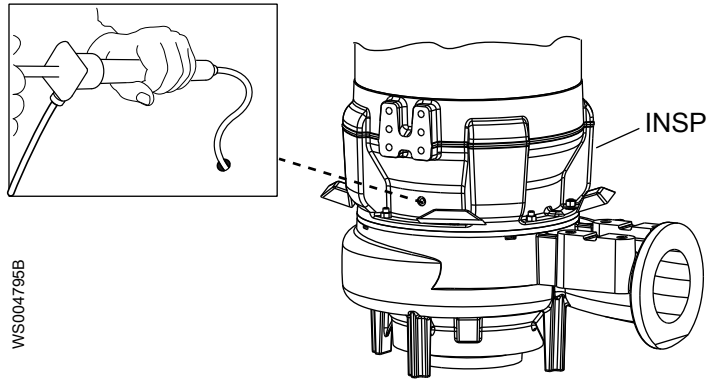
2. If the pump is in a vertical position, then empty the coolant by following this procedure:

- a) Place a container under the coolant outlet.
- b) Remove the coolant plug and empty the water-glycol mixture.

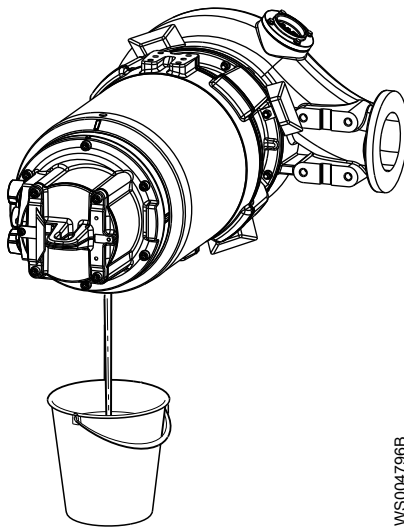


Most of the liquid will drain by gravity.

c) Use the hand pump to remove the remaining water-glycol mixture.

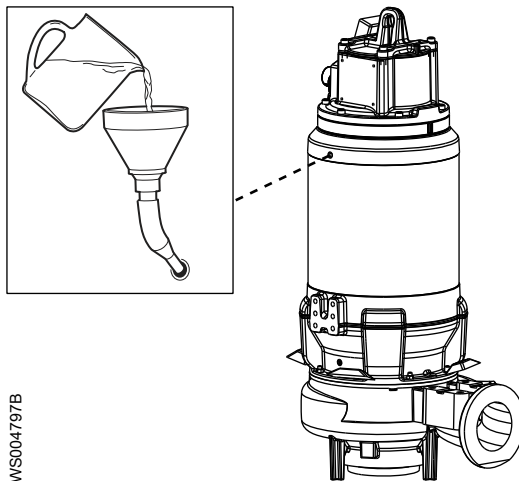


3. If the pump is in a horizontal position, then empty the water-glycol mixture by following this procedure:
 - a) Place a container under the pump.
 - b) Remove the coolant plug and empty the water-glycol mixture.



Fill with water-glycol mixture

1. Make sure that the plug at the bottom has been replaced.
2. Fill with water-glycol mixture until it overflows through the opposite hole, as shown here.



3. Replace the O-rings and the coolant plugs.
4. Tighten the coolant plugs.

Tightening torque: 44 Nm (33 ft-lbs)

7X6 drive units without cooling jacket

This section provides instructions for changing the lubrication fluid in 7X6 drive units without cooling jackets.

