On-load tap-changers, type UZE and UZF, with motor-drive mechanism, type BUF 3
Repair guide
Recommended practices

ABB recommends careful consideration of the following factors for service and repair work on on-load tap-changers.

Do not repair an on-load tap-changer or motor-drive mechanism with a serious mechanical or electrical fault without first consulting ABB.

Before you start any work, make sure that the personnel doing the job have read and fully understood the Repair documents provided with the unit.

To avoid damaging the unit, never exceed the operating limits stated in delivery documents and on rating-plates.

Do not alter or modify a unit without first consulting ABB.

Follow local and international wiring regulations at all times.

Use only factory authorized replacement parts and procedures.

WARNING, CAUTION and NOTE

WARNING
A WARNING provides information which, if disregarded, could cause injury or death.

CAUTION
A CAUTION provides information which, if disregarded, could cause damage to the equipment.

NOTE: A NOTE provides additional information to assist in carrying out the work described.

Safety precautions

WARNING
Before any work is carried out on the on-load tap-changer:
Make sure that the transformer is disconnected and that earthing is properly carried out. Obtain a signed certificate from the engineer in charge.

The relevant technical documents should be read and understood before any work is started, and the procedures in this document should be followed at all times.

Before starting any work in the on-load tap-changer the protective motor switch and the LOCAL/REMOTE switch must be set at "0".

Before starting any work inside the motor-drive mechanism, the auxiliary power must be switched off.

N.B. The motor, contactors and heating element may be energized from separate sources.

The hands or tools must be kept away from the contacts when making a manual or electrical operation. The contact arm is operated by a spring battery and can cause severe damage.

CAUTION
ABB recommends that only service engineers with appropriate skills regarding on-load tap-changers carry out the repairs.

ABB recommends that only maintenance engineers trained by ABB carry out contact replacement.
During service

WARNING
Small amounts of explosive gases will always come out from the breathing devices (dehydration breather or one-way breather). Make sure that no open fire, hot surfaces or sparks occur in the immediate surroundings of the breathing devices.

If a failure in power supply occurs during operation, the operation will be completed when the power returns.

The hand crank must not be inserted during electrical operation.

If the on-load tap-changer is not in its exact position and the hand crank is pulled out, the motor-drive mechanism will start and go to the exact position if the power supply is on.

CAUTION
After a pressure relay trip, follow the instructions in the chapter "Pressure Relay" in this Guide.

During oil handling

WARNING
Unused transformer oil is slightly harmful. Fumes from unused warm oil may irritate the respiratory organs and the eyes. After long and repeated contact with transformer oil skin becomes very dry.

Used on-load tap-changer oil from diverter switch housings and selector switch housings contains harmful substances. Fumes are irritating to the respiratory organs and the eyes and are very easily set on fire. Used transformer oil may well be carcinogenic.

Avoid contact with the oil as much as possible and use oiltight protective gloves when handling the oil.

First aid:
Skin contact: Wash the hands. Use skin cream to counteract drying.
In the eyes: Rinse the eyes in clean water.
Swallowing: Drink water or milk. Avoid vomiting. Call a doctor.

Collect used oil in oil drums.

Waste and cleaning up: Should be absorbed by an absorber. Treat it as hazardous to the environment.

Upon fire: The fire should be extinguished by using powder, foam or carbon acid.

When oil that has been used in a selector switch compartment is pumped out, conducting tubes and hoses that are earthed should be used to avoid the risk of explosion due to the gases produced by the arcs during service.

The oil in the selector switch compartment may be hot. Be cautious!

There is always a cushion of explosive gases over the oil surface. This is sucked into the on-load tap-changer tank during draining of the oil. No open fire, hot surfaces or sparks may be present when the front cover is opened.
CAUTION
Take care to avoid ingestion of moist air when oil is drained. If the ambient air is moist, let incoming air pass through a dehydrating breather with slow air flow to obtain proper dehydration.

Do not fill oil into the on-load tap-changer if the transformer tank is under vacuum and the on-load tap-changer is not.

Do not fill oil into the transformer tank if the on-load tap-changer is under vacuum and the transformer tank is not.

Mounting of gaskets

CAUTION
Sealing surfaces and gaskets must be clean and undamaged. Diametrically opposed bolts in sealing joints must be tightened alternately several times, beginning with a low tightening torque and finally with the recommended tightening torque as described in section 1.6 Tightening Torque, in this guide.

