SE and SL pumps, range 56

25-63 kW, 33-84 Hp

Service instructions

GRUNDFOS

SE and SL pumps, range 56

English (GB)

Original service instructions

Table of contents

1. General information

Read this document before you install the product. Installation and operation must comply with local regulations and accepted codes of good practice.

1.1 Hazard statements

The symbols and hazard statements below may appear in Grundfos installation and operating instructions, safety instructions and service instructions.

DANGER
Indicates a hazardous situation which, if not avoided, will result in death or serious personal injury.

WARNING
Indicates a hazardous situation which, if not avoided, could result in death or serious personal injury.

CAUTION
Indicates a hazardous situation which, if not avoided, could result in minor or moderate personal injury.

The hazard statements are structured in the following way:

SIGNAL WORD
Description of the hazard
Consequence of ignoring the warning
- Action to avoid the hazard.

1.2 Notes

The symbols and notes below may appear in Grundfos installation and operating instructions, safety instructions and service instructions.

A blue or grey circle with a white graphical symbol indicates that an action must be taken.

A red or grey circle with a diagonal bar, possibly with a black graphical symbol, indicates that an action must not be taken or must be stopped.

If these instructions are not observed, it may result in malfunction or damage to the equipment.

Tips and advice that make the work easier.

2. General safety instructions

Pump installation in pits must be carried out by trained persons.

All work in pits must be supervised by a person outside the pump pit.

CAUTION
Biological hazard
Minor or moderate personal injury
- Pits for sewage and wastewater may contain toxic and/or contagious substances. Persons must always wear appropriate personal protective equipment and clothing before entering the pit.

DANGER
Electric shock
Death or serious personal injury
- Before the installation, switch off the power supply and lock the main switch in position 0.

DANGER
Electric shock
Death or serious personal injury
- It must be possible to lock the main switch in position 0. Type and requirements are specified in EN 60204-1.

CAUTION
Hot surface
Minor or moderate personal injury
- Do not touch the pump or the cables during operation as the surface temperature may exceed 70 °C.

CAUTION
Sharp element
Minor or moderate personal injury
- Wear protective gloves when working on the pump.

Maintenance and service work must be carried out when the pump is outside the pit. For safety reasons, all work inside pits must be supervised by a person outside the pit.

Observe all safety regulations at the installation site.

WARNING
Crushing hazard
Death or serious personal injury
- Make sure the lifting bracket is tightened before lifting the pump.

3. Receiving the product

The pump is supplied from the factory in a proper packaging in which it should remain until installation. Make sure that the pump cannot roll or fall over.

3.1 Transporting the product

All lifting equipment must be rated for the purpose and checked for damage before lifting the pump. The lifting equipment rating must not be exceeded. The pump weight is stated on the nameplate.

WARNING
Crushing hazard
Death or serious personal injury
- Lifting and moving must be done by a trained person.

CAUTION
Sharp element
Minor or moderate personal injury
- Packaging parts may be pointy or sharp. Wear hand protection.

CAUTION
Crushing hazard
Minor or moderate personal injury
- Make sure the pump cannot roll or fall over.

WARNING
Crushing hazard
Death or serious personal injury
- Always lift the pump by its lifting bracket or use a forklift.

DANGER
Electric shock
Death or serious personal injury
- Never lift the pump by the power cable, hose, or pipe.

Leave the cable-end protectors and control cables on the power supply until making the electrical connection. Whether insulated or not, the free cable end must never be exposed to moisture.

3.2 Inspecting the product

During storage, protect the pump against moisture and heat.

If the pump is not in operation or is being stored for more than a month, turn the impeller once a month.

WARNING
Crushing hazard
Death or serious personal injury
- Do not turn the impeller by hand. Always use an appropriate tool.

On pumps fitted with a guide vane, be careful not to damage the guide vane when turning the impeller.

After storage, inspect the pump before putting it into operation. Make sure that the impeller can rotate freely. Pay attention to the condition of the shaft seals, O-rings, cable entries, and potential glycol leakage.

3.3 Lifting the product

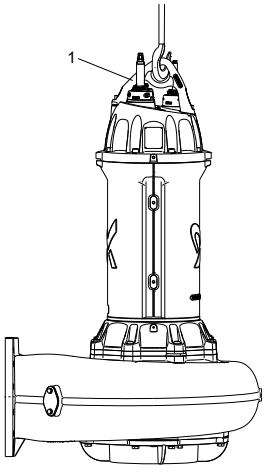
DANGER
Crushing hazard
Death or serious personal injury
- Always check the lifting bracket and chain for corrosion or wear before lifting.
- Always lift the pump by its lifting bracket or by a forklift truck.

DANGER
Crushing hazard
Death or serious personal injury
- When lifting the pump, make sure the centre of gravity is between the forklift arms. The approximate centre of gravity is marked with a label attached to the transport stand.

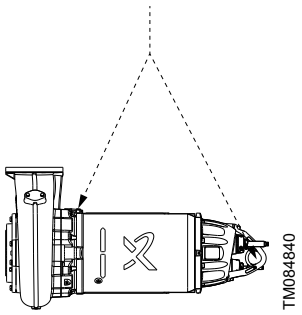
DANGER
Electric shock
Death or serious personal injury
- **Never** lift the pump by the power cables.

When lifting the pump, use the right lifting point to keep the pump balanced for proper installation. The table below shows the correct lifting point.

Installation type	Pump type	Pressure range	Lifting bracket assembly	Lifting point
Vertical	SL/SE	M, L, H	-	Pos. 1, lifting handle
Horizontal	SE	M, L, H	-	Pos. 1, lifting handle Pos. 2, lifting eye in seal housing



Lifting point for vertical installation, SL pump



Lifting points for horizontal installation, SE pump

3.4 Storage

During storage, the pump must be protected against moisture and heat.

After a period of storage, inspect the pump before putting it into operation. Make sure that the impeller can rotate freely. Pay attention to the condition of the shaft seals, O-rings and the cable entries.

Do not store the product in direct sunlight.

Storage temperature is -20 °C to +55 °C. A maximum of 70 °C is allowed for short periods, not exceeding 24 hours, according to EN 60204-1.

Do not remove the cable-end protectors until the cables are installed to protect them against moisture.

If the pump is being stored for more than a month, turn the impeller at least every month to prevent the seal faces of the lower mechanical shaft seal from seizing up.

Avoiding this may cause damage to the shaft seal and motor bearings when the pump is started.

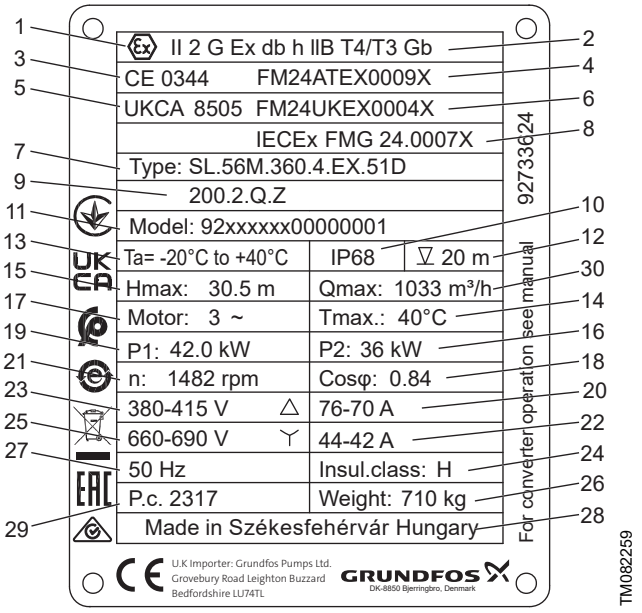
If the impeller cannot be turned, contact an authorised service workshop.

WARNING
Crushing hazard
Death or serious personal injury
- Do not turn the impeller by hand. Always use an appropriate tool.

On pumps fitted with guide vane, be careful not to damage the guide vane when turning the impeller.

4. Identification

4.1 Nameplate



Pos.	Description
1	Marking of explosion protection
2	Ex description
3	EU Notified Body approving the Ex manufacturer
4	EU Explosion protection certificate No
5	UK Approved Body approving the Ex manufacturer and UK Explosion protection certificate No
6	UK Explosion protection certificate No
7	Pump type designation
8	IEC Explosion protection certificate No
9	Pump type designation (line 2)
10	Enclosure class
11	Model number
12	Maximum installation depth
13	Ambient temperature
14	Maximum liquid temperature
15	Maximum head

Pos.	Description
16	Rated power output P2
17	Number of phases
18	Cos φ, 1/1-load
19	Rated power input P1
20	Rated current, delta connection
21	Rated speed
22	Rated current, star connection
23	Rated voltage, delta connection
24	Insulation class
25	Rated voltage, star connection
26	Weight
27	Frequency
28	Country of origin
29	Production code (YYWW)
30	Maximum flow

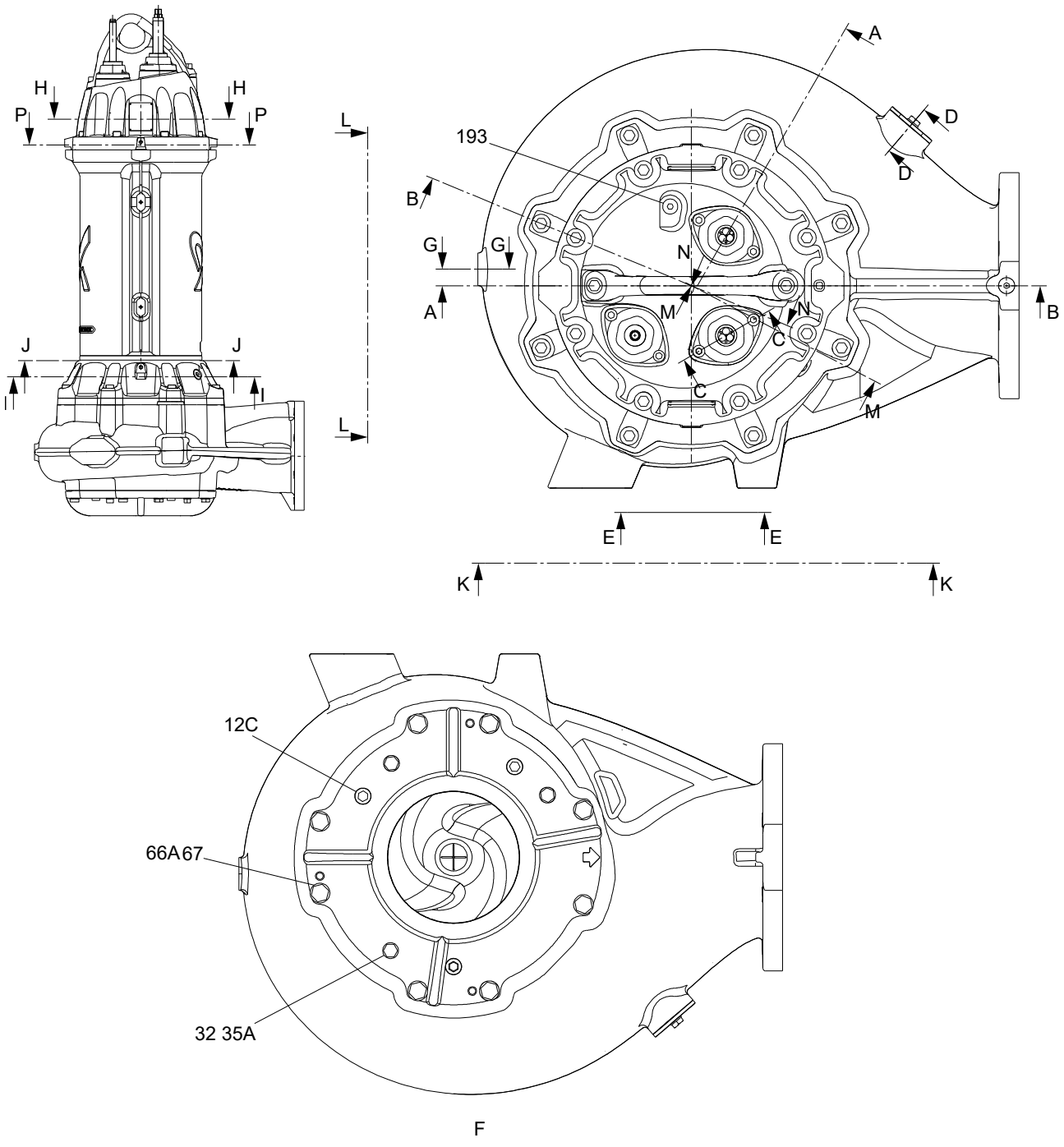
4.2 Type key

Example: **SL.56M.210.4.51D.200**

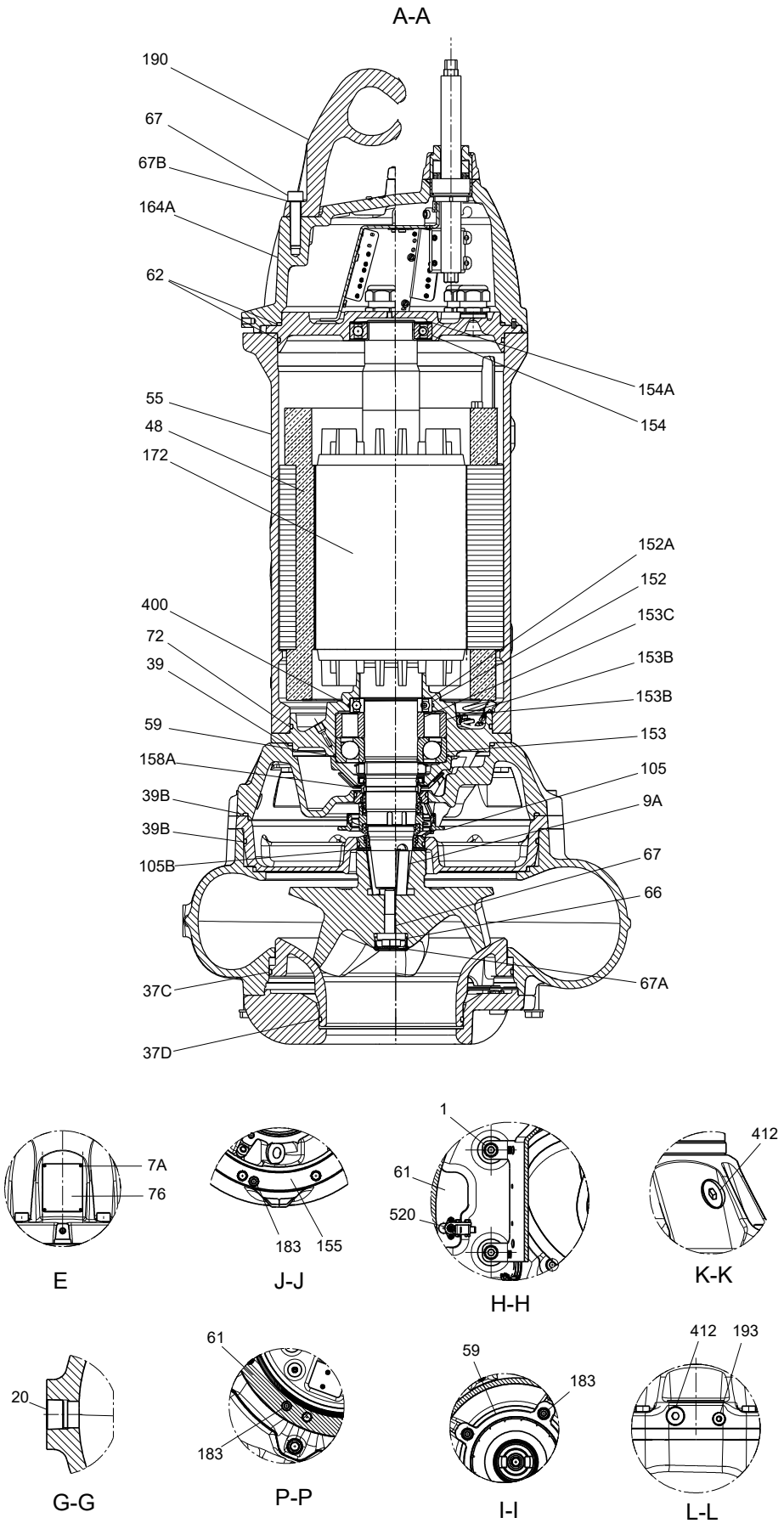
Code	Explanation	Designation
SL	Sewage pump without cooling jacket	Pump type
SE	Sewage pump with cooling jacket	
56	Frame 56	Frame size
M	Medium pressure	Pressure range
L	Low pressure	
H	High pressure	
210	Power P2 × 10 [21 kW]	Power [kW]
4	4-pole motor	Number of poles
6	6-pole motor	
EX	Pumps with Ex approval	Pump version
- (blank)	Pumps without Ex approval	
50D	3 × 380-415D, (DOL, EMC) 50 Hz	Voltage code for 50 Hz
51D	3 × 380-415D, 660-690Y (Standard) 50 Hz	
60G	3 × 380-480D (DOL, EMC) 60 Hz	Voltage code for 60 Hz
61G	3 × 380-480D, 660-690Y (Standard) 60 Hz	
100	Pump outlet nominal diameter (DN200 = 200)	Pump outlet [mm]
150		
200		
250		
300		
- (blank)	Standard sensor version	Sensor versions
1	Sensor version V1	
2	Sensor version V2	
Z	Custom-built products	Customisation

5. Design

5.1 Sectional views

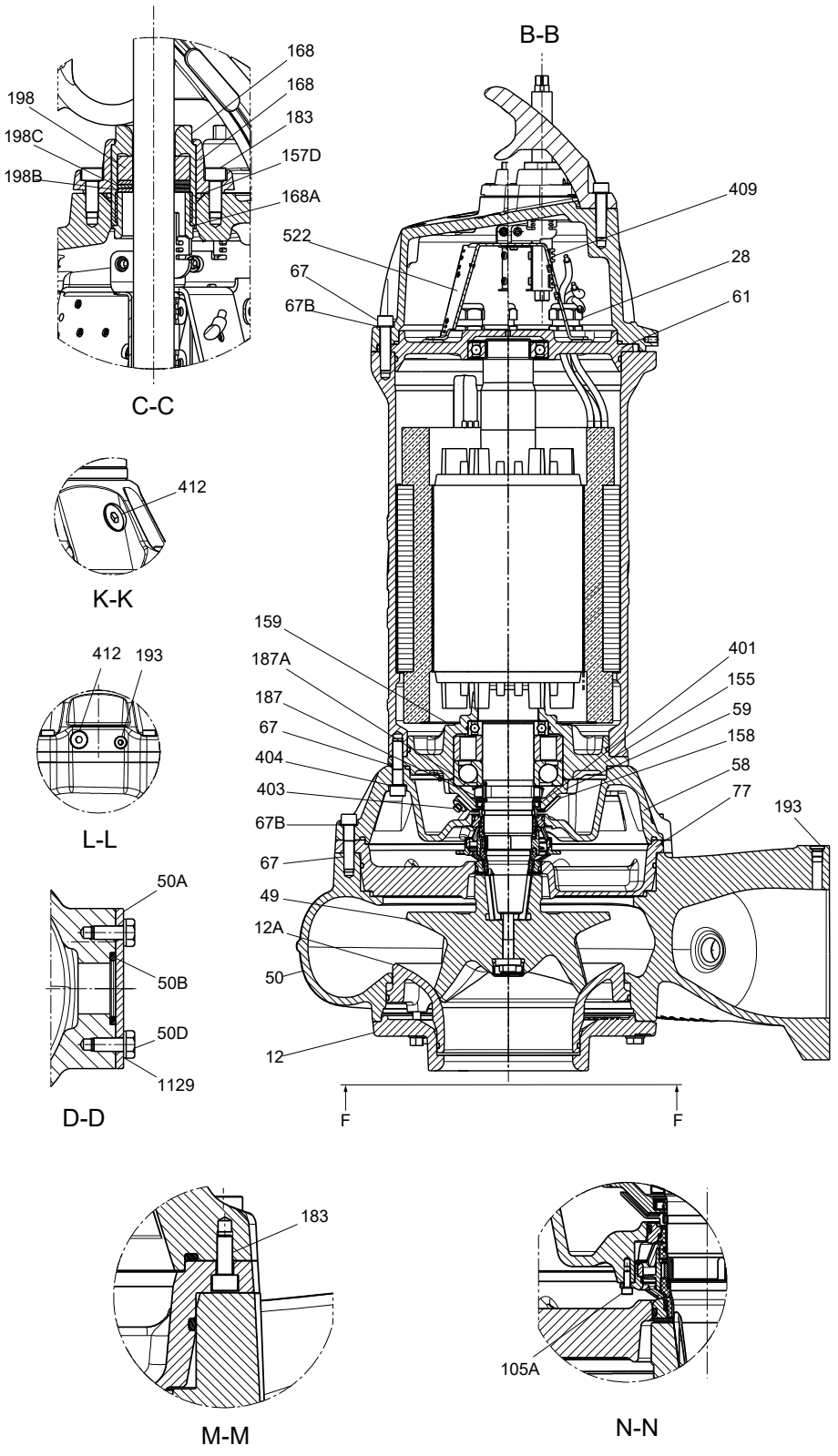


SL pump



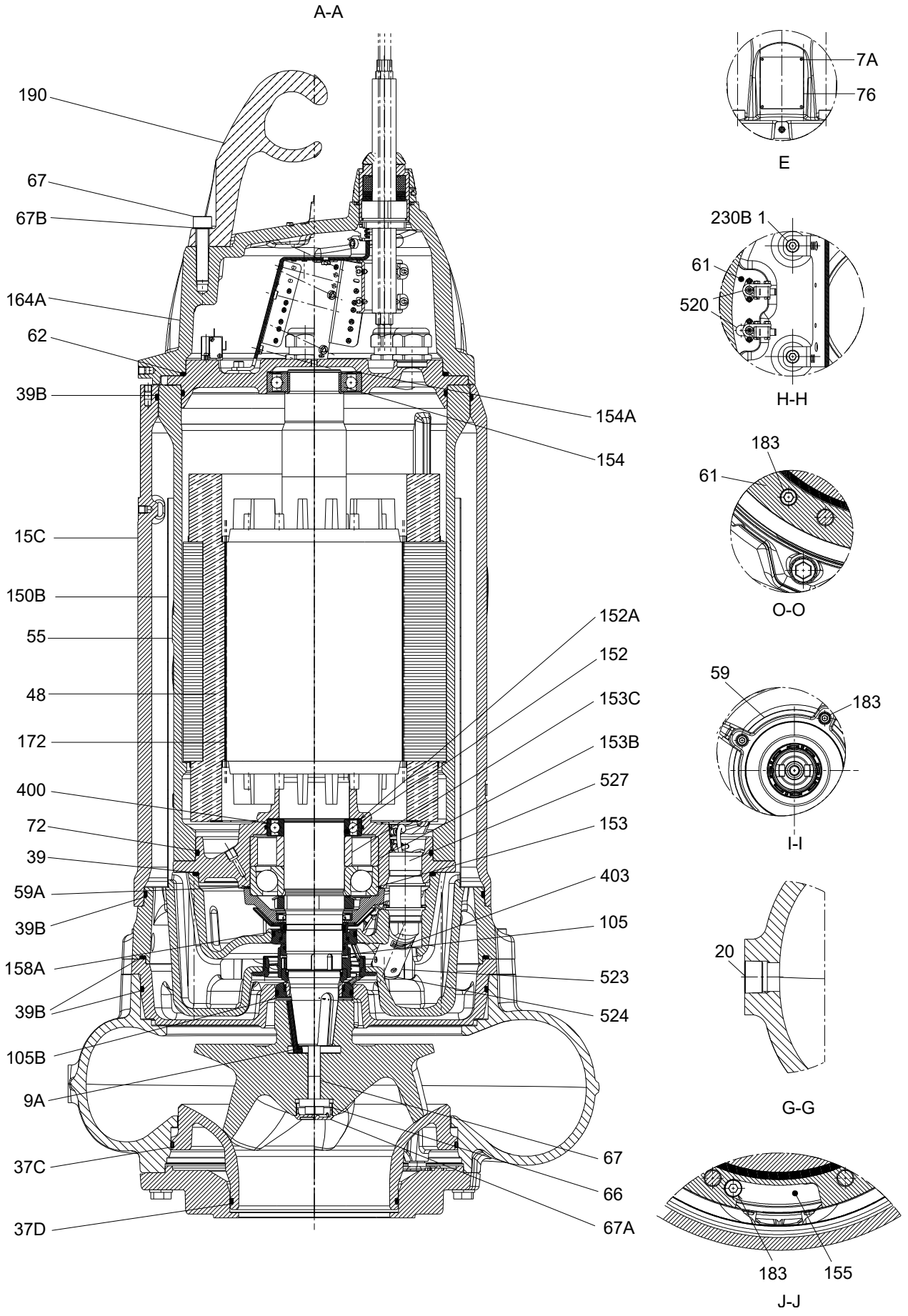
TM083058

SL pump

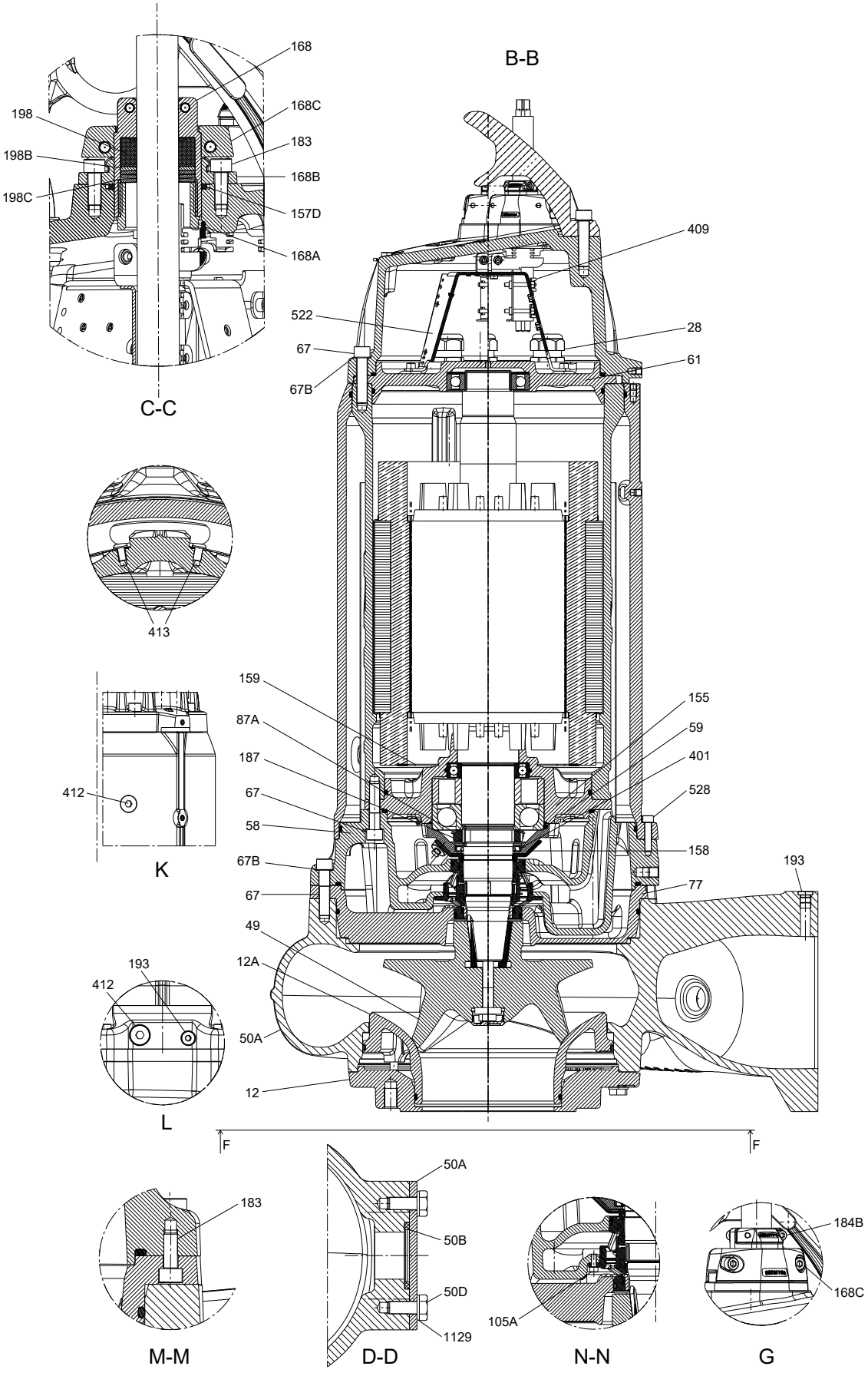


TM083059

SL pump

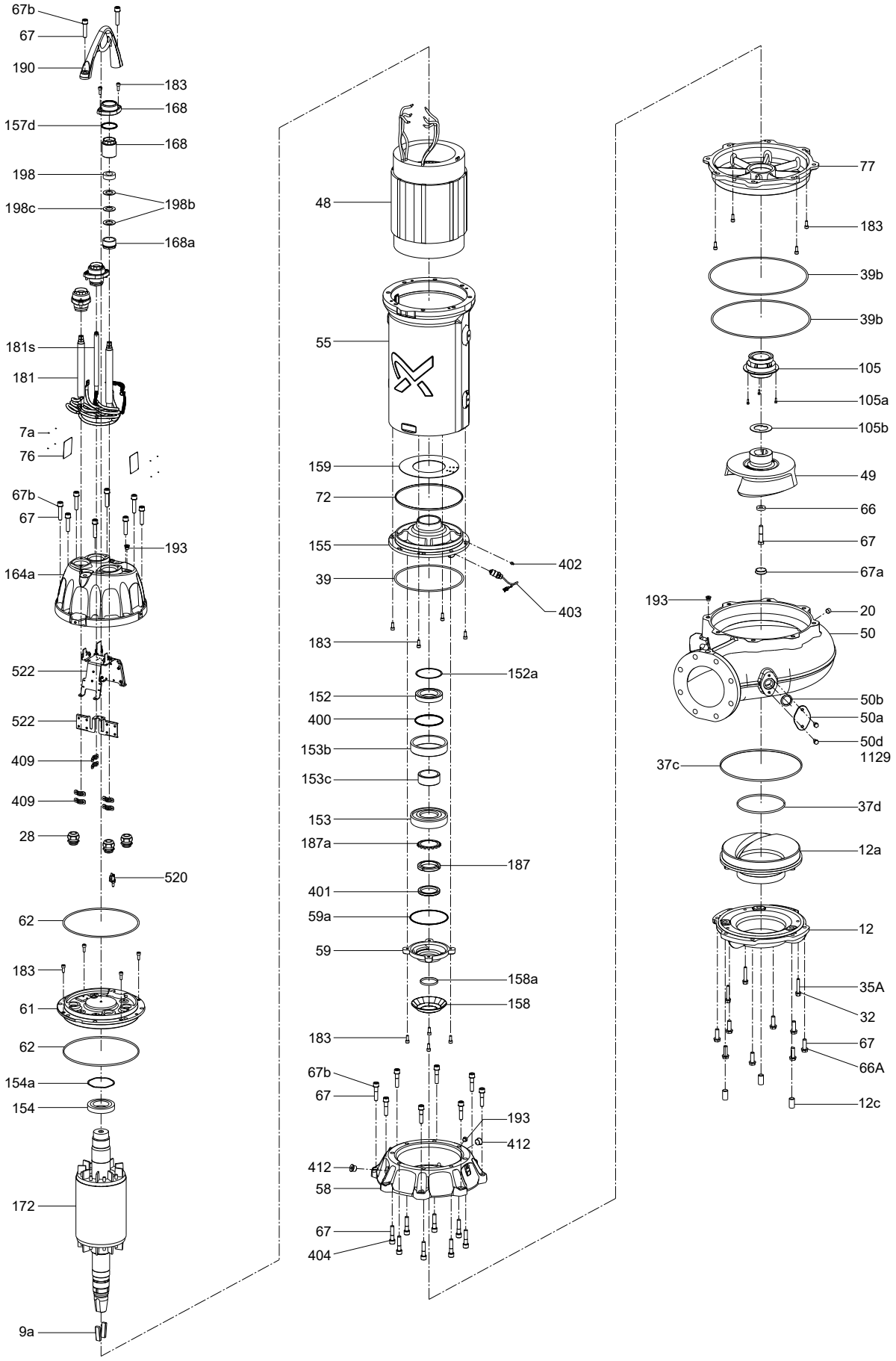

A-A
190
67
67B
164A
62
39B
154A
154
15C
150B
55
48
172
400
72
39
59A
39B
158A
39B
105B
9A
37C
37D
152A
152
153C
153B
527
153
403
105
523
524
67
66
67A
7A
76
E
230B 1
61
520
H-H
183
61
O-O
59
183
I-I
20
G-G
183
155
J-J
TM085226