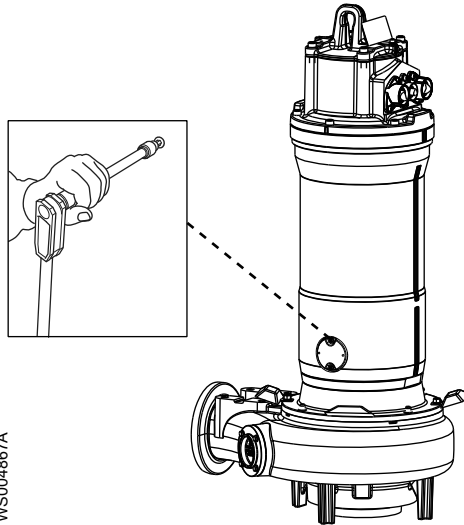
Empty the lubricant



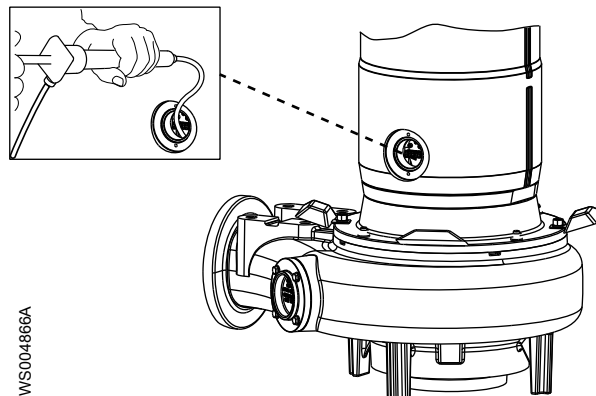
WARNING:

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

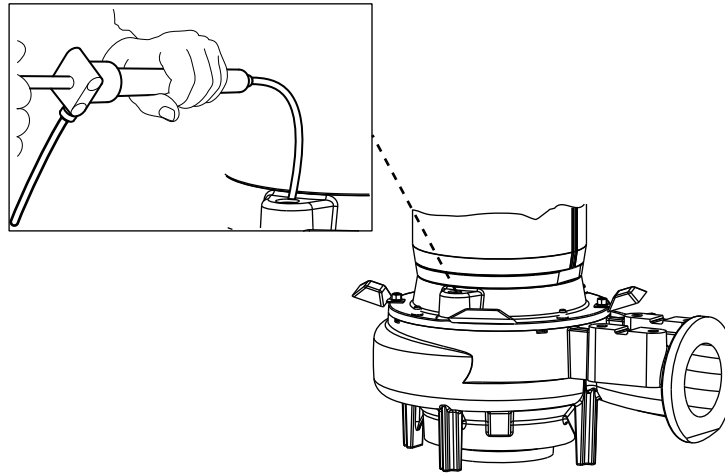
1. Remove any liquid from the stator housing:
 - a) Remove the cover.



- b) Pump out any liquid from the stator housing, as shown here.

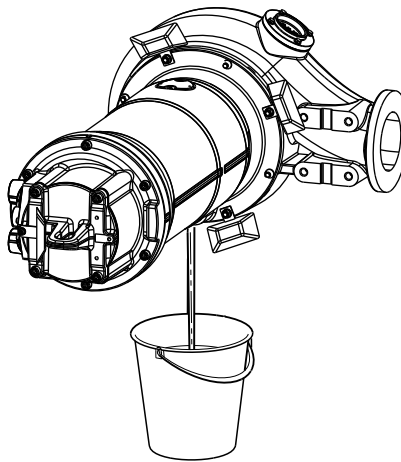


- c) Replace the cover.
2. If the pump is in a vertical position, then empty the lubricant by following this procedure:
 - a) Use the hand pump to remove the water-glycol mixture.



WS004865A

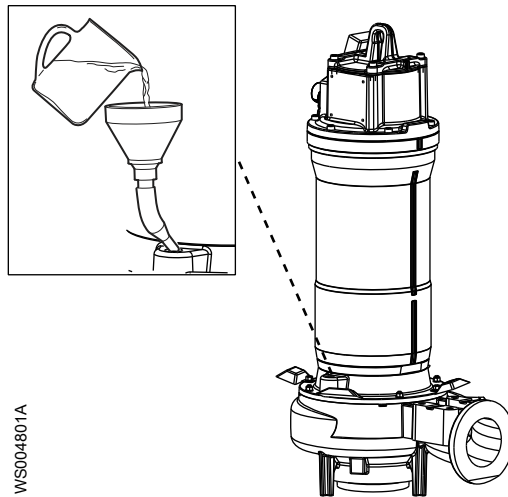
3. If the pump is in a horizontal position, then empty the lubricant by following this procedure:
 - a) Place a container under the pump.
 - b) Remove the plug and empty the water-glycol mixture.



WS004864A

Fill with lubricant

1. Fill the with water-glycol mixture, as shown here.



WS004801A

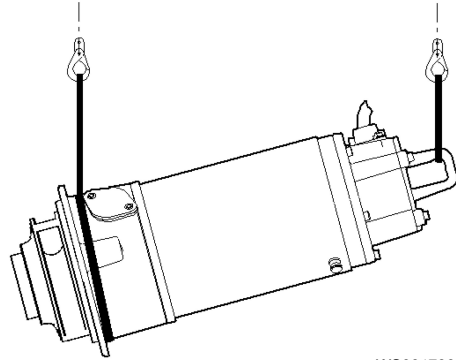
2. Replace the O-ring and the plug.
3. Tighten the plug.
Tightening torque: 80 Nm (60 ft-lbs)

Horizontal lifting

Two sets of lifting equipment must be used to lift the unit for repair work.