After oil filling

CAUTION
Do not energize the transformer earlier than three hours after oil filling in atmospheric pressure. This waiting period is needed to allow air bubbles to disappear.
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1. Introduction

1.1 General
The UZ range of on-load tap-changers manufactured by ABB has been developed over many years to provide maximum of reliability. The simple and rugged design gives a service life equal to the service life of the transformer. Minimum maintenance is required for trouble-free operation. The only parts requiring maintenance are contacts that might need replacement during the service life, the insulating oil and the motor-drive mechanism. The design allows excellent access to all parts, making inspection and maintenance quick and simple.

The on-load tap-changer type UZE/UZF is placed in an oil filled tank separated from the transformer tank. The motor-drive mechanism is attached to the side of the on-load tap-changer tank.

1.2 Repair categories
Repairs on the UZ range of on-load tap-changers fall into two categories:

■ Repairs. Repairs are to replace worn or end-of-service-life parts.
■ Modifications. Modifications are only issued by ABB to improve the already very high standard of reliability and to assist in prolonging the service life of the equipment.

The modifications fall into two areas:

■ Immediate, where the modification should be completed at the earliest possible opportunity.
■ Routine, where the modification should be completed during a routine service.

1.3 Serial number
Before consulting ABB for technical advice to assist with repairs or to order spare parts to complete the repairs, the on-load tap-changer serial number must be known. The serial number can be found on the rating plate (figure 2 shows the location of the rating plate).

If the on-load tap-changer serial number cannot be obtained, the transformer serial number should be used (only if the transformer is manufactured by ABB in Ludvika, Sweden).

NOTE: One of these serial numbers must be quoted in all correspondence and telefax messages, and during any telephone conversations with ABB. Failure to use the serial number may cause delays.
1.4 Spare parts list

The Repair Guide does not contain information about spare parts and how to order them. For information about spare parts, please see the Spare Parts List 1ZSE 5492-132, On-Load Tap-Changers, types UZE and UZF with Motor-Drive Mechanism, type BUF 3. The Spare Parts List also contains several exploded views, which can be very handy when making repairs.
1.5 Maintenance guide

Inspection and overhaul of the UZ-type on-load tap-changer is carried out according to the instructions in the Maintenance Guide. Contact replacement is also described in the Maintenance Guide. Since references are made to the Maintenance Guide, you will need the Maintenance Guide.

1.6 Tightening torque

The following tightening torques are recommended:

- M6, 10 Nm ±10 %
- M8, 24.5 Nm ±10 %
- M10, 49 Nm ±10 %
- M12, 84 Nm ±10 %

if not otherwise is stated in this guide.
2. Trouble-shooting

This chapter mainly contains information used to locate a fault. Instructions for correcting the fault, replacement of parts etc. are contained in chapter 3, Repairs and Adjustments.

2.1 On-load tap-changer

<table>
<thead>
<tr>
<th>Error condition</th>
<th>Fault finding procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>High oil level alarm.</td>
<td>A rising oil level in the on-load tap-changer oil conservator may indicate a leakage between the on-load tap-changer and the transformer main tank. Make sure that the cause for the alarm is not over-filling at commissioning or overhaul. This can be checked by adjusting the oil level according to “Correct Oil Level” in the Installation and Commissioning Guide and then rechecking some time later.</td>
</tr>
<tr>
<td>Low oil level alarm.</td>
<td>A lowering oil level in the on-load tap-changer may indicate a leakage. If there is no visible leakage, adjust the oil level according to “Correct Oil Level” in the Installation and Commissioning Guide then rechecking some time later.</td>
</tr>
</tbody>
</table>

2.2 Pressure relay

**CAUTION**

To take the transformer into service after a pressure relay trip without opening the front cover and carrying out a careful investigation of the active part, and repairing faults, if any, may cause severe damage to the on-load tap-changer and the transformer.