SE pump

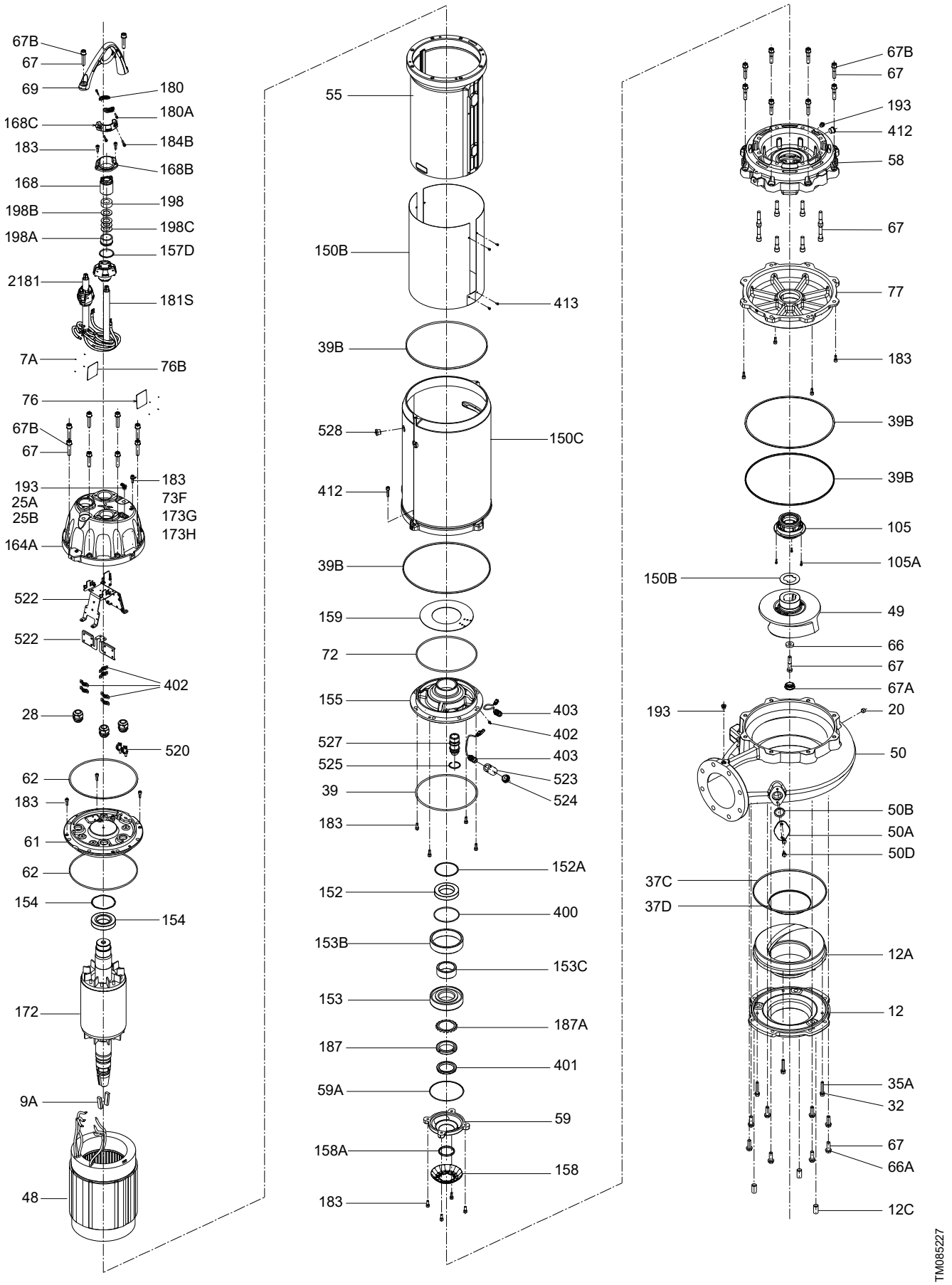

B-B
C-C
168
198
168C
198B
183
198C
168B
157D
168A
409
522
28
67
61
67B
413
159
155
87A
59
187
401
67
528
58
158
67B
193
67
77
49
12A
193
412
50A
12
L
F
F
50A
183
50B
50D
1129
105A
184B
168C
K
412
M-M
D-D
N-N
G
TM085225

SE pump

5.2 Exploded view



SL pumps


67B
67
69
180
180A
168C
184B
183
168B
168
198
198B
198C
198A
157D
2181
181S
7A
76B
76
67B
67
193
183
25A
73F
25B
173G
173H
164A
522
522
402
28
520
62
183
61
62
154
154
172
9A
48
55
150B
413
39B
528
150C
412
39B
159
72
155
403
402
527
403
525
523
39
524
183
152A
152
400
153B
153C
153
187A
187
401
59A
59
158A
158
183
67B
67
193
412
58
67
77
183
39B
39B
105
105A
150B
49
66
67
67A
193
20
50
50B
50A
50D
37C
37D
12A
12
35A
32
67
66A
12C
TM085227

SE pumps

5.3 Components and material specification

Pos.	Component	Material	Standard
1	M8 x 16 Hexagon socket head cap screw	A4-70	ISO 4762
2	Ferrule 1.5/10	-	-
7A	2.5 x 5 Round Head Rivets	A2	ISO 1051B
9A	Impeller key	EN 1.4571	DIN 6885 B
12C	M24 x 45 Set Screw	A4-80	ISO 4026
20	1/2" Plug	DeltaTone/Silico	-
27	Lock washer	D11 x D6.4 x 0.7	-
28	M40 x 1.5 Cable gland	Polyamide/CR	-
32	13 x 24 x 2.5 Flat washer	A4-70	ISO 7089/7090
35A	M12 x 70 Hexagon head screw	A4-80	ISO 4017
37b	*O-ring	NBR 70	ISO 3601-1 Class B
39	*O-ring	NBR 70	ISO 3601-1 Class B
39 A	O-ring	NBR 70	ISO 3601-1 Class B
39b	O-ring	NBR 70	ISO 3601-1 Class B
48	Stator	-	-
49	Impeller	NBR	ISO 3601-1 Class B
50	Pump Housing	EN-GJL-250	ISO 185
50A	Cover plate for inspection hole	EN 1.4401	-
50B	42.2 x 5 O-ring	NBR 70	ISO 3601-1 Class B
50D	M10 x 25 Hexagon head screw	A4-70	ISO 4017
55	Stator housing	EN-GJL-250	ISO 185
58	Upper seal housing	EN-GJL-250	ISO 185
59	Bearing cover	EN-GJL-250	ISO 185
59A	167 x 3 O-ring	NBR 70	ISO 3601-1 Class B
61	Upper bearing bracket	EN-GJL-250	ISO 185
62	339.3 x 5.7 O-ring	NBR 70	ISO 3601-1 Class B
66	17 x 40 x 5 Washer for impeller	EN 1.4404	-
66a	M16 x 50 Hexagon head screw	A4-80	ISO 4017
67A	Impeller plug	Makrolon 9415 PC-GF 10 FR	-
67B	17 x 26 x 1.2 Serrated Lock washer	A4	DIN 6798 A
67	M16 x 70 Hexagon socket head cap screw	A4-80	ISO 4762
72	299 x 5.7 O-ring	NBR 70	ISO 3601-1 Class B
77	Lower seal housing	EN-GJL-250	ISO 185
89	M8 x 12 Hexagon socket head cap screw	A2-70	ISO 4762
89 A	Spring lock washer	1.4401	-
93	M6 x 30 Hexagon socket head cap screw	A4-70	ISO 4762
105	Shaft seal cartridge	SiC-SiC	
105A	M6 x 16 Hexagon socket head cap screw	A4-80	ISO 4762
105B	Disc for shaft seal protection	PTFE	-
150 B	*Inner cooling jacket	EN 1561 EN-GJL-250	-
150 C	*Outer cooling jacket	EN 1561 EN-GJL-250	-
152	Ball Bearing 6016 2RS1/C3 WT		
152 A	Wave spring 124 x 114 x 0.6 H4.8		
153	Angular contact ball bearing 7316 BECBP		
153 B	*Outer dummy bearing	EN 1.0580	-
153 C	*Inner dummy bearing	EN 1.0580	-
154	Ball bearing 6214 2RS1/HC5C3 WT		
155	Lower bearing bracket	EN-GJL-250	ISO 185
157D	65 x 5 O-ring	NBR 70	ISO 3601-1 Class B
158	Centrifugal cup	PA6.6	-
158A	72.39 x 5.33 O-ring	NBR 70	ISO 3601-1 Class B
159	Wire Cover	PTFE	-
164 A	Motor top cover	EN-GJL-250	ISO 185
168	Upper cable entry	EN-GJL-250	ISO 185
168 A	Lower cable entry	EN-GJL-250	ISO 185
168 B	Cable entry clamp	EN-GJL-250	ISO 185
172	Shaft with rotor	-	-
183	M10 x 25 Hexagon socket head cap screw	A4-80	ISO 4762
187	M80 Lock Nut	-	-
190	Lifting Handle	1.4408	-
193	ISO 228-G 3/8" Plug	AISI 316	-
198	Seal ring*	KTT CR601	-
198	Rubber seal*	KTT CR601	-
198b	*x56x2 Washer	A4	-
198c	*x56x* Disc spring	A4	ISO 16983
230B	lock washer	A4-70	DIN 6798 A
400	126 x 3.53 O-ring	NBR 70	ISO 3601-1 Class B
401	Seal ring	KTT CR601	-
402	M10 x 1 Grease nipple	Carbon steel Zinc plated	DIN 71412 A
403	Leakage switch / dry run sensor	-	-
405	8.4 x 16 x 1.6 Washer	Brass	DIN 125 A
406	M8 Nut	Brass	ISO 4032
407	Cable terminal 16-8	-	
410	M10 x 16 Set screw (plug)	PTFE	ISO 4026
411	M16 x 16 Set screw	PTFE	ISO 4026
412	ISO 228-G 3/4" Plug	AISI 316	-
413	M6 x 10 Hex Socket Button Head Cap Screw	A4-80	ISO 4762

Pos.	Component	Material	Standard
520	Moisture switch	-	-
520a	M3 x 10 Slotted cheese head screw	4.8 (zinc plated)	ISO 1207
522*	Bracket for wire termination	S235JRG2C	-
522*	Bracket screen sermination	S235JRG2C	-
528	M10 x 40 Hexagon Socket Head Cap Screw	-	-
1084	M3 x 12 Hexagon Socket Head Cap Screw	A2	ISO 4762
1129	10.5 x 20 x 2 Washer	A4	ISO 7089/7090
1173	17 x 23 Seal washer	Cu	-

6. Service tools

Service tools

	Designation	Description
	Molex plug removal tool	SV2117
	Locking-ring pliers	Circlip range 122-400 mm
	Refractometer	
	Ball bearing puller/ strong back pullers	SKF TMBS100E
	Ball bearing mounting kit	SKF TMMK20-50

7. Tightening torques and lubricants

Pos.	Designation	Quantity	Dimension	Torque [Nm]	Torque (lb-ft)	Lubricant
1	Hexagon socket head cap screw	6	M8 x 16	15 ± 3 Nm	11 ± 2.2 lb-ft	Thread-EZE Ultra
9A	Impeller key	2	12 x 20 x 70	-	-	Thread-EZE Ultra
12C	Set screw	3	M24 x 45	-	-	Thread-EZE Ultra
20	Plug	1	ISO 228-G 1/2"	30 ± 3 Nm	22.2 ± 2.2 lb-ft	Thread-EZE Ultra
35A	Hexagon head screw	3	M12 x 70	50 ± 5 Nm	36.9 ± 3.7 lb-ft	Thread-EZE Ultra
50D	Hexagon head screw	2	M10 x 25	30 ± 2 Nm	22.2 ± 1.5 lb-ft	Thread-EZE Ultra
67	Hexagon socket head cap screw	34	M16 x 70	70 ± 5 Nm	51.6 ± 3.7 lb-ft	Thread-EZE Ultra
67	Hexagon head bolts with shank	1	M16x*	175 ± 5 Nm	129 ± 3.7 lb-ft	Thread-EZE Ultra
89	Hexagon socket head cap screw	1	M8x12	15 ± 3 Nm	11 ± 2.2 lb-ft	Thread-EZE Ultra
93	Hexagon socket head cap screw	14	M6x30	6 ± 2 Nm	4.4 ± 1.5 lb-ft	Thread-EZE Ultra
105A	Hexagon socket head cap screw	5*	M6x16	6 ± 2 Nm	4.4 ± 1.5 lb-ft	Thread-EZE Ultra
158	Centrifugal cup	1	-	-	-	LGHP 2 SKF
183	Hexagon socket head cap screw	20*	M10 x 25	30 ± 4 Nm	22.2 ± 2.9 lb-ft	Thread-EZE Ultra
193	Plug	3	ISO 228-G 3/8"	30 ± 3 Nm	22.2 ± 2.2 lb-ft	Thread-EZE Ultra
402	Grease nipple	1	M10 x 1	15 ± 3 Nm	11 ± 2.2 lb-ft	Thread-EZE Ultra
403	Leakage switch / Dry run sensor	1		30 ± 4 Nm	22.2 ± 2.9 lb-ft	Thread-EZE Ultra
406	Nut	12	M8	10 ± 1 Nm	7.3 ± 0.7 lb-ft	-
410	Set screw (Plug)	10	M10x*	-	-	Thread-EZE Ultra
412	Plug	2	ISO 228-G 3/4"	30 ± 3 Nm	22.2 ± 2.2 lb-ft	Thread-EZE Ultra
1084	Hexagon socket head cap screw	10	M3 x 12	1 ± 0.15 Nm	0.7 ± 0.11 lb-ft	Thread-EZE Ultra
All	O-rings	all	-	-	-	Rocol Sapphire Aqua-Sil grease

*depends on pump version

8. Electrical connection

EMC shielding of power and control cables must be connected and fixed by the installer.

Connect pumps installed in hazardous locations to a control box with a motor protection relay with an IEC trip class 10.

1. Do not install pump controllers, Ex barriers or the free end of the power cable in potentially explosive environments.
2. The classification of the installation site must comply with the local rules.
3. On explosion-proof pumps, make sure that an external ground conductor is connected to the external ground terminal on the pump by a secure cable clamp. Clean the surface of the external ground connection and mount the cable clamp.
4. The ground conductor must be minimum AWG 12 type RHH, RHW, RHW-2 or similar, rated for 600 V and minimum 90 °C, yellow and green.
5. Make sure that the ground conductor is protected from corrosion.
6. Make sure that all protective equipment has been connected correctly.
7. Float switches used in potentially explosive environments must be approved for this application. They must be connected to the Grundfos Dedicated Controls, DC, DCD or the SLC, DLC controllers, by an intrinsically safe barrier to ensure a safe circuit.

DANGER
Electric shock
Death or serious personal injury
- Unauthorised people must not have any access to this product.

DANGER
Electric shock
Death or serious personal injury
- Before starting any work on the product, make sure that the power supply is switched off and that it cannot be switched on unintentionally.

WARNING
Electric shock
Death or serious personal injury
- Before installation and startup, check the power cable for damage.

DANGER
Electric shock
Death or serious personal injury
- The pump must be grounded. Before connecting the pump to the voltage supply, make sure the connection to ground complies with the local regulations.

Connect the pump to an external main switch ensuring all-pole disconnection with a contact separation according to EN 60204-1, 5.3.2. It must be possible to lock the main switch in position 0.

The supply voltage and frequency are marked on the nameplate. Make sure that the motor is suitable for the power supply at the installation site.

The electrical connection must comply with the local regulations.

Connect the pumps to a controller with a motor protection relay with IEC trip class 10 or 15 or NEMA-equivalent.

The power supply for the motor protection circuit must be low voltage, class 2.

If the power cable is damaged, it must be replaced by the manufacturer or approved service provider.

Connect the pump to a motor-protective circuit breaker.

Set the motor-protective circuit breaker to the rated current of the pump, +10 % service factor for 50 Hz motors, +15 % service factor for 60 Hz motors. The rated current is stated on the nameplate.

The supply voltage and frequency are marked on the nameplate.

The voltage tolerance at the motor terminals must be within ± 10 % of the rated voltage.

The motor is effectively grounded with the power cable and pipes. The motor top cover is equipped with connections for external grounding or an equipotential bonding conductor.

Maintenance and service work on explosion-proof pumps must be carried out by Grundfos or an authorised service workshop.

Before installation and the first startup of the pump, check the condition of the cable to avoid short circuits.

The most commonly used startup methods are the following:

- Direct-on-line starting (DOL).
- Star-delta starting (Y/D).
- Soft start.

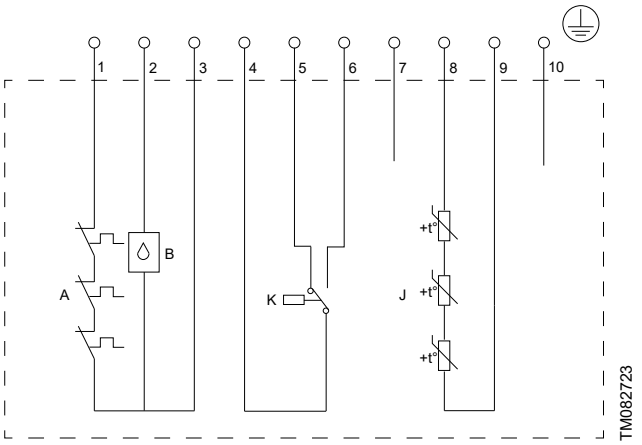
The suitable starting method depends on several considerations on usage and mains supply conditions.

When using star-delta start, it is important to keep switching transient time to a minimum to avoid high transient torques. Use a time relay with a switching time of maximum 50 milliseconds, or according to the manufacturer's specifications.

The pump can be operated with a frequency converter according to the specifications of the manufacturer.

8.1 Wiring diagrams

8.1.1 Sensor wiring diagrams

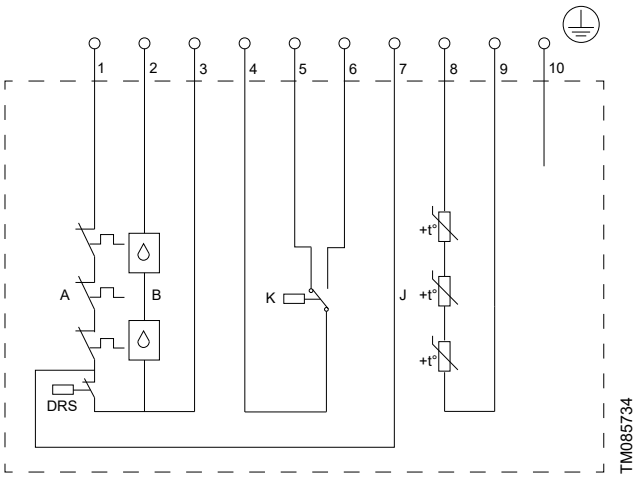


Sensor connection, standard version

Pos.	Description
A	3 × PTO
B	Moisture switch (motor top)
K	Float switch in leakage chamber
J	3 × PTC

Cable screening must be connected to the ground. To connect the leakage switch to SM113 module, use resistor kit 93185991. The resistor converts the digital signal from the leakage switch (Terminal 4, 5 and 6) and this signal must be converted to analog 4-20 mA signal. The resistor kit must be connected as follows:

1. Connect Sensor wire "4" (common point of leakage switch) to SM113 Terminal "3".
2. Connect Sensor wire "5" (leakage switch lower position: 4-6 mA = "OK" signal) to "R1" of the resistor kit.
3. Connect Sensor wire "6" (leakage switch upper position: 16-18 mA = "Alarm" signal) to "R2" of the resistor kit.
4. Connect the common end of the resistor kit to Terminal "4" of the SM113 module.

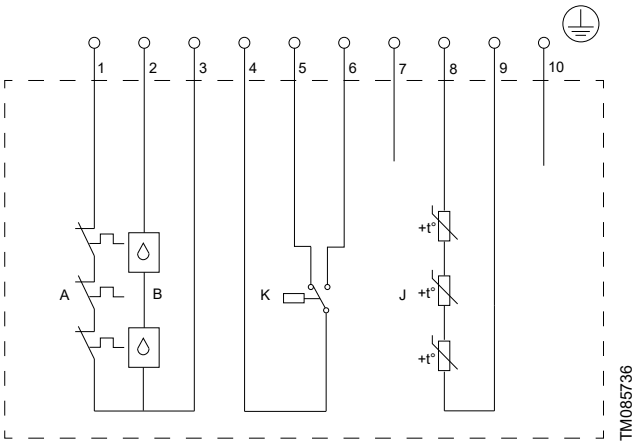


Sensor connection, standard Ex version (SE pumps)

Pos.	Description
A	3 × PTO
B	2 × Moisture switch (motor top)
K	Float switch in leakage chamber
J	3 × PTC
DRS	Dry running switch

Cable screening must be connected to the ground. Sensor wire 7 is the control wire for service. If not used, then the wire end must be insulated. To connect the leakage switch to SM113 module, use resistor kit 93185991. The resistor converts the digital signal from the leakage switch (Terminal 4, 5 and 6) and this signal must be converted to analog 4-20 mA signal. The resistor kit must be connected as follows:

1. Connect Sensor wire "4" (common point of leakage switch) to SM113 Terminal "3".
2. Connect Sensor wire "5" (leakage switch lower position: 4-6 mA = "OK" signal) to "R1" of the resistor kit.
3. Connect Sensor wire "6" (leakage switch upper position: 16-18 mA = "Alarm" signal) to "R2" of the resistor kit.
4. Connect the common end of the resistor kit to Terminal "4" of the SM113 module.

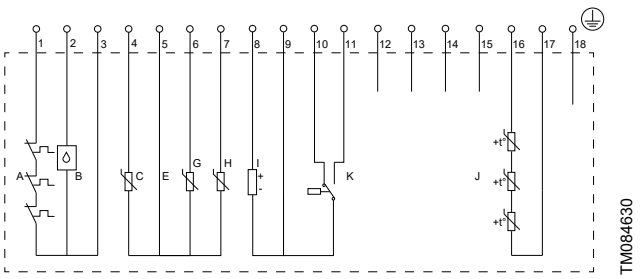


Sensor connection, standard Ex version without Dry Running Switch (SL pumps)

Pos.	Description
A	3 × PTO
B	2 × Moisture switch (motor top)
K	Float switch in leakage chamber
J	3 × PTC

Cable screening must be connected to the ground. Sensor wire 7 is the control wire for service. If not used, then the wire end must be insulated. To connect the leakage switch to SM113 module, use resistor kit 93185991. The resistor converts the digital signal from the leakage switch (Terminal 4, 5 and 6) and this signal must be converted to analog 4-20 mA signal. The resistor kit must be connected as follows:

1. Connect Sensor wire "4" (common point of leakage switch) to SM113 Terminal "3".
2. Connect Sensor wire "5" (leakage switch lower position: 4-6 mA = "OK" signal) to "R1" of the resistor kit.
3. Connect Sensor wire "6" (leakage switch upper position: 16-18 mA = "Alarm" signal) to "R2" of the resistor kit.
4. Connect the common end of the resistor kit to Terminal "4" of the SM113 module.

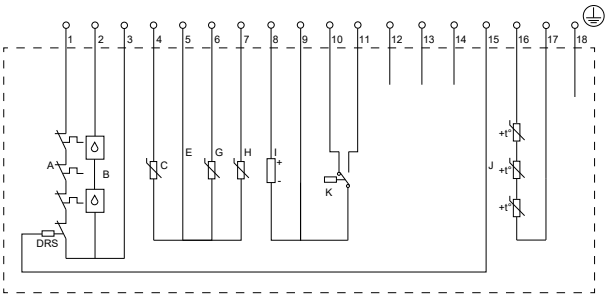


Sensor connection, version V1

Pos.	Description
A	3 × PTO
B	Moisture switch (motor top)
C	Pt100 (lower bearing)
E	Common ground for sensors
G	Pt100 (upper bearing)
H	Pt100 (stator winding)
I	Vibration sensor
K	Float switch in leakage chamber
J	3 × PTC

Cable screening must be connected to the ground. To connect the leakage switch to SM113 module, use resistor kit 93185991. The resistor converts the digital signal from the leakage switch (Terminal 9, 10 and 11) and this signal must be converted to analog 4-20 mA signal. The resistor kit must be connected as follows:

1. Connect Sensor wire "9" (common point of leakage switch) to SM113 Terminal "3".
2. Connect Sensor wire "10" (leakage switch lower position: 4-6 mA = "OK" signal) to "R1" of the resistor kit.
3. Connect Sensor wire "11" (leakage switch upper position: 16-18 mA = "Alarm" signal) to "R2" of the resistor kit.
4. Connect the common end of the resistor kit to Terminal "4" of the SM113 module.

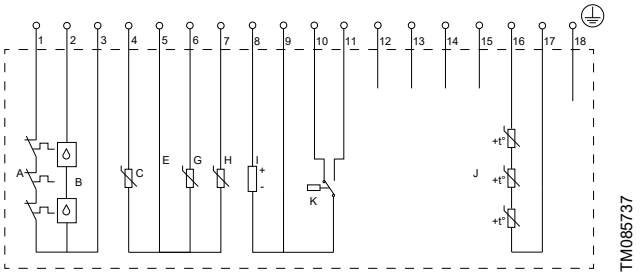


Sensor connection, version V1 Ex (SE pumps)

Pos.	Description
A	3 × PTO
B	2 × Moisture switch (motor top)
C	Pt100 (lower bearing)
E	Common ground for sensors
G	Pt100 (upper bearing)
H	Pt100 (stator winding)
I	Vibration sensor
K	Float switch in leakage chamber
J	3 × PTC
DRS	Dry running switch

Cable screening must be connected to the ground. Sensor wire 15 is the control wire for service. If not used, then the wire end must be insulated. To connect the leakage switch to SM113 module, use resistor kit 93185991. The resistor converts the digital signal from the leakage switch (Terminal 9, 10 and 11) and this signal must be converted to analog 4-20 mA signal. The resistor kit must be connected as follows:

1. Connect Sensor wire "9" (common point of leakage switch) to SM113 Terminal "3".
2. Connect Sensor wire "10" (leakage switch lower position: 4-6 mA = "OK" signal) to "R1" of the resistor kit.
3. Connect Sensor wire "11" (leakage switch upper position: 16-18 mA = "Alarm" signal) to "R2" of the resistor kit.
4. Connect the common end of the resistor kit to Terminal "4" of the SM113 module.

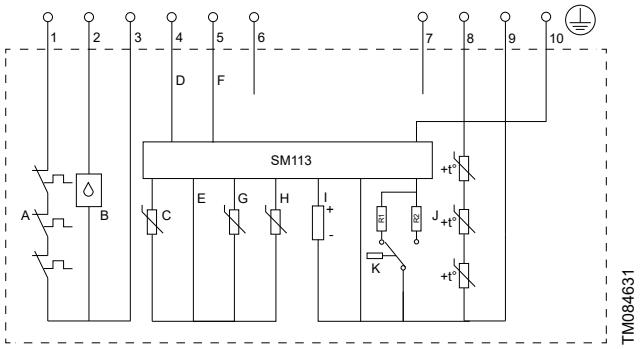


Sensor connection, version V1 Ex without Dry Running Switch (SL pumps)

Pos.	Description
A	3 × PTO
B	2 × Moisture switch (motor top)
C	Pt100 (lower bearing)
E	Common ground for sensors
G	Pt100 (upper bearing)
H	Pt100 (stator winding)
I	Vibration sensor
K	Float switch in leakage chamber
J	3 × PTC

Cable screening must be connected to the ground. Sensor wire 15 is the control wire for service. If not used, then the wire end must be insulated. To connect the leakage switch to SM113 module, use resistor kit 93185991. The resistor converts the digital signal from the leakage switch (Terminal 9, 10 and 11) and this signal must be converted to analog 4-20 mA signal. The resistor kit must be connected as follows:

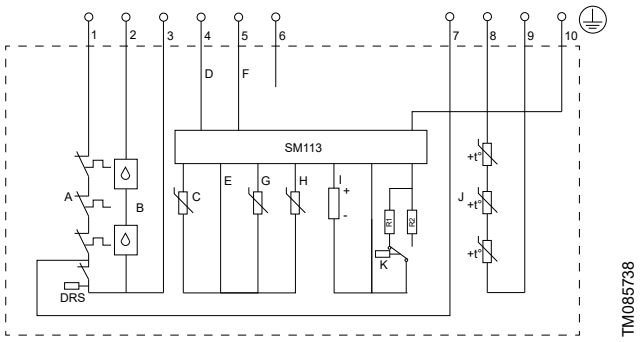
1. Connect Sensor wire "9" (common point of leakage switch) to SM113 Terminal "3".
2. Connect Sensor wire "10" (leakage switch lower position: 4-6 mA = "OK" signal) to "R1" of the resistor kit.
3. Connect Sensor wire "11" (leakage switch upper position: 16-18 mA = "Alarm" signal) to "R2" of the resistor kit.
4. Connect the common end of the resistor kit to Terminal "4" of the SM113 module.



Sensor connection, version V2

Pos.	Description
A	3 × PTO
B	Moisture switch (motor top)
C	Pt100 (lower bearing)
D	Supply input for sensor board from IO113
E	Common ground for sensors
F	Communication signal for IO113
G	Pt100 (upper bearing)
H	Pt100 (stator winding)
I	Vibration sensor
K	Float switch in leakage chamber
J	3 × PTC

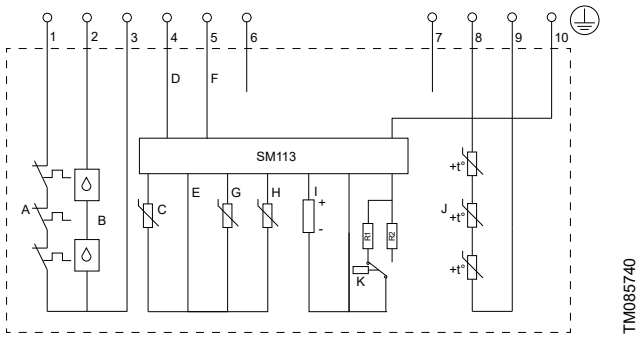
Cable screening must be connected to the ground.



Sensor connection, version V2 Ex (SE pumps)

Pos.	Description
A	3 × PTO
B	2 × Moisture switch (motor top)
C	Pt100 (lower bearing)
D	Supply input for sensor board from IO113
E	Common ground for sensors
F	Communication signal for IO113
G	Pt100 (upper bearing)
H	Pt100 (stator winding)
I	Vibration sensor
K	Float switch in leakage chamber
J	3 × PTC
DRS	Dry running switch

Cable screening must be connected to the ground. Sensor wire 7 is the control wire for service. If not used, then the wire end must be insulated.

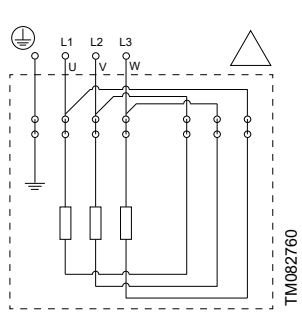


Sensor connection, version V2 Ex without Dry Running Switch (SL pumps)

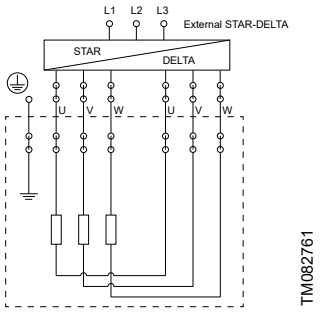
Pos.	Description
A	3 × PTO
B	2 × Moisture switch (motor top)
C	Pt100 (lower bearing)
D	Supply input for sensor board from IO113
E	Common ground for sensors
F	Communication signal for IO113
G	Pt100 (upper bearing)
H	Pt100 (stator winding)
I	Vibration sensor
K	Float switch in leakage chamber
J	3 × PTC

Cable screening must be connected to the ground. Sensor wire 7 is the control wire for service. If not used, then the wire end must be insulated.