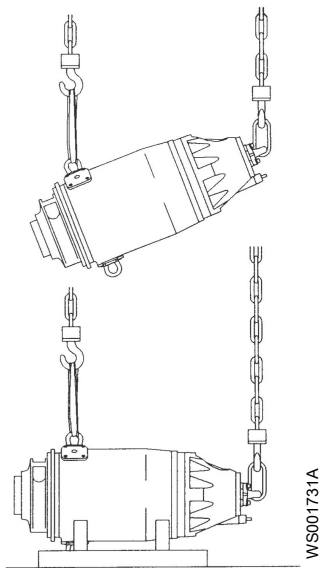
The drive unit must never be placed on the shaft unit or the impeller/propeller. Damage to the impeller/propeller, seals or bearings can result from placing the drive unit on the impeller/propeller or shaft.

Use the following method to lift the unit in the horizontal position.



WS001730A

Figure 40: Drive units 605-776



WS001731A

Figure 41: Drive units 805-998

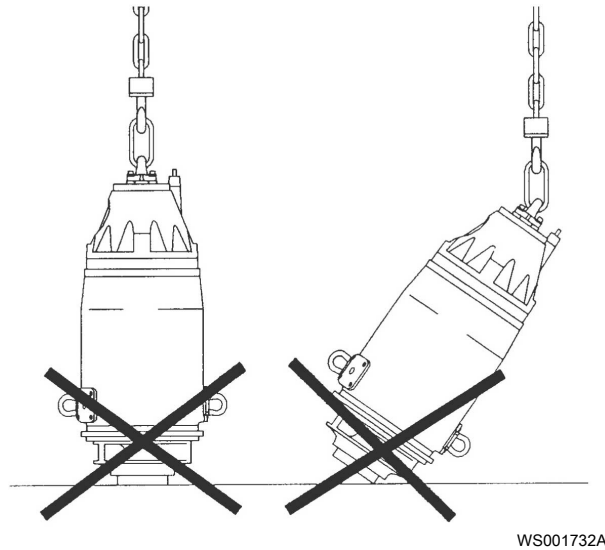


Figure 42: Incorrect lifting method

Replace the wear parts

When the clearance between the impeller skirt and the pump housing wear ring exceeds 2 mm (0.08 in.) one or more of the following replacements must be made.

Replace the pump housing wear ring

If the wear ring is made of brass this procedure will be easier if the suction cover is first heated, and/or the wear ring is cooled down.

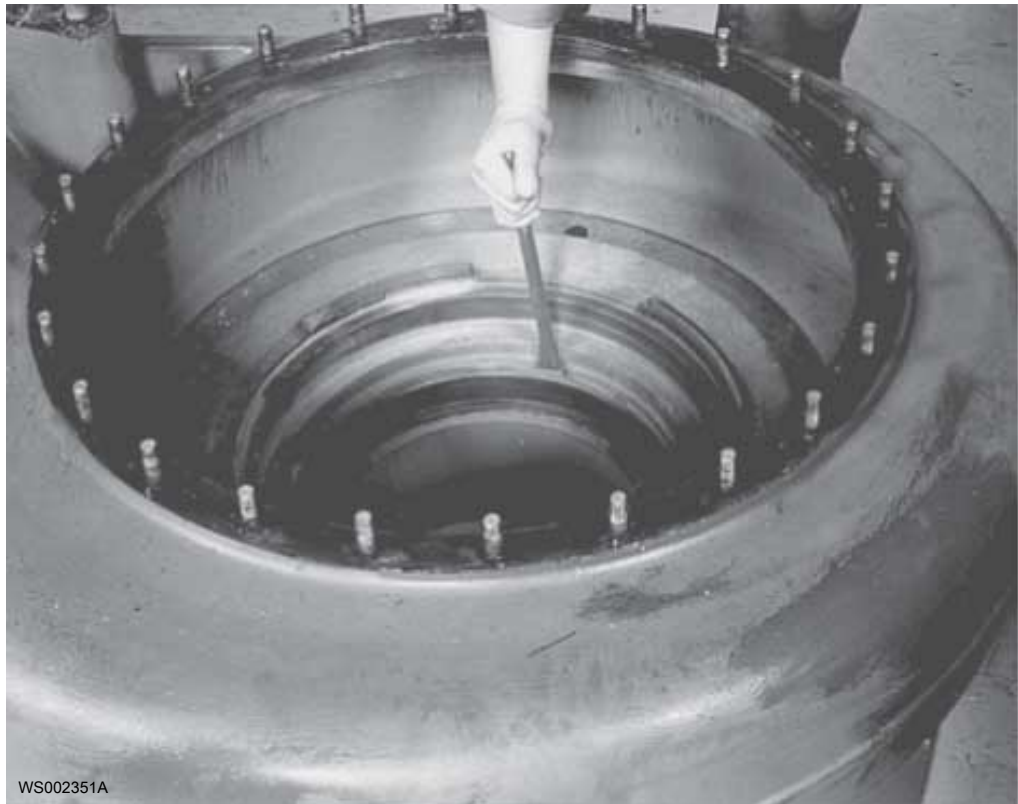
1. Disconnect and lift off the drive unit with pump housing from the suction cover.
2. Lay the drive unit in a horizontal position.



