SULZER

# Submersible Drainage Pump XJ 900


22.09.2020

en

## Workshop Manual

www.sulzer.com

**Submersible drainage pump XJ**

XJ 900 ND (50/60 Hz)

XJ 900 HD (50/60 Hz)

## Contents



Sulzer reserves the right to alter specifications due to technical developments !

# 1 Health and safety instructions

When carrying out any repair work the instructions in the “Safety Instructions for Sulzer Products Type ABS” brochure and “Installation and Operating Instructions” must be observed.
Prior to starting with any maintenance work the Sulzer unit must be completetly disconnected from the mains by a qualified person and protected from being inadvertently switched back on.

Pumps must always be cleaned prior to maintenance, and if necessary, thoroughly decontaminated. High pressure water is recommended. If the pump has been operating in tough applications additional solvents can be used. The specific local hygiene and safety regulations must be observed.

When carrying out any repair or maintenance work, the safety regulations covering working in enclosed areas as well as “**good technical practice**”, must be observed!

Observe all accident prevention measures and regulations!

Changing the direction of rotation at control panels without a changeover switch should only be carried out by a qualified person.

The oil in the oil chamber may be under pressure. Before opening the oil drain plug, always put a cloth over the oil filler screw, loosen it to release any pressure and screw it down again! The regulations covering oil and grease or cooling liquids must be observed. Any waste oil, grease or cooling liquid should be correctly disposed of.

To avoid the possibility of injury from expelled objects when using an hydraulic press to assemble components that require compression fit, ensure that the placed components are squarely aligned beneath the hydraulic ram and are behind a protective screen.

# 2 General

## 2.1 Service

This workshop manual can be used for both inspection and complete service of the pump. For assistance contact your Sulzer authorized workshop.

- For regular inspection on the pump such as electrical check, oil/motor check and check of hydraulic parts, proceed and follow sections 1 to 5 in this manual.
- For complete overhaul on the pump proceed and follow sections 3 to 13 in this manual.
- For electrical information and wiring diagrams see sections 14 - 16.

The submersible drainage pump XJ 900 is built for long periods of trouble-free operation. It gets sufficient cooling from the pumped media and sufficient lubrication and cooling from the oil in the housing between the seals. All the bearings are filled with high performance bearing grease for lifetime duty.

Regular inspection and preventive maintenance will ensure more reliable operation. The pump should be inspected routinely, dependant on operating hours and the nature of the medium being pumped. If the operating conditions of the pump are severe it may be required more frequently.

Use only Sulzer spare parts.

Spare parts list and assembly drawing is available from the Documents tab at www.sulzer.com > Products > Pumps > Dewatering pumps > Drainage pumps > XJ 900.

## 2.2 Service kits

The service and o-ring kits include preselected spare parts which ensures fast and efficient maintenance, and avoids unnecessary downtime for the pump. For contents of the service kit see the spare parts list.

Wet-end service kit 50 Hz: 00833910

Wet-end service kit 60 Hz: 00833915

Repair kit: 00833916

O-ring kit: 00833911

HD to ND conversion kit: 00833913

ND to HD conversion kit: 00833912

## 2.3 Tools:

Sulzer submersible drainage pumps can be maintained with standard tools. Sulzer does not recommend the use of impact tools for removal and installation of screws and nuts. Special tools are available for mechanical seal assembly and stator insertion. See drawings in section 18.

**Required:**

- Mechanical seal press tools.
- Stator press tool.
- Pressure test tools.
- Cable cap assembly tool.
- For lifting: M10, M12, M16, M20 swivel eyebolts

**Torque ratings:**

| **Size** | M6 | M8 | M10 | M12* | M16 | M20 |
|---|---|---|---|---|---|---|
| **Nm** | 7 | 17 | 33 | 56 | 136 | 267 |
| **lb-ft** | 5.2 | 12.5 | 24.3 | 41.3 | 100.3 | 196.9 |

* M12 bolts (A4-80) securing volute halves together = 90 Nm (66.4 ft-lb).

## 2.4 Decommissioning, disposal and recycling

Recycling of individual pump parts are beneficial to the environment. The pump can be fully dismantled for recycling. Stainless steel, ductile iron and high chrome cast iron can be recycled when a pump is scrapped. Wear parts which consist of rubber/cast iron, and cables/stators with copper, must have their component parts properly separated before recycling is possible. Environmental white oil should be disposed of at designated areas.

Sulzer products are designed so that their service would be as easy as possible by replacing worn or damaged parts with new, original Sulzer spare parts. Parts can also be re-used after reconditioning them at Sulzer Customer Support Service Centers. Sulzer Customer Support Service Centers must be used in the assessment of re-use and reconditioning. If you need additional instructions or guidance, please contact our representative.

The materials used in Sulzer products are disclosed in the parts list supplied with the product. At the end of the life cycle of a product or its parts, the appropriate materials and parts must be recycled or disposed of using methods which are acceptable in terms of environmental protection and which conform to local legislation and regulations. If a product or its part contains environmentally harmful substances, they must be removed and disposed of by following valid regulations.

Packaging materials must be recycled or disposed of using methods which are acceptable in terms of environmental protection and which conform to local legislation and regulations.

Make sure that hazardous substances are disposed of safely and that personnel use appropriate personal protective equipment. Safety considerations must always meet the requirements of valid regulations.

## 3. Service inspection

### 3.1 Pump start and cable check

Test the insulation between cable end / plug and earth.
Check if the pump starts by connecting it to the power supply.

**DANGER! Always check that the pump is disconnected from the electric power supply before opening any part of the pump.**

1. Check the cable for damage and that there is no water or corrosion in the connecting plug.
2. Remove screws (86) and washers (85) and prise off inspection cover (84) with screwdriver.
3. Check o-ring (83) for damage and replace if necessary.
4. Disconnect cables from terminal block.

**ATTENTION: take note of connection arrangement for future reconnection.**

5. Remove nuts (13.3), strain relief endplate (13.2) and outer part of strain relief (12.1).
6. Remove screws (16.2) from stuffing box (16.1).
7. Pull out cable assembly.
8. Check o-ring (16.6) for damage and replace if necessary.
9. If water has penetrated through the packing nut (16) and the cable seal (18), then the cable seal should be replaced.

**ATTENTION: for re-assembly, take note of the distance the cable outer sheath protrudes through the cable seal and stuffing box.**

10. Remove screw (16.3) from stuffing box.
11. Unscrew packing nut from stuffing box and replace cable seal.
12. Re-assemble cable assembly.

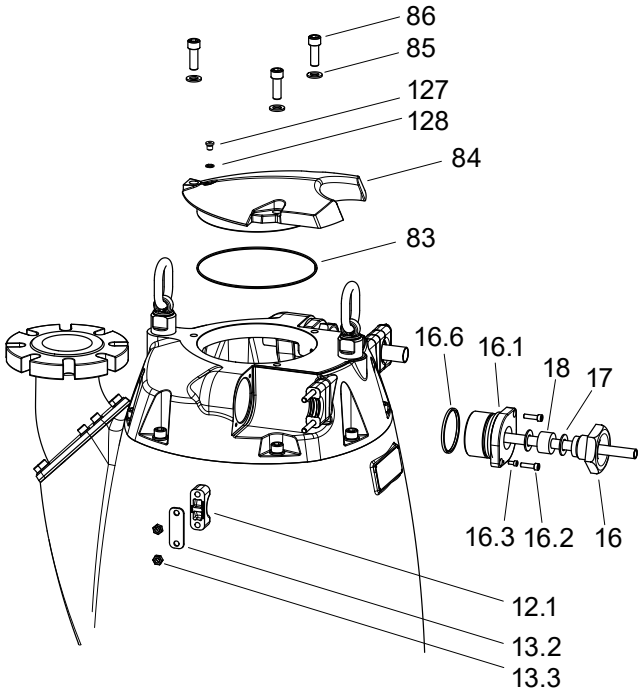
If using cable cap assembly tool (section 17.7):

- Clamp external rim of stuffing box part of assembly fitting in vice (avoid machined surface).
- Fit the cable and packing nut into the stuffing box and turn by hand until several threads are engaged.
- Attach ratchet to cable cap assembly tool and tighten packing nut to 40 Nm.

Without cable cap assembly tool:

- Clamp external rim of stuffing box part of assembly fitting in vice (avoid machined surface) and fit cable and packing nut.
- Tighten the packing nut until the seal grips to the cable.
- From this point, tighten the packing nut by at least one more full rotation for the control cable, and at least two full rotations for the power cable.

**ATTENTION: Measure the inner diameter of the cable seal to check that it corresponds to the cable diameter. When using non standard cable, note the cable diameter and select parts 16, 16.1, 17 and 18 accordingly from the spare parts list.**




13. Slide the stuffing box in as far as the o-ring.
14. Tighten the stuffing box into the top cover using screws (16.2). Alternate between the two screws to ensure the o-ring is not pinched.
15. Refit cable assembly into top cover in reverse sequence to dismantling.
16. Refit inspection cover.
17. Remove plug screw (127) and seal ring (128) from inspection cover.
18. Connect pressure test tool (section 17.6) to inspection cover.
19. Apply leak detection spray or soapy water solution to all inspection cover and top cover joints.
20. Apply pressure of 0.5 bar and inspect for air bubbles.
21. If no leakage is detected, remove pressure test tool and refit plug screw and seal washer.

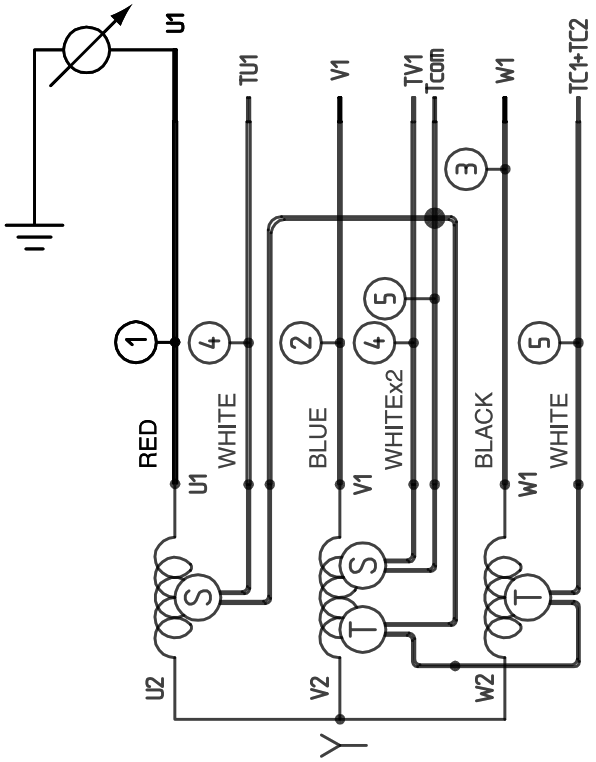
**NOTE:**

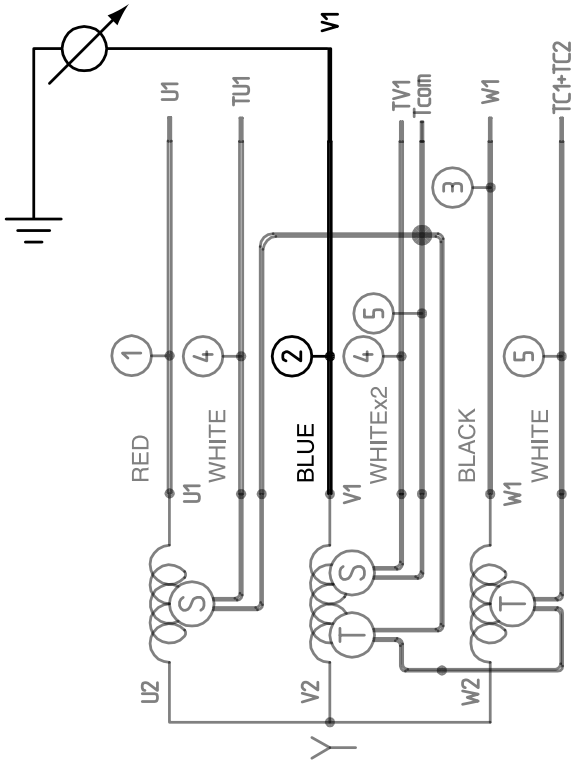
Use anti-seize grease such as K Nate or equivalent on packing nut threads

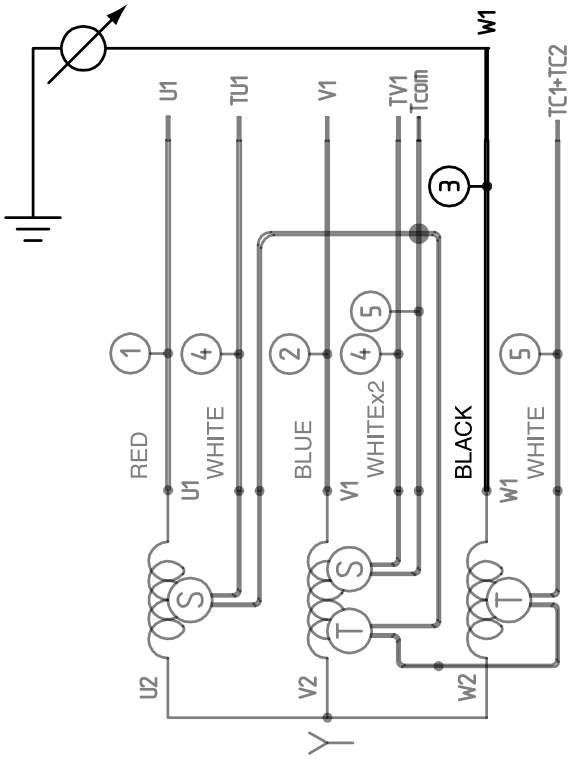
### 3.2 Insulation test

Remove inspection cover (see section 3.1). Disconnect stator leads. Check that the contact points are not burned. Measure insulation resistance between the different phase windings, between windings and earth, and between windings and thermal sensor circuit.

The insulation resistance should be measured with 500 V megohmeter (megger) and the reading should be at least 1 MΩ. If the insulation resistance is lower, the stator unit should be dried in an oven. If the stator insulation reading after drying is still low, the stator unit should be replaced (see section 13.




The insulation between the separate turns in the winding should also be checked. This can be done by measuring the resistance of the phase windings, which should give the same reading for all three windings for 3-phase motors. For resistance values and wiring diagrams refer to sections 14 - 16.

## 4. Oil / Motor check

### 4.1 Oil check

If the pump is connected to an external starter and the leakage monitor lamp lights up then the oil must be checked. Check the seal leakage monitor by disconnecting the leakage lead from the terminal board. Measure the insulation between the leakage lead and earth. The value should be larger than 100 kΩ, if it is not the oil should be checked.

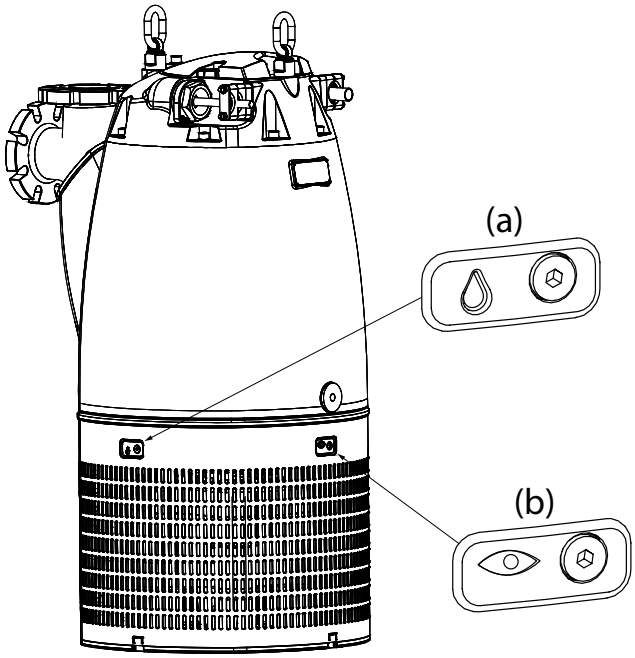
- Lay the pump down in a horizontal position on it's side.

**Note:** there are two drain points, one on either side, identified by the drop symbol cast into the bearing housing beside the plug screw (a). To ease the drain of the oil unscrew both of the oil plugs on the pump

> ⚠ **Remember to always secure the pump with the lifting chain. The lifting tackle must always be designed to suit the pump weight.**

- Unscrew the oil plugs.
- Drain off the oil into a clean container and examine it. If it is clean and contains no water, the mechanical seal unit / shaft seals are free from defects and can be used again. If the oil contains water (milky emulsion) and sediments, the mechanical seal unit / shaft seals must be changed and the lower ball bearing checked.

**Oil capacity:** 4.8L




### 4.2 Motor check

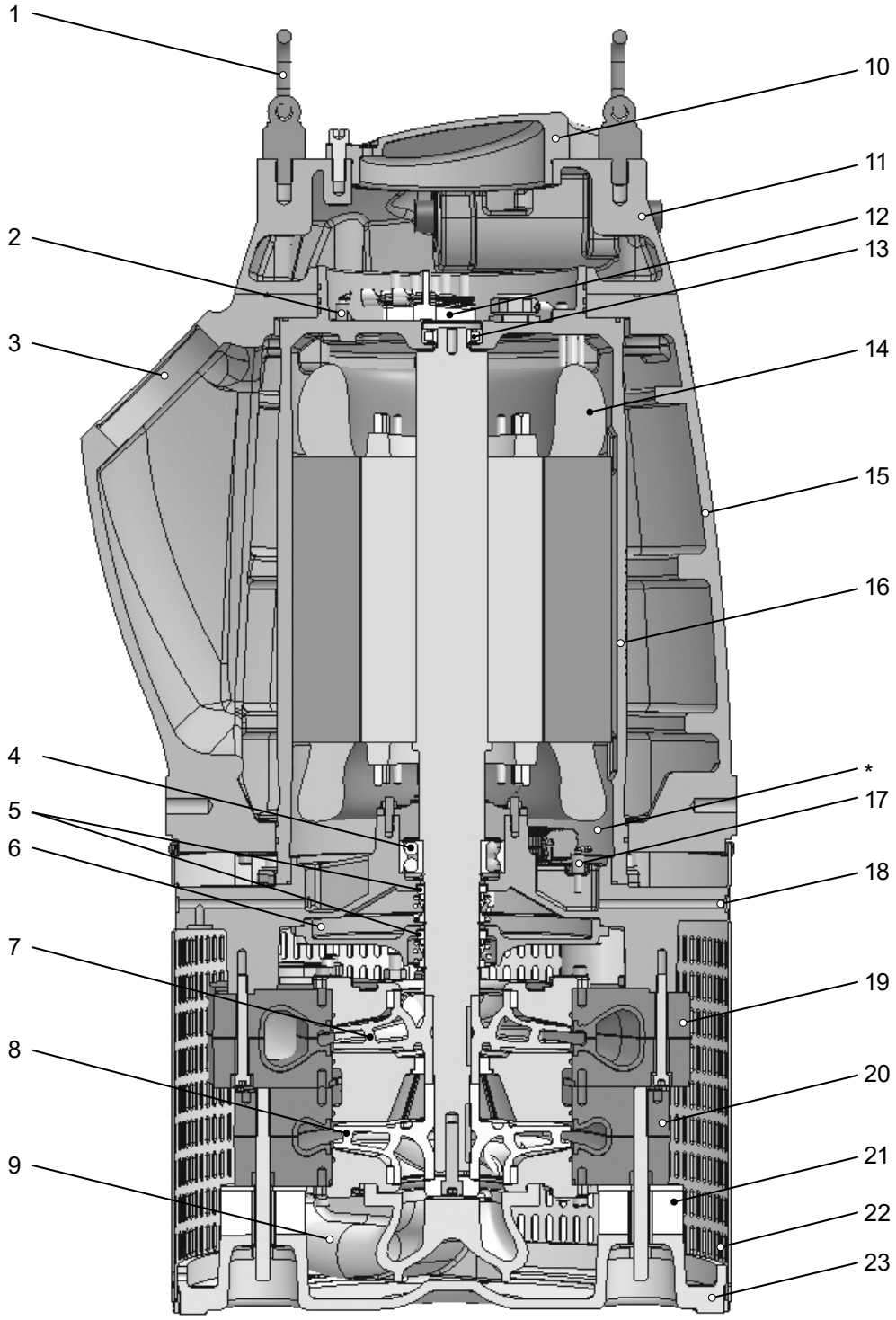
Unscrew inspection plug, identified by the eye symbol cast into the bearing housing beside the plug screw (b), and check that no water or oil has entered into the motor housing.