8.1.2 Motor wiring diagrams



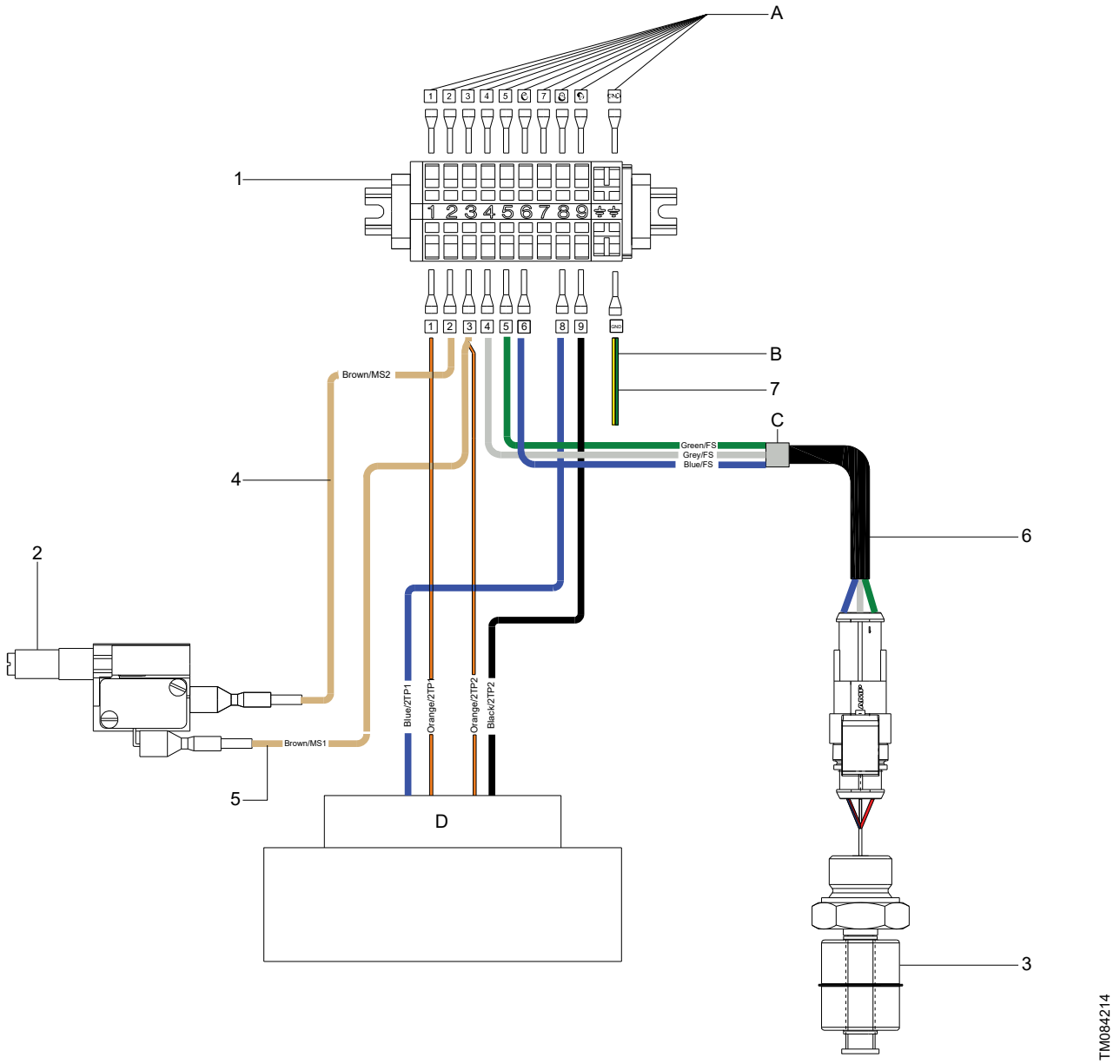
Delta connection



Y/D connection

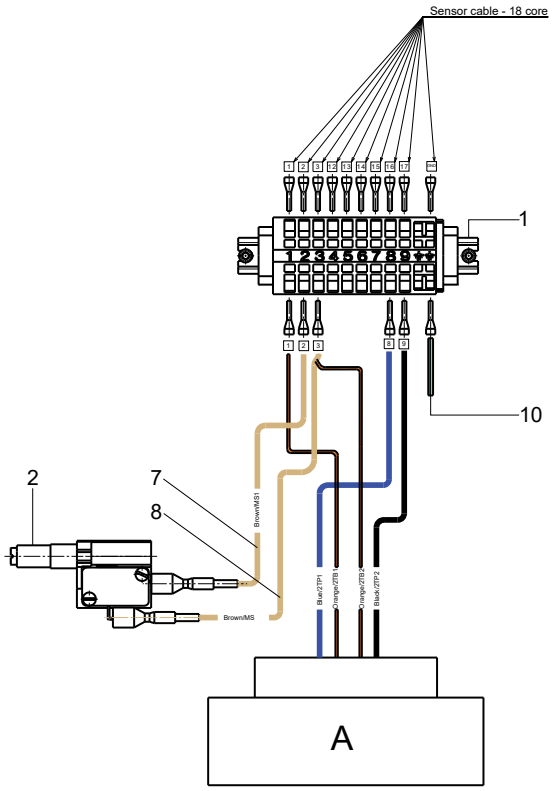
8.2 Motor top wiring connections

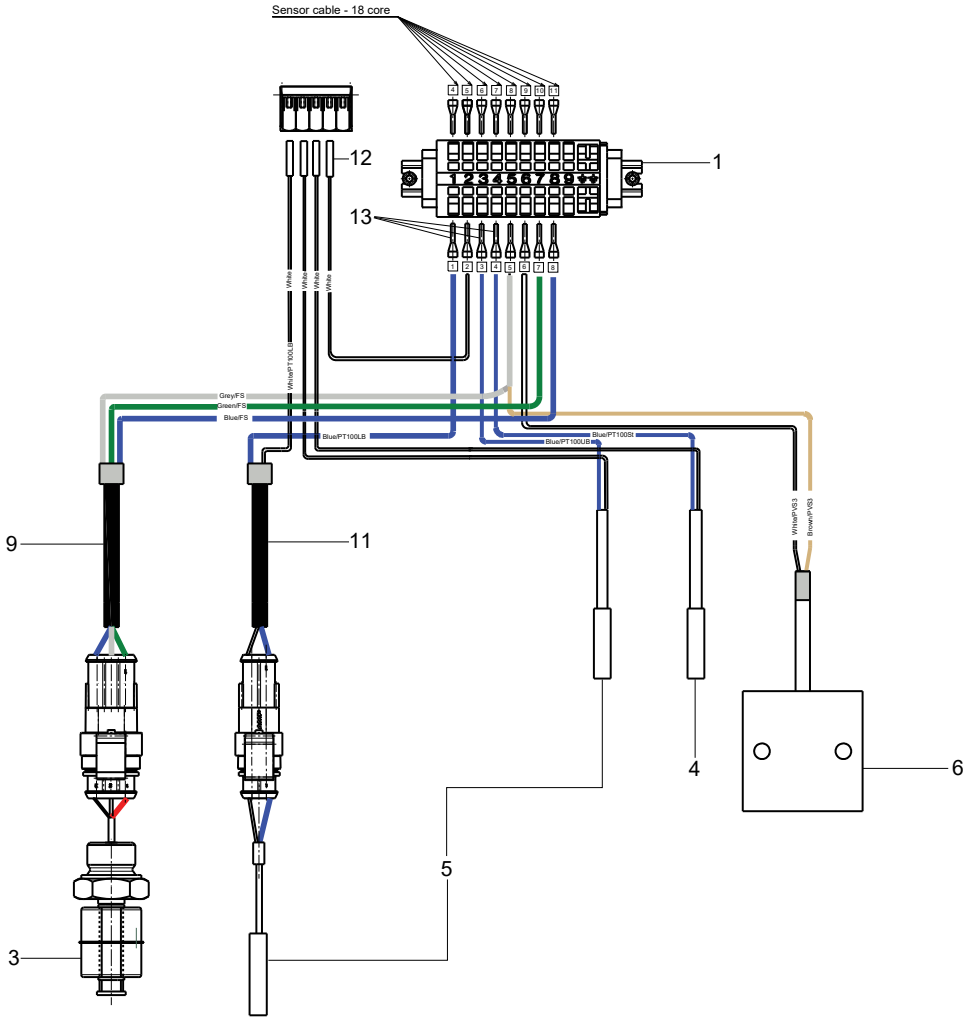
8.2.1 Standard sensor version



Item	Component	Item	Description
1	Terminal board	**A**	Sensor cable - 10 core
2	Moisture switch	**B**	Connect the earthing cable to the upper bearing bracket
3	Leakage switch	**C**	Screening cable must be clamped to the terminal bracket
4	Moisture switch wire 1	**D**	Stator
5	Moisture switch wire 3		
6	Leakage switch harness		
7	Earthing cable		

8.2.2 Sensor version V1





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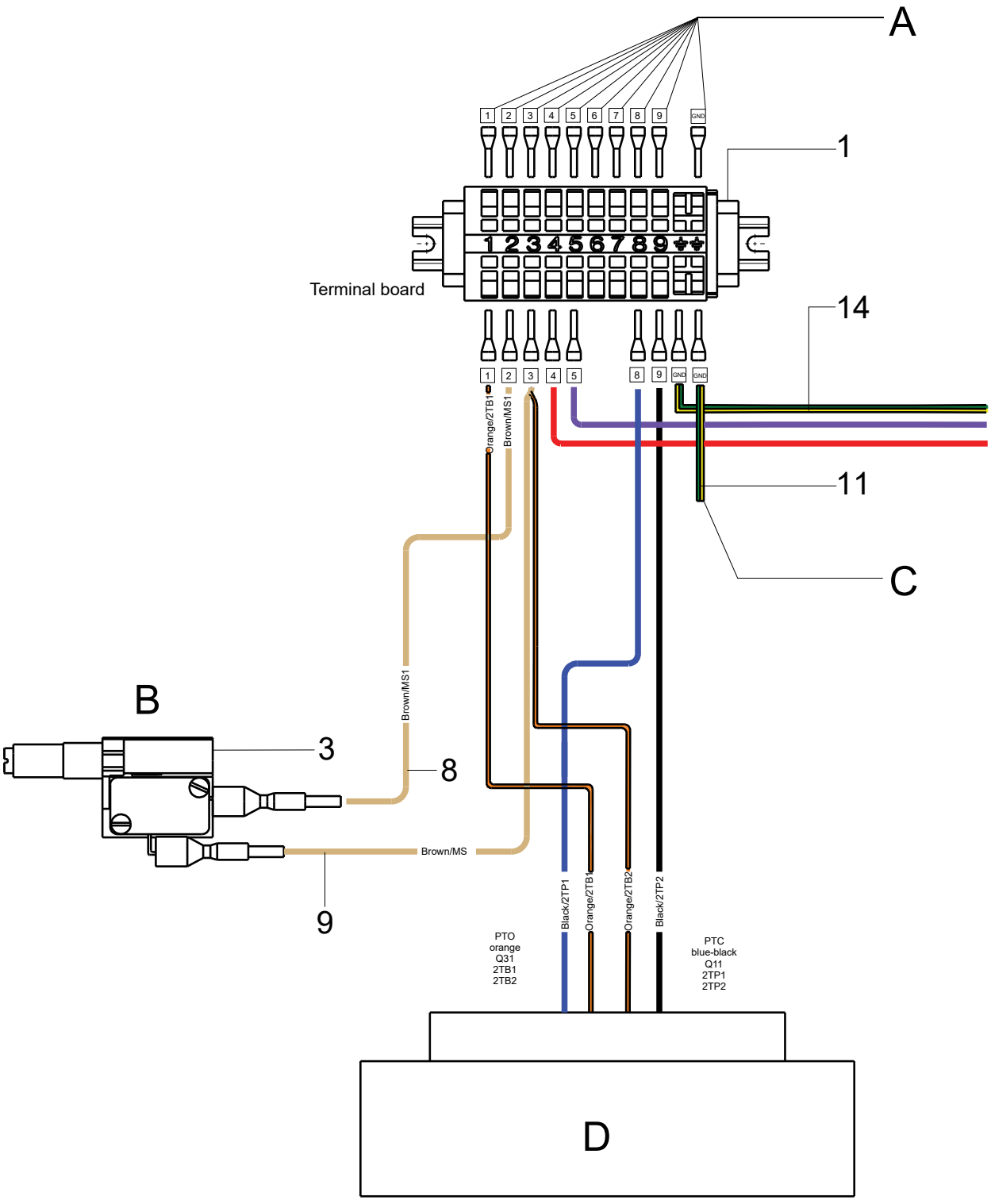
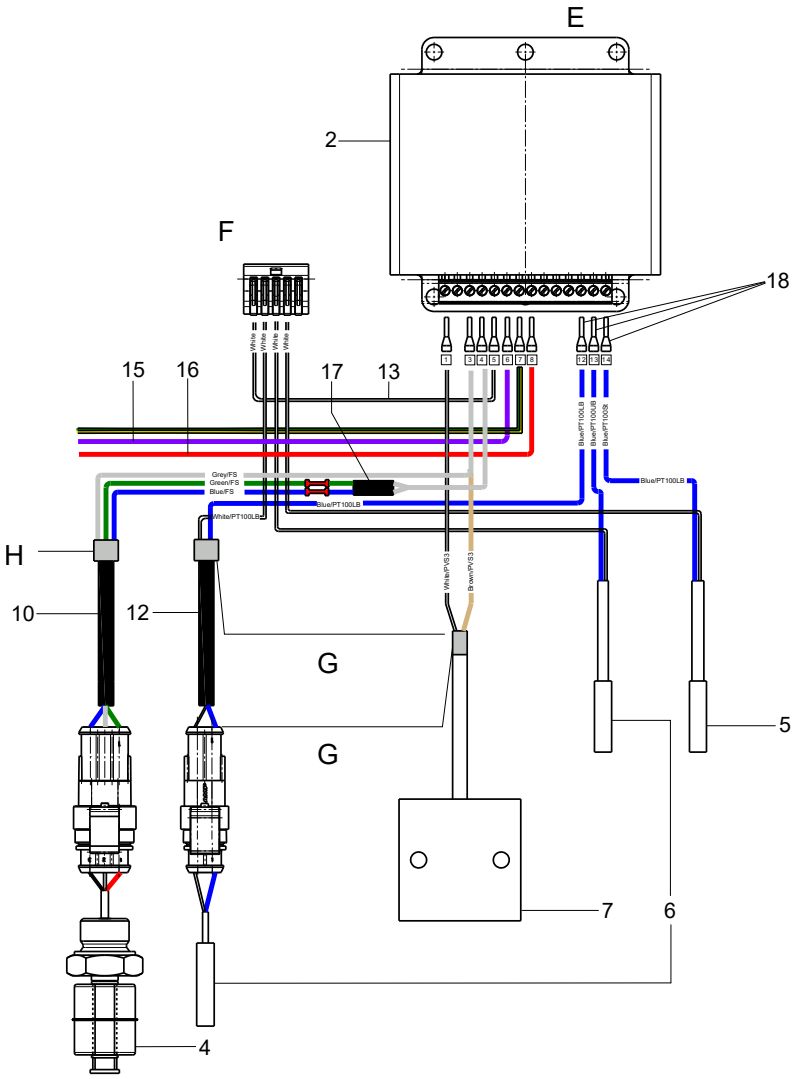
Item	Component
1	Terminal board
2	Moisture switch
3	Leakage switch with cable
4	PT100 insulated temperature sensor
5	PT100B temperature sensor
6	PVS3 Vibration sensor
7	Wire for moisture switch 1
8	Wire for moisture switch 2
9	Harness for float switch 2
10	Earthing cable
11	Harness PT100
12	Wire for common grounding
13	End sleeve DIN 46228-4 1-8
A	Stator

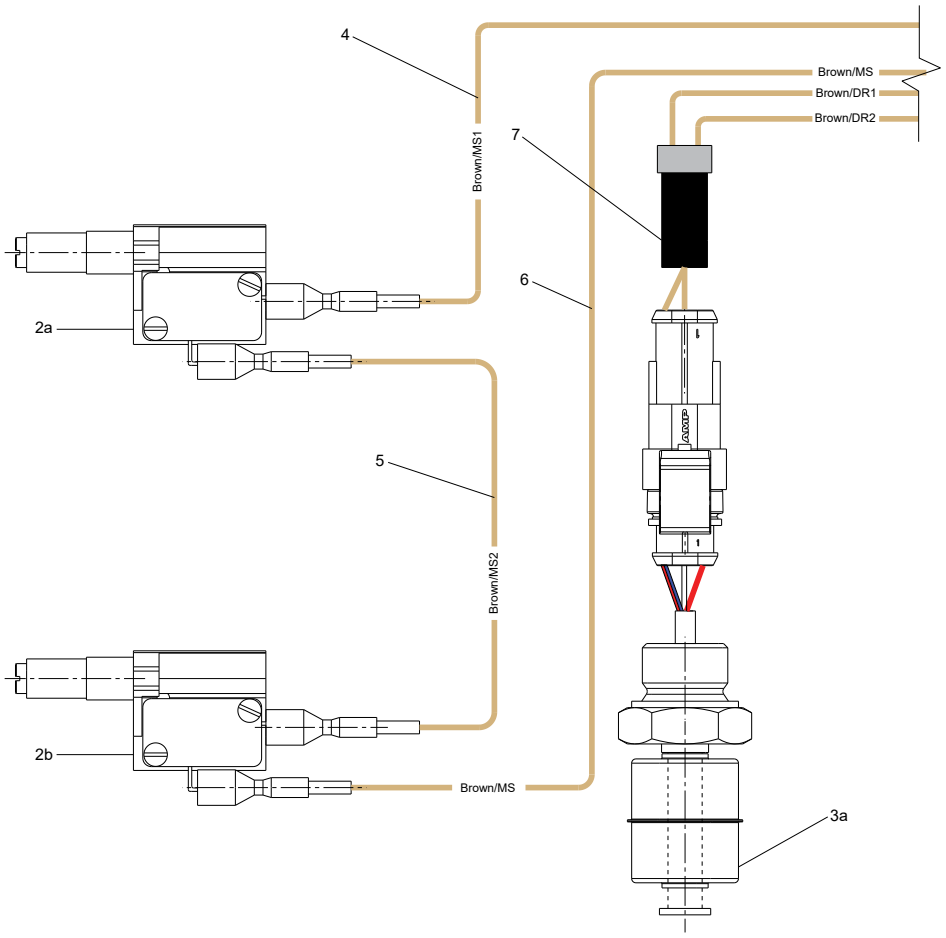
8.2.3 Sensor version V2



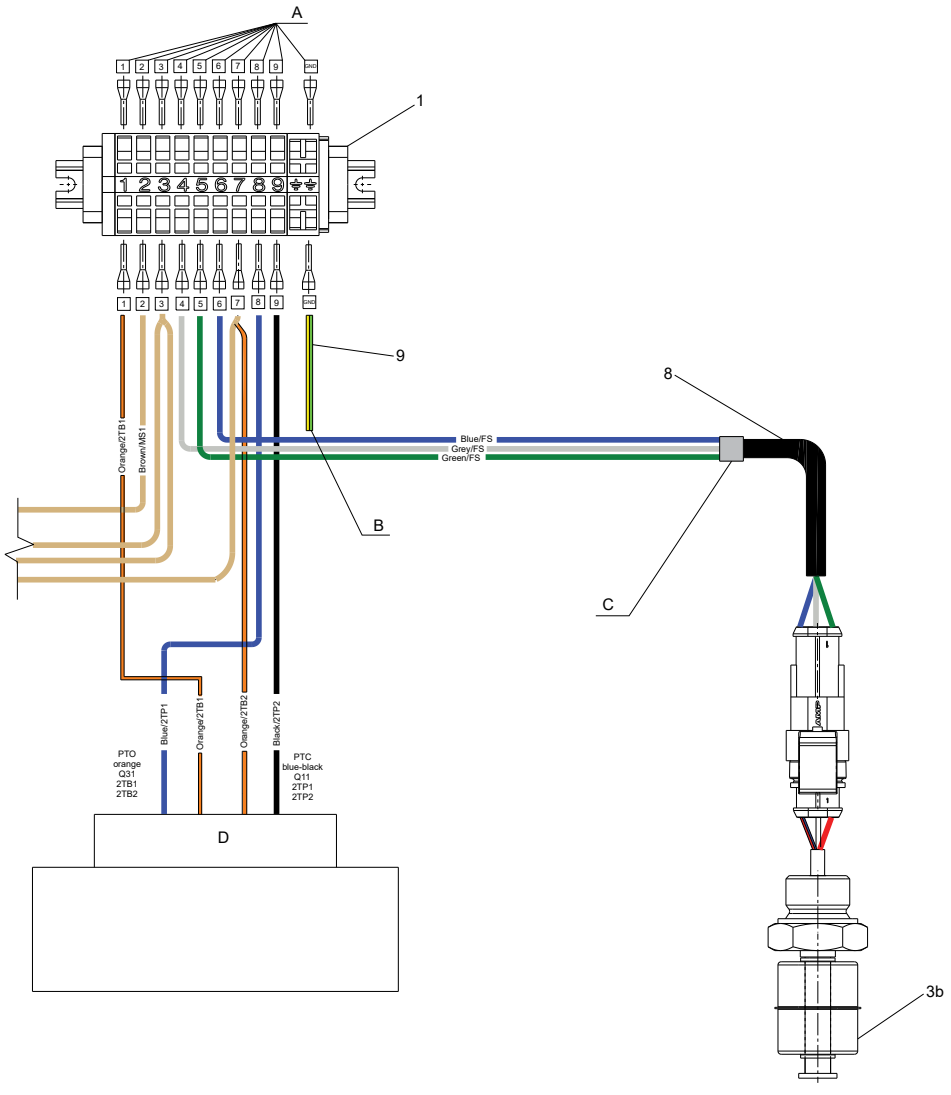


Item	Component	Item	Description
1	Terminal board	**A**	Sensor cable - 10 cire
2	SM113 module	**B**	Moisture switch in motor top compartment
3	Moisture switch	**C**	Connection to upper bearings
4	Leakage switch with cable	**D**	Stator
5	PT100 insulated temperature sensor	**E**	SM113 module
6	PT100B temperature sensor	**F**	WAGO connector
7	PVS3 vibration sensor	**G**	Screening must be fixed to the terminal bracket with the help of a clamp
8	Wire for moisture switch 1	**H**	Protective earth bracket
9	Wire for moisture switch 2		
10	Harness for float switch 2		
11	Earthing cable		
12	Harness for PT100		
13	Wire for common earthing		
14	Earthing cable between modules		
15	Communication signal for SM113		
16	Supply input for SM 113		
17	Resistor kit		
18	End sleeve DIN 46228-4 1-8		

8.2.4 Standard Ex version

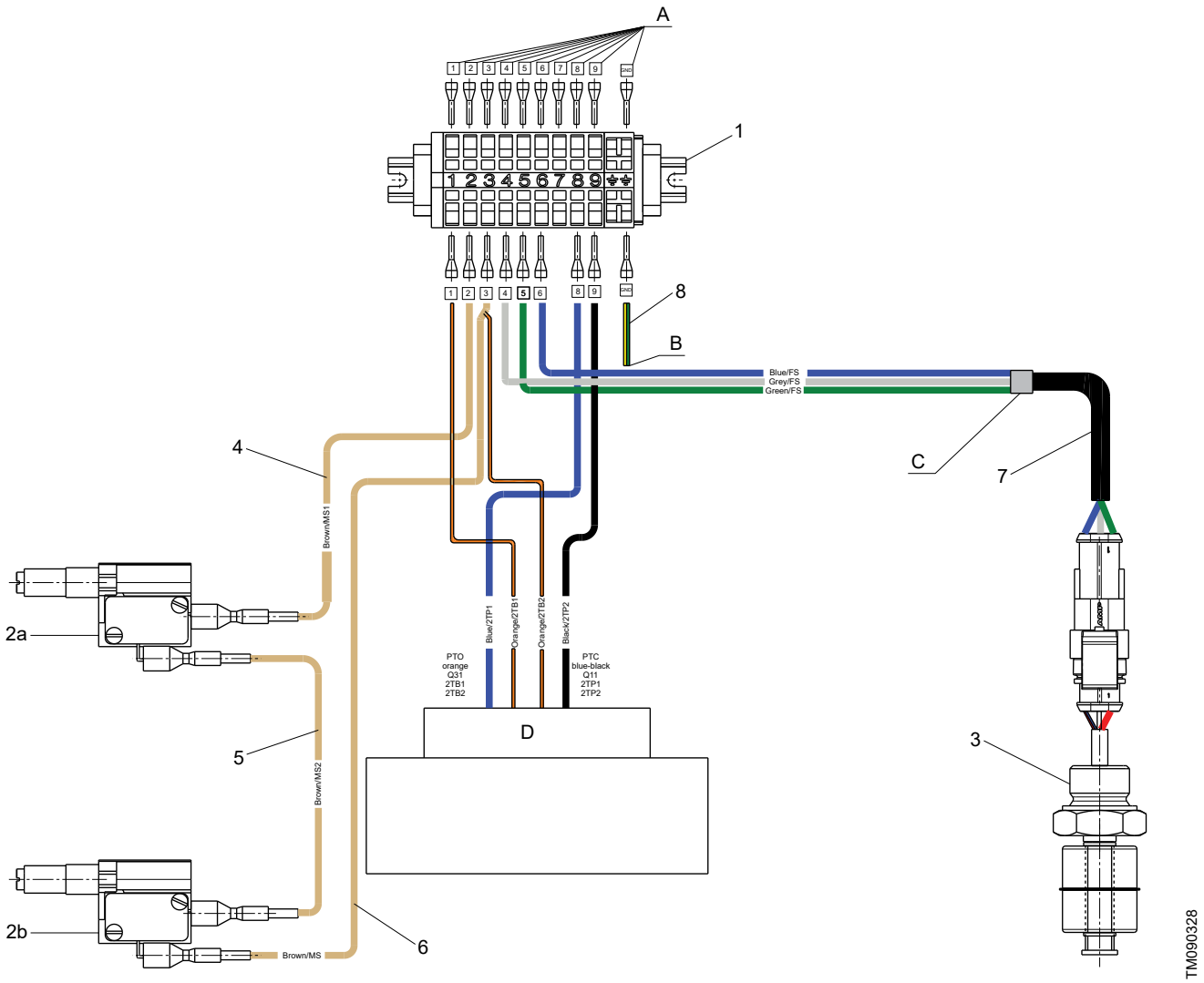


TM090330



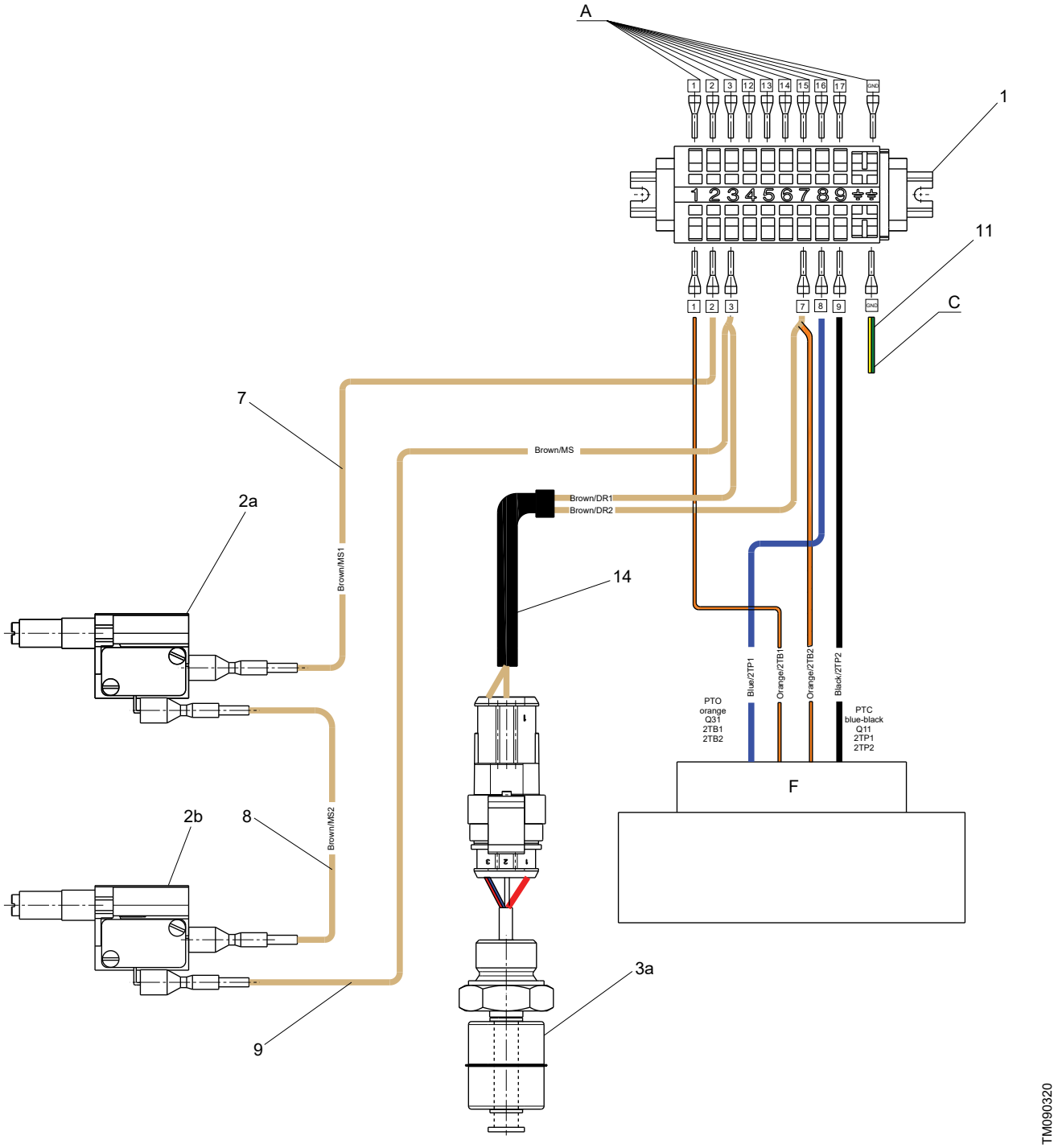
Position	Description
A	Sensor cable - 10 core
B	Connect to the protective earth of upper bearing bracket
C	Stripped cable must be fixed to the terminal bracket with the help of a clamp
D	Stator
1	Terminal board
2a	Moisture switch in motor top compartment
2b	Moisture switch in stator top compartment
3a	Dry run sensor
3b	Leakage switch in leakage chamber
4	Wire for moister switch 1
5	Wire for moister switch 2
6	Wire for moister switch 3
7	Harness for dry run sensor
8	Harness for leakages switch
9	Earthing cable

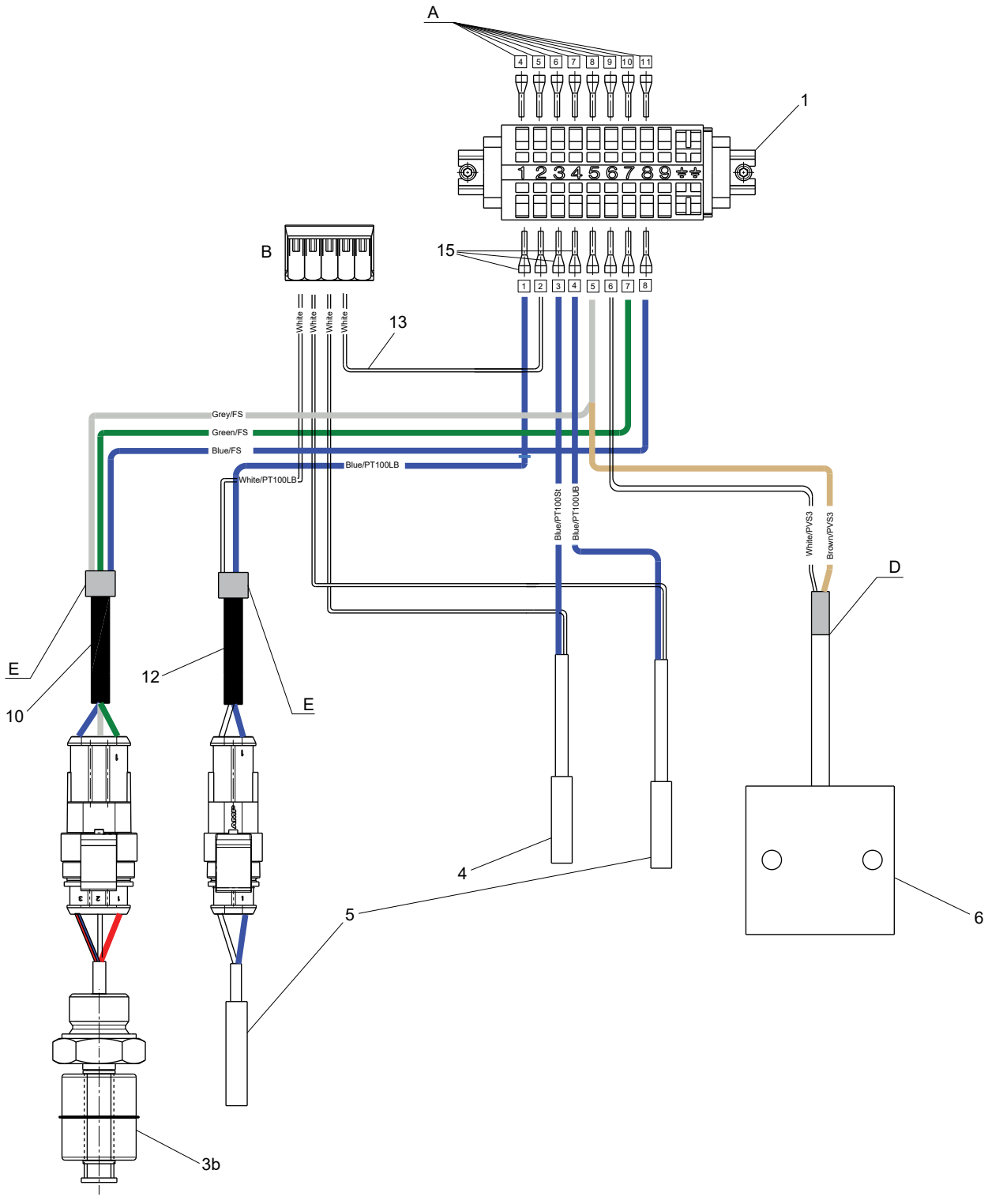
8.2.5 Standard Ex version without dry-running



Position	Description
A	Sensor cable - 10 core
B	Connect to the protective earth of upper bearing bracket
C	Screening must be fixed to the terminal bracket with the help of a clamp
D	Stator
1	Terminal board
2a	Moisture switch in motor top compartment
2b	Moisture switch in stator top compartment
3	Leakage switch
4	Wire for moister switch 1
5	Wire for moister switch 2
6	Wire for moister switch 3
7	Harness for leakages switch
8	Earthing cable