WARNING:

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

3. Remove the wear ring by using a crow bar.



4. Drive in the new wear ring.
To prevent deformation, use a maul and a wooden block.

Replace the impeller wear ring

1. Disconnect and lift off the drive unit from the pump housing.
2. Lay the drive unit in a horizontal position.



WARNING:

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

3. Knock off the wear ring from the impeller.
If necessary, use a grinder to make grooves in the wear ring.
4. Heat the new wear ring and press it onto the impeller.



Replace the impeller

Before you replace the impeller, you must drain the oil in the oil housing. See applicable steps in *Empty the oil* (page 92).

When replacing the impeller, the mechanical face seal should be replaced to ensure maximum sealing properties. Use a Xylem new or factory reconditioned mechanical face seal unit. This work requires special tools and should be carried out by a service technician authorized by Xylem.

Remove the impeller



WARNING:

A worn impeller and/or pump housing can have very sharp edges. Wear protective gloves.

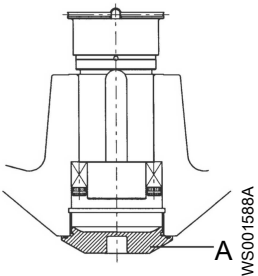
1. For all pumps except C3300/6x5 HT, complete these steps:
 - a) Disconnect and lift off the drive unit from the pump housing.
 - b) Lay the drive unit in a horizontal position.
 Make sure it cannot roll.


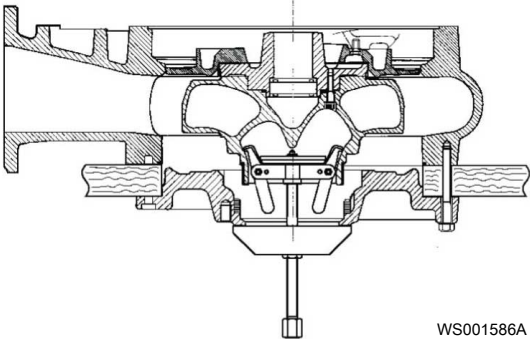
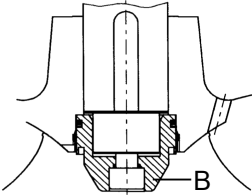


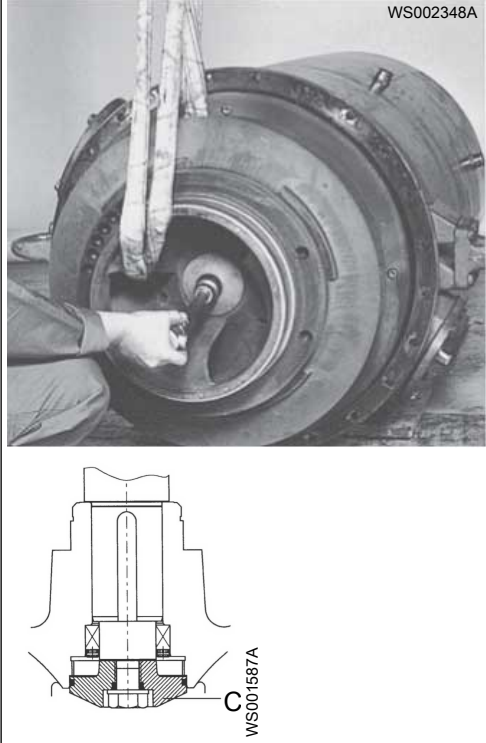
WARNING:

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

2. Depending on which pump model you have, do one of the following:

Pump	Action
C3300/6x5 LT and MT	Remove the centre screw in the impeller-sealing washer. The locking assembly is now accessible for removal.
C3231, C3306, or C3356	Remove the impeller-sealing washer (A) using the Allen key hole in the washer. (The washer is threaded into the impeller hub.) Use a 19 mm Allen key. <div style="text-align: center;">  <p>WS001588A</p> </div> The locking assembly is now accessible for removal.