**Hint!** Use an air tool to blow into motor housing and check if water comes out of housing.

## 5. Hydraulic check

If a test run against shut off head shows that the pump is not close to expected head then the wear ring and impeller should be checked and replaced if the gap between both is widened beyond an acceptable tolerance due to excessive wear (see section 9).

## 6. Sectional drawing (HD version)




| | | | | | |
|---|---|---|---|---|---|
| 1 | Lifting eyebolts | 9 | Suction bell (HD version only) | 17 | Moisture sensor (DI) in oil chamber |
| 2 | Moisture sensor (DI) in connection chamber | 10 | Inspection cover | | |
| | | 11 | Top cover | 18 | Inspection port |
| 3 | Discharge outlet | 12 | Terminal block (power leads) | 19 | Top volute |
| 4 | Lower bearing - double row | 13 | Upper bearing - cylindrical roller bearing | 20 | Bottom volute |
| 5 | Double mechanical seals | 14 | Motor with thermal sensors | 21 | Vibration damper |
| 6 | Oil chamber | 15 | Cooling jacket | 22 | Protective screen |
| 7 | Upper impeller | 16 | Motor housing | 23 | Base plate |
| 8 | Lower impeller | * Not shown: moisture sensor (DI) in motor chamber | | | |

## 7. Removal and fitting of top cover

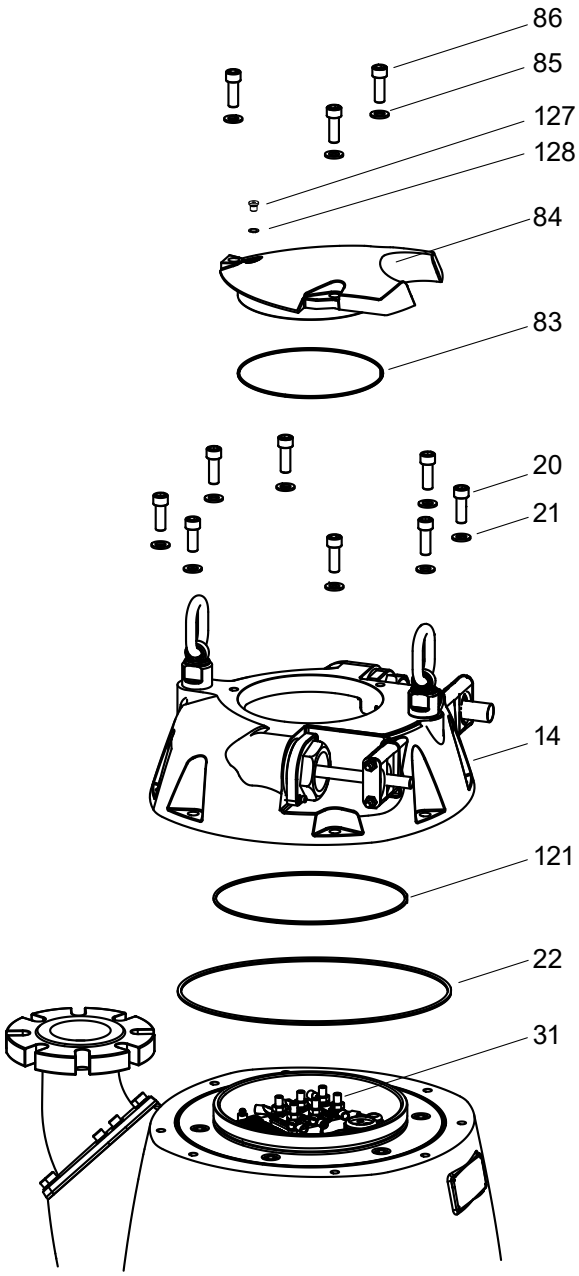
1. Remove screws (86) and washers (85) and prise off inspection cover (84).
2. Disconnect cables from terminal block (31).

**ATTENTION: take note of connection arrangement for future reconnection. Alternatively refer to wiring diagrams section 14.**

3. Remove screws (20) and washers (21) and lift the top cover assembly (14) using a hoist and two chains.
4. Check o-rings (83), (121) and (22) for damage and replace if necessary.
5. Lubricate o-rings with oil before refitting.

**Fitting:**

1. Lower top cover until it sits on o-ring (22).
2. Refit screws and washers, and use torque gun to partially tighten down screws. Use criss-cross method and bring the screws down bit by bit. This will bring the top cover down evenly and avoid damaging the o-ring.
3. Refit inspection cover and gently tap into place with mallet.
4. Refit screws and washers.
5. Conduct pressure test to inspect for leakage through all sealed areas of top cover assembly (see section 3.1, steps 17 - 21).



## 8. Removal and fitting of base plate and screen

1. Remove top cover assembly (see section 7).
2. Remove screws (28), washers (28.1), discharge spigot (27) and o-ring (26).
3. Check o-ring (26) for damage and replace if necessary.
4. Fit two M20 swivel eyebolts to top of cooling jacket and two M20 to either side.
5. Lift the pump using a hoist and two chains attached to the top eyebolts.
6. Attach spreader bar to side eyebolts and raise pump until it rotates to horizontal.
7. Lower hoist and allow pump to rotate into upside down position.
8. Remove eyebolts and lower pump using spreader bar.

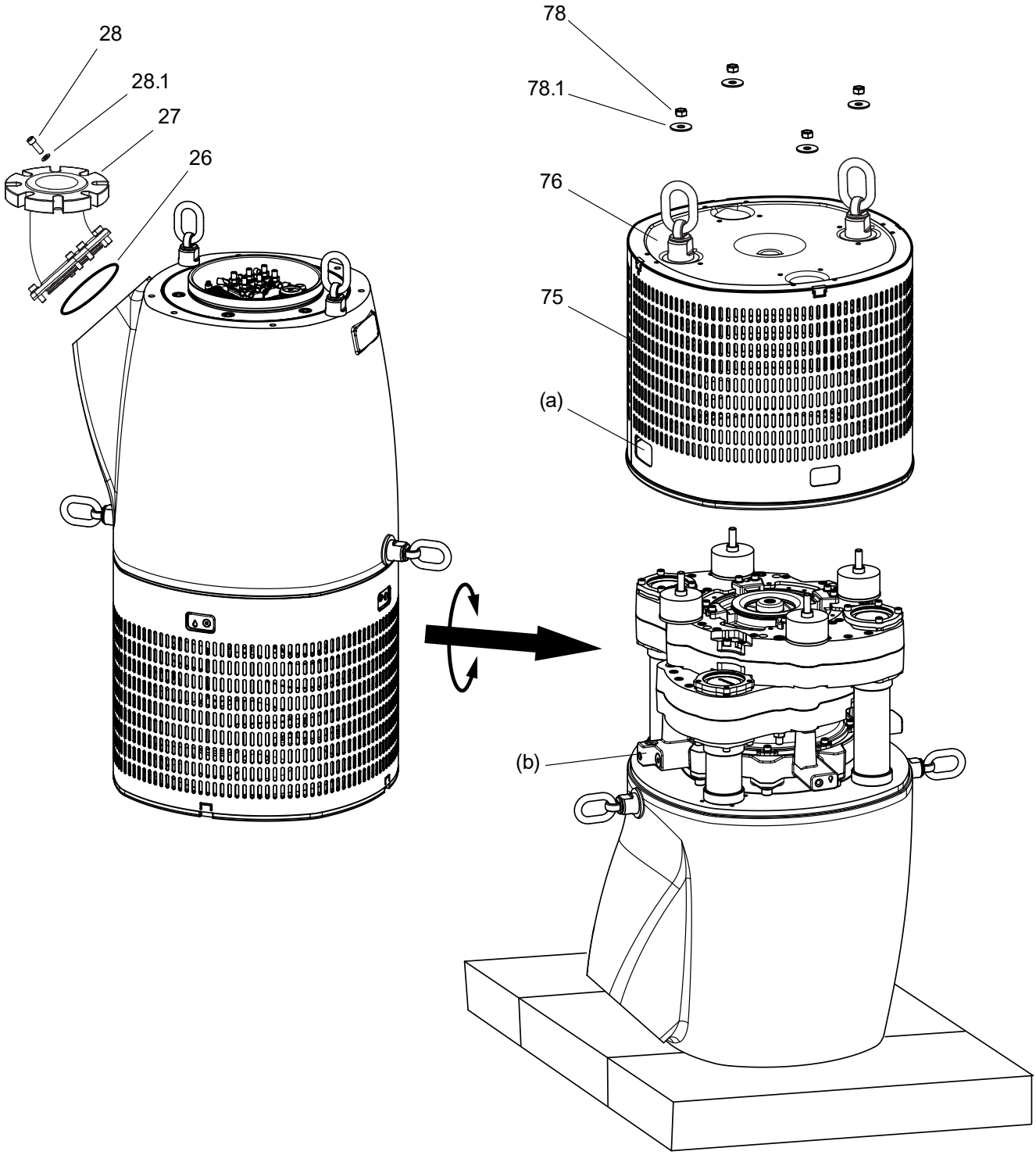
**ATTENTION: support the pump with an adequately dimensioned wooden frame that fits around the motor housing when placed under the cooling jacket. Do not stand the pump on the protruding rim of the motor housing as this would provide unstable support. In addition to this, when changing mechanical seals or bearings the motor housing would need to be removed and would no longer provide support.**

9. Remove nuts and washers (78 & 78.1).
10. Fit two M12 swivel eye bolts into base plate (76), and using two chains and hoist lift base plate and strainer (75) from cooling jacket.

**Refit in reverse sequence**.

**NOTES:**

- All o-rings should be lubricated before fitting.
- Ensure that the access ports (a) of the strainer line up with the oil and inspection plugs on the oil chamber (b).


28
28.1
27
26
78
78.1
76
75
(a)
(b)

## 9. Impeller and wear ring check and replace

1. Remove top cover assembly (see section 7).
2. Remove base plate and screen (see section 8).

**Lower impeller:**

1. Remove vibration damper assemblies (79) and stud bolts (77).
2. Remove screws (116.1) and pull suction bell (116) from volute (89B). **HD VERSION ONLY.**
3. Depending on how the parts detached, remove tube assemblies (113) from either bottom volute assembly (89B) or suction bell. **HD VERSION ONLY.**
4. Check o-rings (114.1) and (116.2) for damage and replace if necessary. If tube inserts (112) have detached then check also o-rings (114). **HD VERSION ONLY.**
5. Remove screws (73) and washers (73.1) from wear plate (72.1).
6. Lever out wear plate from volute.
7. Check o-ring (55) for damage and replace if necessary.
8. Check wear ring (72) for damage or wear. For optimum performance the difference between the internal diameter of the wear ring and the external diameter of the impeller inlet should not exceed 0.8 mm.
9. Remove screw (69) and impeller washer (68).
10. Remove impeller (97).

**Upper impeller:**

1. Remove nuts (74.1) and bolts (74).
2. Fit two M10 swivel eyebolts to bottom volute (89B) and lift from top volute assembly (89T).
3. Depending on how the parts detached, remove tube assemblies (111) from either bottom volute assembly (89B) or cooling jacket (25).
4. Check o-rings (114.1) for damage and replace if necessary. If tube inserts (112) have detached then check also o-rings (114).
5. Remove screws (58.1).
6. Remove intermediate piece (58) from top volute and shaft.
7. Remove intermediate wear bushing (72.2) and o-ring (55). Inspect for damage and replace if necessary. The difference between the internal diameter of the wear bushing and the external diameter of the impeller hub should not exceed 0.7 mm.
8. Lift impeller (67) from top volute.
9. Check wear ring (72) for damage or wear. For optimum performance the difference between the internal diameter of the wear ring and the external diameter of the impeller inlet should not exceed 0.8 mm.

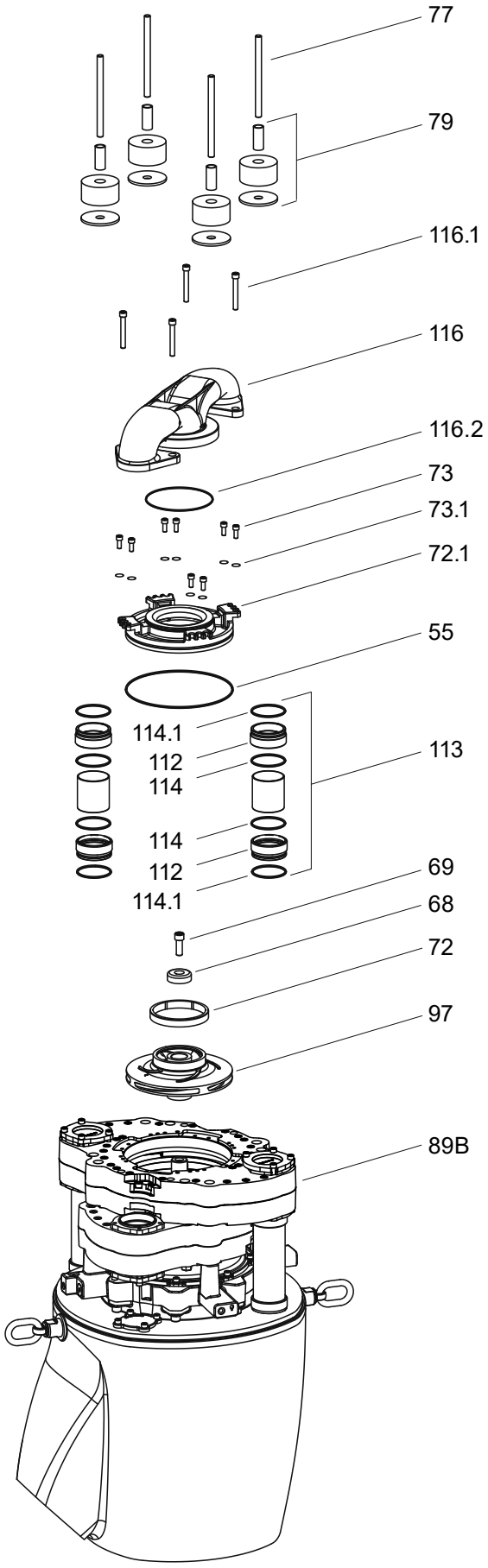
### Reassemble in reverse sequence.

**NOTES:**

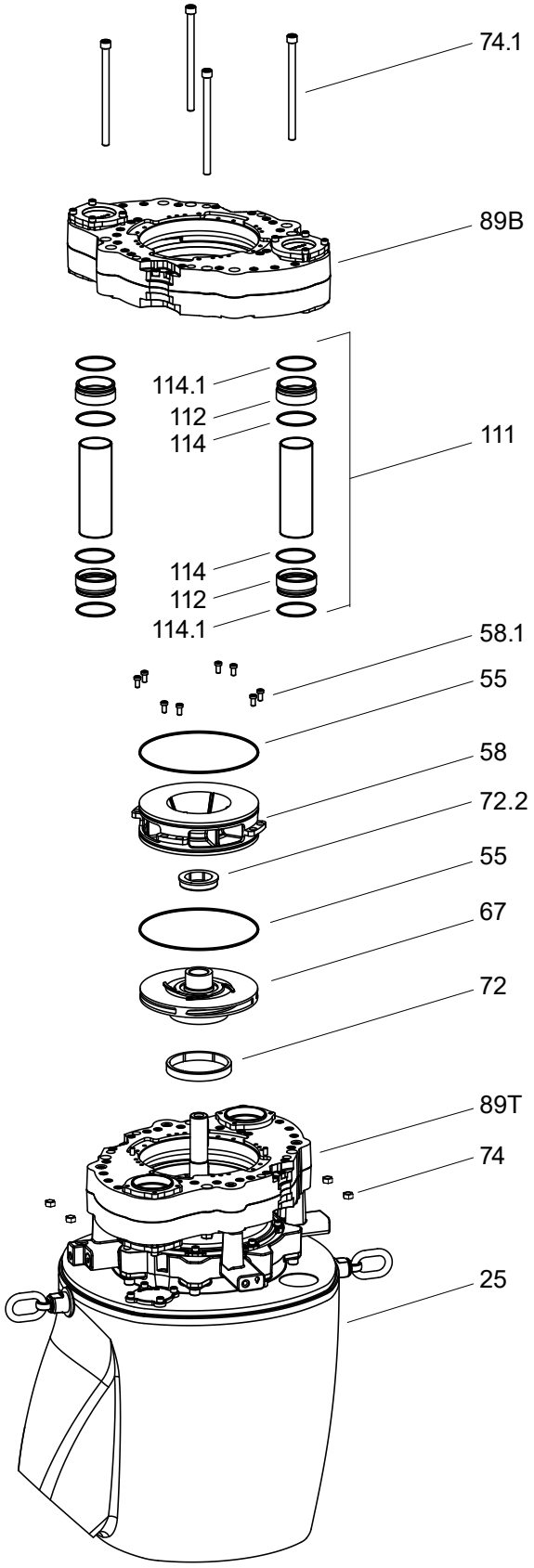
- All o-rings should be lubricated before fitting.
- When assembling, grease the inner face of the wear plates and outer face of the wear rings.
- Torque suction bell screws to 90 Nm (66.4 lb-ft).
- Torque impeller screw to 158 Nm (116.5 lb-ft).
- The centre slots on the wear plate lugs are surplus and unused.

Impellers may have sharp edges. To avoid injury wear protective gloves and handle with care!