8.2.6 Sensor V1 Ex version

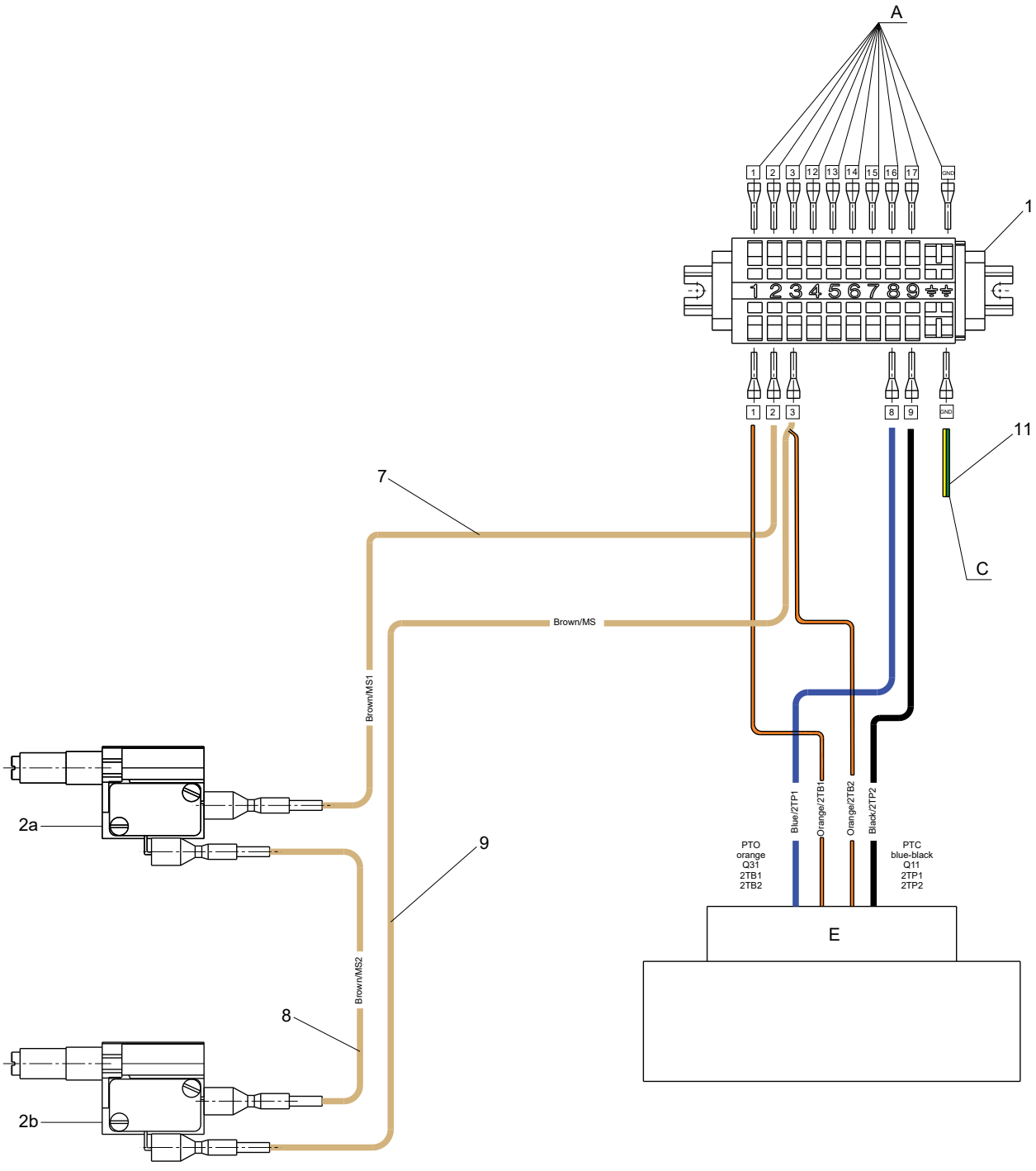




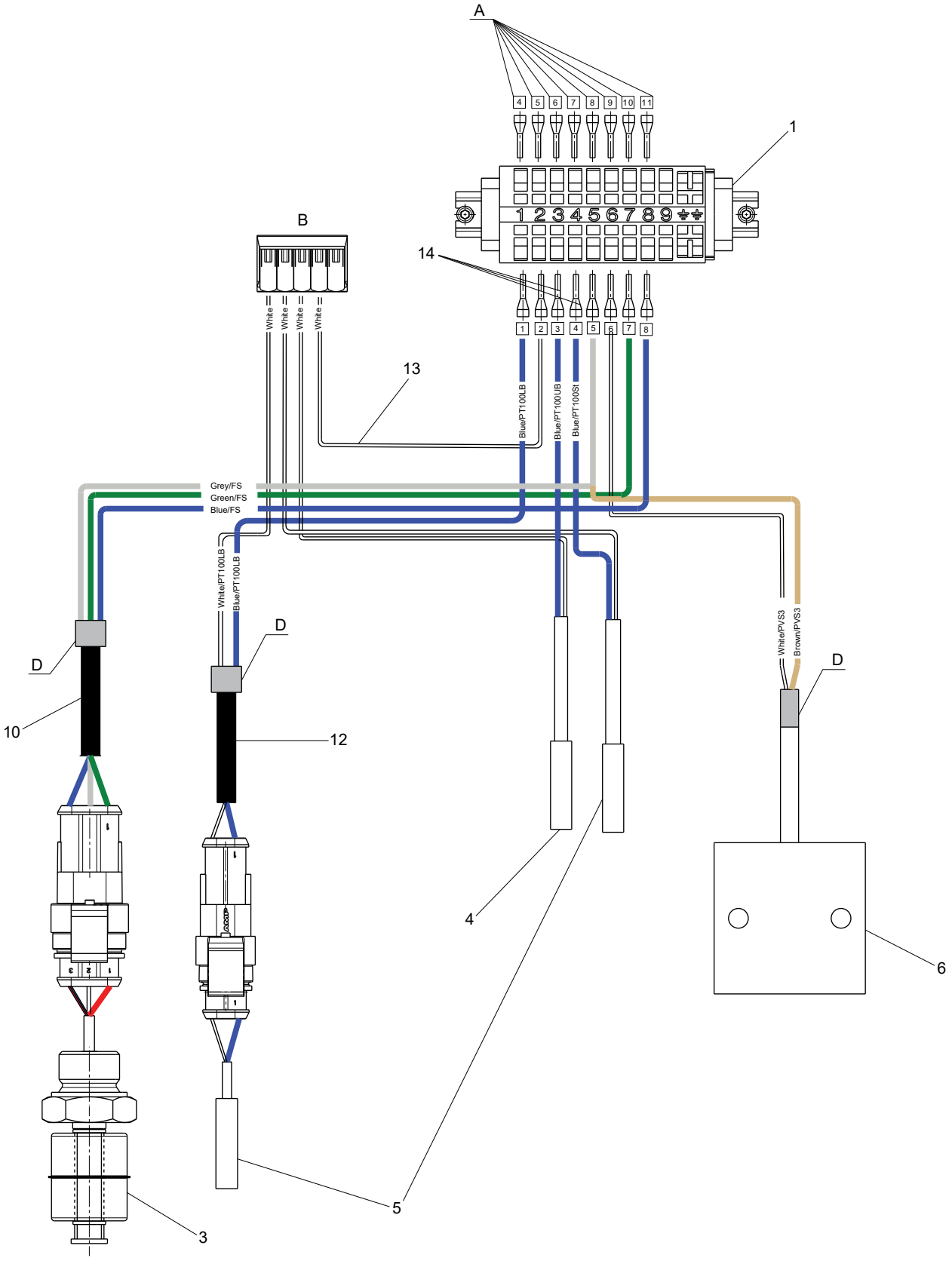
Position	Description
A	Sensor cable - 18 core
B	Wago terminal
C	Connect to the protective earth of upper bearing bracket
D	Screening must be fixed to the terminal bracket with the help of a clamp
E	Stripped cable must be fixed to the terminal bracket with the help of a clamp
F	Stator
1	Terminal board
2a	Moisture switch in motor top compartment
2b	Moisture switch in stator top compartment
3a	Dry run sensor
3b	Leakage switch in leakage chamber

Position	Description
4	Temperature sensor insulated PT100
5	Temperature sensor PT100B
6	PVS3, vibration sensor
7	Wire for moister switch 1
8	Wire for moister switch 2
9	Wire for moister switch 3
10	Harness for leakages switch
11	Earthing cable
12	Harness for PT100
13	Wire for common grounding
14	Harness for dry run sensor
15	End sleeve DIN 46228-4 1-8

8.2.7 Sensor version V1 Ex no dry running



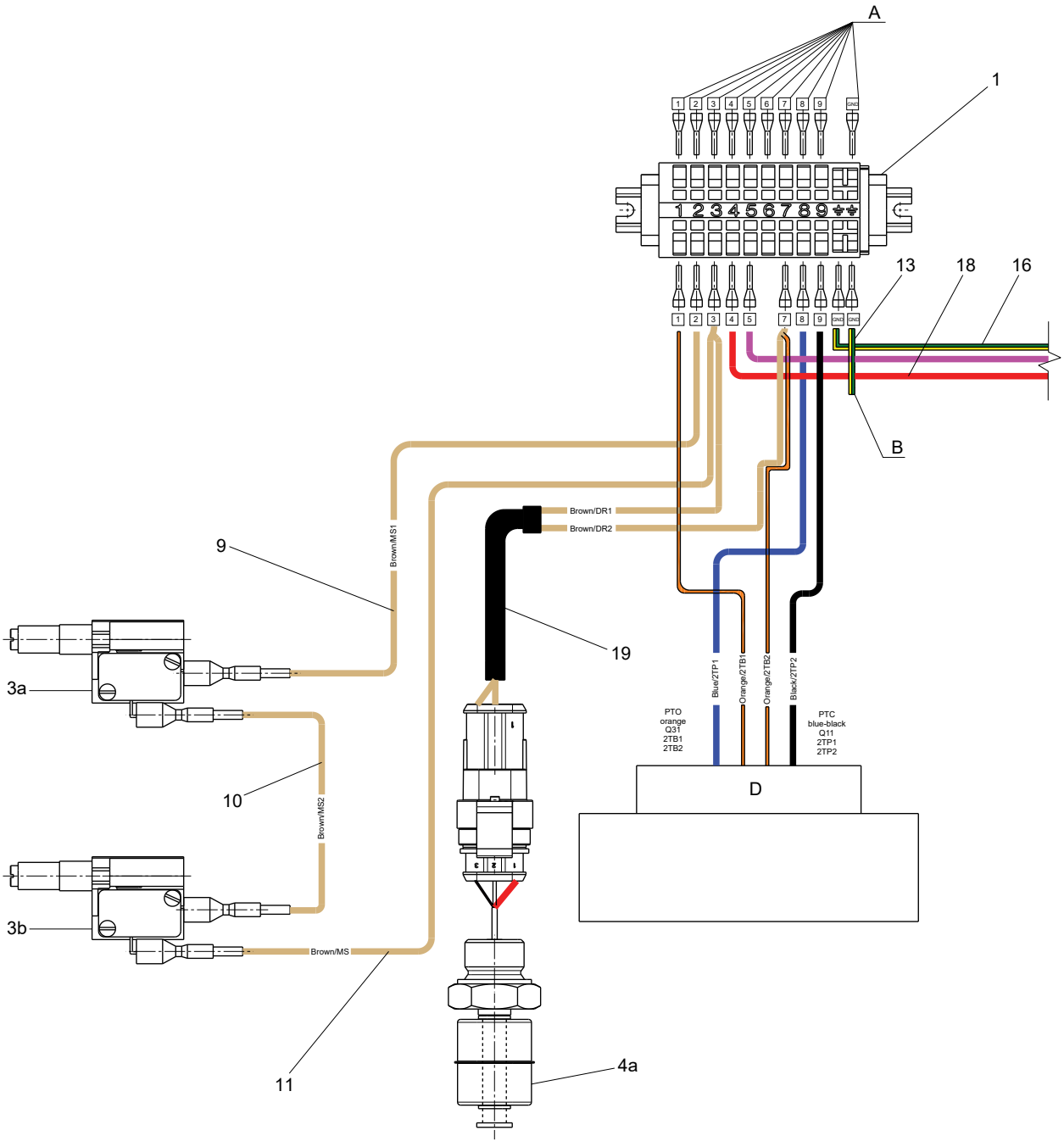
TM090326

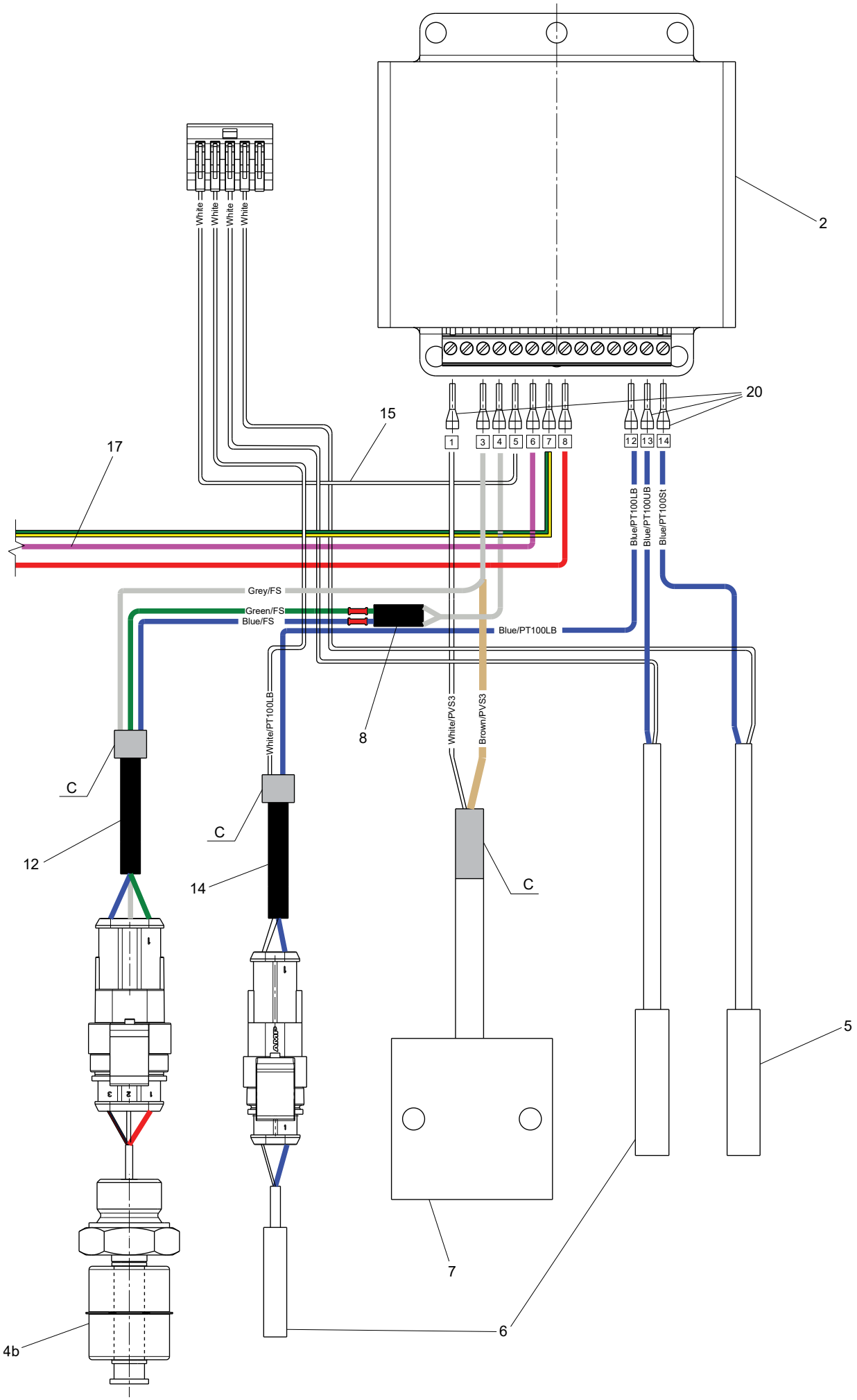


Position	Description
A	Sensor cable - 18 core
B	Wago terminal
C	Connect to the protective earth of upper bearing bracket
D	Screening must be fixed to the terminal bracket with the help of a clamp
E	Stator
1	Terminal board
2a	Moisture switch in motor top compartment

Position	Description
2b	Moisture switch in stator top compartment
3	Leakage switch in leakage chamber
4	Temperature sensor insulated PT100
5	Temperature sensor PT100B
6	PVS3, vibration sensor
7	Wire for moister switch 1
8	Wire for moister switch 2
9	Wire for moister switch 3
10	Harness for leakages switch
11	Earthing cable
12	Harness for PT100
13	Wire for common grounding
14	End sleeve DIN 46228-4 1-8

8.2.8 Sensor V2 Ex version

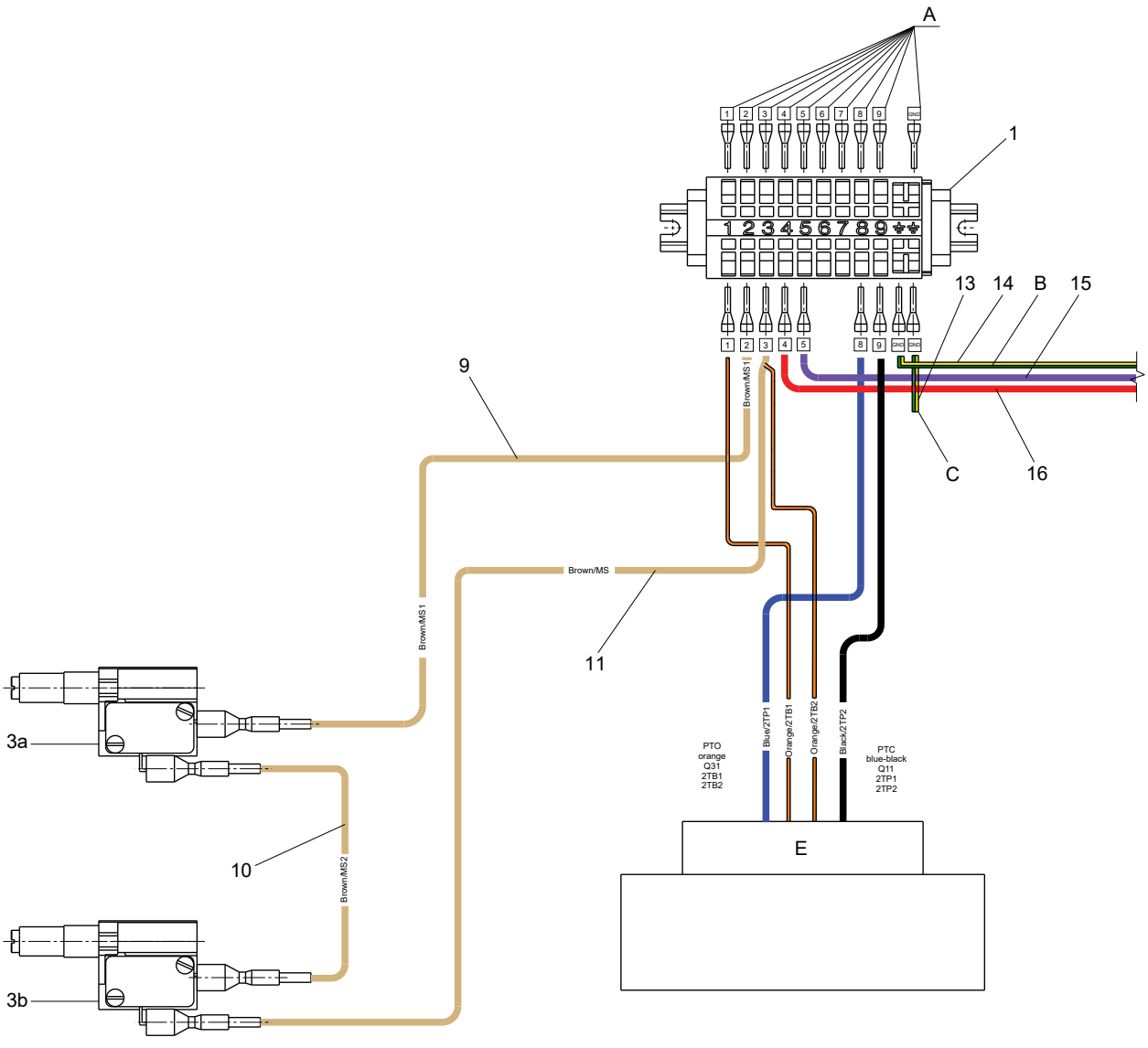



White
White
White
White
2
20
15
17
1
3
4
5
6
7
8
12
13
14
Blue/PT100LB
Blue/PT100UB
Blue/PT100St
Grey/FS
Green/FS
Blue/FS
Blue/PT100LB
White/PT100LB
White/PVS3
Brown/PVS3
C
C
C
12
14
5
7
6
4b

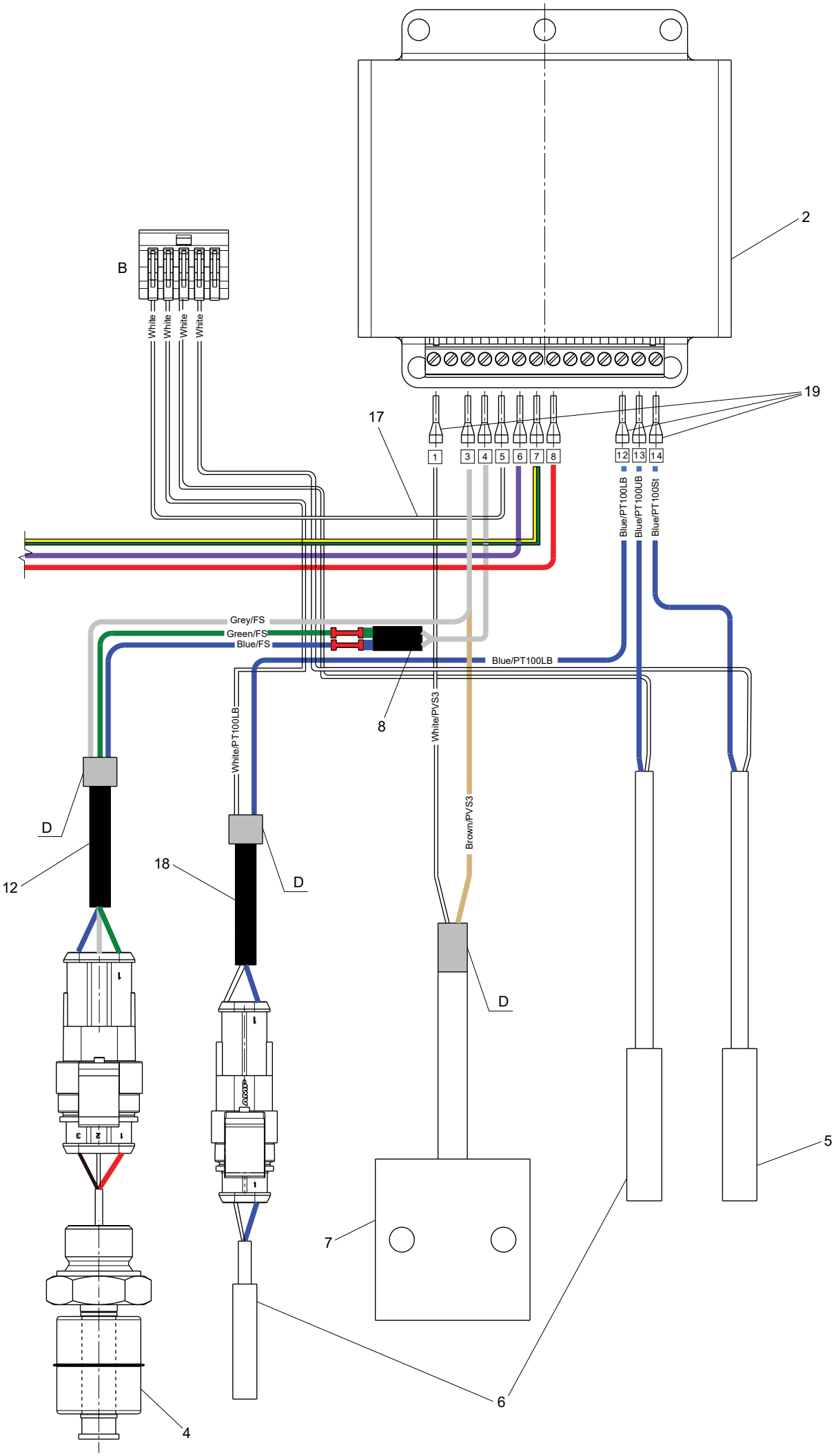
TM090323

Position	Description
A	Sensor cable - 10 core
B	Connect to the protective earth of upper bearing bracket
C	Screening must be fixed to the terminal bracket with the help of a clamp
D	Stator
1	Terminal board
2	SM113 module
3a	Moisture switch in motor top compartment
3b	Moisture switch in stator top compartment
4a	Dry run sensor
4b	Leakage switch in leakage chamber
5	Temperature sensor insulated PT100
6	Temperature sensor PT100B
7	PVS3, vibration sensor
8	Resistor kit
9	Wire for moister switch 1
10	Wire for moister switch 2
11	Wire for moister switch 3
12	Harness for leakages switch
13	Earthing cable
14	Harness for PT100
15	Wire for common grounding
16	Earthing cable between modules
17	Communication signal for SM113
18	Supply input for SM113
19	Harness for dry run sensor
20	End sleeve DIN 46228-4 1-8

8.2.9 Sensor V2 version Ex no dry running



TM090324


2
B
White
White
White
White
19
17
1
3
4
5
6
7
8
12
13
14
Blue/PT100LB
Blue/PT100UB
Blue/PT100St
Grey/FS
Green/FS
Blue/FS
Blue/PT100LB
8
White/PVS3
White/PT100LB
Brown/PVS3
D
12
18
D
D
7
6
5
4

TM090325

Position	Description
A	Sensor cable - 10 core
B	Wago terminal
C	Connect to the protective earth of upper bearing bracket
D	Screening must be fixed to the terminal bracket with the help of a clamp
E	Stator
1	Terminal board
2	SM113 module
3a	Moisture switch in motor top compartment
3b	Moisture switch in stator top compartment
4	Leakage switch in leakage chamber
5	Temperature sensor insulated PT100
6	Temperature sensor PT100B
7	PVS3, vibration sensor
8	Resistor kit
9	Wire for moister switch 1
10	Wire for moister switch 2
11	Wire for moister switch 3
12	Harness for leakages switch
13	Earthing cable
14	Earthing cable between modules
15	Communication signal for SM113
16	Supply input for SM113
17	Wire for common grounding
18	Harness for PT100
19	End sleeve DIN 46228-4 1-8

8.3 Power cable data

	Cable type	Outer cable diameter [mm]		Minimum bending radius
	[mm²]	min.	max.	[mm]
Standard power cable	4 × 10	20.9	23.4	70
	4 × 16	23.8	26.3	80
	4 × 25	28.9	31.4	100
Screened EMC power cable	4 × 10	23.1	25.1	100
	4 × 16	26.6	29.6	120
	3 × 25 + 3G16/3	25.3	28.3	120
	3 × 35 + 3G16/3	28.3	31.3	130
Screened EMC sensor cable	10 × 1.5	16.7	18.7	80
	18 × 1.5	24	27	110

The minimum size of the ground conductor must be equal to or bigger than the phase conductor.

The top cover of the explosion-proof pumps is provided with an external ground terminal to ensure the connection to the ground. The electrical installation must include an external connection from this terminal to the ground. The ground conductor must comply with all electrical safety regulations in force.

Before installation and the first startup of the pump. check the condition of the cable to avoid short circuits.

8.4 Sensors

The pumps can be equipped with various switches and sensors for protection. The specification table below indicates which switch and sensor types can be used.

Switch and sensor specification

Ex sensor versions come with 2 moisture switches and 1 dry running switch.

Sensor version	Standard and Standard Ex	V1 and V1 Ex	V2 and V2 Ex
Thermal switches / PTC	•	•	•
Moisture switch	•	•	•
Leakage switch in leakage chamber	•	•	•
Dry running sensor	•	•	•
Pt100 in motor winding		•	•
Pt100 in upper bearing		•	•
Pt100 in lower bearing		•	•
PVS3 vibration sensor		•	•
SM113 (integrated in the motor top)			•
IO113 (not integrated in the motor top)			•

Voltage tolerances

Component	Voltage	Tolerance
Motor	See the pump nameplate	± 10 %
Thermal switches	Maximum 24 V DC	± 10 %
Thermistors	2.5 V	-
Moisture switches	12-24 V DC	-
Other sensors (optional)	Maximum 14 V DC	± 1 V
SM 113 (optional)	Maximum 14 V DC	± 1 V

8.5 Thermal switches

Three bimetallic thermal switches are built into the stator windings. A contact opens in case of overtemperature (150 °C). The motor insulation is class H (180 °C).

The supply voltage to the thermal switches must be 12-24 V DC.

The thermal switches are connected to the control cable and must be connected to the safety circuit of the separate pump controller.

Use a multimeter to check that the circuit resistance does not exceed the maximum of 1.5 Ω (including 3 × PTO and control cable) at 20 °C.

The motor-protective circuit breaker of the pump controller must include a circuit which automatically disconnects the power supply in case the protective circuit is opened.

In case the thermal switches or the moisture switches are not working, install an automatic circuit breaker.

8.6 Moisture switches and leakage switches

Non-Ex version

One moisture switch and one leakage switch are installed in the pump. The moisture switch is placed in the top cover and the leakage switch is in the chamber above the shaft seal.

Ex version:

Two moisture switches, a leakage switch and a dry running sensor are mounted in an Ex pump. The moisture switches are placed in the top cover and the leakage switch is in the leakage chamber. See the Appendix.

All switches in both non-Ex and Ex versions are hardwired from the pump to IO 113. If moisture or a leakage is detected, they break the electric circuit. This generates both a hardware and a software alarm in IO 113, and the alarm relay opens.

Moisture- and leakage switches are motor protection devices protecting the motor from moisture or leakage. The moisture switch is non-reversing, and it must be replaced after being released. The leakage switch does not have to be replaced after being released.

The moisture- and leakage switches are connected in a separate circuit and to the control cable.

8.7 Thermistors

The standard pump range has bimetallic thermal switches connected, however, a pump with PTC thermistors connected are available as a Factory Product Variant (FPV).

The thermistors can be used as motor protection devices to monitor stator temperature instead of thermal switches and must be connected to the thermistor relay in the control cabinet.

The operating voltage of PTC thermistors is 2.5 V.

After the electrical connection, use a multimeter to:

1. check that the overall circuit resistance is between 250-750 Ω.
2. check that the insulation between the circuit and the stator housing is outside the range.
3. carry out similar measurements at the end of the power cable.

8.8 IO 113 module

The IO 113 module is the interface between a pump with analogue and digital sensors and the pump controller. The most important sensor data are indicated on the front panel.

One pump can be connected to one IO 113.

With the sensors, IO 113 provides a galvanic separation between the motor voltage in the pump and the connected controller.

The IO 113 enables the following functions:

- overtemperature protection
- monitoring the sensors for analogue measurement of:
  - motor temperature (with Pt100 installed in the windings)
  - pump vibrations (with PVS3 vibration sensor
  - stator insulation resistance
  - bearing temperature (with Pt100 installed at the bearings)
  - moisture in motor
- stopping the pump in case of alarm
- monitoring the pump through RS485 communication (Modbus or GENIbus).

Insulation resistance measurement

IO 113 measures the insulation resistance between a stator winding and ground:

- resistance above 10 MΩ = OK
- resistance between 10 MΩ and 1 MΩ = warning
- resistance below 1 MΩ = alarm.

9. Startup

Pumps in dry installation must be vented.

Before the first startup and after a long standstill period, make sure that the pump is filled with the pumped liquid.

Make sure that the pump is filled with the pumped liquid.
Dry-running is not allowed.

In case of abnormal noise or vibrations, stop the pump immediately. Do not restart the pump until the cause of the fault is identified and eliminated.

Make sure the pump is connected to an overcurrent protective device.

No automatic disconnection device is applied in the product.

DANGER
Electric shock
Death or serious personal injury
- Make sure the pump is grounded.

WARNING
Electric shock
Death or serious personal injury
- Make sure the connections are correct.

CAUTION
Hearing impairment
Minor or moderate personal injury
- Use hearing protection when working nearby an environment with a sound pressure level above 70 dB(A).

In case of abnormal noise or vibrations, stop the pump immediately. Do not restart the pump until the cause of the fault is identified and eliminated.

1. Remove the fuses or switch off the main switch.
2. Check the motor liquid level in the cooling chamber.
3. Check if the impeller can rotate freely.
4. Check if the switches are closed, replace if necessary.
5. Check whether the monitoring units, if used, are operating properly.
6. For pumps in a submerged installation, make sure that the pump is submerged in the liquid.
7. Open the isolating valves, if fitted.
8. Check if the system is filled with liquid and vented.
9. Check the settings of the level switches.
10. Start the pump and check the operation for abnormal noise or vibrations.
11. After startup, the actual pump duty point must be established. Make sure the operating conditions are met.

The pump may only be started for a short period without being submerged for checking the direction of rotation. The correct direction is highlighted on the pump.

Always operate the pump in accordance with established routines and perform scheduled checks of pump monitoring equipment and accessories. Make sure that the pump and equipment settings cannot be changed by unauthorised persons.

10. Maintenance and service

The maintenance and service work on explosion-proof pumps must be carried out by Grundfos or an authorised service workshop.

Do not open the pump if the ambient atmosphere is explosive or dusty.

DANGER
Electric shock
Death or serious personal injury
- Before starting any work on the product, make sure that the power supply is switched off and it cannot be switched on unintentionally.

CAUTION
Crushing hazard
Minor or moderate personal injury
- Make sure the pump cannot roll or fall over.

DANGER
Electric shock
Death or serious personal injury
- Make sure the pump is grounded.

CAUTION
Sharp element
Minor or moderate personal injury
- Be careful of sharp edges. Wear protective gloves.

Maintenance and service must be carried out by qualified persons.

Before carrying out maintenance and service, make sure that the pump is thoroughly flushed with clean water. Rinse the pump parts after dismantling.

Change the motor liquid after 12.000 operating hours or 3 years, whichever comes first.

Frequency converter use may reduce the lifespan of the bearings and the shaft seal, depending on the operating mode and other circumstances.

When the pump is new or after replacement of the shaft seals, check the motor liquid level and its water content after one week of operation. If the motor liquid level has dropped, the shaft seal may be defective.

Pumps running normal operation must be inspected every 12.000 operating hours or once in 3 years.

Check the following during inspection:

- **Power consumption**
- **Motor liquid (glycol) level.**

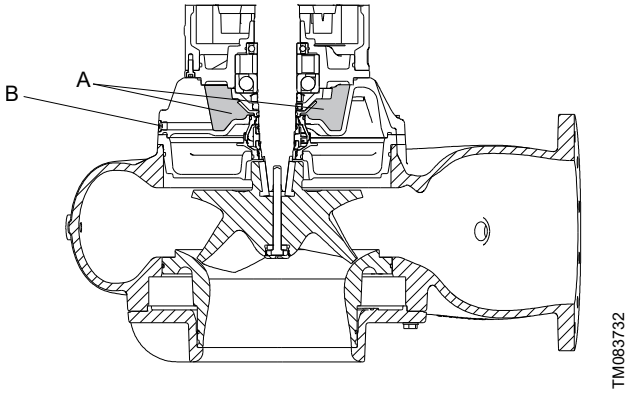
  Disposal of the motor liquid must comply with local regulations.
- **Cable entries**: Make sure that the cable entries are waterproof and the cables are not sharply bent or pinched.
- **Impeller clearance**: Check the impeller clearance.
- **Pump parts**: Check the pump housing and other parts for possible wear. Replace defective parts.
- **Ball bearings**: Check the shaft for noisy or heavy operation; turn the shaft manually. Replace defective bearings. A general overhaul of the pump is usually required in case of defective bearings or poor motor function. This work must be carried out by an authorised service workshop. Bearings are lubricated for lifetime.
- **Vibration**: If the pump is vibrating at an abnormal level, do not restart the pump until the cause of the fault is identified and eliminated.
- **General maintenance**: It is usually required in case of defective ball bearings or poor motor function. This work must be carried out by an authorised service workshop.
- **Dry-running switch**: Test the dry-running switch during inspection to make sure it functions properly. If the switch does not function properly, it must be replaced.