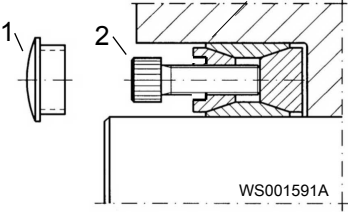

Pump	Action
C3300/6x5 HT	<p>Make sure that the pump housing is still connected to the drive unit. The impeller for this version is fitted to a hub with two screws.</p> <ol style="list-style-type: none"> 1. Lay the pump on its side. <hr/> <div style="display: flex; align-items: center;">  <div> <p>WARNING:</p> <p>Make sure that the unit cannot roll or fall over and injure people or damage property.</p> </div> </div> <hr/> <ol style="list-style-type: none"> 2. Remove the screws for the suction cover and replace three of the screws with the longer screw 813963 (M16 x 160). 3. Push out the suction cover and place a distance block between the pump housing and the suction cover. Minimum distance = 30 mm (1.18 in). 4. Remove the two screws for the impeller. 5. Apply the puller unit 4917400 according to the illustration and pull off the impeller. Remove the suction cover and the impeller. 6. Disconnect and lift off the drive unit from the pump housing. <div style="text-align: center;">  <p>WS001586A</p> </div> <p>The locking assembly is now accessible for removal.</p>
R3231	<p>Remove the sealing washer unit (B). Use a 17 mm Allen key for removal. Since this version has no locking assembly, you can now remove the impeller.</p> <div style="text-align: center;">  <p>WS001589A</p> </div>

Pump	Action
C3240, C3312, C3351, C3400, C3501, C3531, C3602 or C3800	<p data-bbox="586 165 1471 233">Remove the impeller screw. Insert the puller screw 576 84 00 in the thread of the impeller-sealing washer (C) to remove the washer.</p>  <p data-bbox="586 989 1471 1024">Figure 43: C3240, C3312, C3351, C3400, C3501, C3531, C3602 or C3800</p> <p data-bbox="586 1045 1471 1077">The locking assembly is now accessible for removal.</p>

Remove the locking assembly

1. Remove the locking assembly:

Locking assembly:	Action:
<ul style="list-style-type: none"> • 84 59 12 • 84 59 13 • 84 59 14 • 84 59 17 	<p>1. Loosen the screws on the locking assembly evenly and in sequence. See Sequence for tightening or loosening locking assembly bolts (page 110). If the locking assembly is still locked, do as follows:</p> <p>a. Loosen the inner ring by tapping it lightly, as shown in the illustration.</p> <div data-bbox="704 348 1273 642" style="text-align: center;"> <p>Diagram WS001700A: A cross-sectional view of a locking assembly. A hammer is shown tapping the outer ring of the assembly. A curved arrow indicates the direction of the tap. The inner ring is shown with a dashed line, indicating its position before or after the tap.</p> </div> <p style="text-align: right;">WS001700A</p> <p>b. If tapping did not loosen the ring, replace the three "light-colored" screws with three M10 draw-bolts (for 84 59 12 and 84 59 13) or M12 draw-bolts (for 84 59 14 and 84 59 17).</p> <div data-bbox="704 768 1062 1010" style="text-align: center;"> <p>Diagram WS001590A: A cross-sectional view of the locking assembly. An arrow points to the location where the screws are replaced. Labels 'M10' and 'M12' are shown with arrows pointing to the respective draw-bolts.</p> </div> <p style="text-align: right;">WS001590A</p> <p>2. Remove the locking assembly.</p>

Locking assembly:	Action:
<ul style="list-style-type: none"> • 84 60 11 	<ol style="list-style-type: none"> 1. Remove the four plastic plugs (labelled "1" in figure below) covering the threaded holes for the special separation screws. <div style="text-align: center;">  <p>WS001591A</p> </div> 2. Loosen the inner ring by means of four locking assembly screws (M14) as separation screws (labelled "2" in figure above). See illustration below. <div style="text-align: center;">  <p>WS002350A</p> </div> 3. Remove the locking assembly.