**Lower impeller**




**Upper impeller**



## 10. Change mechanical seals, bearings, rotor shaft

### 10.1 Mechanical seals:

1. Drain oil from pump (see section 4.1).
2. Remove top cover assembly (see section 7).
3. Remove base plate and screen (see section 8).
4. Remove bottom volute and impellers (see section 9).
5. Remove screw (109.1), sleeve (109.2) and washer (109) to release top volute assembly (89T) from bearing housing (53).
6. Fit two M10 swivel eyebolts to top volute and lift from bearing housing.
7. Depending on how the parts detached, remove tube assemblies (113) from either top volute assembly or cooling jacket (25). **ND VERSION ONLY.**
8. Check o-rings (114.1) for damage and replace if necessary. If tube inserts (112) have detached then check also o-rings (114). **ND VERSION ONLY**.
9. Remove circlip (64).
10. Remove rotating part of primary mechanical seal (63) using two screwdrivers as levers against the rim of the opening to the oil chamber cover (65).
11. Remove screws (66) and washers (66.1).
12. Remove oil chamber cover from bearing housing and rotor shaft (42).
13. Check o-ring (65.1) for damage and replace if necessary.
14. Prise out stationary part of primary mechanical seal from oil chamber cover.
15. Remove circlip (60).
16. Remove rotating part of secondary mechanical seal (59).

**Note:** stationary part of secondary seal cannot be removed until after disassembly of bearing housing and rotor shaft. Follow instructions 10.2 Bearings,steps 1 - 10).

**Refit seals in reverse sequence.**

**NOTES:**

- All o-rings should be lubricated before fitting.
- Ensure circlips are correctly fitted into shaft grooves.

**Mechanical seals:**

- Use tools (sections 18.1 - 18.4) to press mechanical seals into place.
- Lubricate the mechanical seal seat with P80 lubricant*.
- Fit stationary part of mechanical seal into seal seat with polished seal surface facing outwards.
- Clean seal surface with paper towel and brush with oil.

**Note:** ensure that working edge of seal press tool is clean so as not to contaminate or damage seal surface.

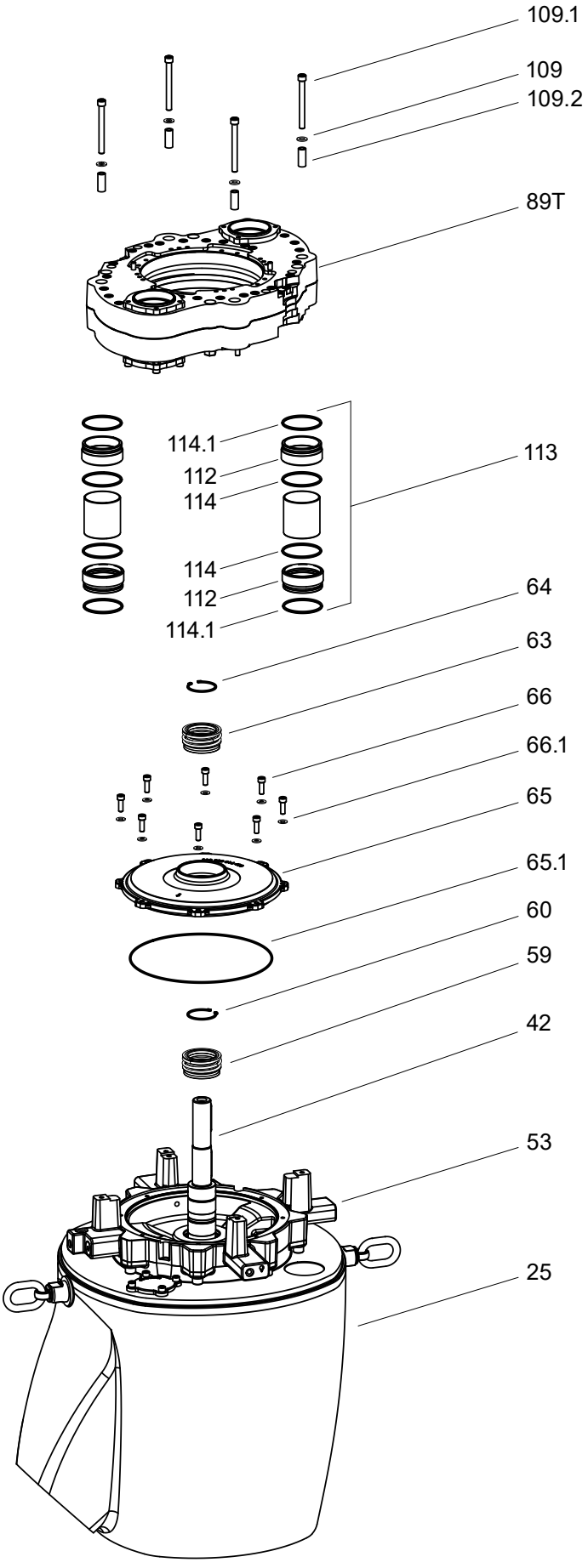
- Lubricate shaft and inside rubber bellow of rotating part of mechanical seal with P-80.
- Place rotating part of seal over shaft, ensuring polished seal surface is facing inwards (to meet with same on stationary part).

*P-80 is a temporary lubricant that dries and returns the lubricated parts to their original condition. It is designed only to aid assembly of rubber parts.

DO NOT use any other synthetic lubricant or oil where P-80 is specified that would leave a residue and prevent the correct functioning of the parts to which it is applied.

**Tip:** if P-80 is not available, a soluble mix of 1 part detergent to 1000 parts water can be used as a substitute.

**ENSURE WORK AREA AND TOOLS ARE CLEAN**


109.1
109
109.2
89T
114.1
112
114
113
114
112
114.1
64
63
66
66.1
65
65.1
60
59
42
53
25

## 10.2 Bearings:

1. Using hoist rotate pump to stand on bearing housing.

**ATTENTION: support the bearing housing on a platform or bench that will accomodate the protruding rotor shaft.**

2. Remove screws (23) to release cooling jacket from motor housing (36).
3. Remove screws (131) and bearing clamp cover (130).
4. Tap out bearing cover (103) and remove support washer (129).
5. Remove screws (131) and bearing clamp cover (130).
6. 4. Tap out bearing cover (103) and remove support washer (129).
7. Fit two M20 swivel eyebolts to cooling jacket and lift from motor housing with hoist.
8. Check o-rings (121 x 3), (35) and (45) for damage and replace if necessary.
9. Remove screws (37) and washers (37.1) to release motor housing from bearing housing.
10. Fit two M16 swivel eyebolts to motor housing and lift slowly to separate it from the bearing housing, but only enough to have access to terminal block (106).
11. Disconnect blue sensor leads, D2, D3, F7, F6 from terminal block, and two black temperature sensor leads if fitted.

**ATTENTION: take note of connection arrangement for future reconnection. Alternatively refer to wiring diagrams section 14.**

12. Lift motor housing completely from bearing housing and check o-ring (52) for damage. Replace if necessary
13. Remove nuts (104.2) from from bearing housing clamp (104).
14. Fit M16 swivel eyebolt to end of rotor shaft and lift shaft slowly from bearing housing.

**ATTENTION: take care not to damage the temperature sensor leads when they are pulled through the hole in the bearing housing clamp.**

### Lower bearing (46)

**Removal:**

1. Remove circlip (48).
2. Pull bearing from shaft using bearing pullers.

**Fitting:**

1. Fill new bearing with white grease and heat to 120 ºC (248 ºF) before sliding into place on shaft and securing in place with circlip.

### Upper bearing (41)

**Removal:**

1. Pull inner race from shaft using bearing pullers.
2. Remove terminal block (31) from motor housing.
3. Tap out bearing cover (103).
4. Remove outer race from bearing housing.

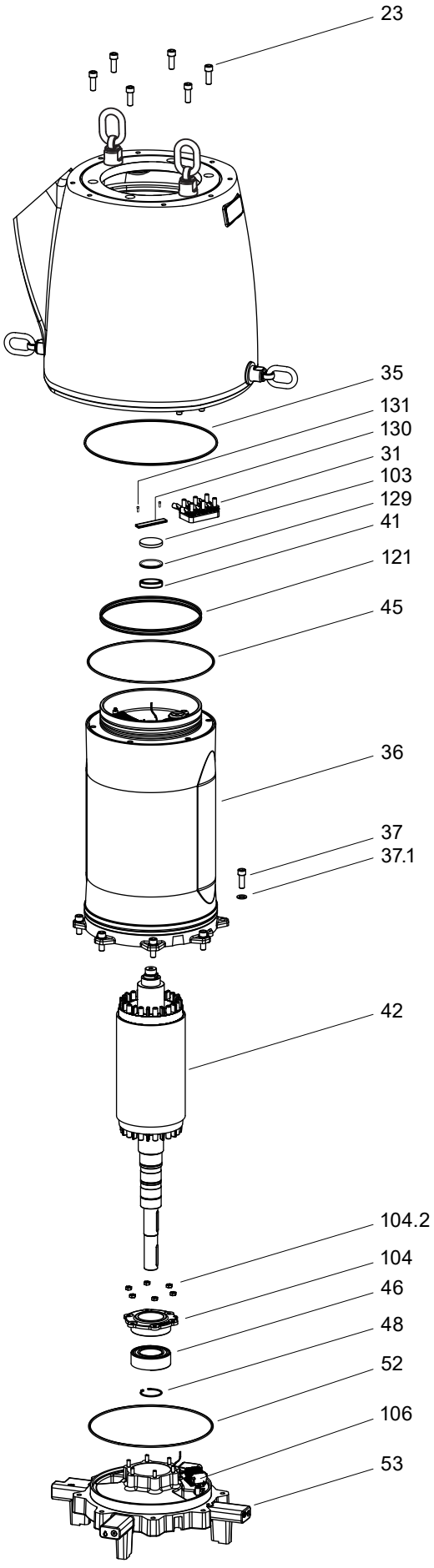
**Fitting:**

1. Heat inner race to 120 ºC (248 ºF) before sliding into place on shaft.
2. Fill the bearing seat in the motor housing with white grease and push in outer race.
3. Spread grease around top of bearing.
4. Refit bearing cover and terminal block.

## Reassemble pump in reverse sequence.

**NOTES:**

- Before separating volutes, bearing housing, motor housing and cooling jacket leave guide marks to aid alignment when reassembling.
- Line up the cast arrow on the oil chamber cover with the cast arrow on the underside of the bearing housing.
- Pressure test the oil chamber through the oil fill port at 0.5 bar and refill with 4.8 L oil.
- Take care to feed the temperature sensor leads through the hole in the bearing housing clamp before attaching clamp to the bearing housing.
- All o-rings should be lubricated before fitting.
- Ensure circlips are correctly fitted into shaft grooves.


23
35
131
130
31
103
129
41
121
45
36
37
37.1
42
104.2
104
46
48
52
106
53

## 11. Convert HD to ND

### Conversion Kit: 00833913

**Stage 1:**

1. Remove top cover assembly (see section 7).
2. Remove base plate and screen (see section 8).
3. Remove vibration damper assemblies (79) and stud bolts (77).
4. Remove screws (116.1), pull suction bell (116) from volute (89B) and discard.
5. Remove and discard o-ring (116.2) from wear plate (72.1).
6. Remove and discard tube assemblies (113 HD).
7. Remove screws (102.2), cover caps (102) and o-rings (102.1) from cooling jacket (25).
8. Remove nuts (74.1) and bolts (74).
9. Fit two M10 swivel eyebolts to bottom volute (89B) and lift from top volute assembly (89T).
10. Depending on how the parts detached, remove tube assemblies (111) from either bottom volute assembly (89B) or cooling jacket (25).
11. Check o-rings (114.1) for damage and replace if necessary. If tube inserts (112) have detached then check also o-rings (114).

**ATTENTION: larger o-ring fits on the inside of tube insert and smaller o-ring on the outside.**

12. Remove screw (69) and impeller washer (68).
13. Remove impeller (97).

**Stage 2:**

1. Remove screws (109.1), sleeves (109.2) and washers (109) to release top volute assembly (89T) from bearing housing (53).
2. Fit two M10 swivel eyebolts to top volute and lift from bearing housing.
3. Remove screws (107.1),flow elbow holders (122) and (115), and o-rings (115.1).
4. Check o-rings for damage and replace if necessary.
5. Remove flow elbows (107) from volute and reinsert from the opposite side.
6. Refit flow elbow holders to secure flow elbows.

**ATTENTION: the screws and holders must be fitted from the same sides of the volute as before, but the o-rings must be transferred to the holders now at the open ends of the elbows.**

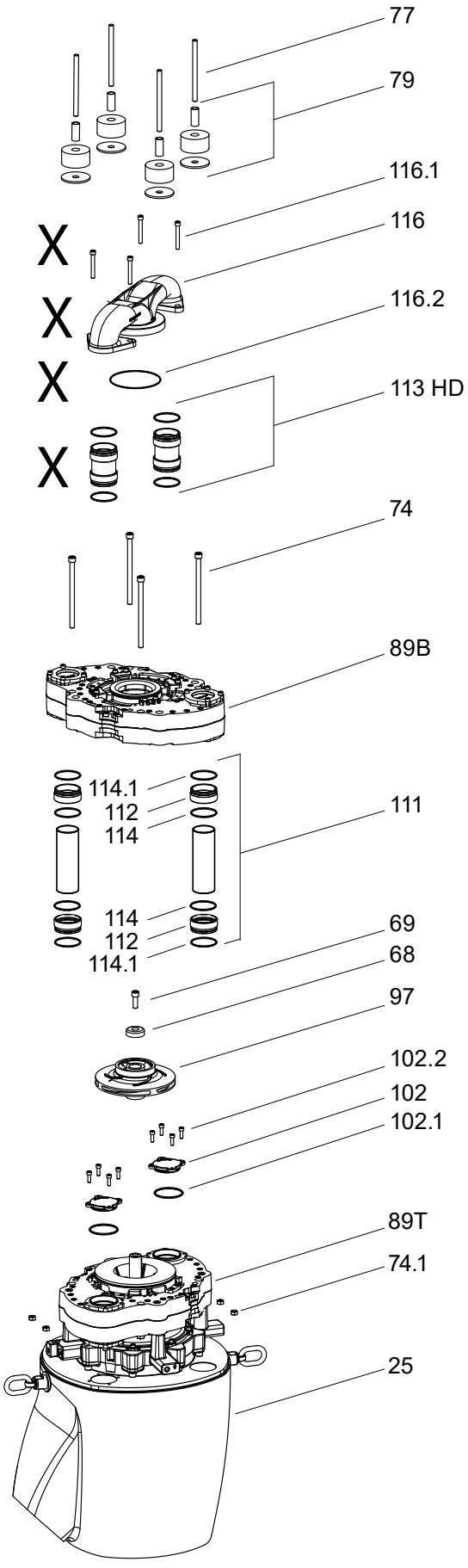
7. Assemble tube inserts (113 ND) from the conversion kit and fit into cooling jacket where cover caps were removed.
8. Refit tube assemblies (111) into cooling jacket.

### Reassemble volutes and pump in reverse sequence.

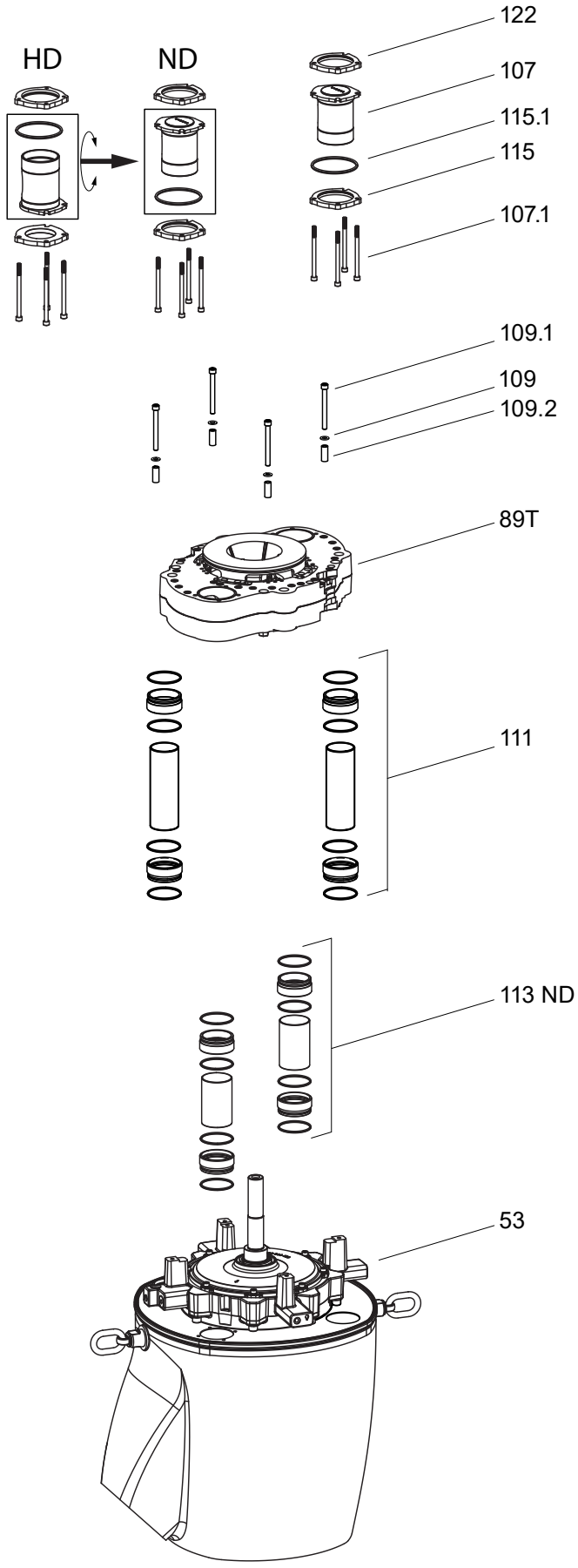
**NOTES:**

- Before separating volutes from each other and bearing housing, leave guide marks to ensure correct alignment when reassembling.
- All o-rings should be greased before fitting.
- Fit discharge spigot DN150 [6"] from conversion kit after pump has been fully reassembled.
- Torque impeller screw to 158 Nm (116.5 lb-ft).

**Stage 1**




**Stage 2**



## 12. Convert ND to HD

### Conversion Kit: 00833912

**Stage 1:**

1. Remove top cover assembly (see section 7).
2. Remove base plate and screen (see section 8).
3. Remove vibration damper assemblies (79) and stud bolts (77).
4. Remove nuts (74.1) and bolts (74).
5. Fit two M10 swivel eyebolts to bottom volute (89B) and lift from top volute assembly (89T).
6. Depending on how the parts detached, remove tube assemblies (111) from either bottom volute assembly (89B) or cooling jacket (25).
7. Check o-rings (114.1) for damage and replace if necessary. If tube inserts (112) have detached then check also o-rings (114).

**ATTENTION: larger o-ring fits on the inside of tube insert and smaller o-ring on the outside.**

8. Remove screw (69) and impeller washer (68).
9. Remove impeller (97).

**Stage 2:**

1. Remove screws (109.1), sleeves (109.2) and washers (109) to release top volute assembly (89T) from bearing housing (53).
2. Fit two M10 swivel eyebolts to top volute and lift from bearing housing.
3. Remove and discard tube assemblies (113 ND).
4. Remove screws (107.1).
5. Remove flow elbow holders (122).
6. Remove flow elbow holders (115) and o-rings (115.1). Check o-rings for damage and replace if necessary.
7. Remove flow elbows (107) from volute and reinsert from the opposite side.
8. Refit flow elbow holders and o-rings to secure the flow elbow.