Replace the ball bearings at least every 25.000 operating hours.

10.1 Drain leakage chamber on SL pumps

Drain the leakage chamber after 12.000 operating hours or three years, whichever comes first.

Normal leakage rate for the shaft seal is 2.000 ml / 12.000 operating hours. If more than 5.000 ml fluid can be drained from the leakage chamber, the shaft seal must be replaced.



Leakage chamber on SL pumps

Pos.	Description
A	Leakage chamber
B	Leakage chamber plug

1. Place a plastic container under the leakage chamber plug.
2. Remove the leakage chamber plug (B).
3. Drain the fluid from the leakage chamber. Tilt the pump if necessary.

10.2 Pump overhaul

Pumps running in normal operation require major overhaul after 24.000 operating hours or 6 years, whichever comes first. The overhaul includes the replacement of the following:

- shaft seal
- bearings
- impeller + suction cover
- moisture switch
- gaskets
- O-rings
- motor liquid.

10.3 Contaminated pumps

The product is classified as contaminated, if it is used for contagious or toxic liquid.

CAUTION
Biological hazard
Minor or moderate personal injury
- Flush the pump thoroughly with clean water and rinse the pump parts after dismantling.

Before returning the product for service, contact Grundfos with details about the pumped liquid. Otherwise, Grundfos can deny to service the product.

Any application for service must include details about the pumped liquid.

Clean the product in the best possible way before returning it.

10.4 Shaft seal inspection

10.4.1 How to avoid shaft seal damage

1. Improper assembly of the pump can lead to shaft seal failures.
   a. The O-ring in the shaft seal must be lubricated, with the lubricant placed on a cleaned shaft. Clean the shaft with soap prior to applying the silicon spray lubricant.
   b. Once the shaft seal is on the shaft, the shaft seal must not be tilted.
      i. The shaft seal protection tool is required to prevent damage caused by accidentally hitting the shaft seal with the seal housing as it is lowered into place. Hitting the shaft seal with the seal housing may tilt and break the shaft seal.
      ii. Tighten the lower seal housing screws in a diagonal sequence, to avoid tilting the seal housing. A misaligned lower seal housing can press against the shaft seal causing the shaft seal to tilt.
2. Special wear-resistant shaft seals with tungsten-carbide sealing surfaces are available for purchase. These shaft seals can be used as a direct replacement of the current shaft seal. For further information, contact Grundfos.

Do not reuse a worn shaft seal.

Do not dismantle and reassemble the shaft seal.

Do not lift or move the pump by the shaft end.

Never rest a vertically tilted pump on its impeller.

10.5 Motor liquid check and change

Clean the outside of the pump regularly to retain the heat conductivity.

Change the motor liquid once a year or after 12.000 operating hours to prevent oxidation.

Lack of motor liquid may cause overheating and damage to the mechanical seals.

Use SML3 coolant for motor cooling.

The ingress level of the pumped liquid into the motor liquid can be checked. Use a refractometer (product no. 98676968) which shows the refractive index in percentage. Always use the propylene glycol scale.

Measured freezing point	Liquid ingress (%)
-20 °C (-4 °F)	0
-18 °C (0.4 °F)	5
-17 °C (1.4 °F)	10
-15 °C (5 °F)	15
-14 °C (6.8 °F)	20

If the refractive index is higher than 20 %, change the motor liquid.

Pump type	Liquid amount (l)
SL	13
SE	31

Do not exceed this level of refractive index to ensure the appropriate condition of the shaft seal and the bearings for reliable operation.

Drain the leakage chamber of the pump after 12.000 operating hours.

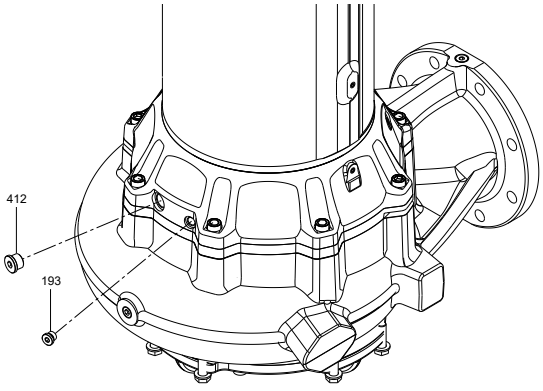
Normal leakage rate for the shaft seal is 2.000 ml / 12.000 operating hours. If more than 5.000 ml fluid can be drained from the leakage chamber, the shaft seal must be replaced.

WARNING
Pressurised system
Death or serious personal injury
- The seal chamber may be under pressure. Loosen the screws carefully and do not remove them until the pressure is completely relieved.

There must be minimum 10 % air in the seal housing due to thermal expansion of the motor liquid during operation.

10.5.1 Drain motor liquid on SL pumps

1. Place the pump in horizontal position, so the filling plug (412) is pointing downwards.

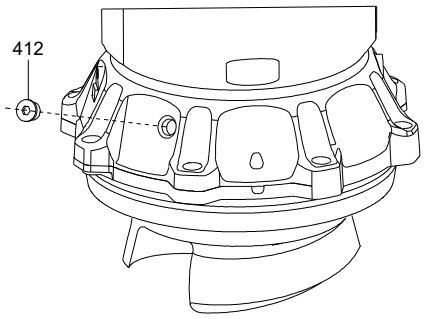


2. Place a container under the filling hole (above 13 liter capacity).
3. Remove the filling plug and drain the motor liquid from the seal housing.

10.5.2 Fill motor liquid on SL pumps

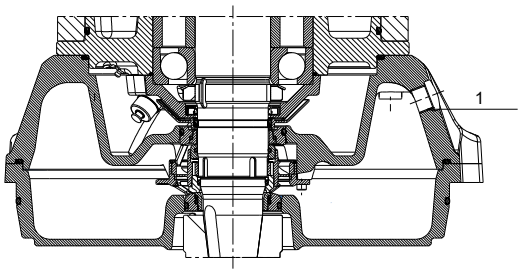
1. Place the pump in vertical position.

2. Remove the filling plug (412) from the seal housing.



TM083647

3. Fill the seal housing through the filling hole with the required motor liquid. The seal housing is full when the liquid level reaches the edge of the filling hole (1). Approximately 13 liters of motor liquid required for full fill-up.)



TM083648

4. After the seal housing is filled up, insert the plug back into the filling hole and tighter with 30 +/- 3 Nm torque.

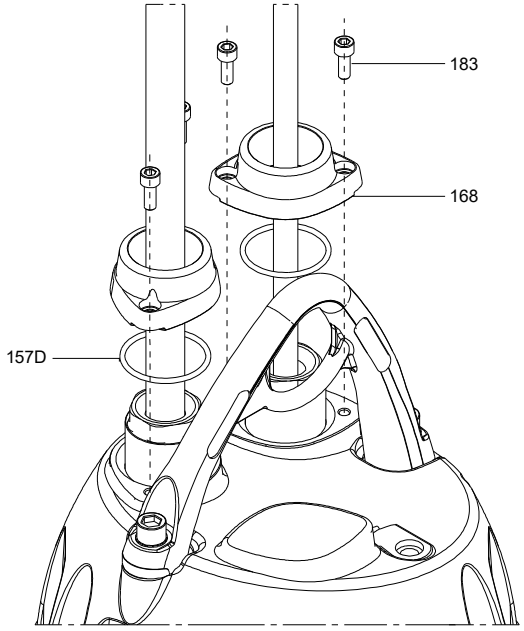
11. Disassembly

Before disassembling the pump:

- Switch off the power supply
- Close the isolating valves, if fitted, to avoid draining the pipe system.
- Disconnect the power supply cable from the pump.
- Note the pump's centre of gravity to prevent it from turning or rolling over.

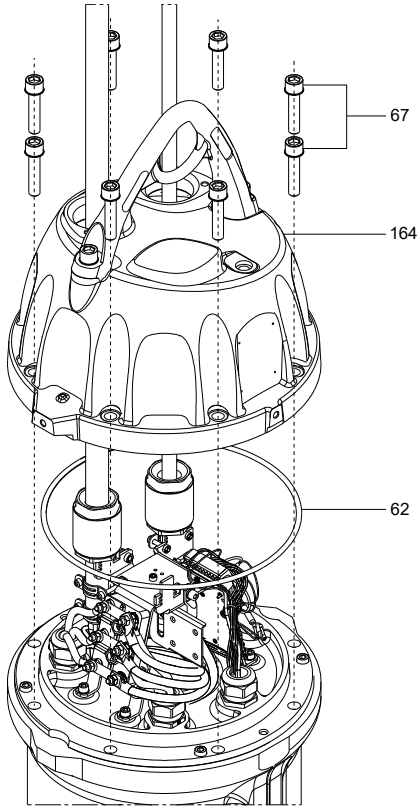
11.1 Remove the motor top cover

1. Remove the screws (183) from the upper part of the cable inlet (168).



TM084194

2. Remove the upper part of the cable inlet (168).
3. Remove the screws holding the motor top to the stator housing (67).

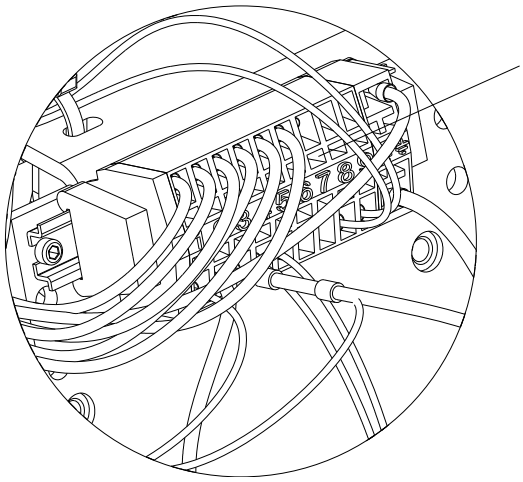


TM084092

4. Attach the lifting equipment to the designated lifting points (lifting handle) lift the motor top off.

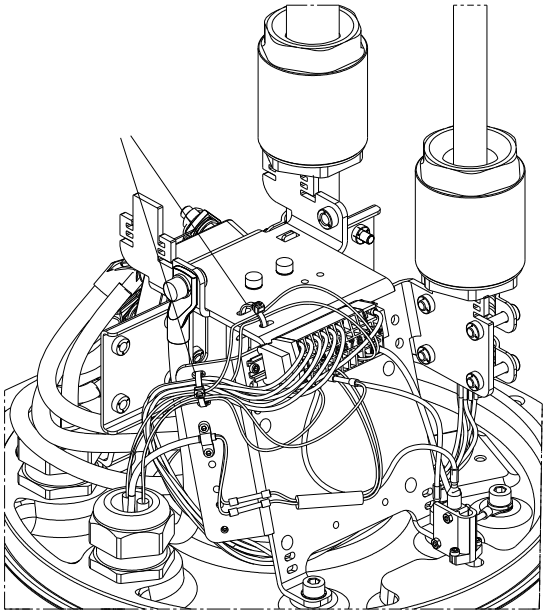
11.2 Remove power and sensor cables

1. Detatch the signal wires from the terminal board. Apply a screwdriver on the marked holes to release the terminal clamps.



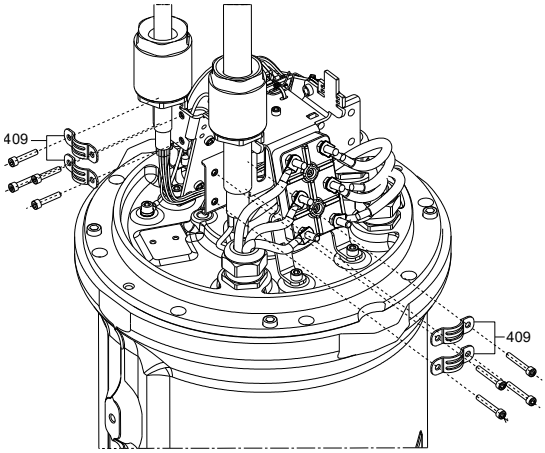
TM084096

2. Remove the wire zip ties highlighted below.



TM084097

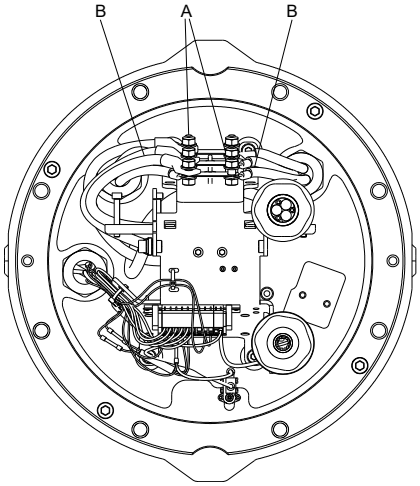
3. Remove the sensor cable clamps (409).



TM084095

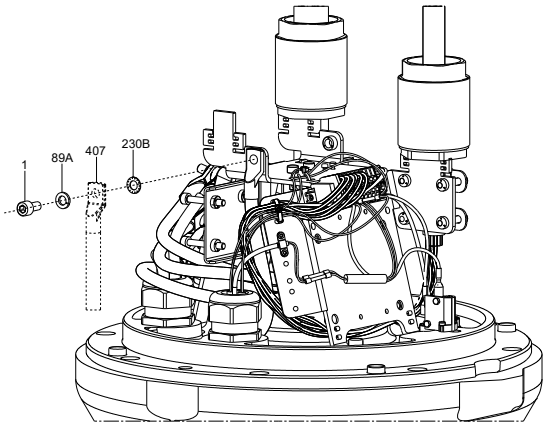
4. Sensor cable can be safely removed from the pump now.

5. Remove the power cables from the main terminal board.
   a. Remove the M8 nuts and flat washers (A).
   b. Remove all power cables. (B)



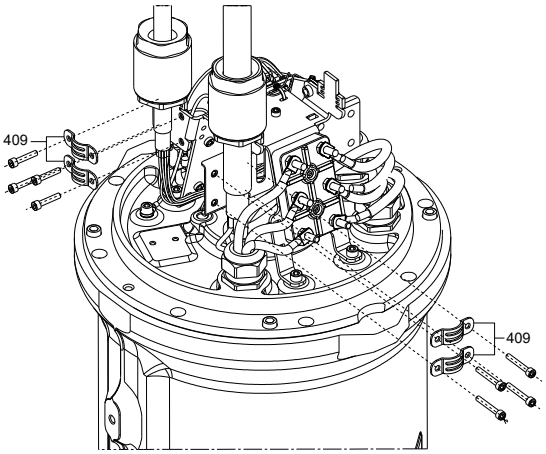
TM084094

6. Detatch the earth cable(s).



TM084093

7. Remove the power cable fixing clamps (409).

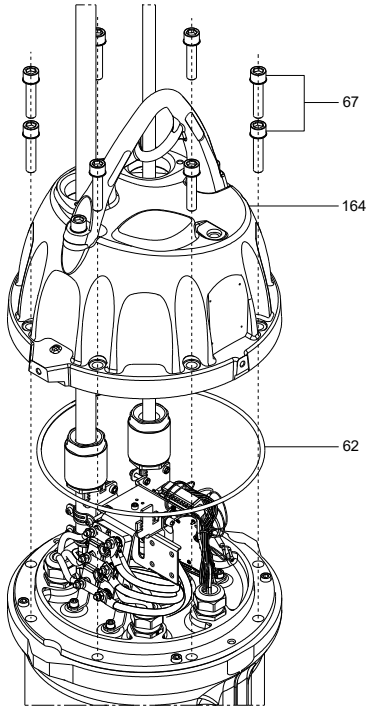


TM084095

8. Power cables can be safely removed from the pump now.
9. Pull the detatched cables away from the motor top.
10. Remove the O-ring (62) between the stator housing and the motor top.

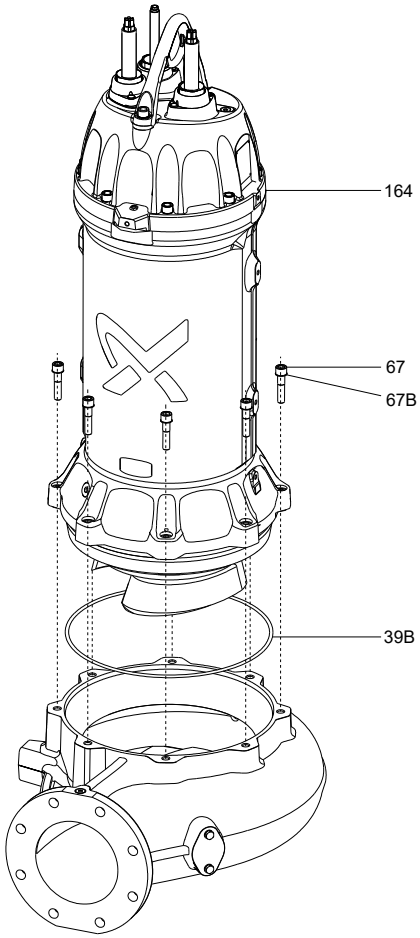
11.3 Separate the motor from the pump housing

1. Attach the motor top cover (164) with the lifting handle to the stator housing. This is necessary to provide a safe lifting point!



TM084092

2. Undo and remove the six M16 screws (67), together with the washers (67B).

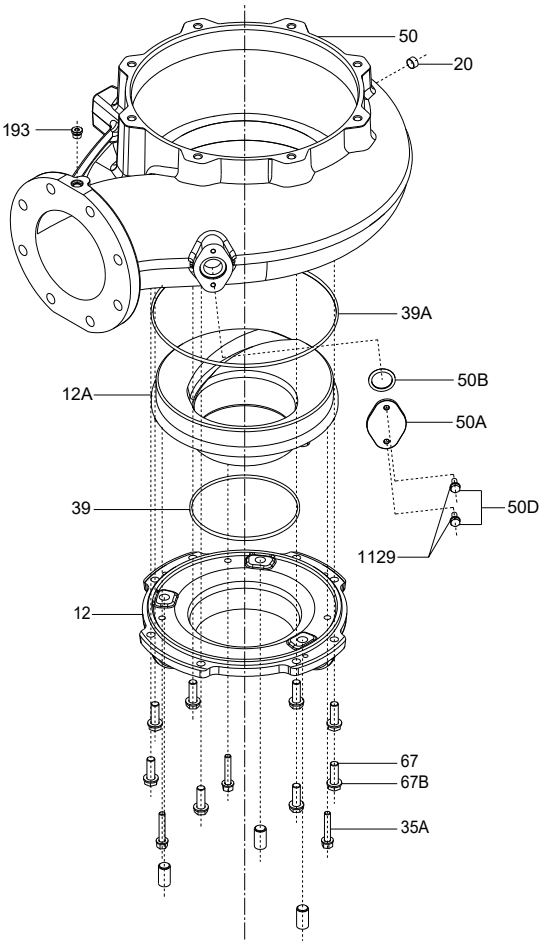


TM084114

3. Attach the lifting chain to the lifting handle and lift the motor up.
4. Remove the O-ring (39B).
5. Move the lifted motor away and carefully place it horizontally on the ground. Secure it in a way to prevent any rolling or sideways movement.

11.4 Pump housing disassembly

1. Insert two lifting eyes into two holes on the discharge flange.
2. Use a crane to turn the discharge flange, by the lifting eyes, to an upside-down position, so the bottom screws become accessible.
3. Remove eight hex-head M16 x 50 screws (67) and their washers (67B) from the suction (12) flange.
4. Remove the assembled suction flange (12) and suction cover (12A).
5. Remove the O-ring (39A).
6. Put the pump housing (50) back to horizontal position.
7. Separate the suction flange and the suction cover by removing the three M12 x 70 hex-head screws (35A) from the suction flange (12).
8. Remove the O-ring (39).

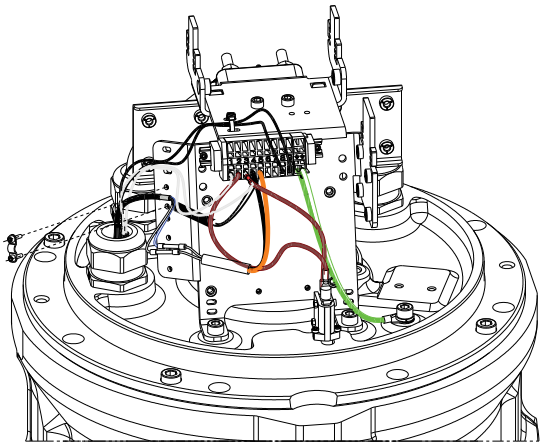


TM084121

11.5 Motor disassembly

11.5.1 Motor top disassembly

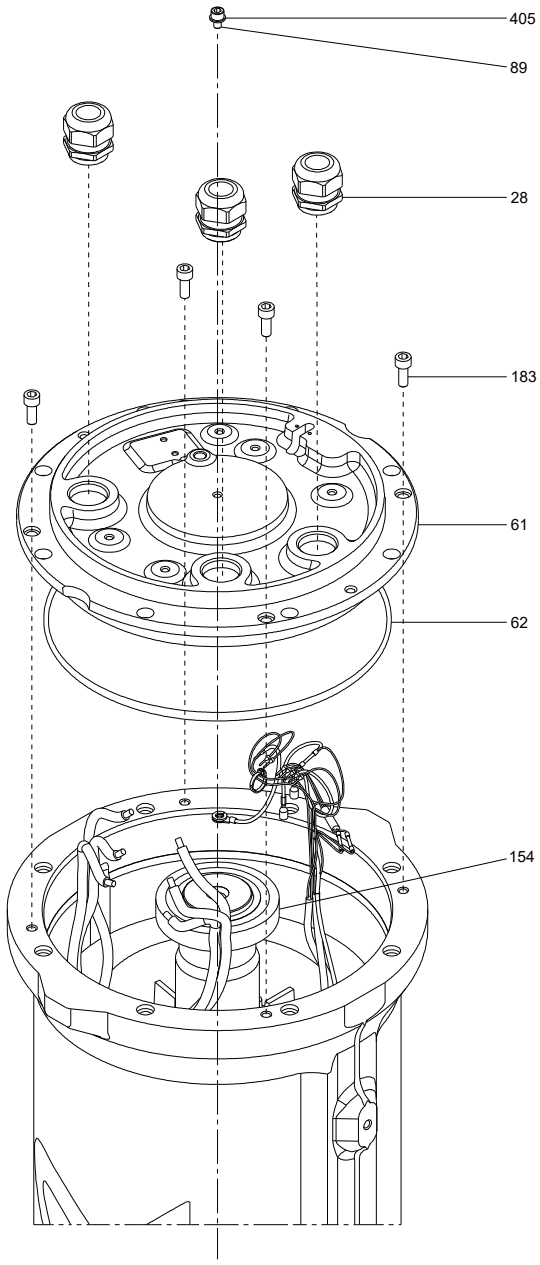
1. Remove the Brown wire (from terminals 2 and 3) from the moisture switch (520).



2. Remove all wires, except for the earth wire (Yellow-Green) from the bottom row of the terminal block (176).
3. Remove the EMC cable clamp from the wire termination bracket (522).

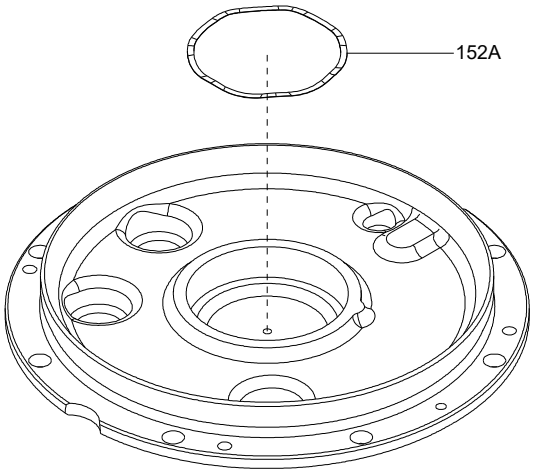
11.5.2 Upper bearing bracket removal

1. Remove 3 M10x25 hex-head screws (183) from the upper bearing bracket (61).



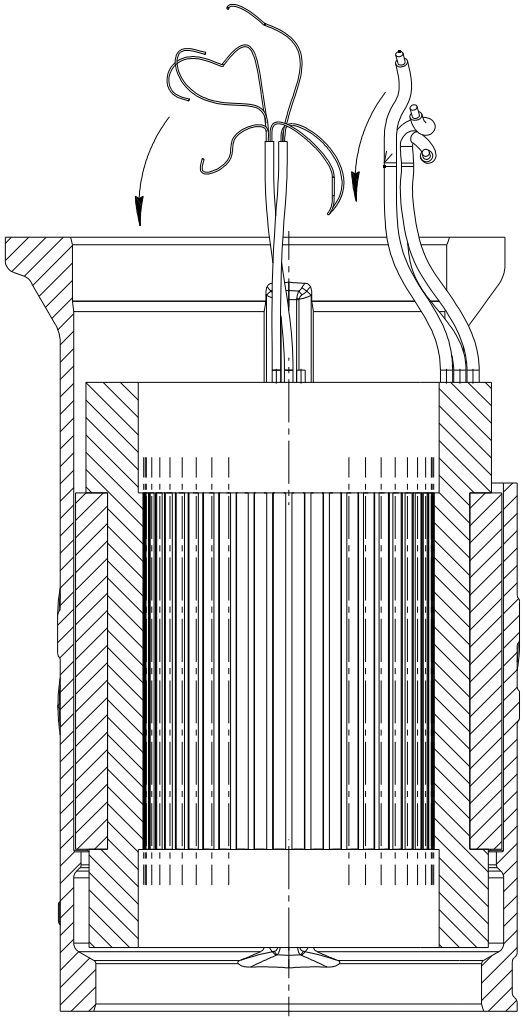
TM084309

2. Lift the upper bearing bracket (61) off the motor. Make sure the wave spring (152A) cannot fall into the motor during removal.
3. Remove the O-ring.
4. Remove the wave spring (152A).



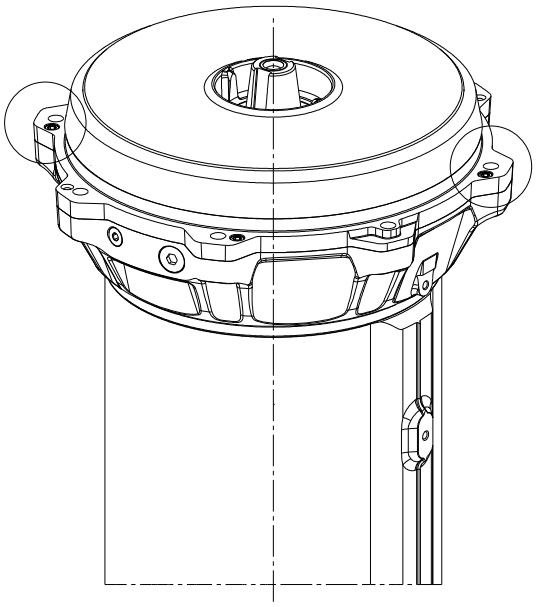
TM084310

5. Clamp together the power wires and fix them to the stator housing so they cannot be damaged when the motor is turned upside-down.
6. Clamp together the signal wires and fix them to the stator housing so they cannot be damaged when the motor is turned upside-down.



TM084118

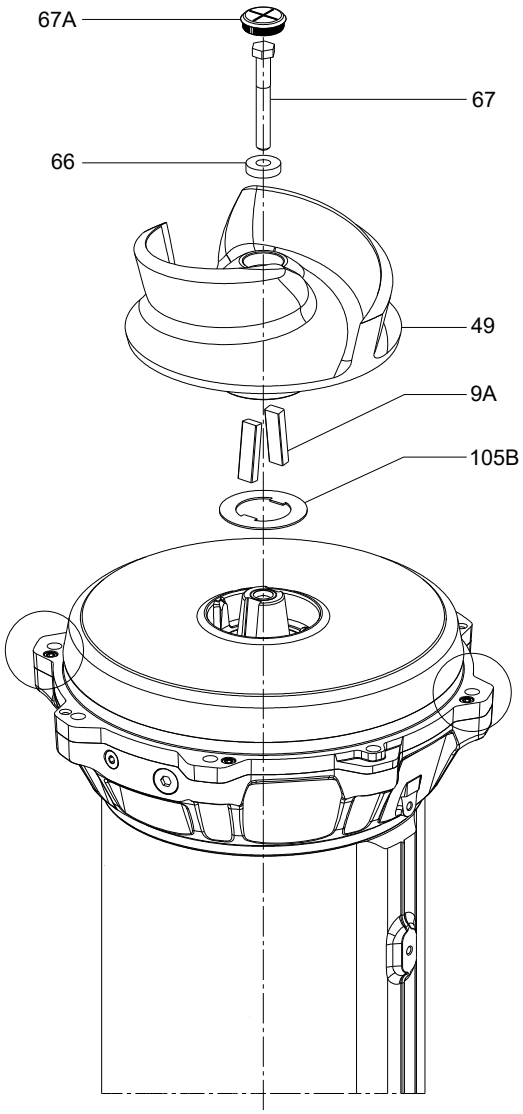
7. Turn the motor upside down. Use lifting eyes fixed to the positions shown below.



TM084312

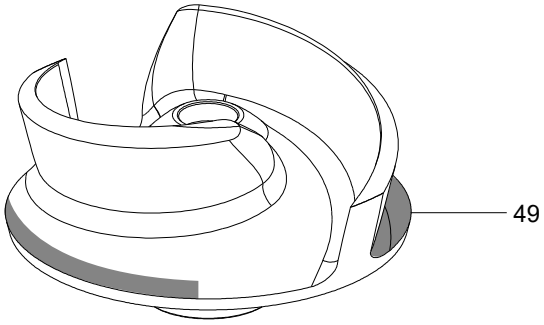
11.5.3 Impeller removal

1. Remove the impeller plug (67A).



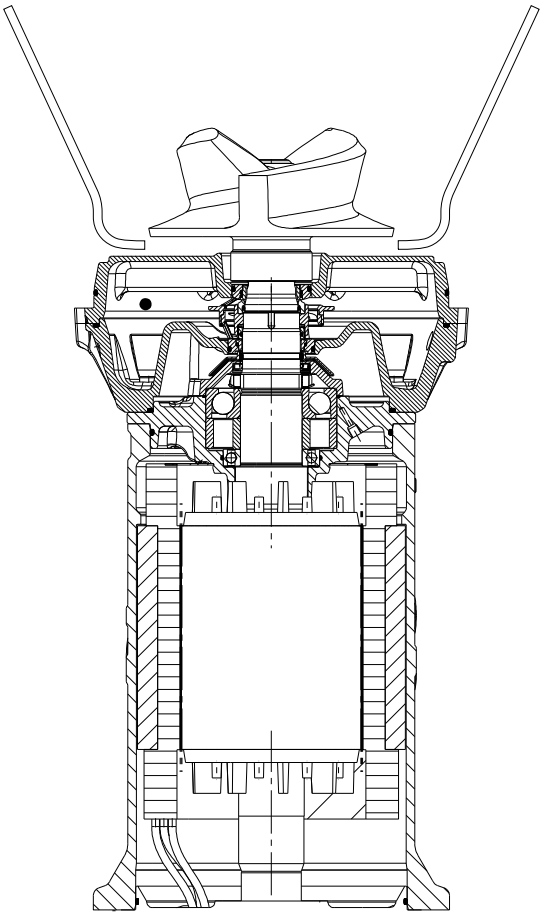
TM084117

2. Remove the M16 x 120 screw (67) and its washer (67A) holding the impeller.
3. Use a plastic hammer to carefully knock around the marked upper edges of the impeller (49), to make it loosen up on the shaft end.



TM084116

4. Use two crowbars opposite of each other, and concentrically reach under the impeller. Push the impeller up to remove it.

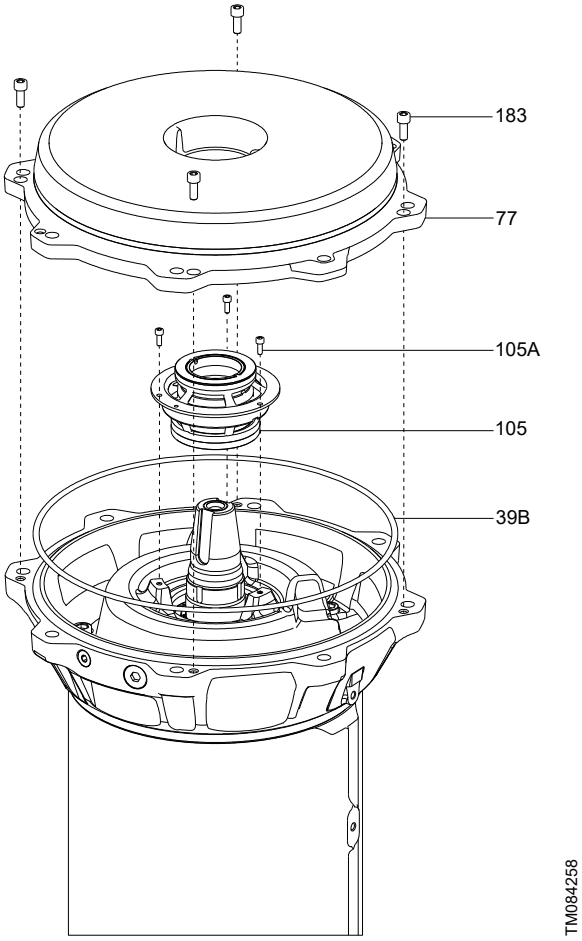


TM084115

5. Remove the impeller (49) from the shaft end.
6. Remove the latches (9A) from the grooves in the shaft end.
7. Remove the shaft seal protector (105B).