2. Pull off the impeller:
 - a) Fit the tools required for impeller removal according to the tool list for the appropriate pump. See [Tools](#) (page 111).
 - b) Pull off the impeller.

Use the hydraulic unit with the partially threaded screw in the Basic kits for removal (or screw unit 602 31 00 for C3800).



WS002349A

Install the impeller

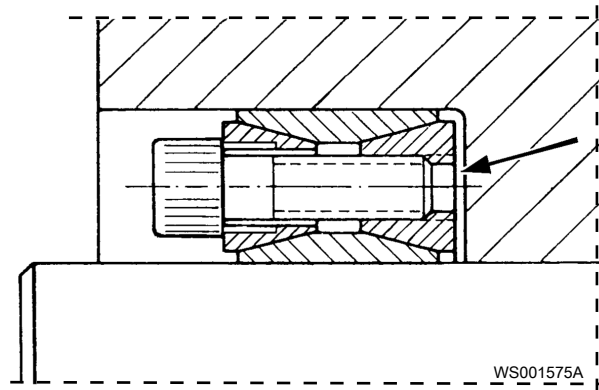
When installing a stainless steel impeller onto a stainless steel shaft, the shaft end should be greased with National Chemsearch THREAD-EZE. Make sure that no grease is on the contact surfaces of the locking assembly.

1. Make sure that the end of the shaft is clean and free of burrs.
Polish off any flaws with fine emery cloth.
2. Grease the end of the shaft and the impeller hub.
3. Depending on which pump model you have, do the following:

If you have pump...	Then...
<ul style="list-style-type: none"> • C3300/6X5 	<ol style="list-style-type: none"> 1. Place the impeller and impeller hub on the shaft and press it onto the shaft with the impeller screw. For C3300/6x5 HT, press the hub onto the shaft. 2. Go on to Install the locking assembly (page 107).
<ul style="list-style-type: none"> • Other C-pump 	<ol style="list-style-type: none"> 1. Place the impeller on the shaft and fit the hydraulic tool with the M16 screw. 2. Use the appropriate washer to press the impeller in place. 3. Remove the hydraulic tool. 4. Go on to Install the locking assembly (page 107).

Install the locking assembly

1. Fit the locking assembly in place:
 - a) Apply a thin layer of grease at the surface indicated by the arrow in the illustration below.
Do not use oil containing molybdenum disulphide (MoS₂).



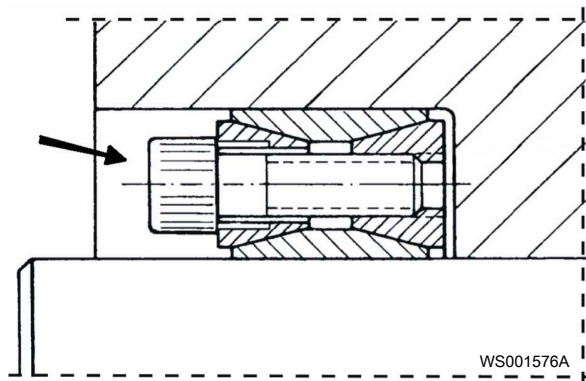
- b) Fit the locking assembly (well-oiled) in the impeller hub without tightening any screws.
2. For C3300/6X5, tighten the screws manually in three stages.
Tighten using the sequence that is shown in [Sequence for tightening or loosening locking assembly bolts](#) (page 110), until the locking assembly keeps the impeller/impeller hub in place.
3. For all pump models except C3300/6X5, fit the impeller:
 - a) Place the washer over the locking assembly.
See [Tools](#) (page 111) for the washer for the respective pump.
For the correct position, use an Allen key through one of the slots in the washer and into one of the "light-colored" screws in the locking assembly.
 - b) Fit the impeller screw, or the screw unit (with hydraulic tool if applicable), through the center hole in the washer and into the shaft end.
See [Tools](#) (page 111) for the screw/screw unit for the respective pump.
 - c) Tighten the centre screw so that the washer keeps the locking assembly and the impeller in place.



- d) When the impeller is firmly seated, slightly tighten the three "light-colored" screws in the locking assembly through the slots in the washer.
This keeps the impeller in place against the shaft shoulder.



- e) Remove the center screw and the washer.
4. Tighten the locking assembly screws evenly in three stages, following the sequence and tightening torques given in [Sequence for tightening or loosening locking assembly bolts](#) (page 110).
 5. Fill the space with grease, allowing space for the sealing washer.
The space to be filled with grease is indicated by the arrow in the illustration below.