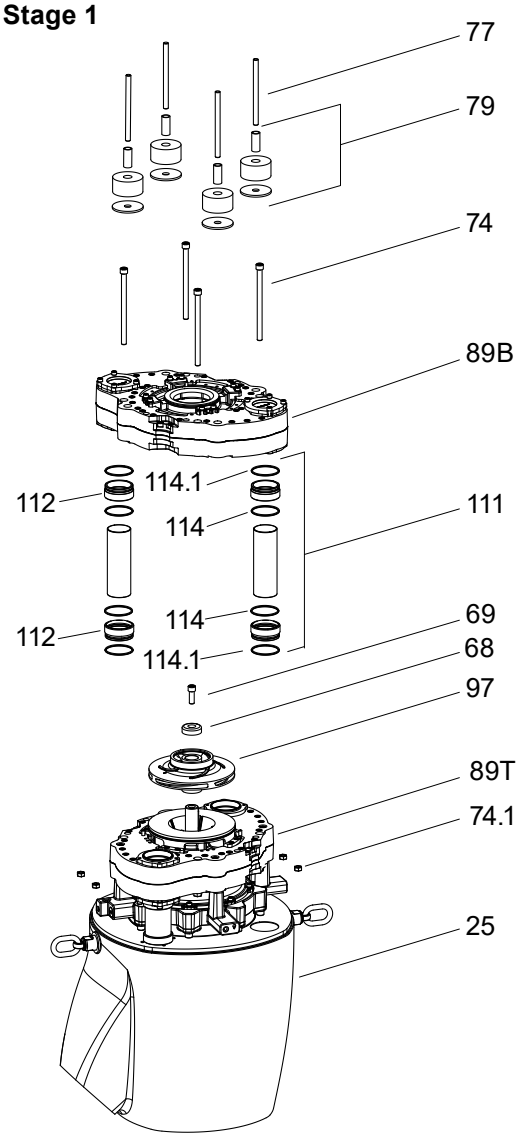
**ATTENTION: the screws and holders must be fitted from the same sides of the volute as before, but the o-rings must be transferred to the holders now at the open ends of the elbows.**

9. Fit cover caps (102) and o-rings (102.1) to cooling jacket where tube assemblies (113 ND) were removed. Secure with screws (102.2).
10. Lift top volute assembly into place on bearing housing and secure in place with screws, sleeves and washers.
11. Refit lower impeller and secure in place with impeller screw and washer.
12. Put the tube inserts (112) from tube assembly (113 HD), with the o-rings fitted and greased, into the flow elbows in the top volute.
13. Refit tube assemblies (111) into cooling jacket.
14. Lift bottom volute into place on top volute and tube assembly (111).
15. Refit nuts (74.1) and bolts (74) to secure top and bottom volutes together.
16. Assemble remainder of tube assembly (113HD) and fit into tube inserts that are already assembled to the top volute.
17. Fit o-ring (116.2) to wear plate (72.1).
18. Fit suction bell (116) to wear plate and tube assemblies.
19. Secure in place with screws (116.1).
20. Refit vibration damper assemblies (79) and stud bolts (77).
21. Refit base plate and screen (see section 6).
22. Refit top cover assembly (see section 5).

**NOTES:**

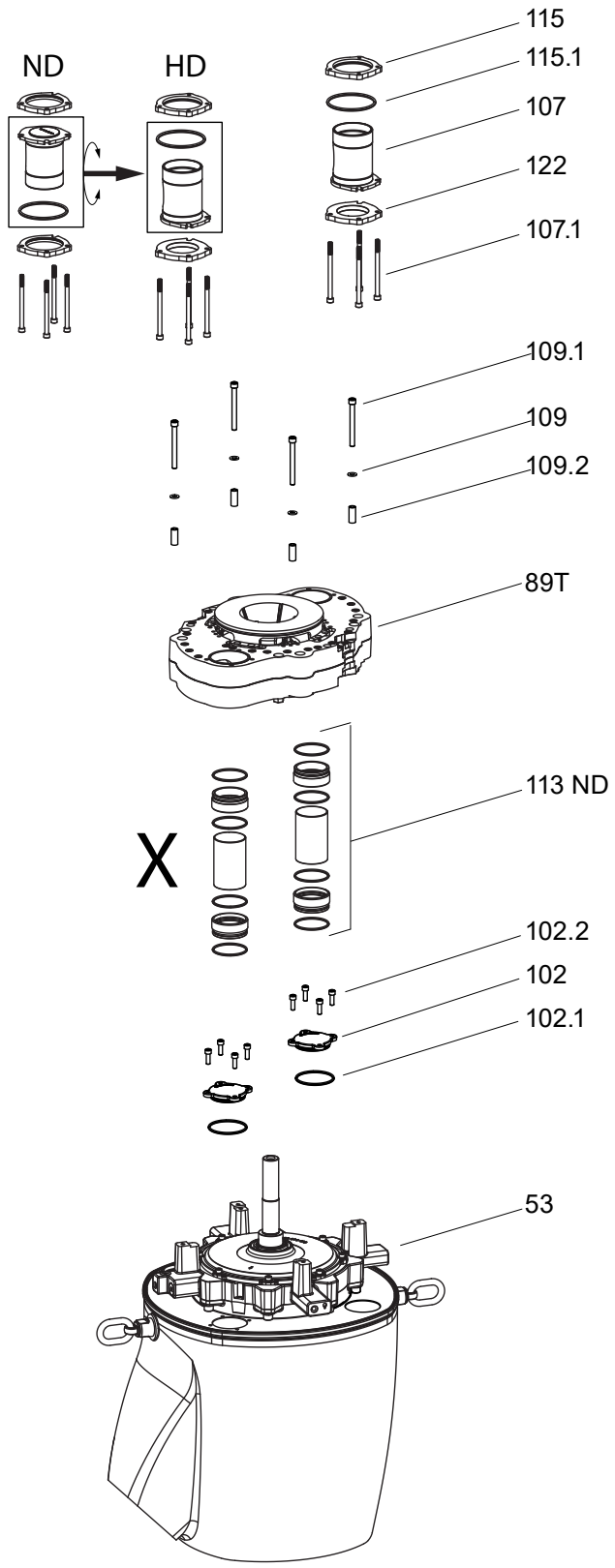
- Before separating volutes from each other and bearing housing, leave guide marks to ensure correct alignment when reassembling.
- All o-rings should be greased before fitting.
- Fit discharge spigot DN100 [4"] from conversion kit after pump has been fully reassembled.
- Torque suction bell screws to 90 Nm (66.4 lb-ft).
- Torque impeller screw to 158 Nm (116.5 lb-ft).

**Stage 1**

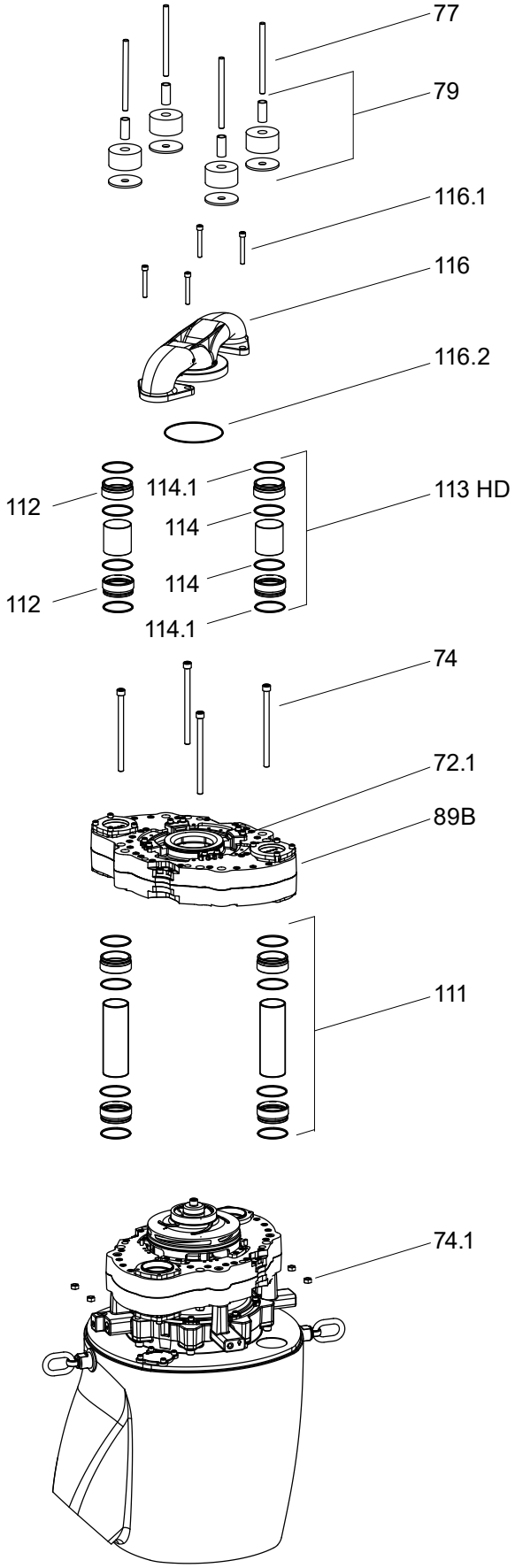


**Stage 2.**

Steps 1 - 9.




Steps 10 - 20.



## 13. Change stator

**Removal:**

**NOTE: the stator is held in by a compression fit only, so therefore it can only be removed by pulling it out by force.**

1. Remove top cover assembly (see section 7).
2. Remove screws (23) to release cooling jacket (25) from motor housing (36).
3. Fit two M20 swivel eyebolts to cooling jacket and lift from motor housing with hoist.
4. Check o-rings (121), (35) and (45) for damage and replace if necessary.
5. Remove screws (37) and washers (37.1) to release motor housing from bearing housing.
6. Fit two M16 swivel eyebolts to motor housing and lift slowly to separate it from the bearing housing, but only enough to have access to terminal block (106).
7. Disconnect blue sensor leads, D2, D3, F7, F6 from terminal block (and two black temperature sensor leads if fitted).
8. Disconnect power and sensor leads from terminal blocks (31.2) and (31.3).

**ATTENTION: take note of connection arrangement for future reconnection. Alternatively refer to wiring diagrams section 14.**

9. Remove cable glands and seals (19) from power and sensor leads and top end of motor housing.

**ATTENTION: take note of exit holes assigned to control and sensor leads.**

10. Sensor leads can now be pulled clear through the channel between the stator and motor housing .

**ATTENTION: take care not to damage the insulation on the leads when pulling clear.**

11. Lift motor housing completely from bearing housing and check o-ring (52) for damage. Replace if necessary.
12. Remove terminal block, screws (131), bearing clamp cover (130), bearing cover (103), support washer (129) and remove outer race of bearing (41) from motor housing.
13. Remove terminal block, bearing cap (103) and outer race of bearing (41) from motor housing.
14. Check bearing for damage and replace if necessary.
15. Using stator extraction tool apply pressure while simultaneously heating the motor housing until the stator begins to pull free.

**NOTE:** heat and pressure must be applied at the same time as it ensures that the stator releases as the motor housing expands but before the stator itself expands.

**Fitting:**

1. Rotate motor housing and stand it on its upper end.
2. Lift stator with the lead end to the bottom.
3. Line up the leads with the exit holes at the upper end of the motor housing.
4. Lower the stator carefully into the motor housing, keeping the stator square as it is being lowered, and until it reaches the stopping point.
5. Attach two swivel eyebolts to stator press tool (section 17.8) and carefully, without making contact with stator windings, lower into position on stator laminations.

**ATTENTION: line up the slots on the leading edge of the stator press tool with the staples of the stator. This ensures that pressure is on the laminations only and the stator core is not damaged.**

6. Attach adequate lifting slings around motor housing underneath the lugs, and with a hoist lift into position under hydraulic press.
7. Press in stator until fully home (when top plate of press tool is pressed against motor housing).

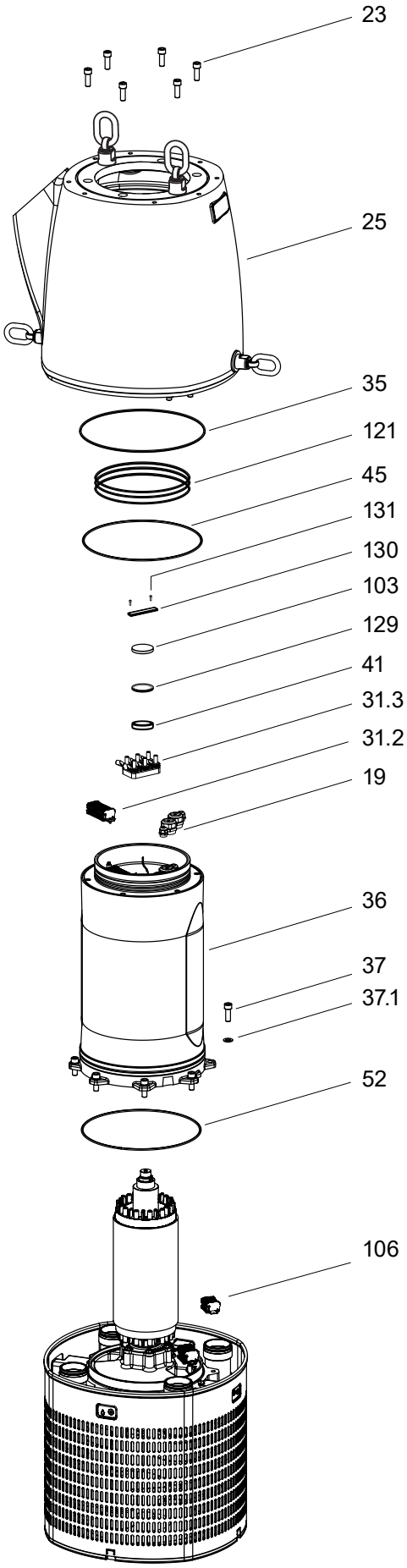
**ATTENTION**: **refitting of stator can only be done by means of a heavy hydraulic press and insertion tool. A pressure of min.70 bar and max.100 is required. Motorhousing must be square to hydraulic ram when the stator is being pressed in.**

8. Remove press tool and lay motor housing on it's side.
9. A hook must now be used to pull the stator leads through the exit holes that were noted previously.
10. Feed blue sensor leads back through the channel between stator and motor housing, leaving the same length as temperature sensor leads at top, and approx 500 mm at open end of motor housing.
11. Secure leads by refitting cable seals and glands.
12. If replacing upper bearing remove inner race from shaft using bearing pullers.
13. Heat replacement inner race to 120 ºC (248 ºF) before sliding into place on shaft.
14. Refit swivel eyebolts and lower motor housing over rotor shaft until sensor leads are in reach of terminal block.
15. Reconnect sensor leads.
16. Lower motor housing fully into place and secure with screws (small untapped lug should be lined up with arrow engraved into bearing housing).

17. Fill the bearing seat in the motor housing with white grease and push in outer race of the upper bearing.
18. Spread grease around top of bearing.
19. Refit bearing cover and terminal block.
20. Reconnect power and sensor leads to terminal block.
21. Refit cooling jacket.
22. Refit top cover (see section 7).

**NOTES:**

- Before separating cooling jacket and motor and bearing housings leave guide marks to ensure correct alignment when reassembling.
- All o-rings should be greased before fitting.



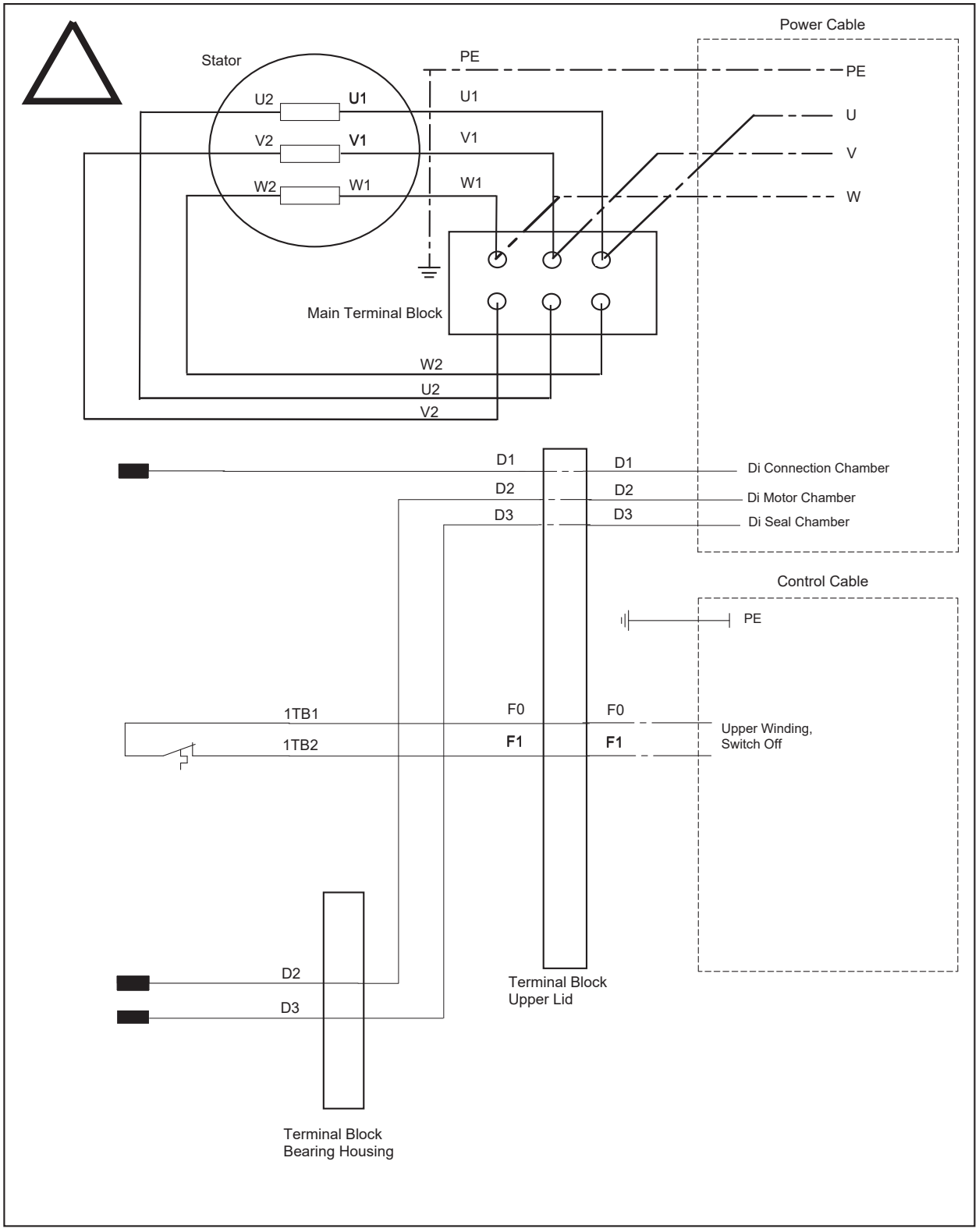
# 14. Wiring diagrams

## 14.1 NSSHOEU power cable, H07RN-F control cable

DOL / Δ. Bimetallic thermal sensors in stator.