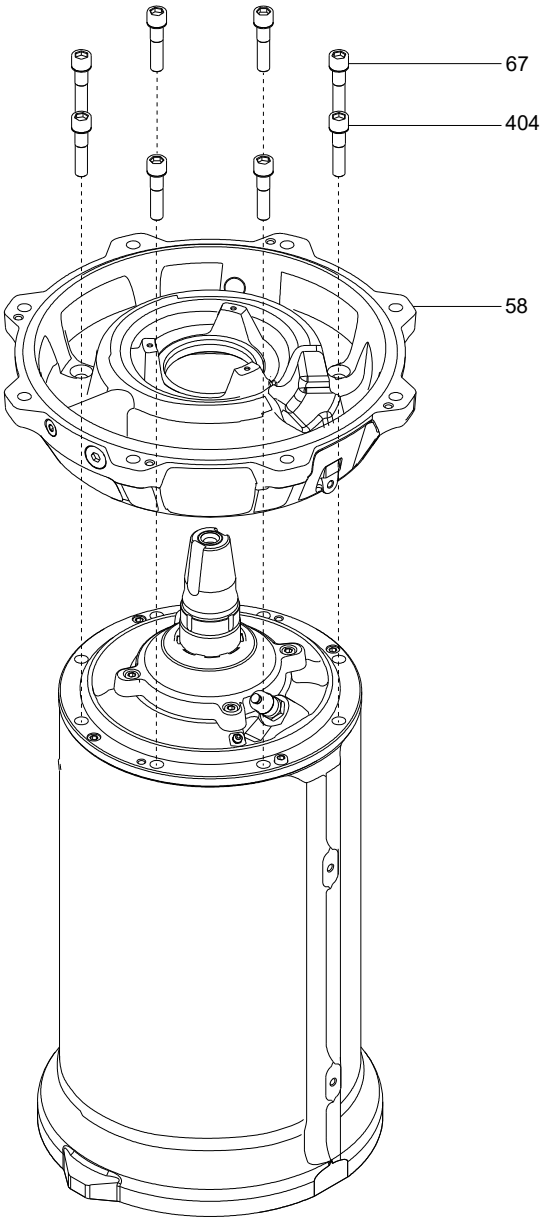
11.5.4 Shaft seal removal

1. Remove the 4 M10x25 screws (183).
2. Lift off the lower seal housing (77).
3. Remove the O-ring (39B).
4. Clean the shaft end, to ease the removal of the shaft seal.
5. Remove the 3 M6x16 screws (105A).
6. Carefully pull off the shaft seal from the shaft end, keeping it parallel to the shaft's centerline.



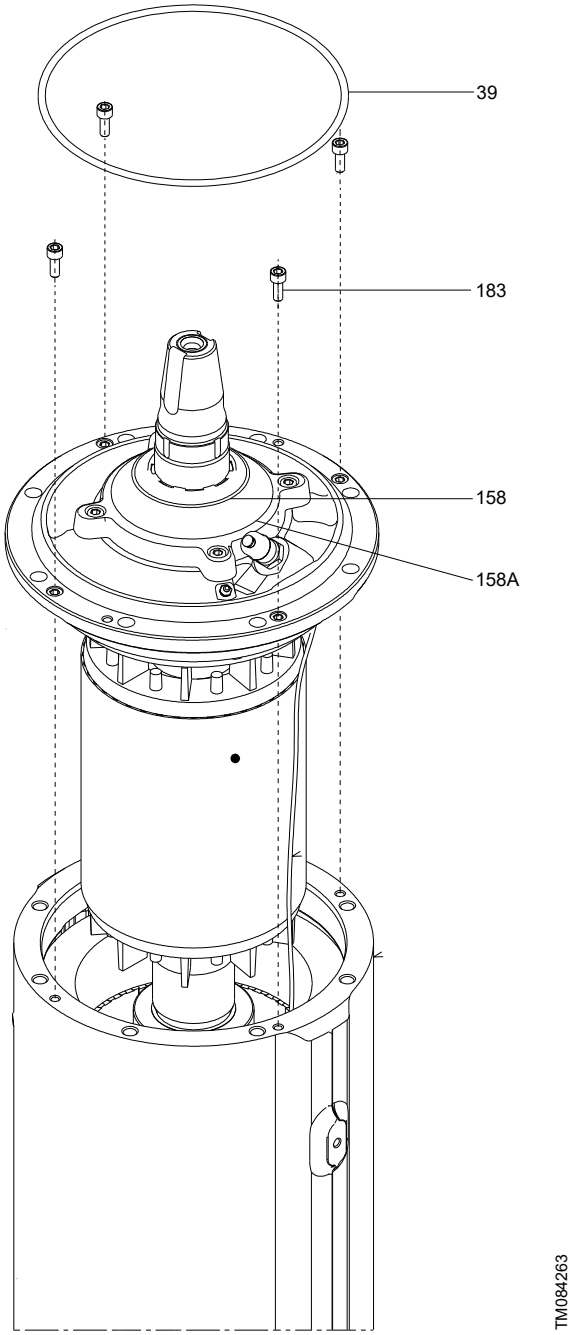
11.5.5 Upper seal housing removal

1. Remove the 8 M16x70 screws (67).
2. Lift off the upper seal housing. Do **NOT** use the marked three threaded holes as lifting points.
3. Remove the O-ring (39).

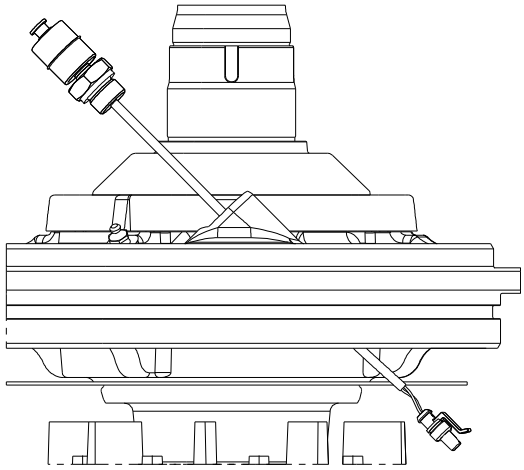


11.5.6 Shaft with rotor assembly removal

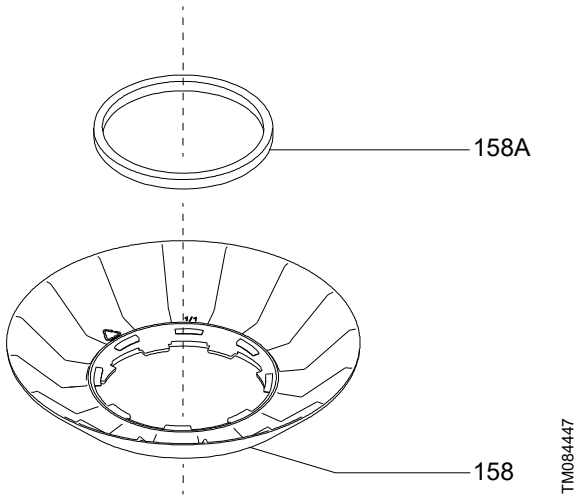
1. Remove the O-ring (39).



2. Remove the 4 M10x25 screws (183).
3. Fix the lifting eye into the threaded hole of the shaft end.
4. Lift the rotor with shaft, together with the lower bearing housing, out of the stator housing. During the lifting process, make sure that the inner cable harness can not be damaged, torn or pinched between the rotor and the stator housing. Use spacers to prevent damage.
5. Immediately after lift-out, fasten the inner cable harness so it cannot be damaged later on.
6. Carefully put the shaft with rotor down on an empty pallet.
7. Screw out the leakage switch, then after pulling the cable connectors apart, remove it.



8. Remove the centrifugal cup (158).
9. Change the O-ring (158A) inside the centrifugal cup

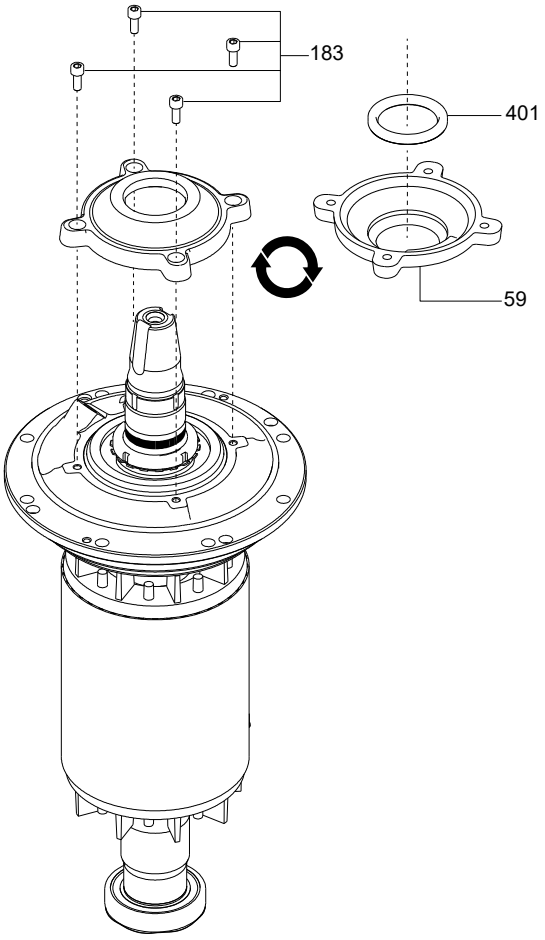


For more information on the removal of the dry run sensor from SE Ex pumps, please check the following instruction:

QR93437168

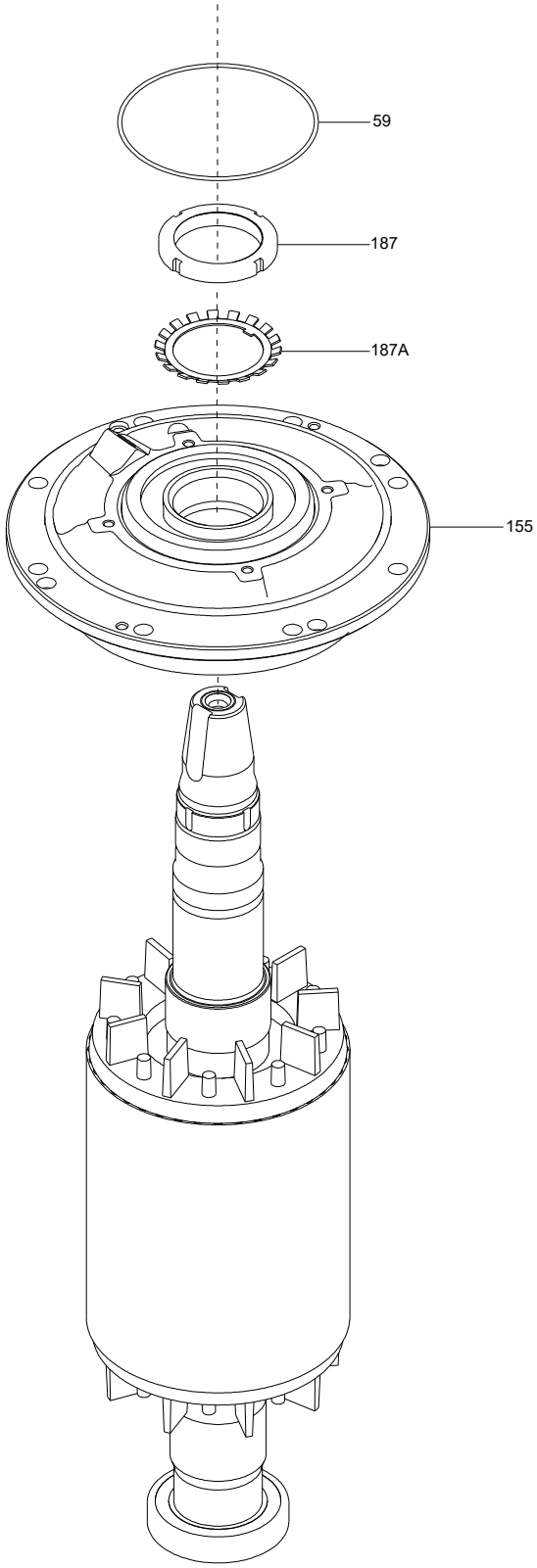
11.5.7 Bearing cover removal

1. Remove the 4 M10x25 screws (183).
2. Lift the bearing cover (59) off of the lower bearing bracket.
3. Remove the radial shaft seal (401) from the bearing cover.



11.5.8 Lower bearing bracket removal

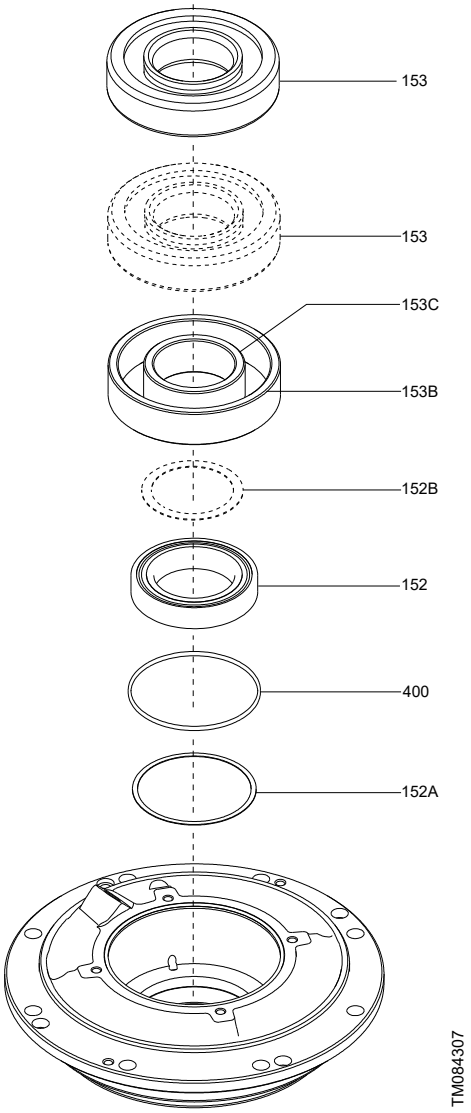
1. Remove the O-ring (59A).
2. Screw the lock nut (187) off of the shaft.
3. Remove the lock washer (187A).
4. Clean the shaft end of any contamination.
5. Pull off the lower bearing bracket (155).



11.5.8.1 Lower bearing bracket disassembly

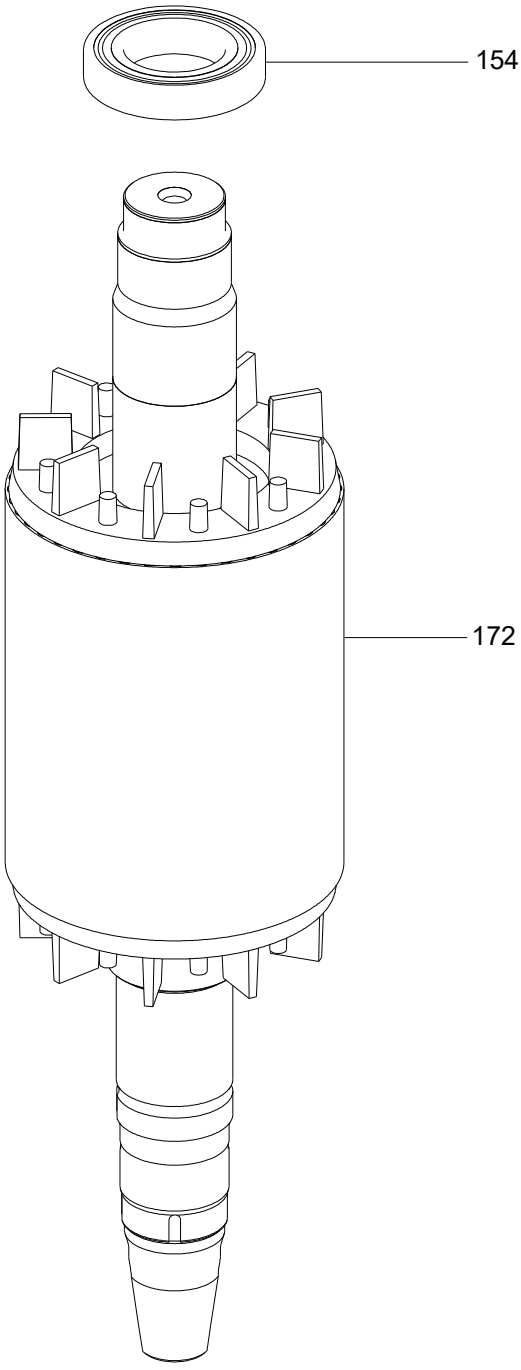
Remove the following from the lower bearing bracket:

- Bearings
  - 152
  - 153
  - 153B
  - 153C
- Washers
  - 152B
  - 152A
- O-ring (400)



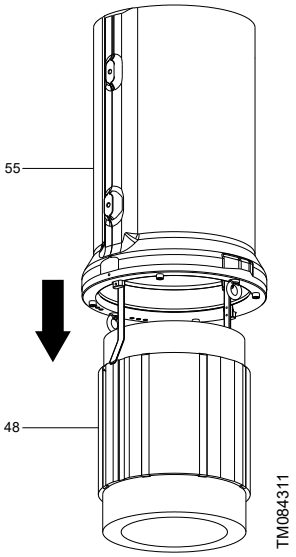
11.5.9 NDE bearing removal

1. Remove the NDE bearing (154) from the shaft (172). Use a bearing puller. Make sure the shaft does not get damaged during the bearing removal.



11.5.10 Stator removal from the stator housing

1. Cut the stator wires off.
2. Turn the stator housing upside-down.
3. Heat the stator housing up to max. 210 °C for max. 10 minutes, or until the stator slides out / moves downwards.
4. Lift the stator housing off the stator.



The heated stator cannot be used again.

WARNING
Hot surface
Death or serious personal injury

- Do not touch the heated parts surfaces. Wear protective clothing.

12. Assembly

Before assembling the pump:

- Clean and check all parts.
- Replace defective parts with new parts.
- Use the Exploded view to follow the alignment grooves in order to place the components together correctly.
- Order the necessary service kits.
- Always replace used gaskets and O-rings with new ones.

Lubricate and tighten all screws and nuts according to the "Tightening torques and lubricants" section.

Related information

5.2 Exploded view

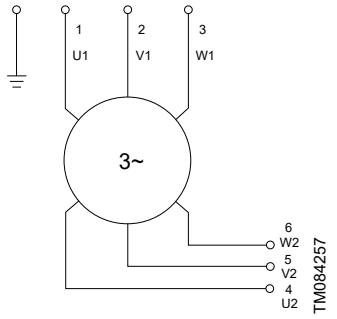
7. Tightening torques and lubricants

12.1 Stator insertion

Before stator insertion, perform stator resistance check according to the following:

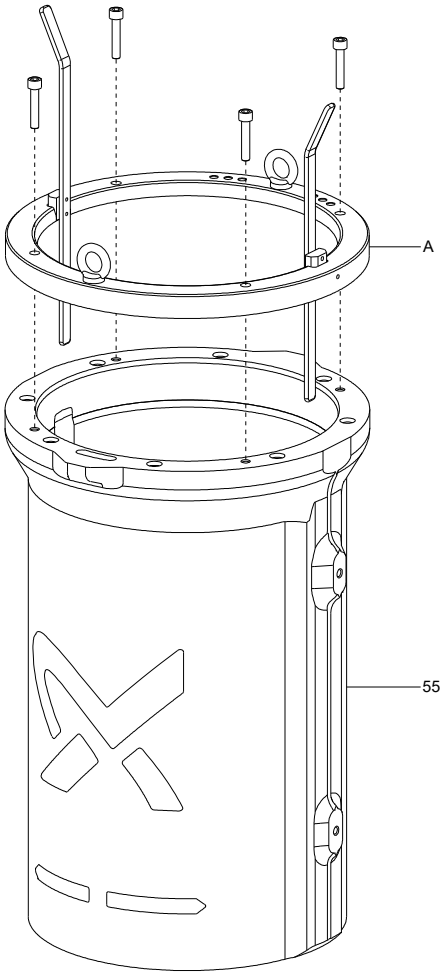
Resistance test [2D]

Check stator resistance before inserting the stator into the stator housing. Use 4-wire handheld measuring tool to check the resistance of each phase according to the figure:



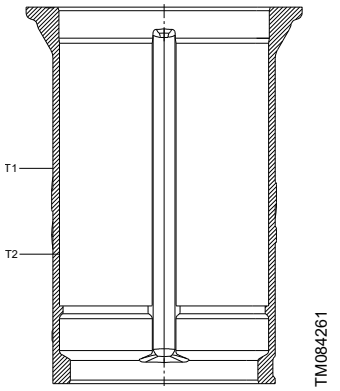
Line - Line measuring points	1-4, 2-5, 3-6
Shortcut under test	No shortcut
Nominal Line-Line resistance should be between:	30-450 [mΩ]
Recommended area temperature during measurement:	20 ± 2 °C

1. Fold the stator wires inside the middle of the stator housing, so they cannot touch the heated walls of the stator housing during the insertion process.
2. Mount the orientation tool (A) on the stator housing (55), according to the image below.



3. Heat up the stator housing (55). If possible, use a furnace to ensure even heating.

WARNING
Hot surface
Death or serious personal injury
- Do not touch the heated parts surfaces. Wear protective clothing.



T1	External surface temperature. Must not exceed 210 °C and must be maintained for a maximum of 15 minutes.
T2	Internal surface temperature. 210 °C during stator insertion.

4. After stator insertion, wait until the stator housing cools down to room temperature, then perform insulation resistance and sensor tests according to the following:

Insulation resistance measurement points

Between stator phase leads and the stator housing	U1+U2+V1+V2+W1+W2 - Stator housing
Between stator phase leads and stator ground wire	U1+U2+V1+V2+W1+W2 - PE

Insulation resistance test parameters

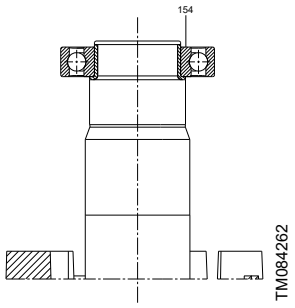
Duration:	60 seconds
Voltage:	1000 V
Voltage upper limit:	1020 V
Voltage lower limit:	980 V
Min. resistance:	1000 mΩ
Max. resistance:	20000 mΩ

Sensor and switch test

Thermal protectors (PTO) continuity test	Terminals: 2TB1-2TB2 Resistance: < 320 mΩ
Thermistors (PTC) continuity test	Terminals: 2TP1-2TP2 Resistance: < 750 mΩ

12.2 NDE bearing mount

1. Heat up the NDE bearing (154) to 90-110 °C. Use an induction heater or similar heating equipment.
2. Press the bearing down on the end of the shaft with rotor assembly (172) or use a ball bearing mounting tool with the right collar.



Correct position of NDE bearing

WARNING
Hot surface
Death or serious personal injury

- Do not touch the heated parts surfaces. Wear protective clothing.

12.3 Lower bearing bracket assembly

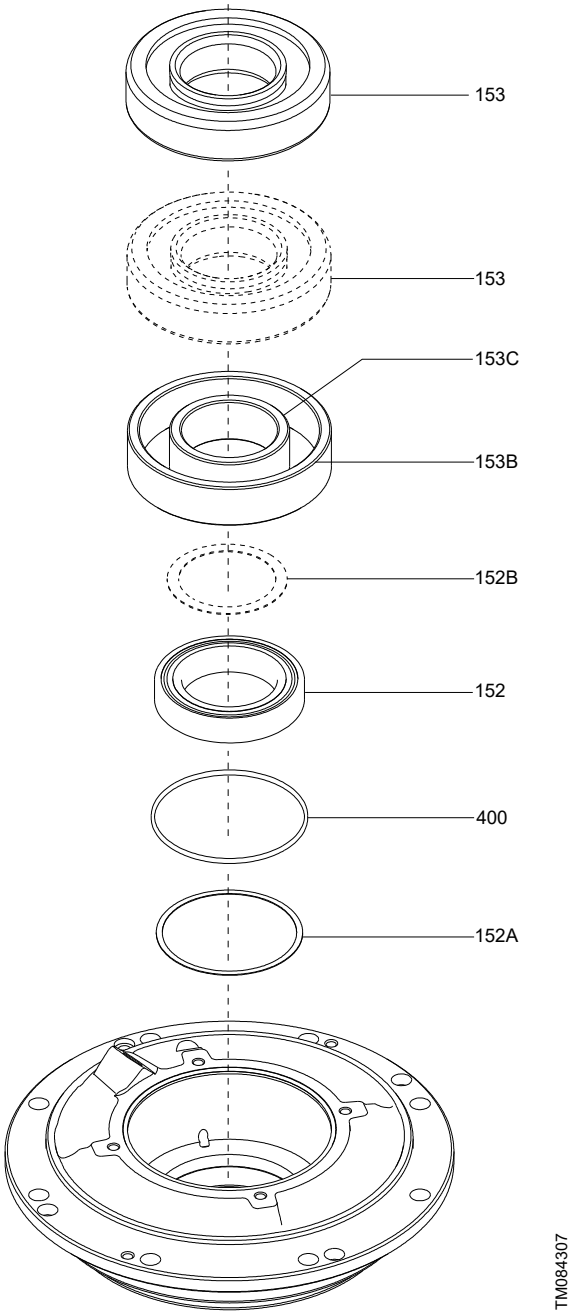
1. **Lubricate the O-ring (400),** then put it in the bearing bracket.
2. Mount the wave spring washer (152A)
3. Grease the bearing seat. Use anti-seize grease.

   Press on only the outer ring when fitting the bearing into the bearing bracket!

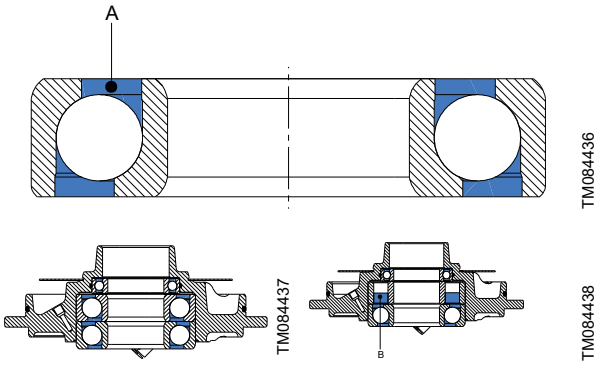
4. Mount the deep groove ball bearing (152).
5. (Optional, if P2 > 41 kW) Mount the space washer (152B). Apply grease on the washer to keep it in place during assembly.

   Press on only the outer ring when fitting the bearing into the bearing bracket!

6. Apply grease to the bearing seat, then mount the inner (153C) or outer (153B) dummy bearing OR mount the first lower bearing (153).



7. Grease the first bearing (153) or apply grease between the inner and outer dummy bearing according to the figures below.



Correct bearing orientation if P2 < or = 41 kW

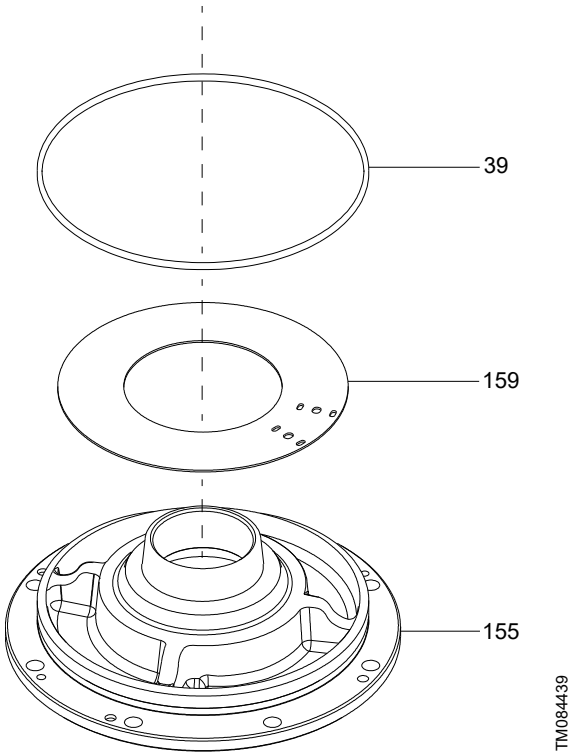
Correct bearing orientation if P2 > 41 kW

A	100% grease filling
B	50% grease filling

O-ring lubrication: Rocol Sapphire Aqua-Sil
Bearing grease: LGHP 2 SKF
Bearing Seat grease: SKF LGA 3E

Press on only the outer ring when fitting the bearing into the bearing bracket!

8. Mount the second lower bearing (153).
9. Grease the bearing according to the figures above.
10. Mount the O-ring (39) on the bearing bracket (155). The O-ring must be lubricated.
11. Mount the wire cover (159) on the bearing bracket (155).

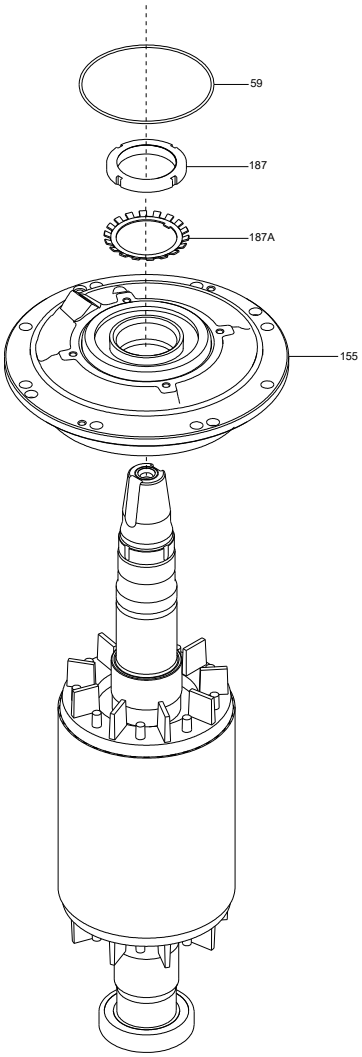


Related information

7. Tightening torques and lubricants

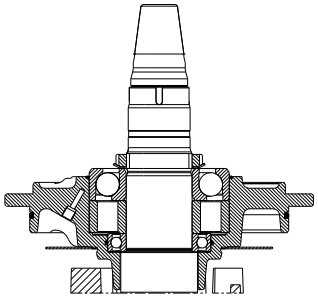
12.4 Mounting the lower bearing bracket on the rotor shaft

1. Mount the assembled lower bearing bracket on the shaft. Make sure the lower bearing bracket is in place, use mounting tool.



TM084306

2. Mount the lock washer (187A)
3. Apply grease on the thread on the shaft end.
4. Mount the lock nut (187).
5. Fasten the lock nut until it stops, and positioned correctly so the slots are aligned.
6. Bend the top of the lock wash into position (into the aligned slots).
7. Mount the lubricated O-ring (59A).



TM084443

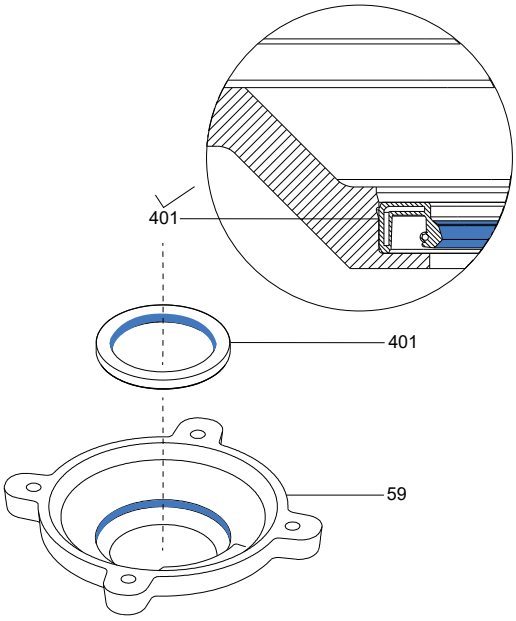
Press on only the inner ring when fitting the bearing into the bearing bracket!

Related information

7. Tightening torques and lubricants

12.5 Bearing cover assembly

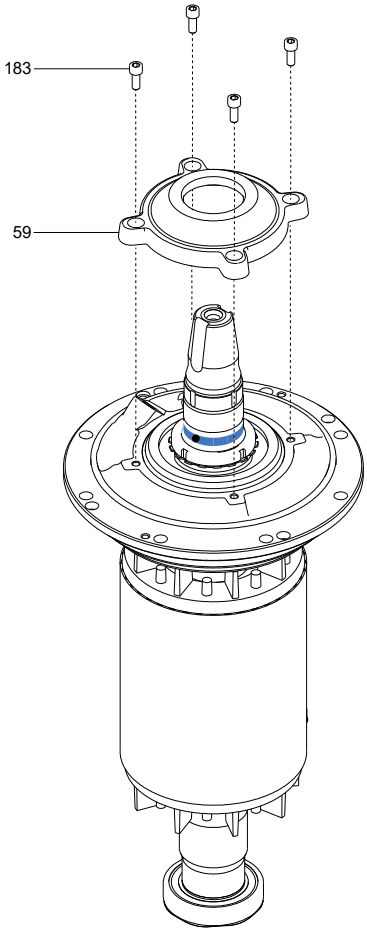
1. Mount and press the radial shaft seal (401) into the bearing cover (59). Use the ball bearing mount tool with the right collar. The check mark indicates the proper orientation of the shaft seal.



TM084446

Apply grease to the marked area

2. Apply grease on the lip of the radial shaft seal and on the shaft. Greasing areas are indicated on the image above.
3. Mount the assembled bearing cover (59) on the lower bearing bracket. Apply grease to the marked area.



TM084445

Apply grease to the marked area

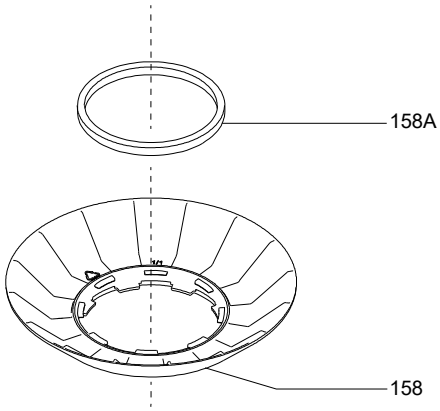
4. Insert the four screws (183) and tighten them to a stop.
5. Tighten the four screws to the required torque. Always go in a sequence, tightening one screw then the opposite.