6. Fit the impeller sealing washer and tighten the impeller screw.
7. For C3300/6x5 HT: place the impeller onto the impeller hub and tighten the two screws that hold the impeller. Tighten to the correct torque.

After installing the impeller you must do the following:

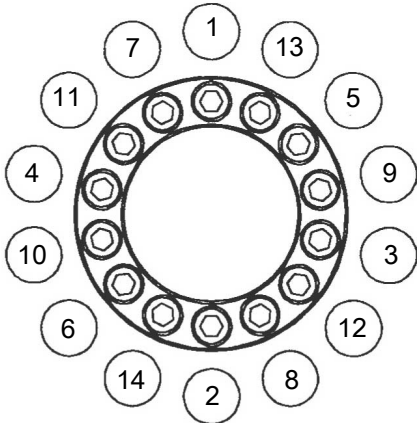
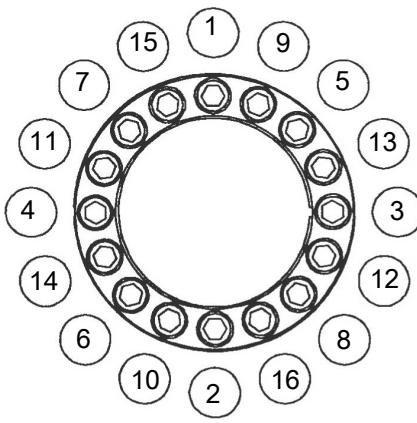
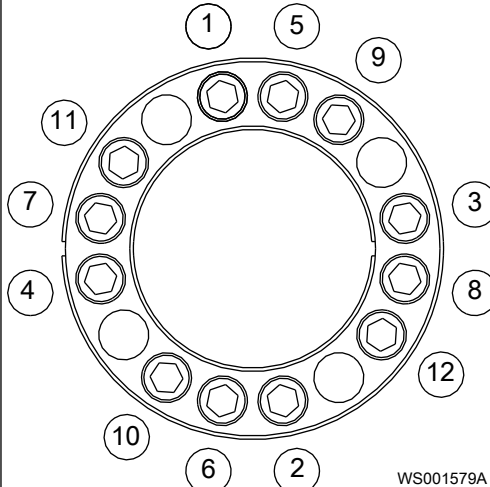
1. Check that the impeller can be rotated by hand.
2. Check the zinc anodes (if applicable) to make sure they are large enough and intact. Replace after approximately 75% consumption.
3. Fit the drive unit to the pump housing. Make sure that the pump housing has the correct orientation. Remember the O-ring between the pump housing and the drive unit.

More extensive repairs require special tools and should be carried out by a service technician authorized by Xylem.

Sequence for tightening or loosening locking assembly bolts

Bolt sequence

The following illustrations show the sequence used for tightening or loosening the impeller locking assembly bolts.

Locking assembly	Shaft end diameter, mm	Sequence for tightening or loosening bolts
84 59 12	70	 <p style="text-align: right;">WS001577A</p>
84 59 13	75	
84 59 14	90	
84 59 17 C3351, C3531, C3602 with drive units 905-960	110	 <p style="text-align: right;">WS001578A</p>
84 60 11 C3351, C3531, C3602 with drive units 965-998; and C3800	110	 <p style="text-align: right;">WS001579A</p>

Tightening torques

The table below gives the torque which should be used in each stage of the bolt-tightening process.

Locking assembly	Shaft end diameter, mm	Torque for tightening bolts
84 59 12	70	<ul style="list-style-type: none"> • Stage 1: 12 Nm (8.8 ft-lbs) • Stage 2: 24 Nm (18 ft-lbs) • Stage 3: 35 Nm (26 ft-lbs)
84 59 13	75	
84 59 14	90	<ul style="list-style-type: none"> • Stage 1: 24 Nm (18 ft-lbs) • Stage 2: 48 Nm (35 ft-lbs) • Stage 3: 70 Nm (52 ft-lbs)
84 59 17 (C3351, C3531, C3602 with drive units 905-960)	110	<ul style="list-style-type: none"> • Stage 1: 24 Nm (18 ft-lbs) • Stage 2: 48 Nm (35 ft-lbs) • Stage 3: 70 Nm (52 ft-lbs)
84 60 11 (C3351, C3531, C3602 with drive units 965-998; and C3800)	110	<ul style="list-style-type: none"> • Stage 1: 70 Nm (52 ft-lbs) • Stage 2: 154 Nm (113 ft-lbs) • Stage 3: 230 Nm (170 ft-lbs)

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 25: 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 26: 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.