400 V, 500 V 50 Hz.

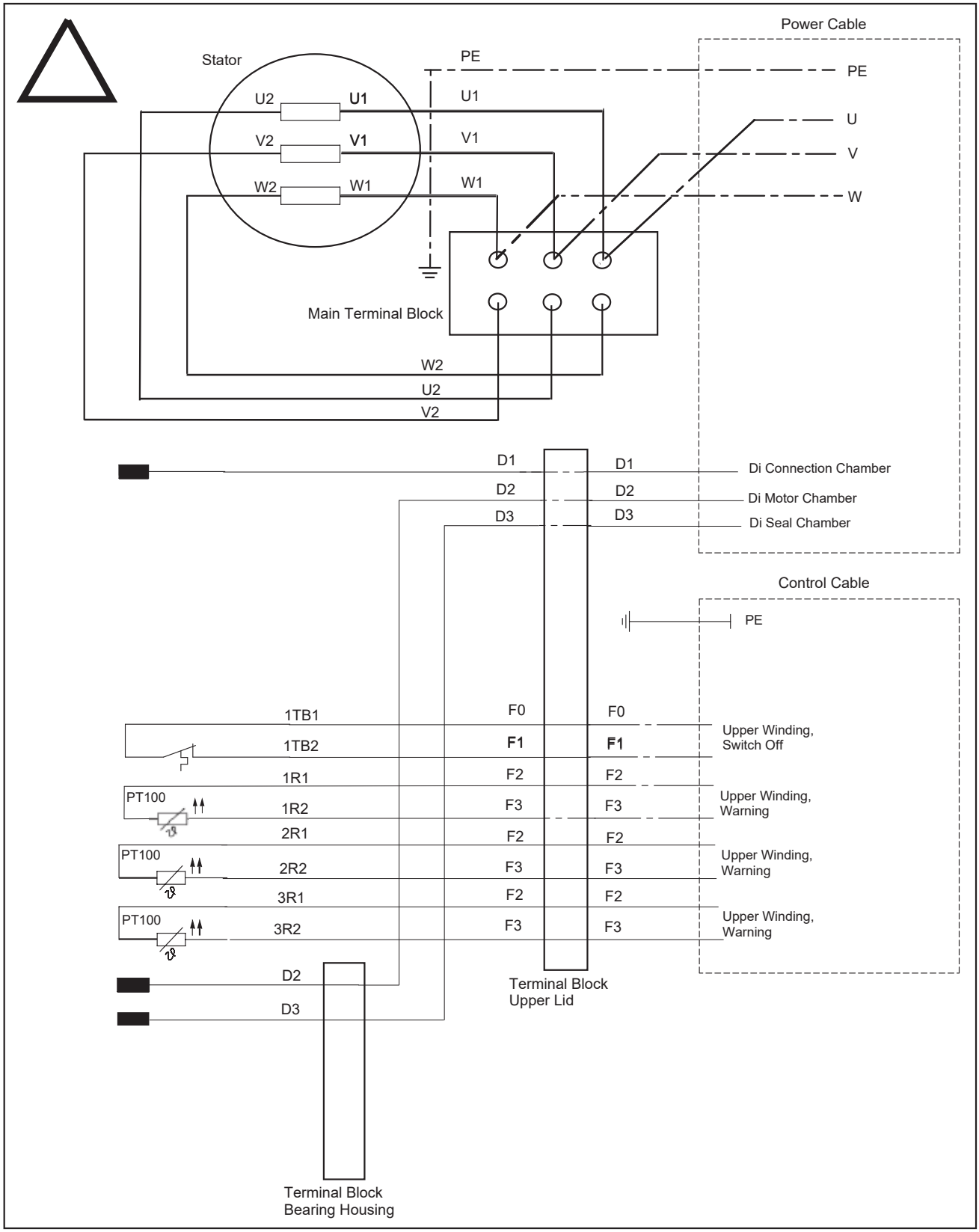
380 V, 460 V 60 Hz.



DOL / Δ. Bimetallic thermal sensors and PT100 in stator.

400 V, 500 V 50 Hz.

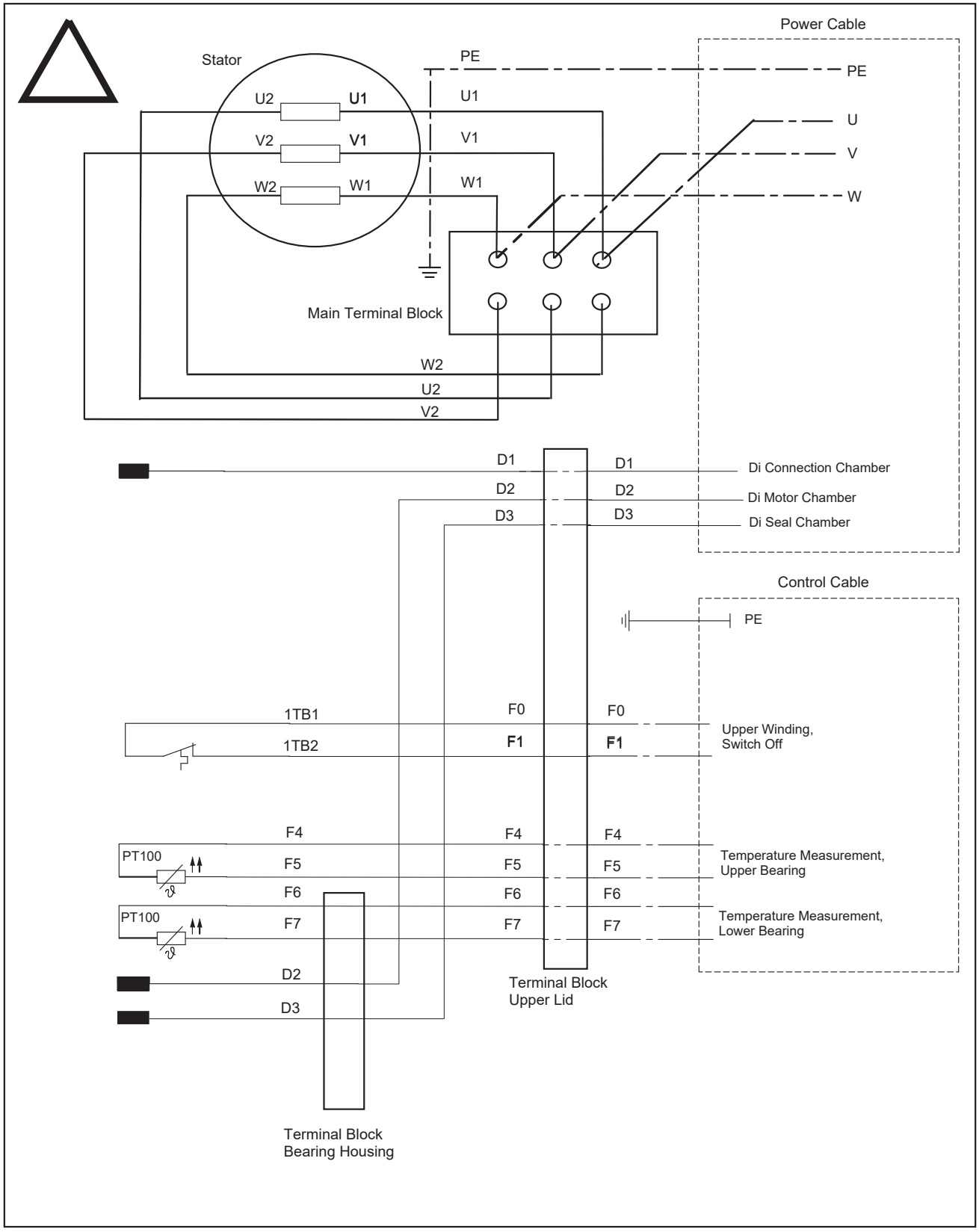
380 V, 460 V 60 Hz.



DOL / Δ. Bimetallic thermal sensors in stator. PT100 temperature monitoring of bearings.

400 V, 500 V 50 Hz.

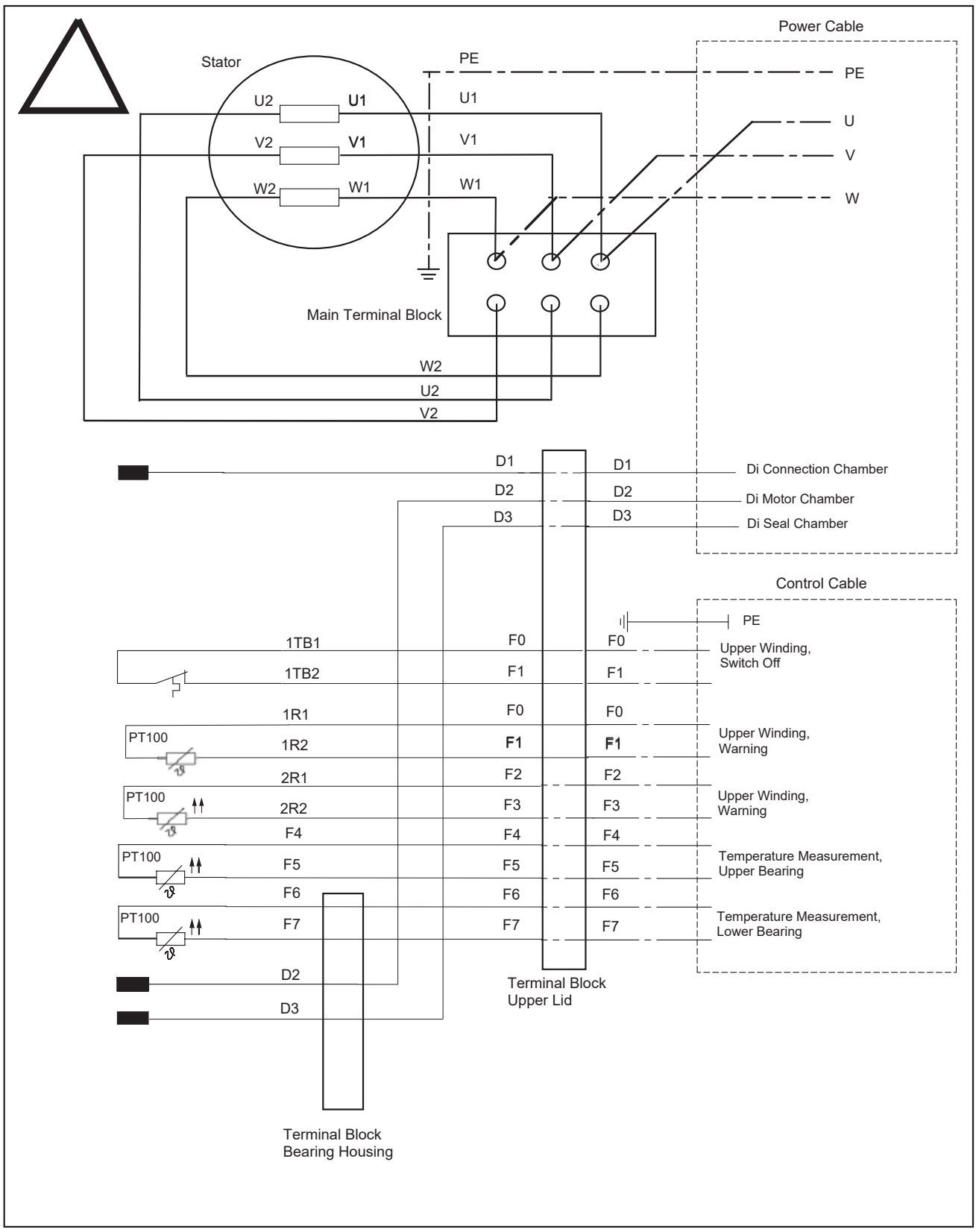
380 V, 460 V 60 Hz.



DOL / Δ. Bimetallic thermal sensors and PT100 in stator. PT100 temperature monitoring of bearings.

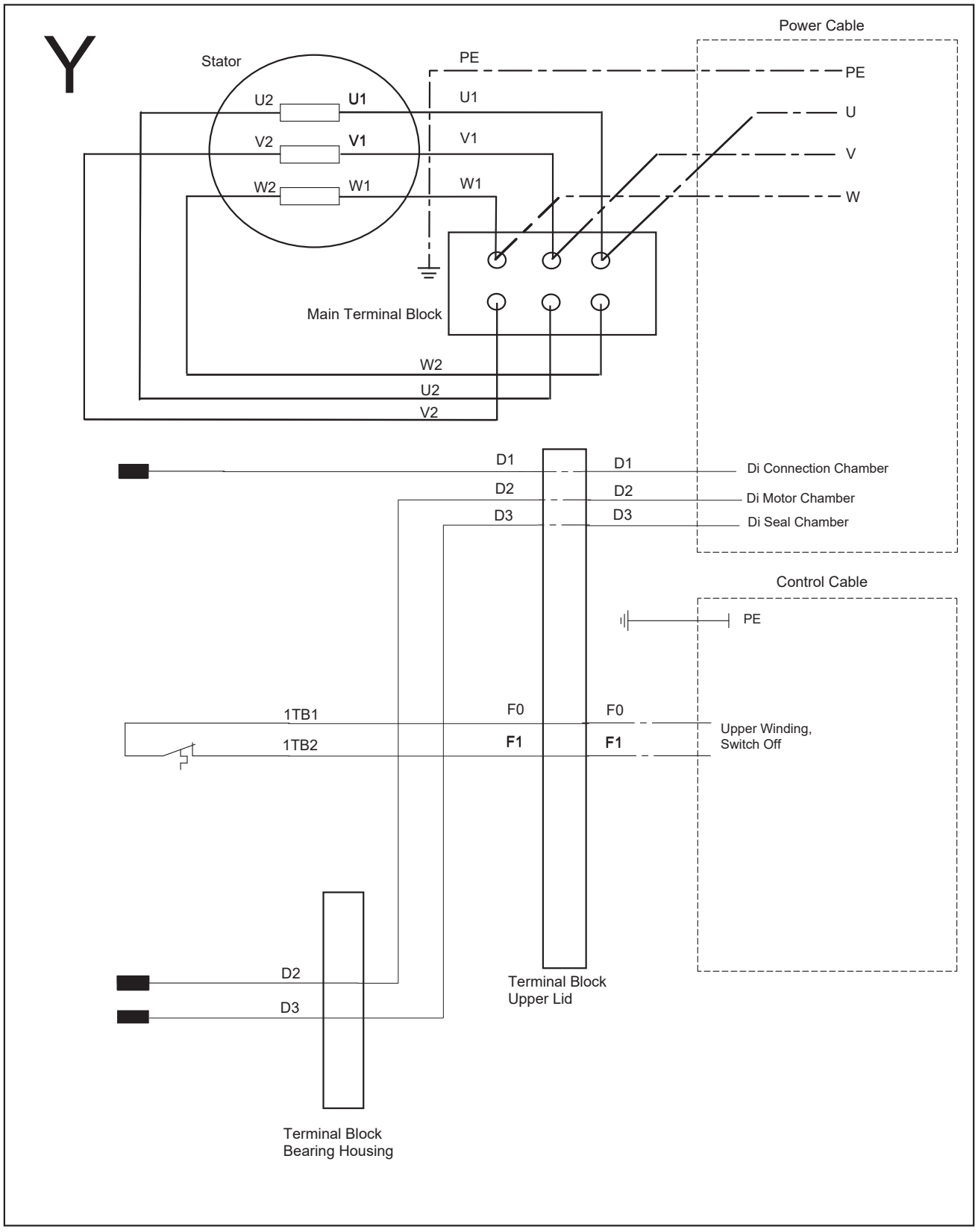
400 V, 500 V 50 Hz.

380 V, 460 V 60 Hz.



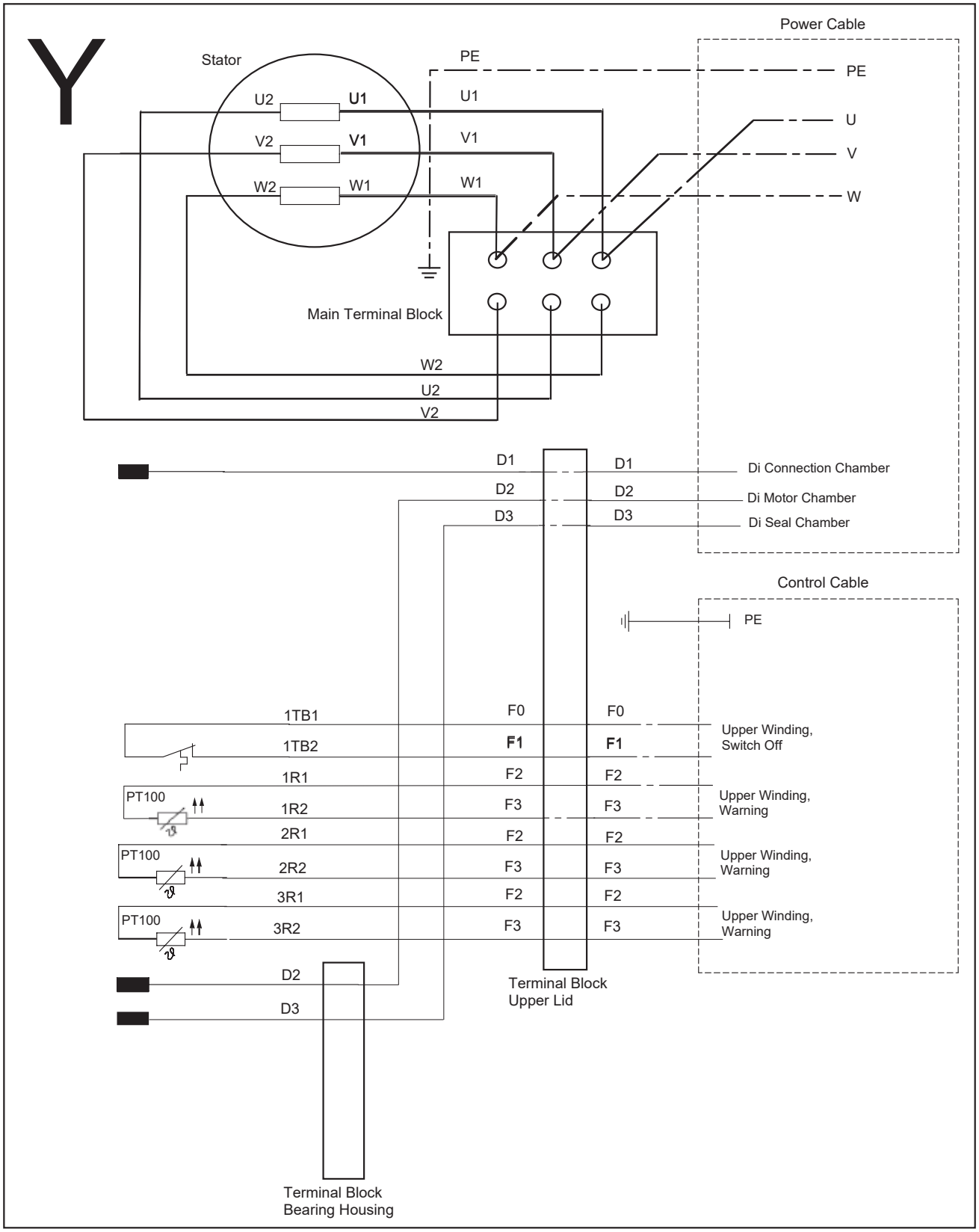
DOL / Y. Bimetallic thermal sensors in stator.