Related information

7. Tightening torques and lubricants

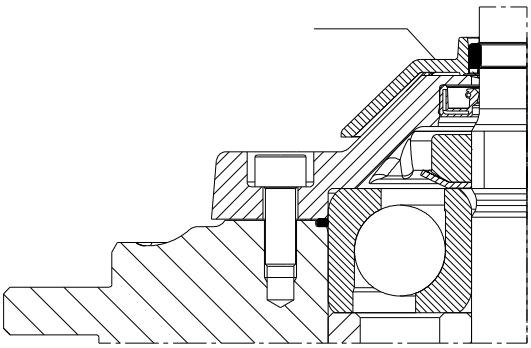
12.6 Centrifugal cup assembly

1. Lubricate the O-ring (158A) then insert it into the Centrifugal cup. Use ball bearing mounting tool.



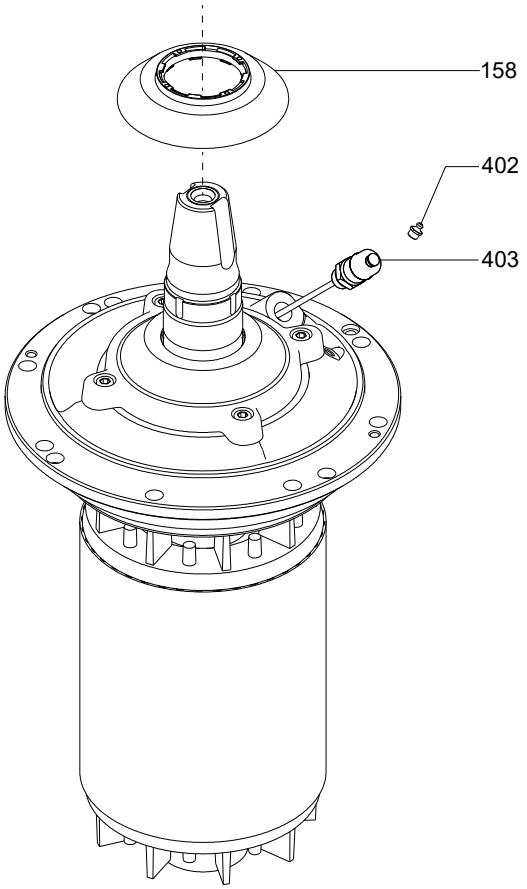
TM084447

2. Apply grease to the gap between the lip seal and centrifugal cup. The area is marked on the image below.



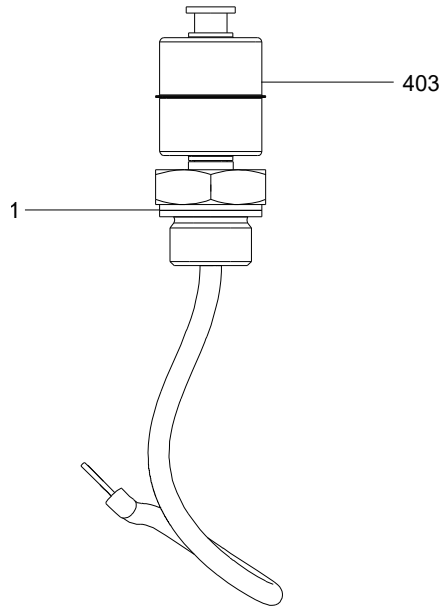
TM084449

3. Push the centrifugal cup down on the shaft until it clicks into place.
4. Mount the grease nipple (402) on the lower bearing bracket (155).



TM084468

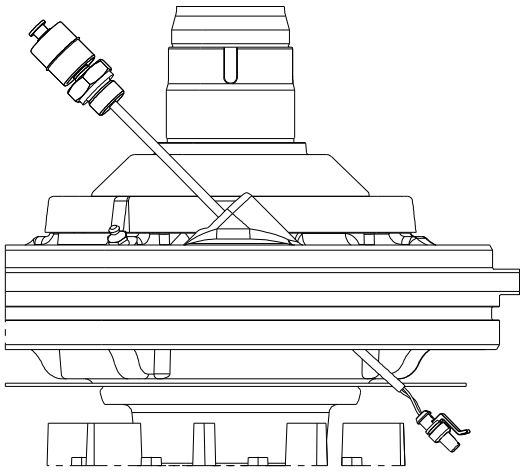
5. Mount the copper seal on the leakage switch (403).



TM084448

1	Copper seal

6. Pull the leakage switch (403) cable through the threaded hole on the lower bearing bracket first, then mount the leakage switch on the bearing bracket.



TM084264

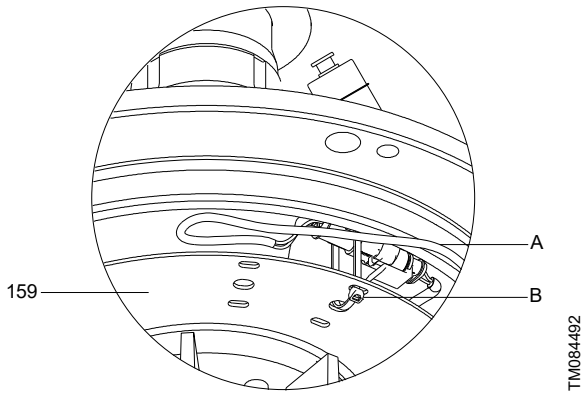
7. Connect the AMP connector on the leakage switch cable end.
8. Tighten the leakage switch to the required torque.

Related information

7. Tightening torques and lubricants

12.7 Shaft with rotor assembly insertion

1. Connect the AMP connector of the leakage switch (403) to the plug of the signal wire.

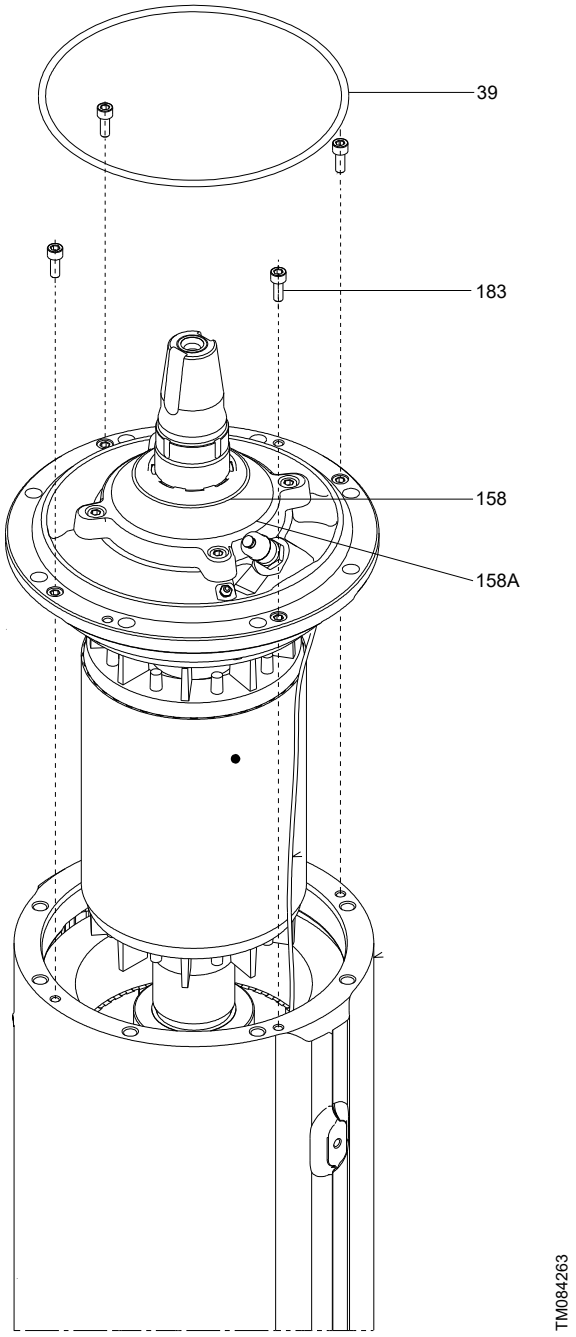


A	Signal wire
B	Cable tie
159	Wire cover

2. Check the electrical connection and the leakage switch function with a multimeter, at the free end of the signal wire.
3. Fix the plugged leakage switch connector with a cable tie to the wire cover.
4. Mount a lifting eye into the threaded hole of the shaft end, and lift up the shaft with rotor assembly.
5. Insert the shaft with rotor assembly into the stator housing.

> **!** Make sure to take care of the stator leads and signal wires during the insertion process. Leave enough space for them to fit.

6. Continuously push down the wire set into the cable tunnel between the stator (48) nd the stator housing (55) during insertion.
7. Lubricate, insert and tighten the screws (183). The screw head closest to the leakage switch (403) will be higher than the edge of the lower bearing bracket (155). This is to help the orientation of the upper seal housing (58).
8. Mount the O-ring (39).

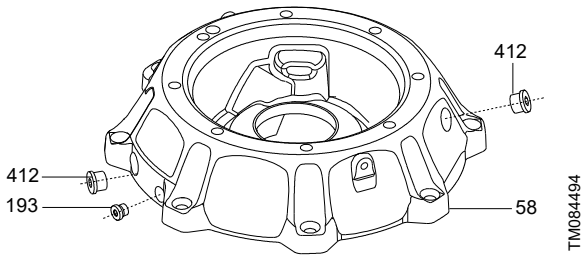


Related information

7. Tightening torques and lubricants

12.8 Upper seal housing assembly

1. Put in the lower plugs (412, 193). Tighten them to the required torque.
2. Insert the upper plug (412). Only tighten it to required torque after the cooling liquid has been filled in, later.

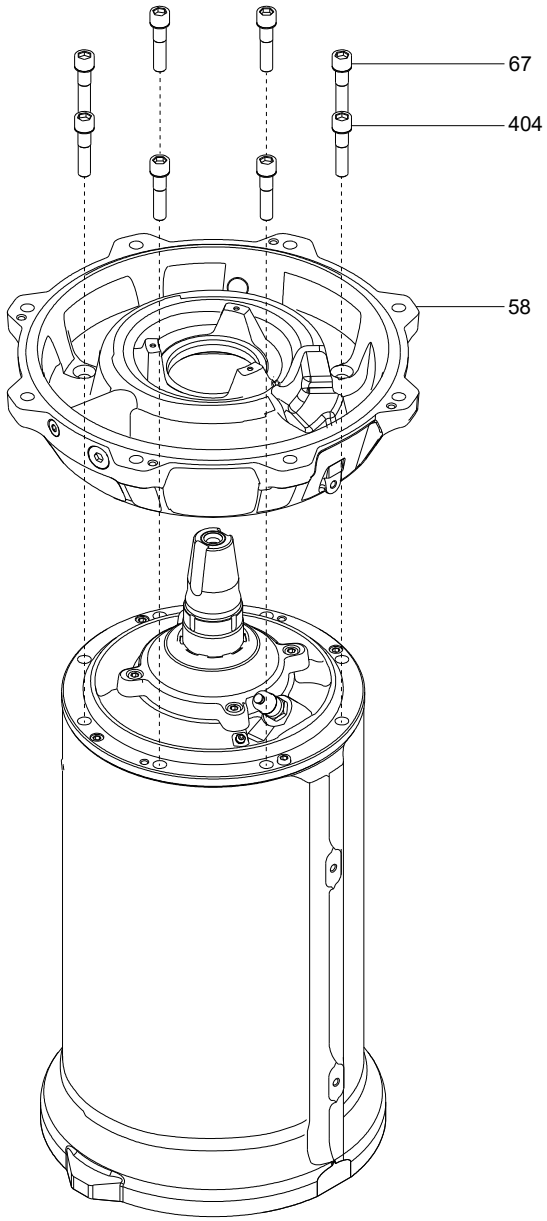


Related information

7. Tightening torques and lubricants

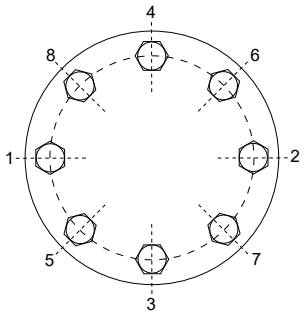
12.9 Mounting the assembled upper seal housing

1. Lift and mount the upper seal housing on the stator housing. Do not use the three marked threaded hole for lifting! The fixing screw of the lower bearing bracket will help to properly orientate the upper seal housing.



TM084259

2. Insert the screws (67) and bonded washers (404).
3. Tighten the screws (67) to the required torque. Tightening sequence:



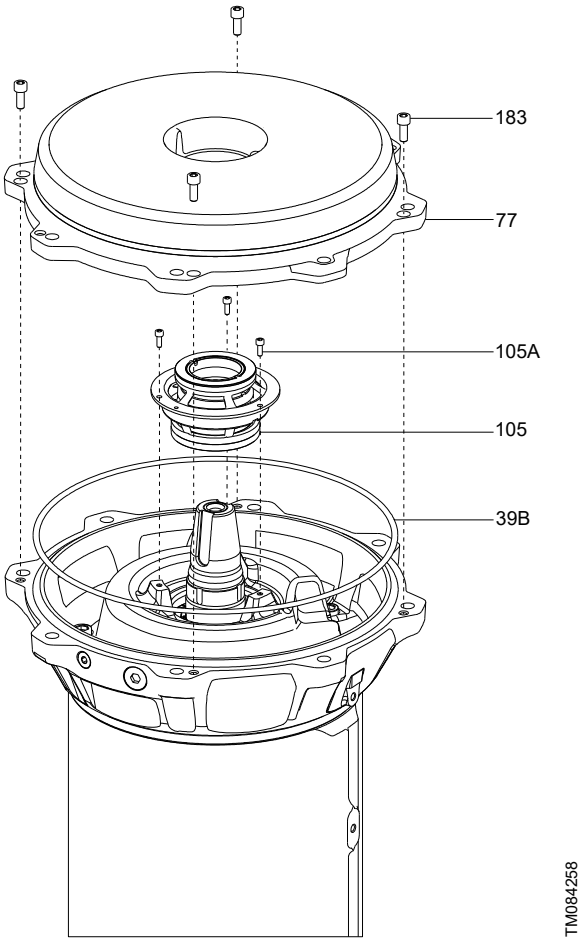
TM084495

Related information

7. Tightening torques and lubricants

12.10 Mounting the shaft seal

1. Grease and mount the O-ring (39B).



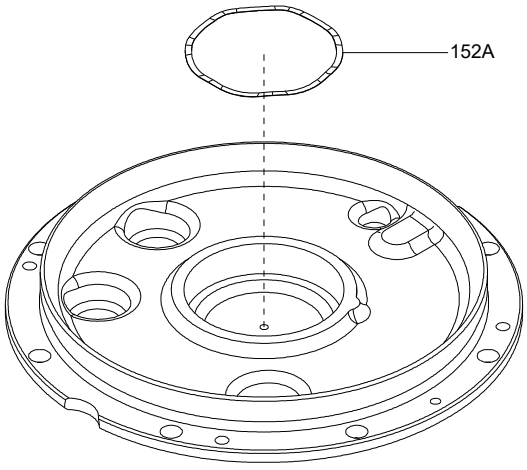
2. Grease the inside of the upper seal housing (58), on the shaft seal bushings, and grease the two O-rings outside of the shaft seal (105).
3. Clean the shaft (172) and the inside of the shaft seal (105) with soapy water.
4. Mount the shaft seal (105) on the shaft (172), using the ball bearing mounting tool. Align the holes of the shaft seal with the holes on the upper seal housing.
5. Insert and tighten the shaft seal screws (105A), tighten them to the required torque.
6. Mount the lower seal housing (77). Check the cast markings on the lower and upper seal housings, they must be aligned.
7. Insert the lower seal housing screws (183) and tighten them to the required torque.

Related information

7. Tightening torques and lubricants

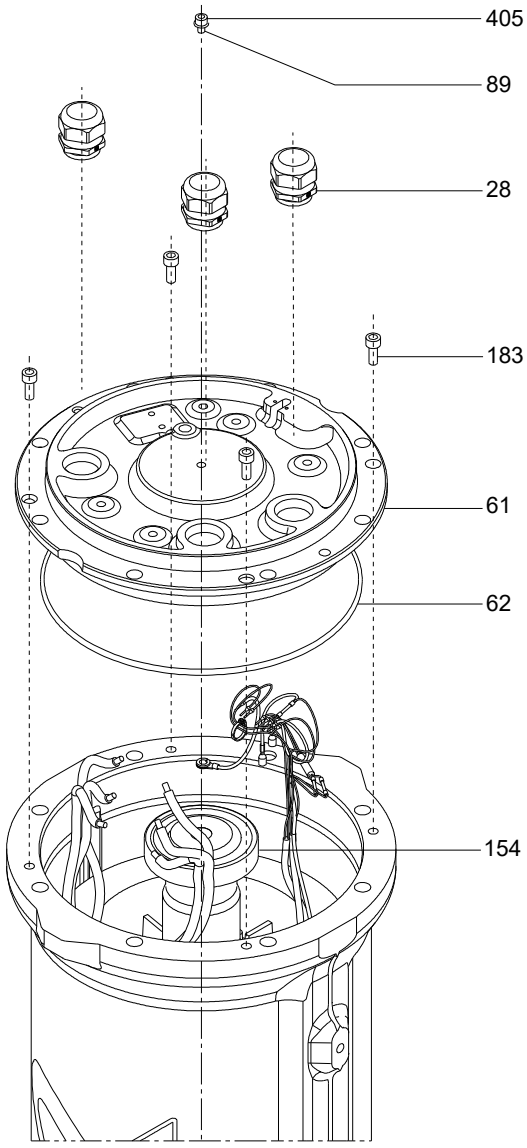
12.11 Mounting the upper bearing bracket

1. Turn the motor upside down and fix it in place so it cannot tilt or fall over. Use lifting eyes and lifting ropes. Make sure the wires cannot be pinched or damaged.
2. Grease and insert the wave spring (152A) into the upper bearing bracket (61).



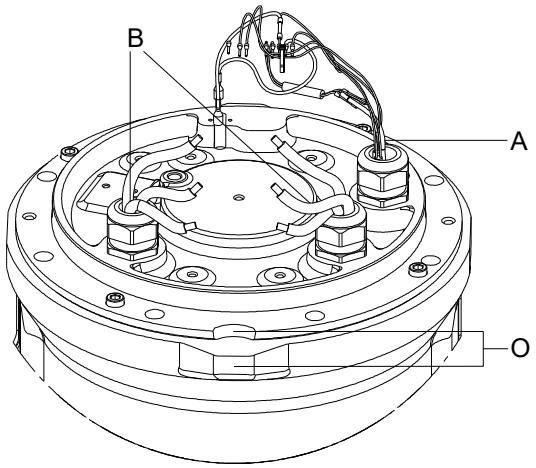
TM084310

3. Grease the bearing seat in the upper bearing bracket (61).
4. Copy the numbers on the stator leads to the lead connectors. This will help connect the leads to the terminal bracket.
5. Grease and insert the O-ring (62).



TM084497

6. Lift the upper bearing bracket up and pull all the cables and wires through the corresponding holes, then mount the upper bearing bracket on the motor. Make sure the cables and wires cannot fall through the holes and back into the motor.
7. Insert the screws (183) into the upper bearing bracket and tighten them to the required torque.
8. Pull the power leads through the cable glands (28).



TM084607

A	Sensor wires
B	Power wires
O	Correct orientation

9. Pull the sensor wires through their separate cable gland.
10. Mount the cable glands, check that they are in the proper position, and tighten them to the required torque.
11. Insert the screw (89) and brass washer on the threaded hole in the middle of the upper bearing bracket.

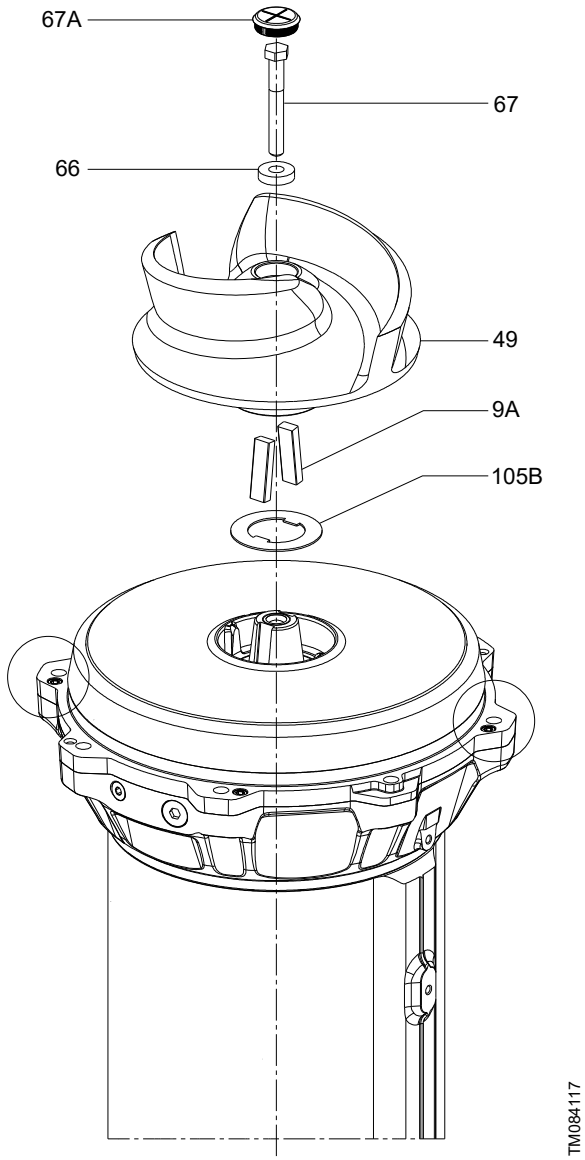
Related information

7. Tightening torques and lubricants

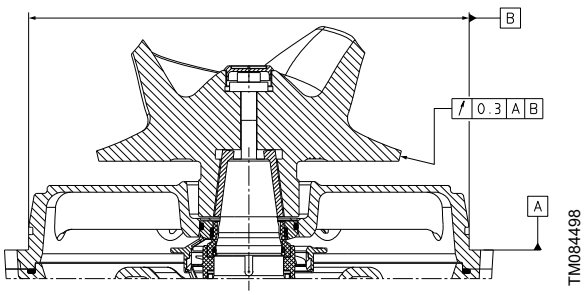
12.12 Mounting the impeller

Place the assembled motor into horizontal position, and fix it against rolling or moving. Make sure that during the assembly procedure, the cables or wires are not damaged.

1. Mount the shaft seal protector (105B) and push it all the way down on the shaft. It must fit into the grooves on the shaft end.



2. Grease and insert the keys (9A) into the keyways on the shaft end. Use plastic or rubber hammer to fit them into place.
3. Mount the impeller (49) on the shaft (172).
4. Mount the impeller washer (66).
5. Insert the impeller screw (67).
6. Tighten the impeller screw with the required torque.
7. Insert the impeller plug (67A) to cover the impeller screw.
8. Check the impeller run-out with a dial indicator.

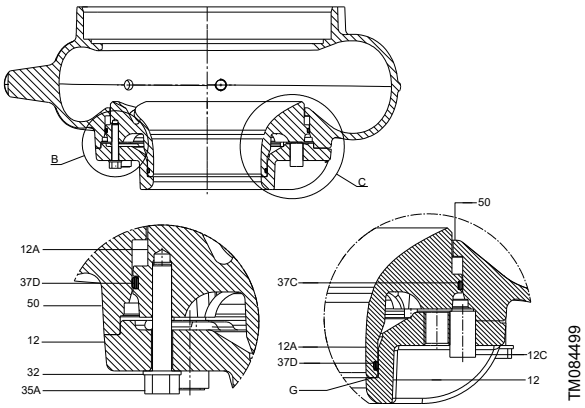


Related information

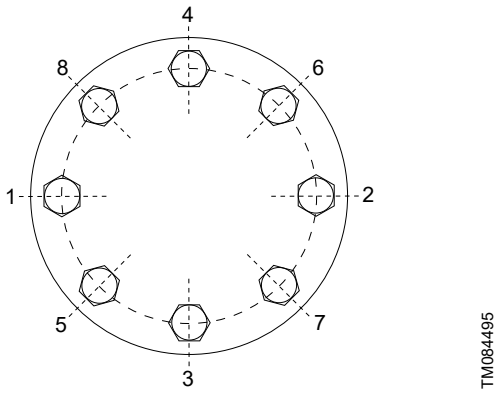
7. Tightening torques and lubricants

12.13 Pump housing assembly

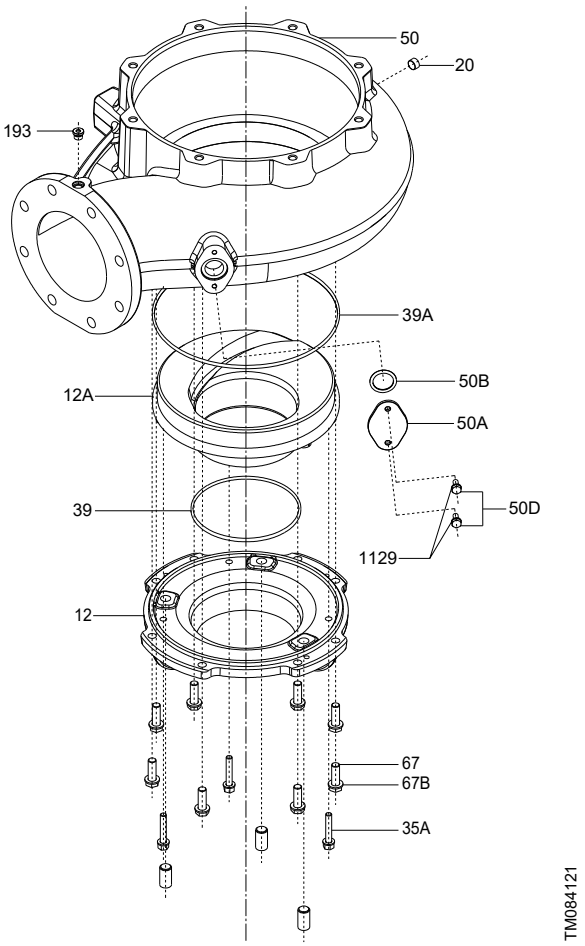
1. Grease and mount the O-rings (37C and 37D) on the suction cover (12A).
2. Preassemble the suction flange (12) with the suction cover (12A) using the fixing screws (35A) and washers (32).
3. Tighten all fixing screws to the required torque. The gap between the suction cover and the suction flange (G) must be 0 mm.



4. Turn the pump housing (50) upside down.
5. Mount the preassembled suction flange and suction cover on the pump housing.
6. Insert the screws (67) and washers (66A) to the suction flange (12) and tighten them to the required torque. Tightening sequence:



7. Insert the set screws (12C) into the suction flange and tighten them carefully.
8. Turn the assembled pump housing with suction flange into normal position, to the suction flange is on the bottom, and secure the pump against tipping or falling over.
9. Grease and insert the O-ring (50B) into the pump housing inspection hole (50).
10. Mount the inspection hole cover (50A) on the inspection hole with the screws (50D) and washers (1129).
11. Insert and tighten the drainage plug (20) and pressure plug (193) with the required torque.

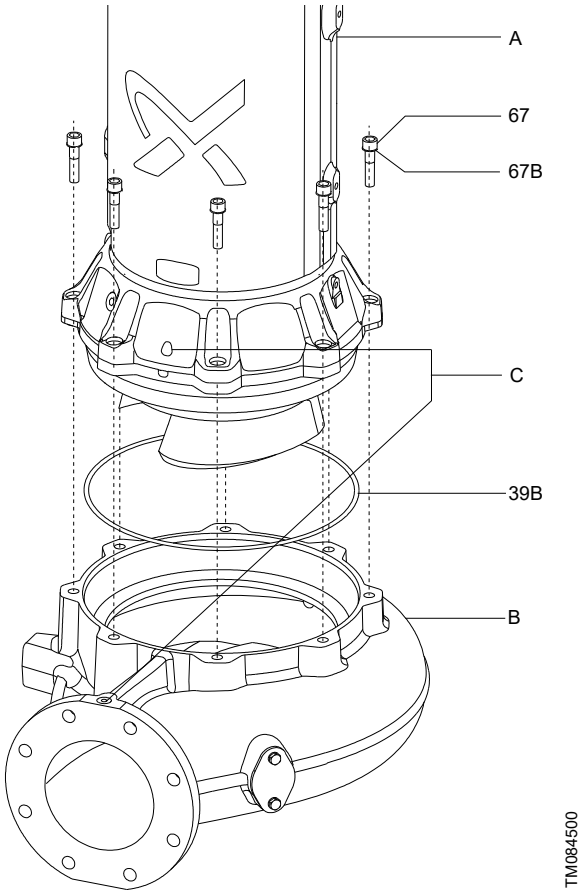


Related information

7. Tightening torques and lubricants

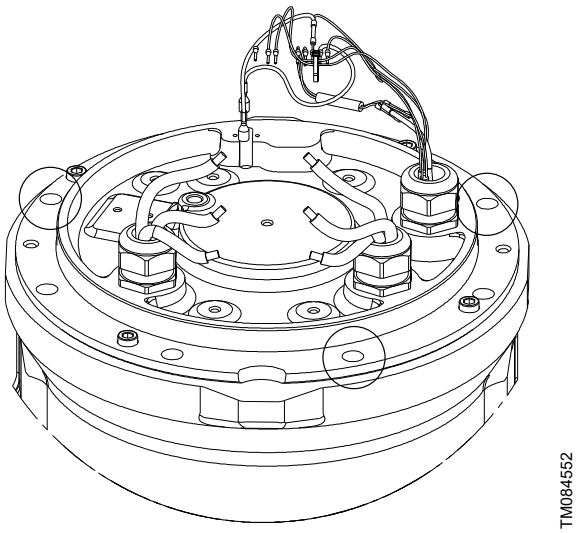
12.14 Mounting the motor on the pump housing

1. Grease and mount the O-ring (39B) on the lower seal housing groove of the motor.

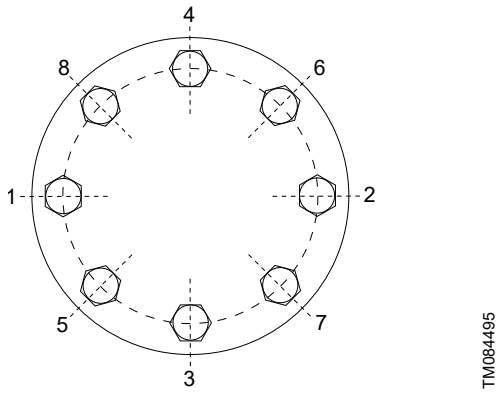


A	Motor housing
B	Hydraulics
C	Alignment grooves

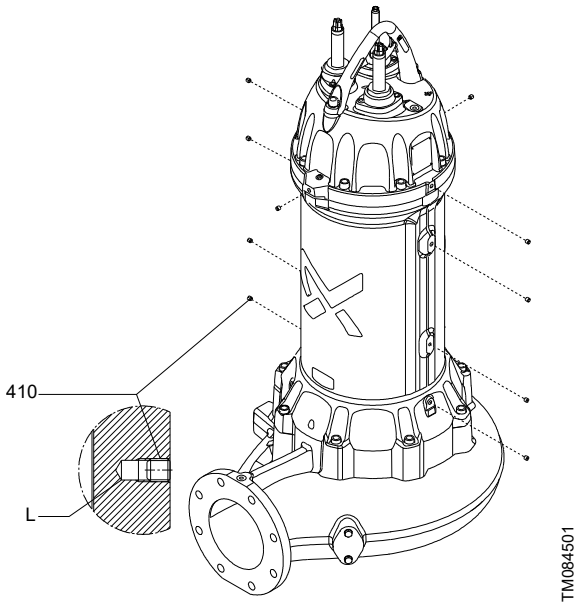
2. Place at least three lifting eyes into the threaded holes marked below.



3. Lift the motor and place it on the pump housing.
4. Insert the screws (67) and washers (67B) then tighten them. Follow the tightening sequence below.



5. Lubricate the blind holes (L) and insert all plug screws (410) as it is shown below.

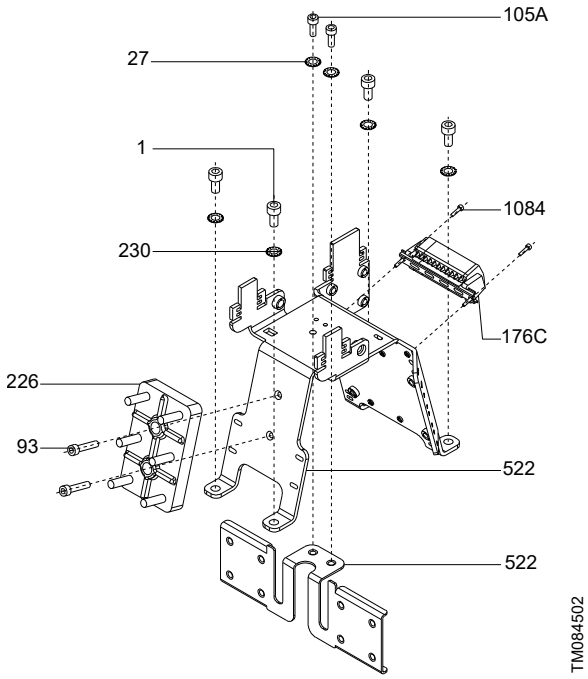


Related information

7. Tightening torques and lubricants

12.15 Terminal bracket assembly

1. Mount the bracket for screen termination (522) on the bracket for wire termination (522) with screws (105A) and serrated lock washer (27.)



2. Mount the terminal board (226) on the assembled bracket for wire termination (522) with screws (93).
3. Mount the terminal block (176C) on the assembled bracket for wire termination (522) with screws (1084).
4. Mount the preassembled terminal bracket on the upper bearing housing with screws (1) and serrated lock washer (230B).