Tools

Beside ordinary tools, the following tools are required in order to perform the necessary maintenance of the pump.

All pumps

Part number	Denomination	Range of use
83 95 42	Oil drainage pumps	Drainage pumps for emptying oil housing
84 13 68	Hydraulic unit, 200 kN	Bearing removal

R3231

Part number	Denomination	Range of use
436 19 00	Basic kit II	
436 74 00	Impeller tool	

C3300/6X5 LT

Part number	Denomination	Range of use
84 20 49	Puller	
479 23 00	Extension	
479 25 00	Washer	

C3300/6X5 MT

Part number	Denomination	Range of use
400 54 03	Dismount./lifting tool (for imp. x41, x42)	
400 54 05	Dismount./lifting tool (for imp. x32)	

C3300/6X5 HT

Part number	Denomination	Range of use
81 39 63	Screw (3 pcs)	
491 74 00	Puller unit	

C3231, C3306, C3356

Part number	Denomination	Range of use
432 43 00	Washer (included in basic kit II)	
436 19 00	Basic kit II	
436 74 00	Impeller tool	
582 65 00	Stand unit	
588 92 00	Washer unit	Mounting the locking assembly

C3240, C3312, C3400, C3501

Part number	Denomination	Range of use
332 91 00	Stop spring removing tool	
399 41 00	Mounting tool set (for shaft with Ø 75 and 90 mm)	Mounting the seal
576 83 01	Washer (for shaft with Ø 75 mm, 7X5 and 7X6 units)	Mounting the locking assembly
576 83 02	Washer (for shaft with Ø 90 mm, 8X5 units)	Mounting the locking assembly
576 84 00	Puller screw	
584 81 00	Washer	

Part number	Denomination	Range of use
587 72 00	Impeller tool (for shaft with Ø 75 and 90 mm)	
587 94 00	Basic kit V	

C3351

Part number	Denomination	Range of use
576 83 04	Washer (for shaft Ø110 mm, 905 - 960 drive units)	Mounting the locking assembly
576 84 00	Puller screw	
584 81 00	Washer	
587 73 00	Impeller tool (for shaft Ø110 mm; 905 - 960 drive units)	
587 94 00	Basic kit V	
660 48 00	Impeller tool (for shaft Ø110 mm, 965 - 998 drive units)	Removing the impeller
660 49 00	Impeller tool (for shaft Ø110 mm, 965 - 998 drive units)	Mounting the locking assembly and the impeller

C3531, C3602

Part number	Denomination	Range of use
332 91 00	Stop spring removing tool	
399 41 00	Mounting tool unit (for shaft Ø75 and Ø90 mm)	Mounting the seal
576 83 01	Washer (for shaft Ø75, 7X5 and 7X6 drive units)	Mounting the locking assembly
576 83 02	Washer (for shaft Ø90 mm, (for 8X5, 905, 915 drive units)	Mounting the locking assembly
576 83 03	Washer (for shaft Ø110 mm, for 905 - 960 drive units)	Mounting the locking assembly
576 84 00	Puller screw	
584 81 00	Washer	
587 72 00	Impeller tool (for shaft Ø75 mm, 7X5 and 7X6 drive units and for shaft Ø90 mm, 8X5, and 905, 915 drive units)	
587 73 00	Impeller tool (for shaft Ø110, 905 - 960 drive units)	
587 94 00	Basic kit V	
660 48 00	Impeller tool (for shaft Ø110, 965 - 998 drive units)	Removing the impeller
660 49 00	Impeller tool (for shaft Ø110 , 965 - 998 drive units)	Mounting the locking assembly and the impeller

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Part number	Denomination	Range of use
576 84 00	Puller screw	
589 23 00	Screw unit (mounting)	The locking assembly and the impeller
602 18 00	Impeller tool	
602 31 00	Screw unit (removal)	

Part number	Denomination	Range of use
660 49 00	Impeller tool (mounting)	The locking assembly and the impeller

Technical Reference

Application limits

Table 27: Process data

Parameter	Value
Liquid temperature	Max. +40°C (+105°F)
Depth of immersion	Max. 20 m (65 ft.)
pH of pumped liquid	pH 6-11
Liquid density	Max. 1100 kg/m ³ (9.17 lb per gal.)