690 V, 1000 V 50 Hz.



DOL / Y. Bimetallic thermal sensors and PT100 in stator.

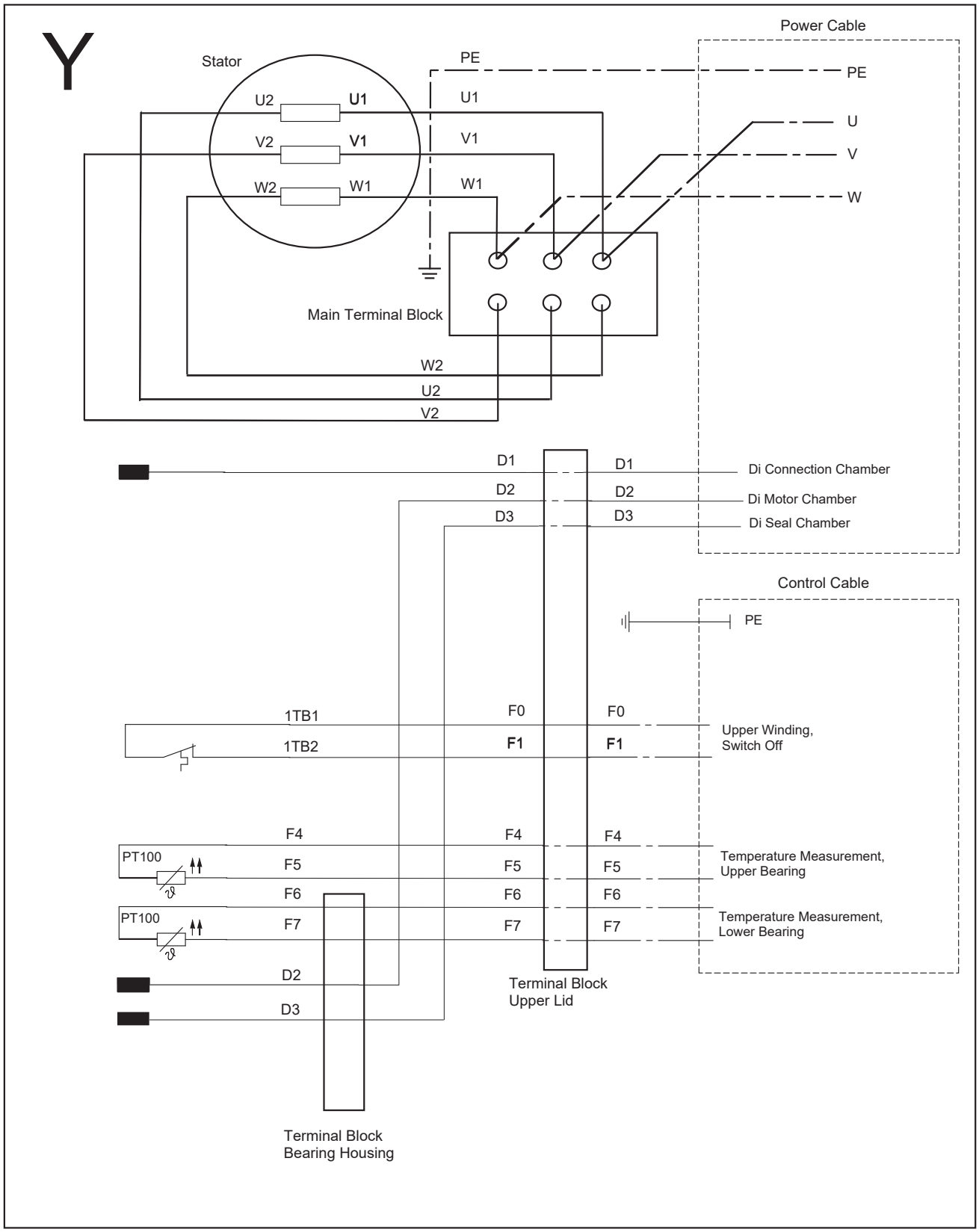
690 V, 1000 V 50 Hz.




.

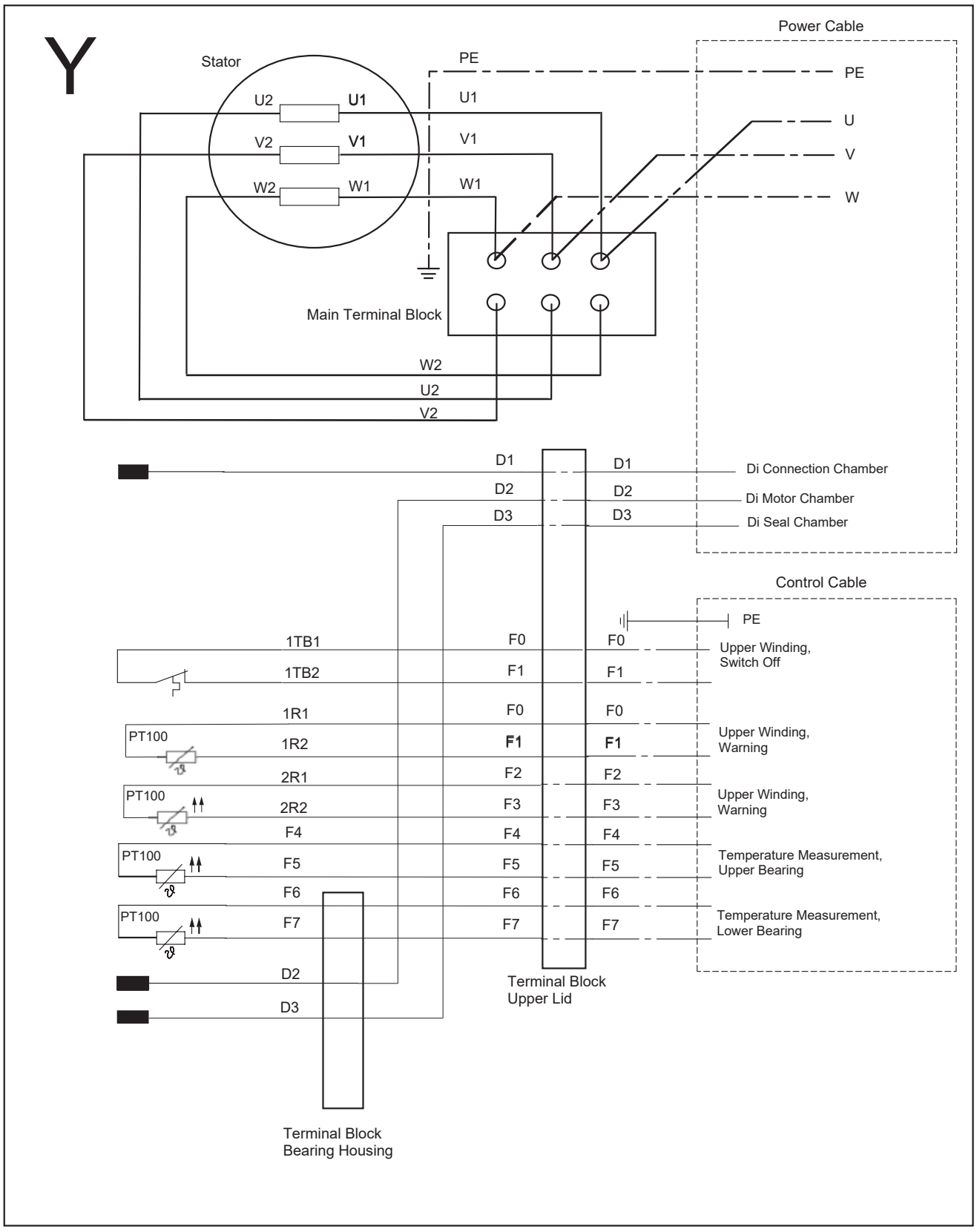
DOL / Y. Bimetallic thermal sensors in stator. PT100 temperature monitoring of bearings.

690 V, 1000 V 50 Hz.



DOL / Y. Bimetallic thermal sensors and PT100 in stator. PT100 temperature monitoring of bearings.

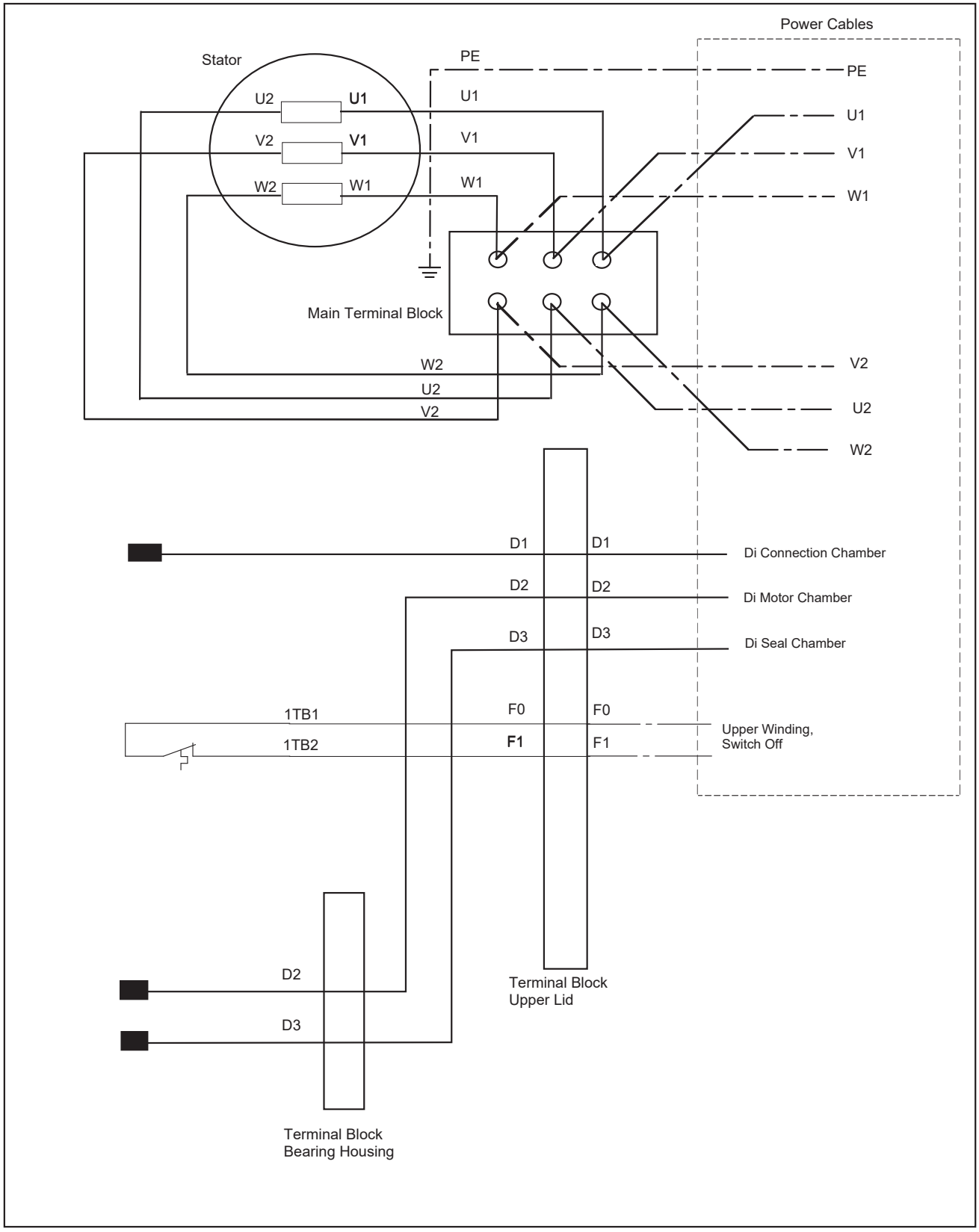
690 V, 1000 V 50 Hz.



Y Δ. Bimetallic thermal sensors in stator.

400 V, 500 V 50 Hz.

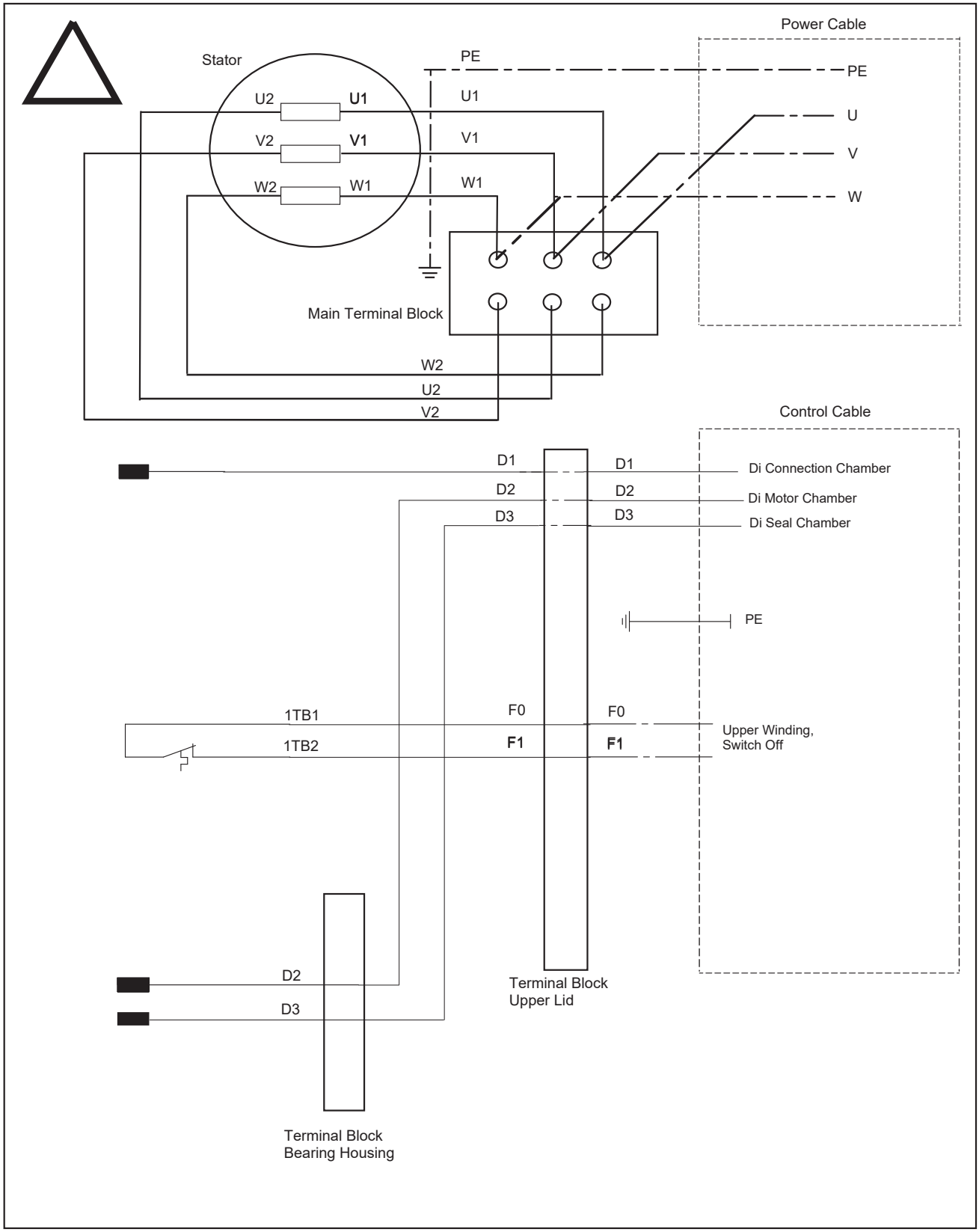
380 V, 460 V 60 Hz.



## 14.2 AWG power cable, SOOW control cable

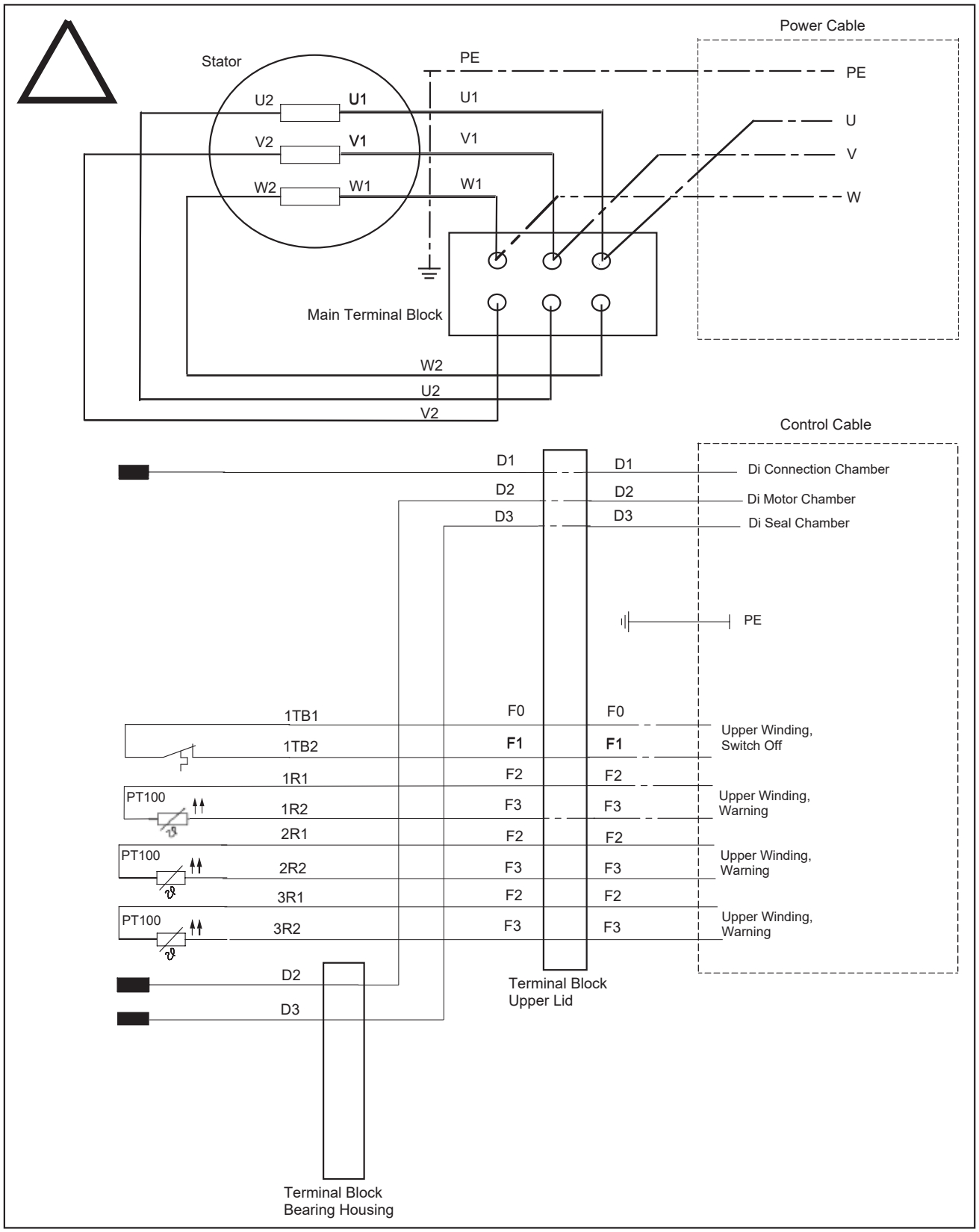
DOL / Δ Bimetallic thermal sensors in stator.