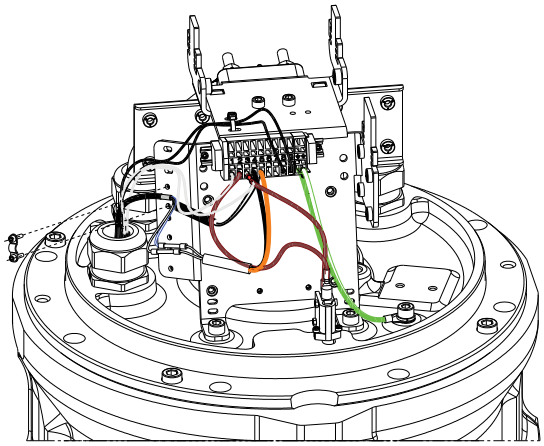
Related information

7. Tightening torques and lubricants
8.2.1 Standard sensor version
8.2.2 Sensor version V1
8.2.3 Sensor version V2

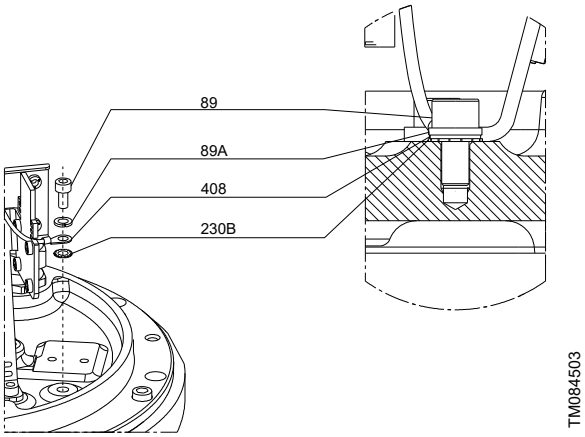
12.16 Motor top internal wiring

Always check the appropriate connection diagram before working on the wiring!

1. Connect the stator power leads to the main terminal board (93). Use M8 nuts (406) and washers (405).



2. Connect the preassembled earth wire to the sensor terminal board (176).
3. Mount the earth wire cable lug to the upper bearing bracket with screws (89), spring lock washer (89A) and serrated lock washer (230B), according to the image below.



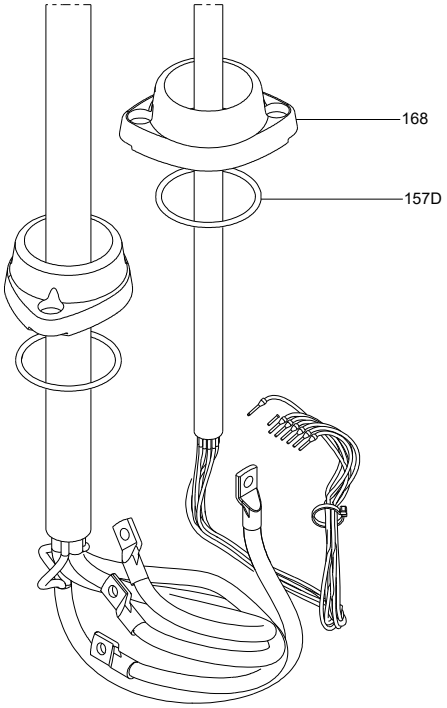
4. Connect the signal wires and the stator wires to the terminal block. Follow the connection diagram.
5. Mount the signal wire clamp to the bracket for wire termination (522) with screws (1084).
6. Tighten the screws (1084) to the required torque.
7. Mount the moisture switch (520) on the upper bearing bracket with screws (1084).
8. Tighten the screws (1084) to the required torque.
9. Connect the moisture switch (520) to the sensor terminal block (176) according to the connection diagram.
10. Fix the wires to the bracket for wire termination with cable ties.

Related information

7. Tightening torques and lubricants
8.2.1 Standard sensor version
8.2.2 Sensor version V1
8.2.3 Sensor version V2

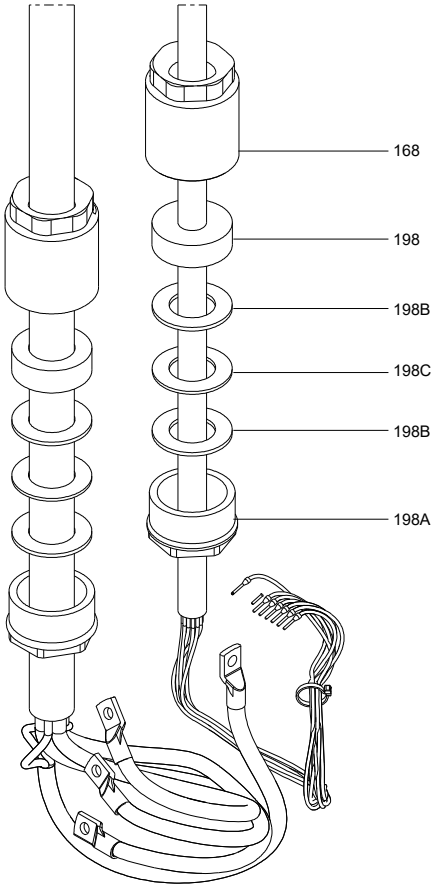
12.17 Cable assembly

1. Pull the upper cable inlet (168) and the O-ring (157D) on the motor end of the power and sensor cables.



TM084504

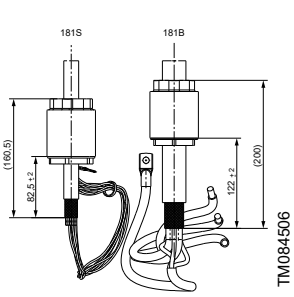
2. Pull the cable through the remaining cable entry parts according to the image below.



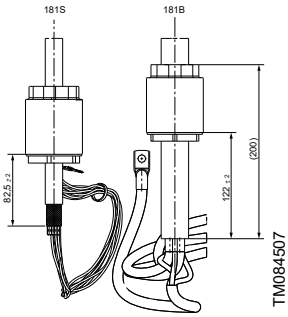
TM084505

3. Grease the thread of the lower cable entry (168A).
4. Fasten the upper cable entry (168) and tighten the lower cable entry (168A). Follow the distances from the striped cable end according to the image below.

Screened cable version **Standard cable version**

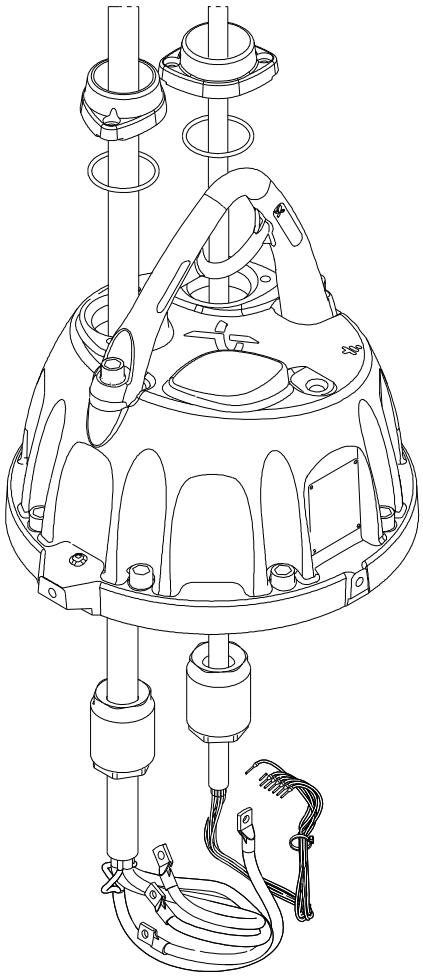


TM084506



TM084507

5. Pull the motor end of the preassembled cables through the corresponding holes of the motor top (164A)
6. Mount the lifting handle (190) on the motor top (164A) with screws (67) and washers (67B).
7. Tighten the screws with the required torque.



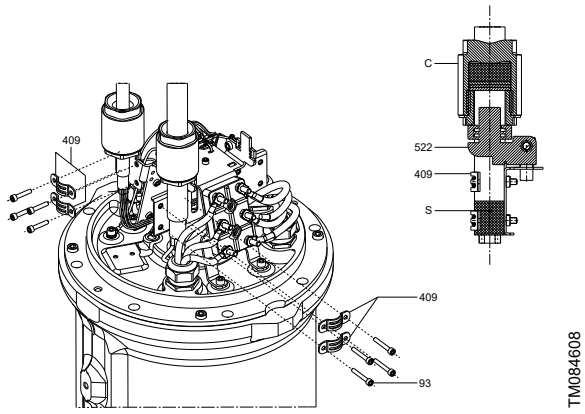
TM084508

Related information

7. Tightening torques and lubricants
8.2.1 Standard sensor version
8.2.2 Sensor version V1
8.2.3 Sensor version V2

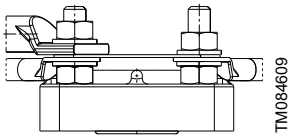
12.18 Mounting the power and sensor cables

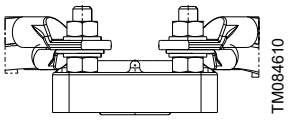
1. Pull the power cable cable bullets through the bullet holder of the bracket for wire termination (522). The cable bullets must be positioned next to the main terminal board (226).



C	Cable bullet assembly
S	Stripped cable end in case of EMC cable

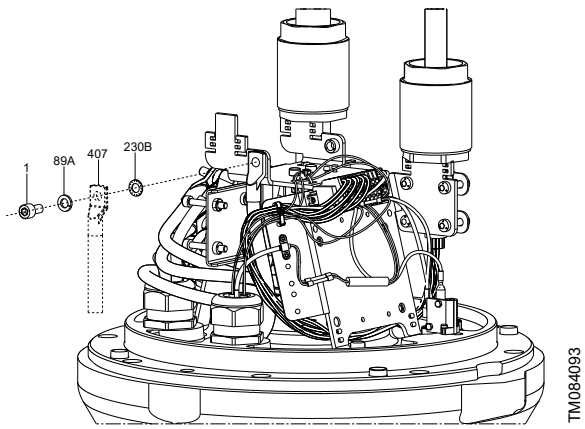
2. Mount the cable clamps (409) on the bracket for wire termination (522) with the screws (93) fixing the power cables.
3. Tighten the screws with the required torque.
4. Lead the power cable cores behind the leg of the bracket for wire termination (522) and screw on the cable lugs according to the connection diagram. Secure the cable lugs with washer (405) and M8 nut (406).





Terminal board assembly - 2-cable version		Terminal board assembly - 3-cable version	
Nut	Nut	Nut	Nut
Washer	Washer	Washer	Washer
Stator cable lug	Stator cable lug	Stator cable lug	Power cable lug
Connection bar		Washer	Washer
Power cable lug	-	Nut	Nut
Washer	Washer		
Nut	Nut		

5. Mount the earth wire of the power cables to the the bracket for wire termination (522) with serrated lock washer (230B), spring lock washer (89A) and screw (1) according to the image below.



Each power cable's earthing wire has got a dedicated place on the bracket for wire termination (522), on the opposite side of the cable.

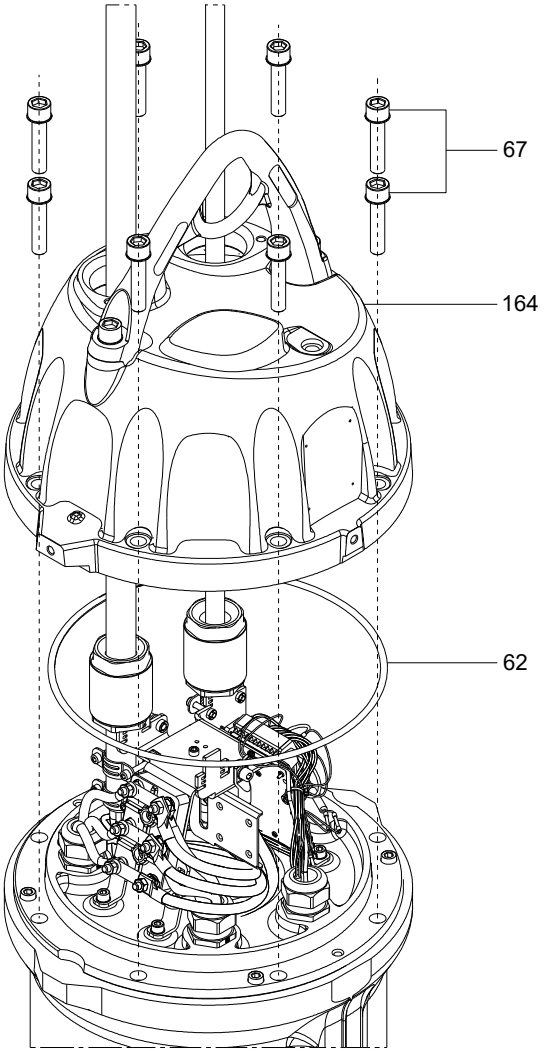
6. Pull the sensor cable bullet onto the bullet holder on the bracket for wire termination (522) with the screws (93) to fix the sensor cable. The bullet must be positioned next to the sensor terminal board (176).
7. Mount the cable clamps (409) on the bracket for wire termination (522) with the screws (93) to fix the sensor cable in place.
8. Tighten the screws (93) to the required torque.
9. Lead the sensor cable cores behind the leg of the bracket for wire termination (522) and connect the wires to the sensor terminal board (176), according to the connection diagram.
10. Secure the sensor wires to the bracket for wire termination (522) with cable ties.

Related information

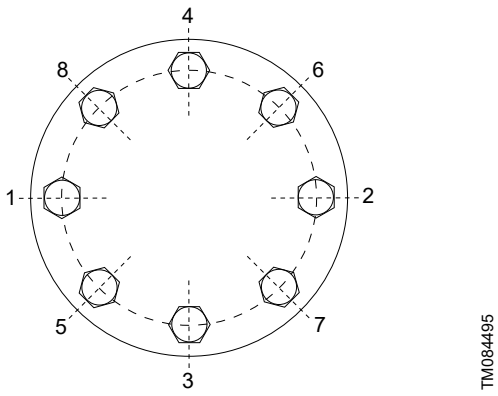
7. Tightening torques and lubricants
8.2.1 Standard sensor version
8.2.2 Sensor version V1
8.2.3 Sensor version V2

12.19 Motor top cover assembly

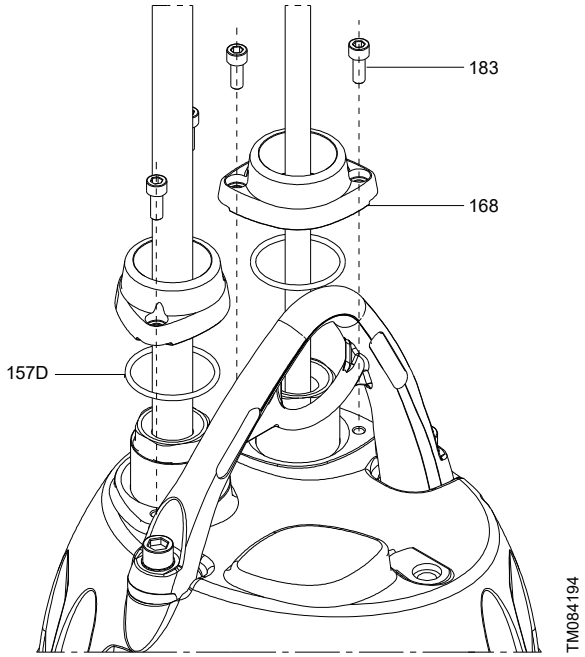
1. Grease and mount the O-ring (62) on the upper bearing bracket of the motor assembly.



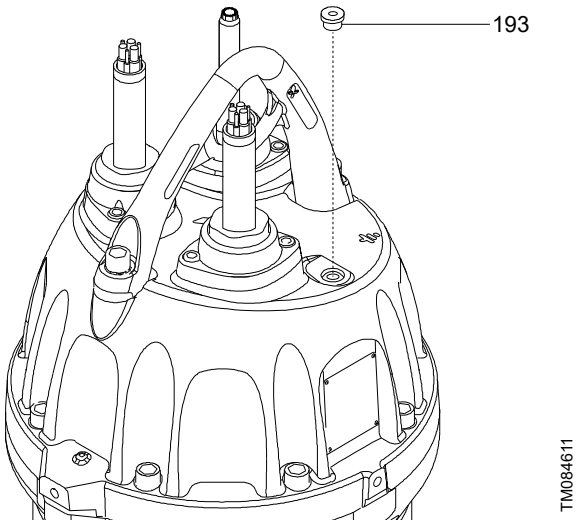
2. Carefully lift the motor top cover (164A) up and place it on the motor assembly. Check the correct orientation of the motor top. Avoid the inner wires, not to pinch them in the process.
3. Insert the screws (67) and serrated lock washers (67B) to the motor top cover (164A) and tighten them to the required torque. Tightening sequence:



4. Grease the cable inlet O-rings (157D) and mount the cable bullets.



5. Mount the upper cable inlet parts (168) on the motor top cover (164A) with its screws (183).
6. Tighten the screws (183) to the required torque.
7. Mount and tighten the seal plug (193) until stop. The plug must be tightened to the required torque after the pump went through the leakage test.



Related information

7. Tightening torques and lubricants
8.2.1 Standard sensor version
8.2.2 Sensor version V1
8.2.3 Sensor version V2

13. Impeller clearance inspection

For pumps fitted with open S-**tube**®, the impeller clearance is the distance between the bottom of the impeller and the suction cover.

The correct impeller clearance is required to maintain the hydraulic performance of the pump and to prevent clogging.

CAUTION
Hot surface
Minor or moderate personal injury
- Check the impeller clearance every time service is carried out to prevent hot surfaces in the hydraulic parts.

Clearance sizes for open S-tube® impellers

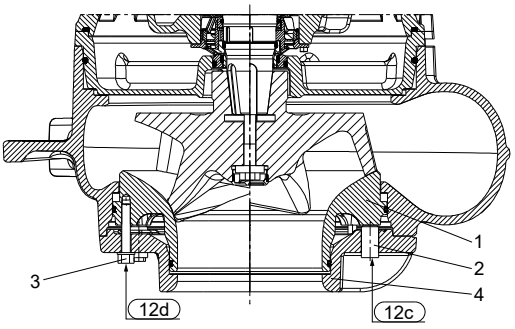
Pressure range	Impeller clearance [mm]
All	0.5 ± 0.1

DANGER
Electric shock
Death or serious personal injury
- Before starting any work on the product, make sure that the power supply is switched off and that it cannot be switched on unintentionally.

The impeller clearance of vertical, submerged installation types is inspected directly through the pump inlet.

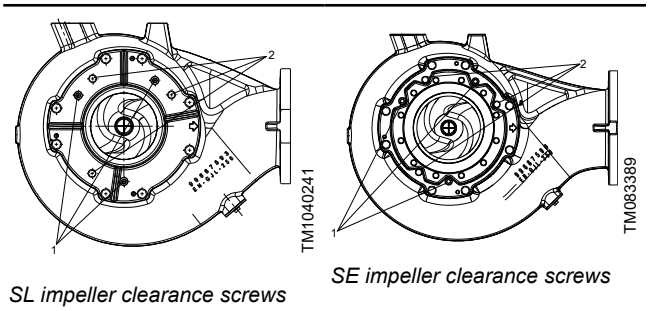
13.1 Impeller clearance adjustment parts

Tighten the set screws carefully to avoid damage to the bearings.



Tip gap adjustment parts

Pos.	Description
1	Suction cover
2	Set screw (12c)
3	Fastening screw (12d)
4	Suction flange



SL impeller clearance screws

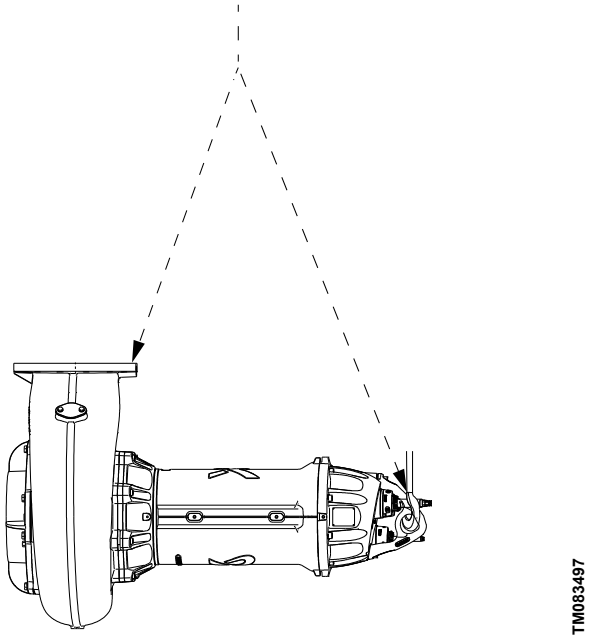
SE impeller clearance screws

Pos.	Description
1	Set screws
2	Fastening screws

13.1.1 Impeller clearance adjustment - in case of minor maintenance when the pump remains in application

Tighten the set screws carefully to avoid bearing damage.

The following method is suitable for pumps in horizontal position.



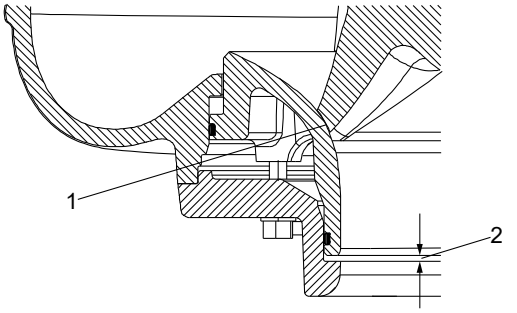
Horizontal lifting points for SL pumps

SL pumps are not intended for horizontal installation. Only move them horizontally for maintenance purposes.

Proceed as follows:

1. Loosen all fastening screws.
2. Slowly tighten all three set screws to a stop. Follow a circular pattern when tightening, use the same torque on each screw (torque wrench not necessary). In this case, the suction cover touches the impeller, and the impeller cannot be turned, the gap is set to 0. To make sure that the Suction Cover is not slanted in any direction, check the "Indirect Gap" around. The gap must be even all around.
3. Loosen all set screws one by one, by turning them 120° counterclockwise.

4. Tighten the fastening screws, required torque is 50 ± 5 Nm. Impeller clearance (1) is set.



TM1040239

Clearance gaps

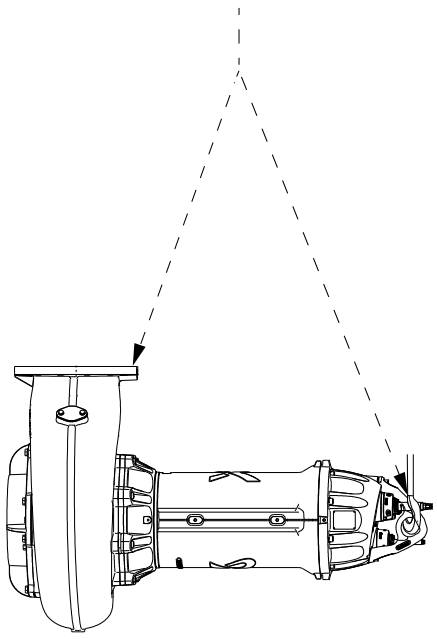
Pos.	Description
1	Tip gap between impeller and suction cover, must be 0.5 ± 0.1 mm.
2	Indirect gap for control measurement

5. Start the pump and listen if there is any noise from the impeller touching the suction cover.
   a. If there is no noise, no further action is necessary.
   b. If there is noise, stop the pump immediately, loosen all fastening screws, then loosen the set screws by rotating them 10° further, then finally tighten the Fixing Screws according to Step 4. If this does not solve the noise issue, start over from Step 1.

13.1.2 Impeller clearance adjustment - in case of major maintenance when the pump is removed from application

! Tighten the set screws carefully to avoid bearing damage.

The following method is suitable for pumps in horizontal position.



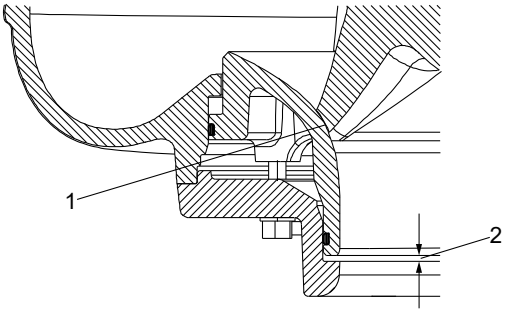
TM083497

Horizontal lifting points for SL pumps

! **SL pumps are not intended for horizontal installation. Only move them horizontally for maintenance purposes.**

Proceed as follows:

1. Loosen all fastening screws.
2. Slowly tighten all three set screws to a stop. Follow a circular pattern when tightening, use the same torque on each screw (torque wrench not necessary). In this case, the suction cover touches the impeller, and the impeller cannot be turned, the gap is set to 0. To make sure that the Suction Cover is not slanted in any direction, check the "Indirect Gap" around. The gap must be even all around.
3. Loosen all set screws one by one, by turning them 120° counterclockwise.
4. Tighten all fastening screws to stop. Follow a circular pattern when tightening, use the same torque on each screw (torque wrench not necessary).
5. Now the impeller clearance (gap between suction cover and impeller) should be 0.5 ± 0.1 mm. Check the gap in 60° steps around by rotating the impeller and using a gap gauge.
6. Tighten the fastening screws, required torque is 50 ± 5 Nm. Impeller clearance (1) is set. Check clearance size with the gap gauge again, to ensure the setting did not alter during the tightening of screws.



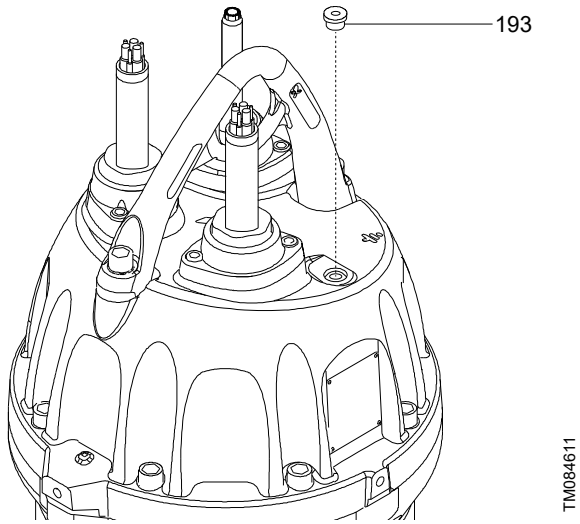
TM1040239

Clearance gaps

Pos.	Description
1	Tip gap between impeller and suction cover, must be 0.5 ± 0.1 mm.
2	Indirect gap for control measurement

14. Leakage test

1. Remove the seal plug (193) from the motor top cover.

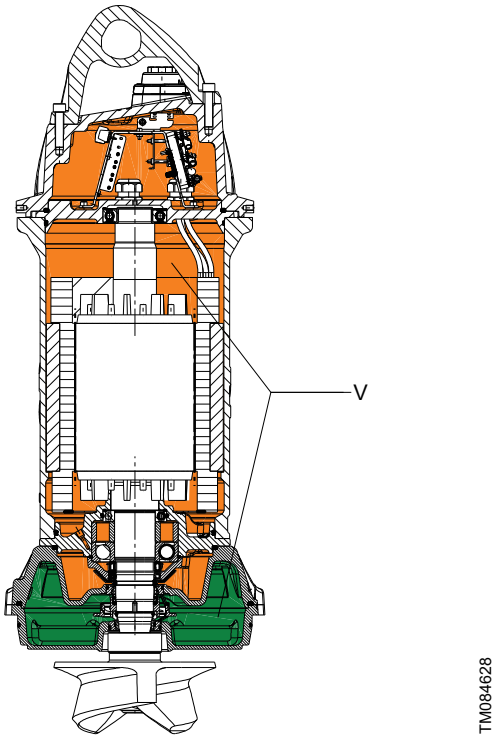


TM084611

2. Seal the power and sensor cable user ends, possibly with heat sinks.
3. Pressurize the motor top compartment with 0.6 bar pressure through the open seal plug hole, for 5 minutes. The pressure medium must be either N_2 or dried air.

> **!** The natural moisture of compressed air may trigger the moisture switch inside the motor top compartment. Use N_2 or dried air for the pressure test.

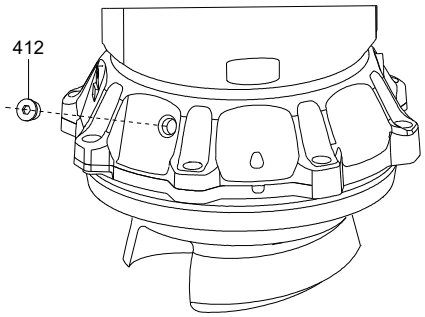
Free net volume [dm³]	SL	SE
Motor top compartment + motor + leakage chamber	16	16.3
Cooling liquid compartment	15.4	40.7



TM084628

V	The two separated volumes which are involved in the leakage test.

4. Check the pressure loss after 5 minutes. Pressure loss must be less than 0.1 bar.
5. Remove the filling plug (412).

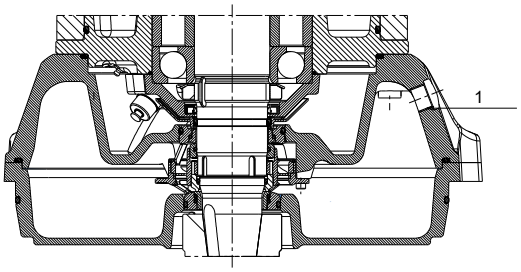


TM083647

6. Pressurize the seal housing with 0.6 bar air pressure through the open filling plug hole. Keep the pressure on 0.6 bar for 5 minutes.

> **!** The natural moisture of compressed air may trigger the moisture switch inside the motor top compartment. Use N_2 or dried air for the pressure test.

7. Check the pressure loss after 5 minutes. It must be less than 0.1 bar.
8. After the leakage test, fill the seal housing with motor liquid according to the image below. The seal housing is full when the liquid level reaches the edge of the hole (1).



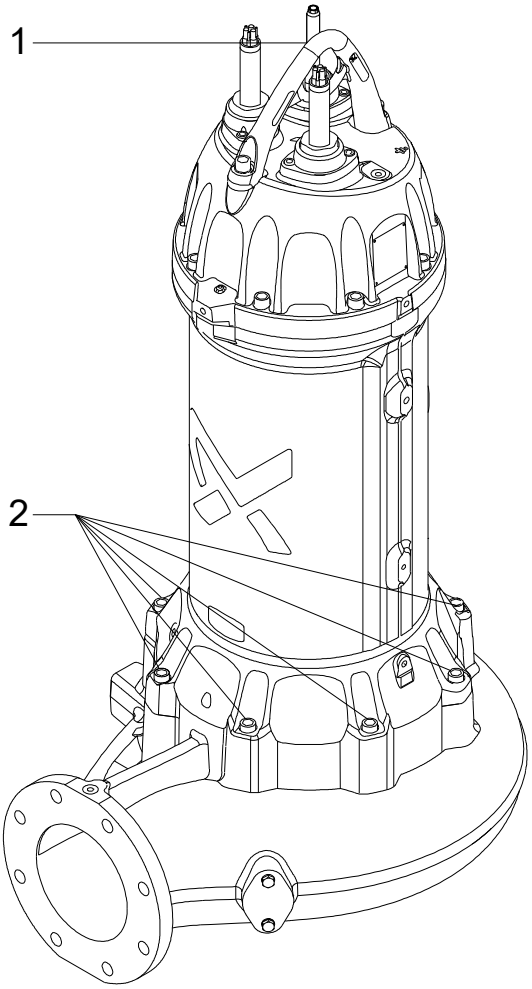
TM083648

9. Insert and tighten the filling plug (412) with the required torque.
10. Insert and tighten the sealing plug (193) with the requried torque.

15. Ground continuity test

Check the ground continuity between the user end of power cable ground wire and the metal housing. Repeat the test with the same parameters two times.

1. Use lifting handle as metal housing point.
2. Use any of the screws highlighted as a metal housing point.

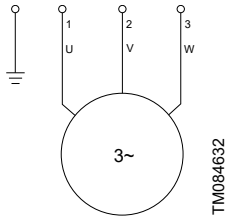
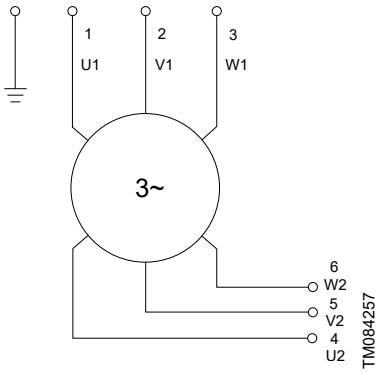


Cable length must be compensated for if it is longer than 10 meters. (Cable resistance: 0.5 - 1.78 mΩ/m). In case of dual cable, parallel PE connection is to be used.

Test duration	5	[sec]
Test voltage	12	[V]
Nominal current	10	[A]
Min. test current	9.6	[A]
Max. test current	10.4	[A]
Min. resistance	0.004	[Ω]
Max. resistance	0.25	[Ω]

16. Insulation resistance test

Insulation resistance must be measured between common phase wires and the protecting earth (grounding) wire.

in case of DOL: U+V+W - PE	in case of Y/D: U1+U2+V1+V2+W1+W2 - PE
 TM084632	 TM084257

Test duration	60 [s]
Test voltage	1000
Test voltage upper limit	1020
Test voltage lower limit	980
Voltage unit	V
Minimum resistance	1000
Maximum resistance	20000
Resistance unit	MΩ

17. List of power cables

Poles	Pump P2 [kW]	Frequency [Hz]	Voltage	Standard cable	EMC cable
4	41	50	1E	-	3 x 35 + 3G16/3
4	41	50	0D	-	3 x 35 + 3G16/3
4	41	50	1D	4 x 16 mm^2	-
4	48	50	1D	4 x 25 mm^2	-
4	63	50	1D	-	3 x 25 + 3G16/3
4	63	50	1G	-	3 x 35 + 3G16/3
6	32.5	50	1E	4 x 25 mm^2	-
6	32.5	50	0D	-	3 x 25 + 3G16/3
6	32.5	50	1D	4 x 10 mm^2	-
6	37.5	50	1E	-	3 x 35 + 3G16/3
6	37.5	50	0D	-	3 x 35 + 3G16/3

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