380 V, 460 V, 575 V 60 Hz



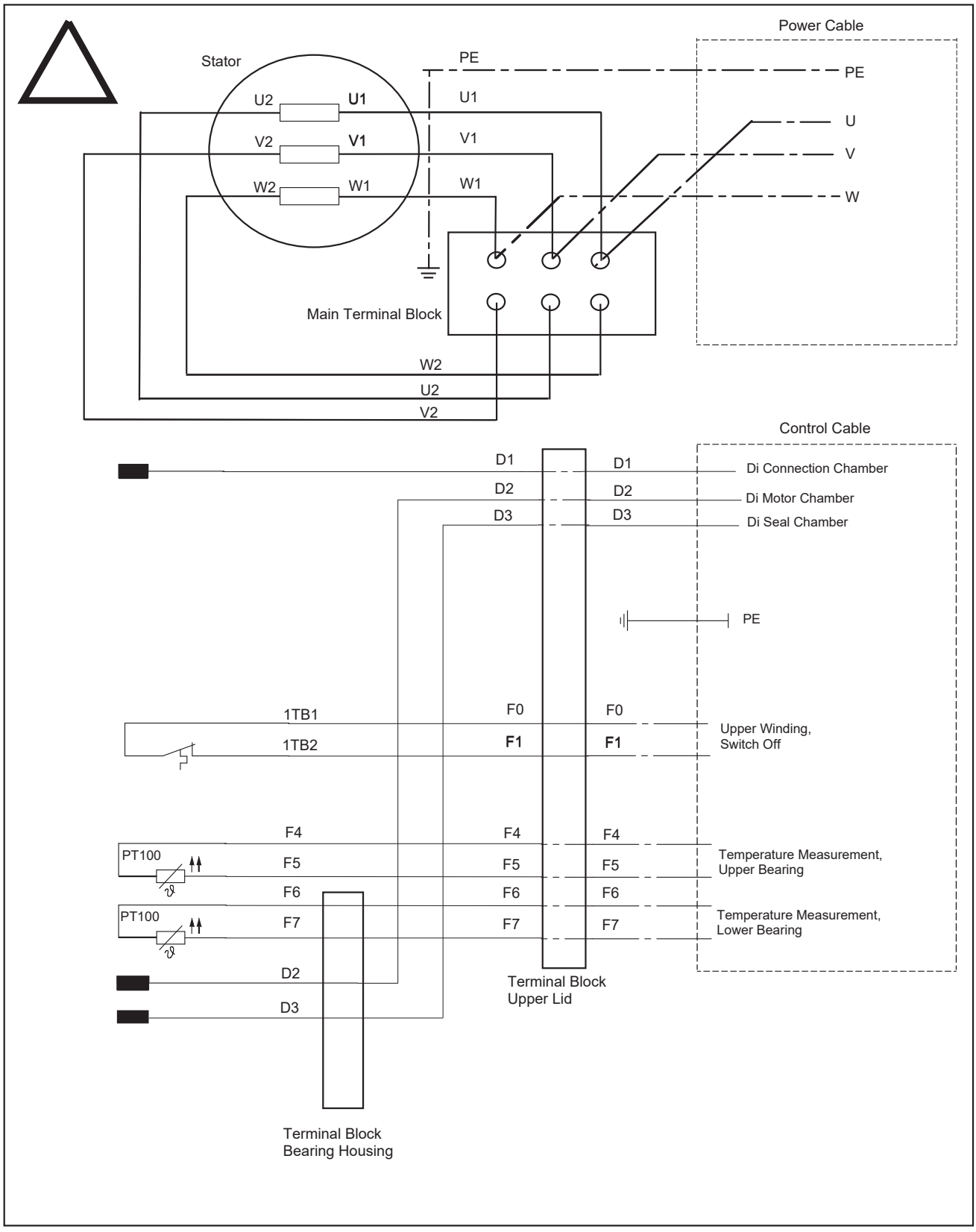
DOL / Δ. Bimetallic thermal sensors and PT100 in stator.

380 V, 460 V, 575 V 60 Hz



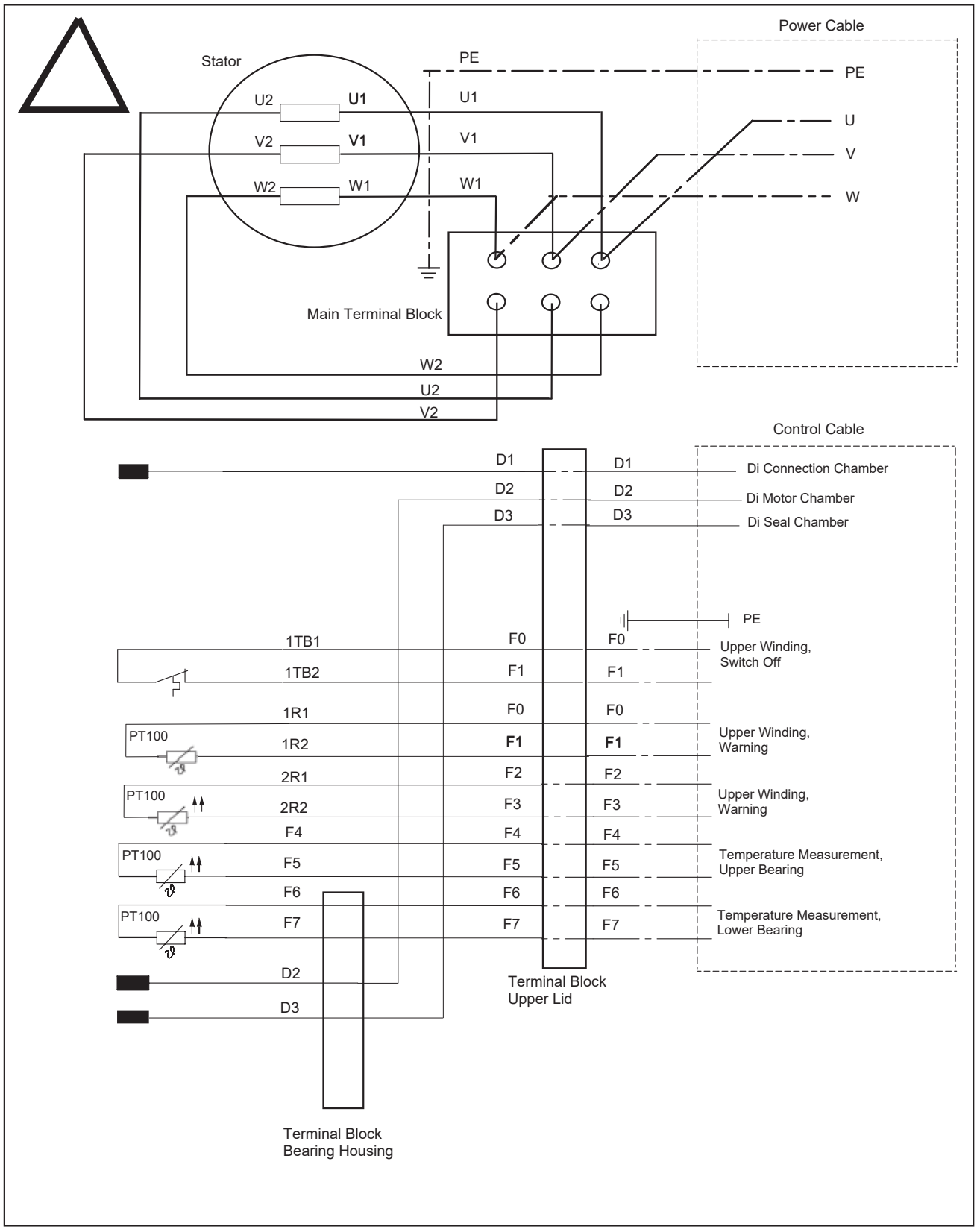
DOL / Δ. Bimetallic thermal sensors in stator. PT100 temperature monitoring of bearings.

380 V, 460 V, 575 V 60 Hz



DOL / Δ. Bimetallic thermal sensors and PT100 in stator. PT100 temperature monitoring of bearings.

380 V, 460 V, 575 V 60 Hz



## 15. Fuses

Fuses are to be installed in the power circuits as short circuit protection. Fuses with a time lag are to be used. The table shows the nominal current on sizes.

| **50 Hz** | 400 V | 500 V | 690 V | 1000 V |
|---|---|---|---|---|
| Run current | 155 A | 124 A | 90 A | 62 A |
| Max. starting current | 1132 A | 1119 A | 657 A | 616 A |

| **60 Hz** | 380 V | 460 V | 575 V |
|---|---|---|---|
| Run current | 190 A | 154 A | 124 A |
| Max. starting current | 1636 A | 1094 A | 1081 A |

## 16. Winding resistance

| 50 Hz | 60 Hz | Resistance |
|---|---|---|
| 400/690 V | 460 V | 0.0582 |
| 500/550 V | 575 V | 0.0780 |
| 1000 V | - | 0.316 |

## 17 Troubleshooting

### 17.1 Troubleshooting in field

| Error | Probable cause | Solution |
|---|---|---|
| The pump will not start. | Dead incoming power lines. | Check power lines. |
| | Blown fuses or breakers. | Check fuses and breakers. |
| | Phase failure. | Check phases. |
| | Blocked impeller(s). | Check for stones, pieces of wood etc. |
| | Loose cable. | Service inspection needed. |
| The motor trips out. | Wrong direction of rotation. | Shift phases. |
| | Excessive water temperature (max 40 ºC). | Check water temperature. |
| | Blocked impeller(s). | Check for stones, pieces of wood etc. |
| | Low voltage due to long cables, or inadequate power supply (generator). | Check cables and power supply. |
| Pump operating at too low capacity. | Clogged strainer. | Clean strainer. |
| | Sharp bends, folds or restrictions of the discharge hose. | Adjust hose. |
| | Excessive wear to impellers and wear rings. | Service inspection needed. |
| Residual Current Device (RCD) trips out. | Moisture in stator. | Service inspection needed. |
| Moisture sensor (DI) alert | Water leakage into connection chamber | Immediate shutdown and service inspection. |
| | Water leakage into motor chamber | Immediate shutdown and service inspection. |
| | Water leakage into oil chamber | Service inspection needed |

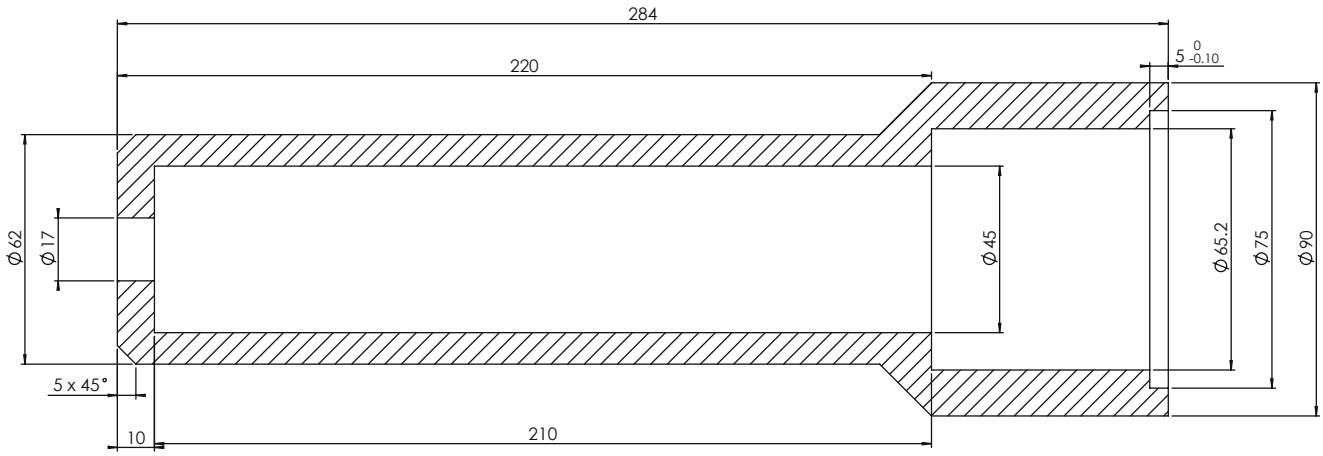
## 17.2 Troubleshooting/service inspection without service program

| Error | Probable cause | Solution | Chapter |
|---|---|---|---|
| The pump will not start. | Defective cable. | Replace cable. | 2.1 |
| | Burned motor. | Complete pump overhaul. | 1-12 |
| | Blocked impeller. | Check for stones, pieces of wood etc. | 8 |
| | Water intrusion. | Check for water intrusion inside top cover, and/or motor housing. | 2.1 + 3.2 |
| | Loose wires between motor / power cable. | Check cables in connection chamber. | 2.1 |
| The motor trips out. | Pump overloaded due to material build up. | Hydraulic check and cleaning. | 8 |
| | Blocked impeller. | Check for stones, pieces of wood etc. Replace damaged impeller. | 8 |
| | Blocked rotor. | Complete pump overhaul. | 1-12 |
| | Burned motor caused by water entering the pump through shaft seal or cable entry area. | Complete pump overhaul. | 1-12 |
| | Oil in motor housing. | Clean from oil. Replace secondary seal. | 9 |
| Water found inside top cover, and/or motor housing. | Pump cable damaged or cut. | Replace cable. | 2.1 |
| | Loose cable gland or faulty assembly of gland. | Replace cable gland and cable seal. | 2.1 |
| | Damaged o-ring, foreign material between motor housing and jacket, or cover. | Complete pump overhaul. Replace damaged parts. | 1-12 |
| | Loose or missing screws that secure top cover to motor housing. | Complete pump overhaul. Replace missing parts. | 1-12 |
| | Water entered through inspection hole. | Check motor inspection plug | 3.2 |
| Water in the oil chamber. | Defective shaft seal. | Change primary seal. | 9 |
| | Faulty assembly of o-rings, mechanical seal. | Replace parts. | 9 |
| | Worn seals. | Replace parts and dry motor. | 12 |
| Pump operating at too low capacity. | Worn or damaged impeller and/or wear ring. | Hydraulic check | 8 |
| Residual Current Device trips out. | Moisture in stator. | Dry motor. | 12 |

# 18 Tools

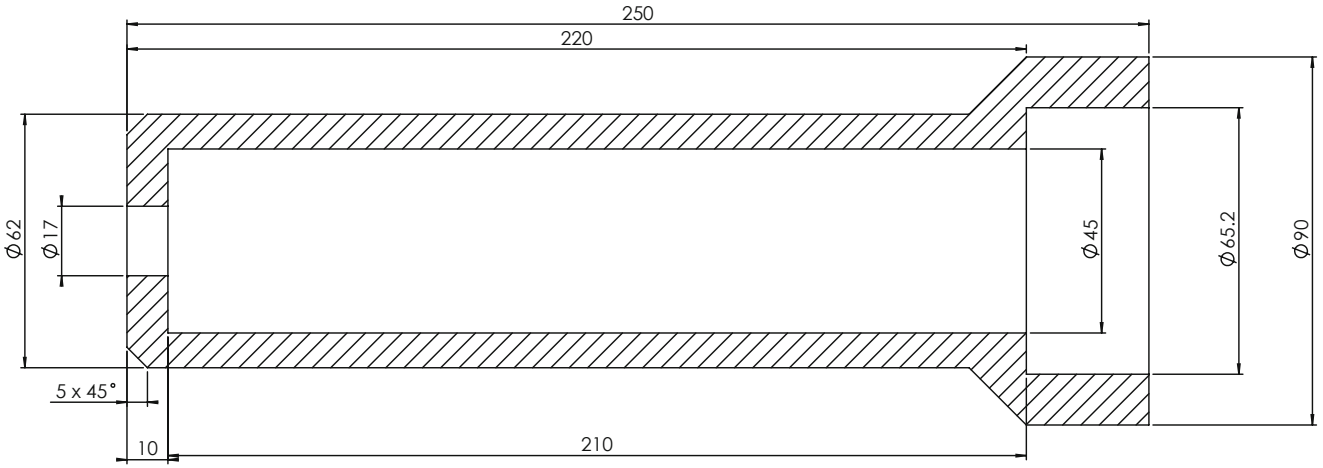
## 18.1 Primary (outer) mechanical seal press tool - static part

Material: NYLON
Dimensions in mm



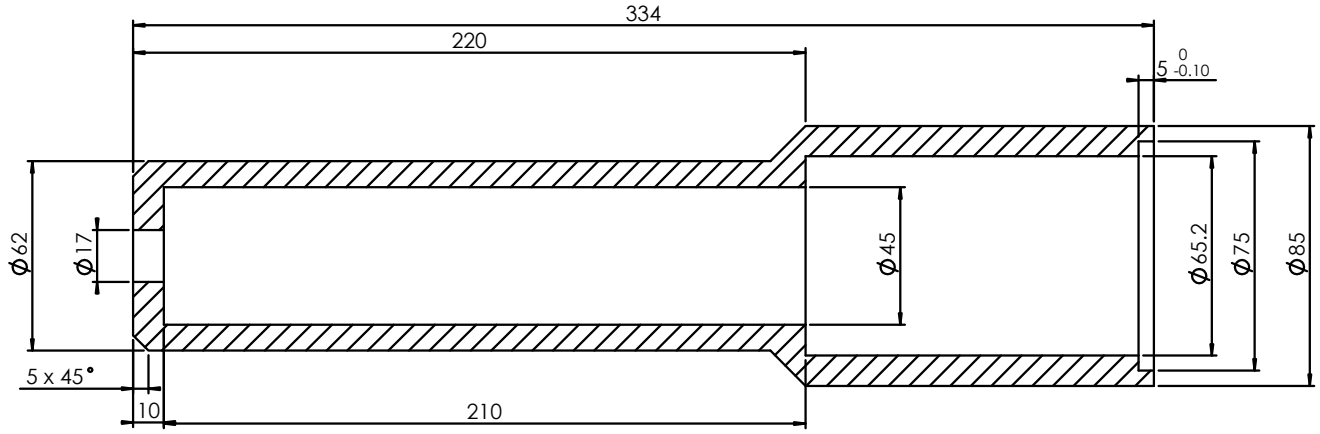

## 18.2 Primary (outer) mechanical seal press tool - rotating part

Material: NYLON
Dimensions in mm



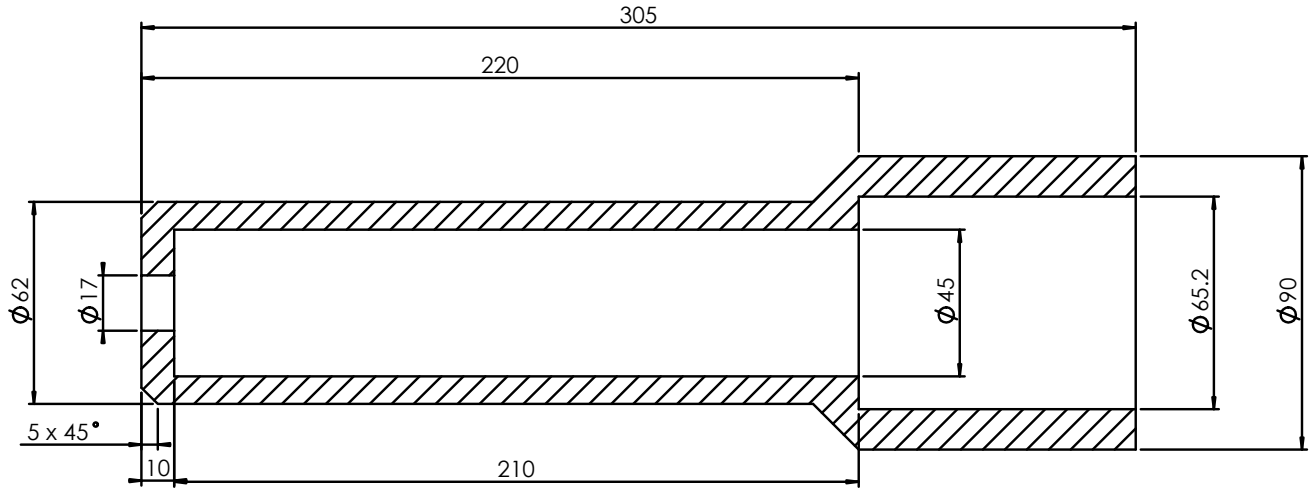
## 18.3 Secondary (inner) mechanical seal press tool - static part

Material: NYLON
Dimensions in mm



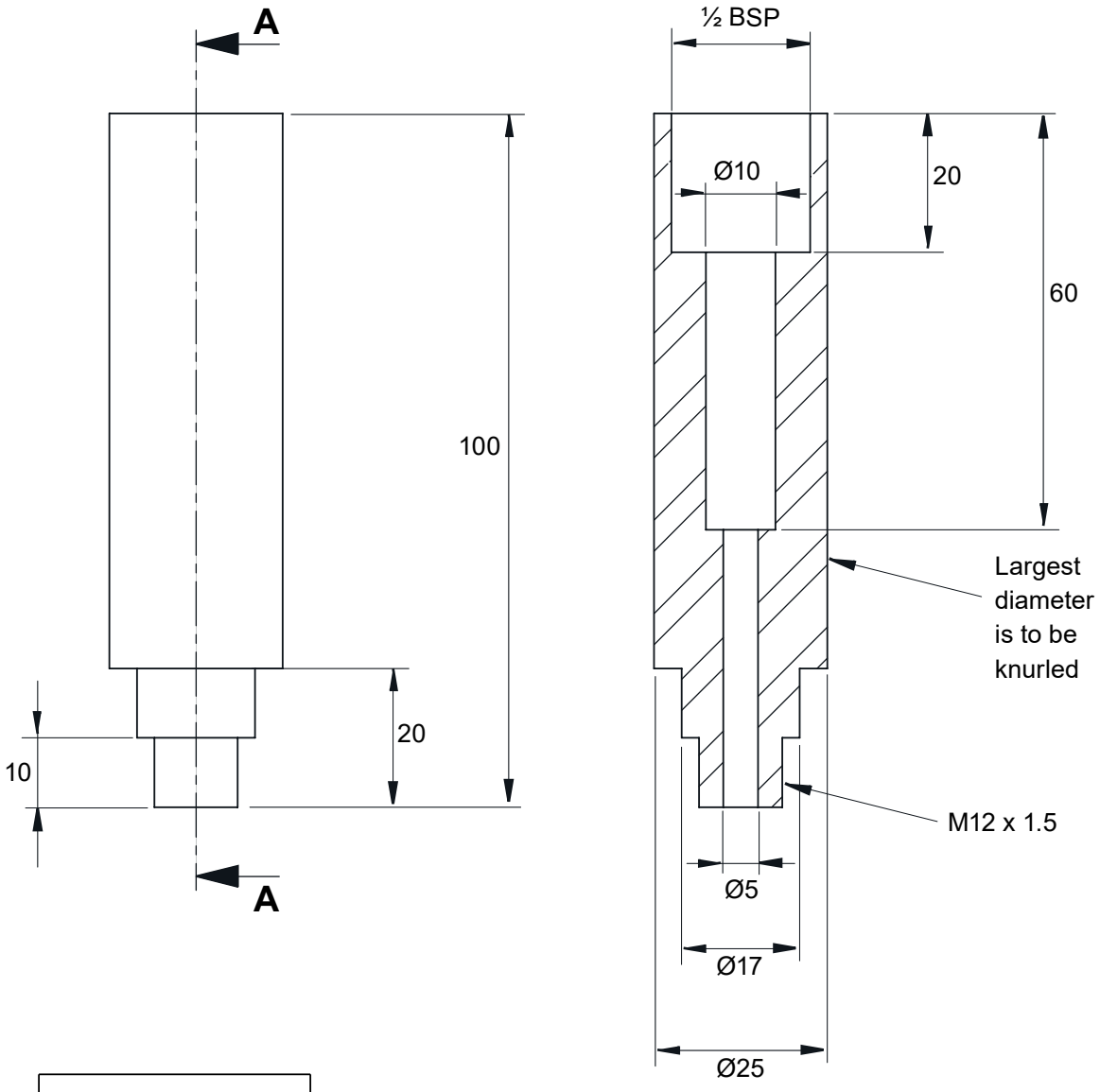

## 18.4 Secondary (inner) mechanical seal press tool - rotating part

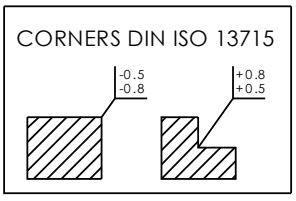
Material: NYLON
Dimensions in mm



## 18.5 Pressure test tool - oil chamber

Material: MILD STEEL
Dimensions in mm



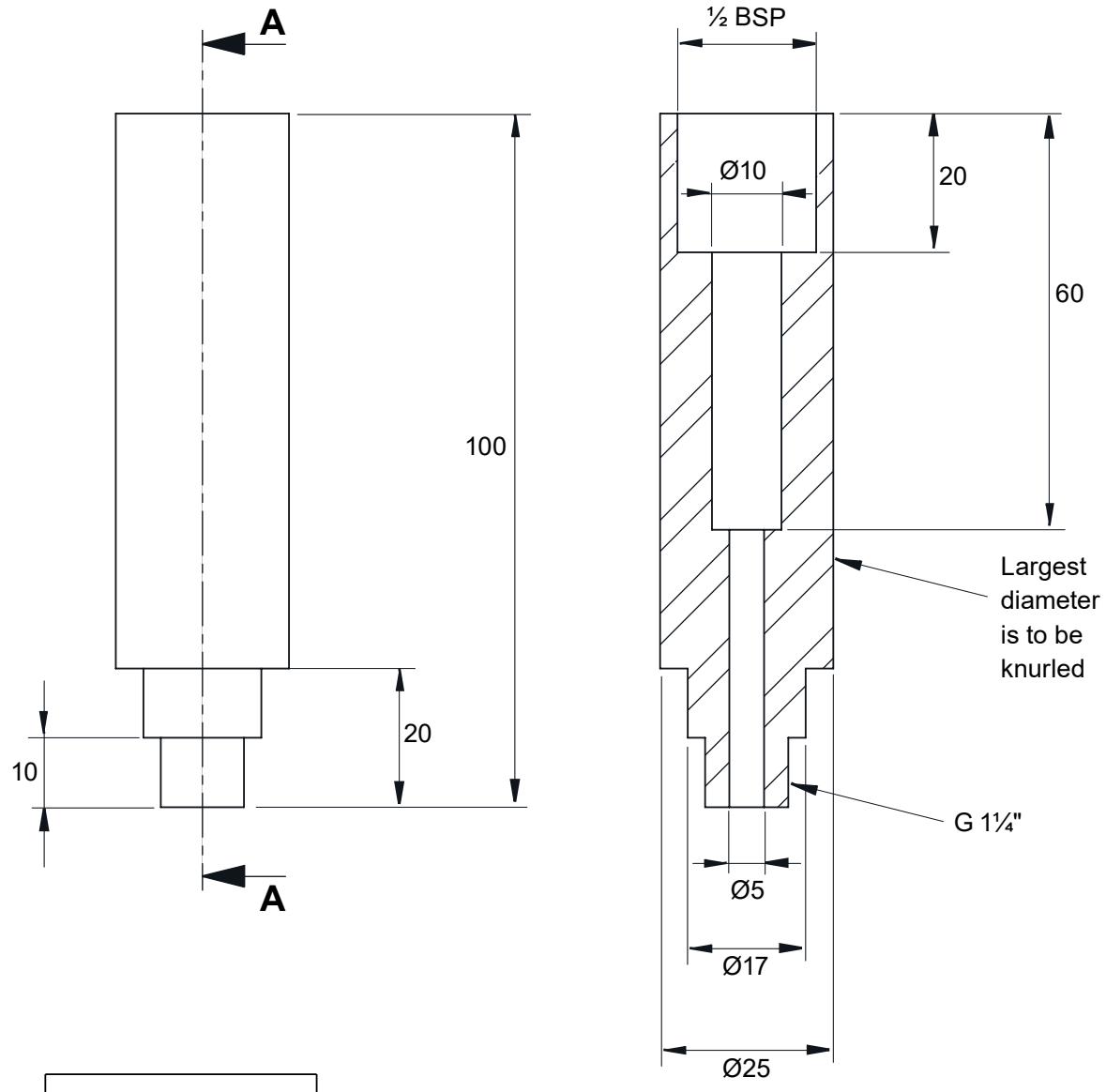



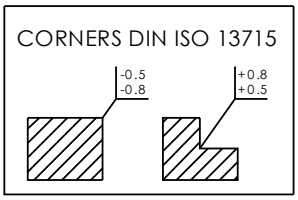

**SECTION A-A**

| Untoleranced machined dimensions to DIN 7168 m | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Nominal size** | 0 to 6 | Over 6 to 30 | Over 30 to 120 | Over 120 to 400 | Over 400 to 1000 | Over 1000 to 2000 | Over 2000 to 4000 |
| **Deviation** | ± 0.1 | ± 0.2 | ± 0.3 | ± 0.5 | ± 0.8 | ± 1.2 | ± 2.0 |

## 18.6 Pressure test tool - top cover

Material: MILD STEEL
Dimensions in mm



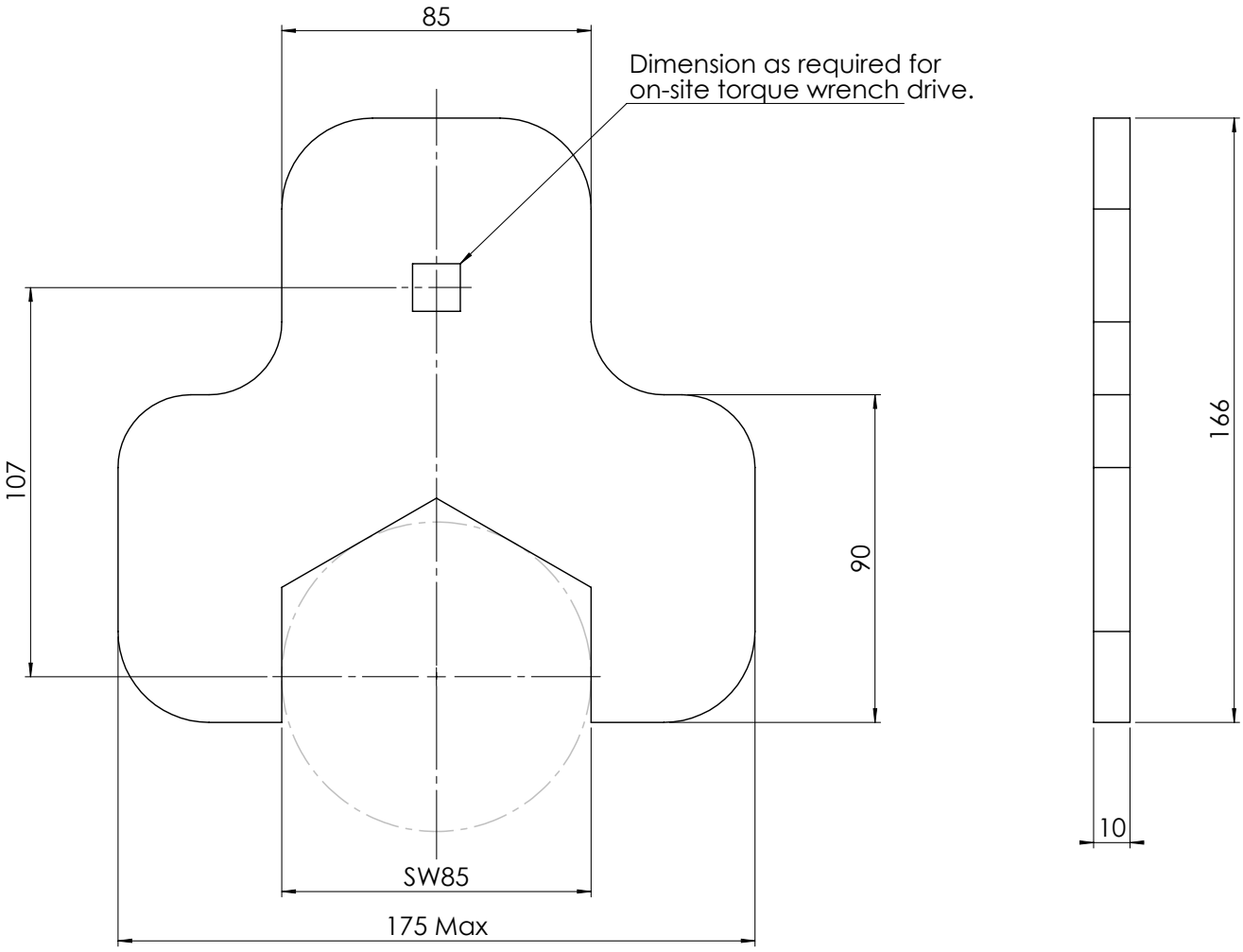




**SECTION A-A**

| Untoleranced machined dimensions to DIN 7168 m | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Nominal size** | 0 to 6 | Over 6 to 30 | Over 30 to 120 | Over 120 to 400 | Over 400 to 1000 | Over 1000 to 2000 | Over 2000 to 4000 |
| **Deviation** | ± 0.1 | ± 0.2 | ± 0.3 | ± 0.5 | ± 0.8 | ± 1.2 | ± 2.0 |

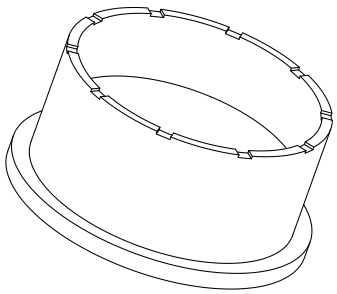
## 18.7 Cable cap tool

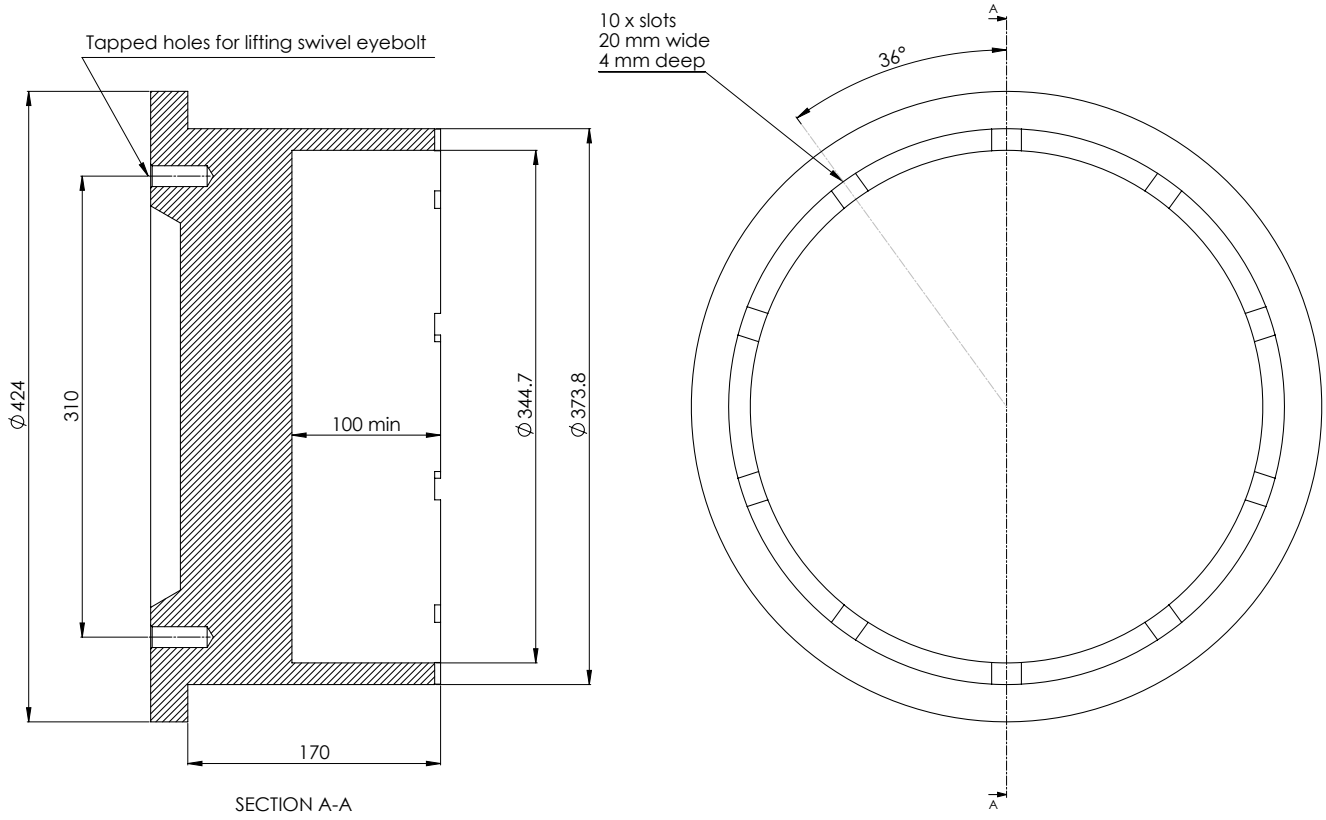
Material: MILD STEEL
Dimensions in mm



## 18.8 Stator press tool

Material: MILD STEEL
Dimensions in mm





# SERVICE LOG

| Pump Type: | Serial No: |
|---|---|

| Date | Hours of Operation | Comments | Sign |
|---|---|---|---|
| | | | |

# SERVICE LOG

| Pump Type: | Serial No: |
|---|---|

| Date | Hours of Operation | Comments | Sign |
|---|---|---|---|
| | | | |

# SERVICE LOG

| Pump Type: | Serial No: |
|---|---|

| Date | Hours of Operation | Comments | Sign |
|---|---|---|---|
| | | | |

SULZER

Sulzer Pump Solutions Ireland Ltd., Clonard Road, Wexford, Ireland
Tel. +353 53 91 63 200, www.sulzer.com

Copyright © Sulzer Ltd 2019