<table>
<thead>
<tr>
<th>Error condition</th>
<th>Fault finding procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>The pressure relay has tripped during normal operation.</td>
<td>Tools required:</td>
</tr>
<tr>
<td></td>
<td>- Air pump</td>
</tr>
<tr>
<td></td>
<td>- Manometer</td>
</tr>
<tr>
<td></td>
<td>- Screwdriver</td>
</tr>
<tr>
<td></td>
<td>- Megger (500–2 000 V)</td>
</tr>
</tbody>
</table>
2 Trouble-shooting

<table>
<thead>
<tr>
<th>Error condition</th>
<th>Fault finding procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. After a pressure relay trip, the on-load tap-changer and the transformer must be carefully investigated. That means that the on-load tap-changer must be drained and the front cover opened. Faults, if any, must be repaired before the transformer is energized. If both the on-load tap-changer and the transformer are functioning properly, continue with the next step.</td>
<td></td>
</tr>
<tr>
<td>2. Carry out the insulation test of the pressure relay. Proceed as follows: Remove the cover of the relay housing. Disconnect from the terminals all wires coming from the control cabinet of the transformer. Connect terminal NO (identified 61) on the pressure relay block to earth. Terminal C (identified 62) should be electrified with the megger (500-2000 V for one minute). Connect the pressure relay housing to earth. Short-circuit the four terminals and apply test voltage 500-2000 V on them for one minute. Remove the short-circuit from the terminals and reconnect the wires from the control cabinet. If the pressure relay does not withstand the electrical stress, the pressure relay should be replaced, see section 3.6 Replacement of Pressure Relay.</td>
<td></td>
</tr>
<tr>
<td>3. Carry out the function test. Proceed as follows: a. Set the valve handle to the test position as shown on the information plate. b. Connect the air pump and the pressure gauge to the test tap on the pressure relay. (Thread R 1/8&quot;). c. Raise the pressure until the pressure relay trips the circuit breakers of the transformer. d. Read the pressure on the manometer and check against the pressure stated on the information plate. Max. permitted deviation is ±10 %. If the deviation is greater, the pressure relay should be replaced. e. Check that the signal disappears when the pressure is released. f. After finishing the check, turn back the valve handle to service position.</td>
<td></td>
</tr>
</tbody>
</table>
2.3 Motor-drive mechanism

2.3.1 Control system

<table>
<thead>
<tr>
<th>Error condition</th>
<th>Fault finding procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOCAL operation or REMOTE operation is not possible.</td>
<td>LOCAL operation is not possible when the control selector switch is in position REMOTE or &quot;0&quot;, and REMOTE operation is not possible in position LOCAL or &quot;0&quot;.</td>
</tr>
<tr>
<td>The position indicator generates no signal.</td>
<td>1. Check that the contact plate and arm on the multi-position switch are free from dust and oxide. Check the contact function with the moving contact arm in all positions.</td>
</tr>
<tr>
<td></td>
<td>2. Check the resilience of the moving contact in the multi-position switch. The clearance between the nut and the contact arm should be 0.4–1.2 mm. For information about how to adjust the resilience, refer to section Position Transmitter and other Position Switches in Maintenance Guide.</td>
</tr>
<tr>
<td>High oil level alarm.</td>
<td>1. If there is a measuring amplifier: Measure the output signal from the measuring amplifier in all position. The signal shall raise linear up to the highest position. If no signal, check the feeding to the measuring amplifier and to the position transmitter.</td>
</tr>
<tr>
<td></td>
<td>2. Check that the signal reaches the position indicator.</td>
</tr>
</tbody>
</table>

![Fig. 5. Pressure relay.](image-url)
Error condition | Fault finding procedure
--- | ---
The on-load tap-changer performs more steps than ordered, or operates towards the end stop. | 1. If the on-load tap-changer makes more than three operations there must be a failure in the time relay for the running through protection. Check the time setting or replace the relay.
2. Check that the flywheel is free from grease. For information about cleaning, see Maintenance Guide.
3. Check that the flywheel stops in its middle position with a tolerance of ± 30 degrees. For information about adjusting the brake, refer to section Disc Brake in Maintenance Guide.
4. Check that the raise and lower contactors function properly (see circuit diagram, Fig. 3, and contact timing diagram, Fig. 4).
5. Check that the starting contact functions properly (see circuit diagram and contact timing diagram). For information about adjusting the contact, refer to section Starting Contact in Maintenance Guide.
6. Check that the maintaining contact functions properly (see circuit diagram and contact timing diagram). Exchange of maintaining contact, see section 3.5.
2.3.2 Power system

<table>
<thead>
<tr>
<th>Error condition</th>
<th>Fault finding procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>The three-phase motor runs back and forth without the on-load tap-changer changes position.</td>
<td>Reverse two of the phases of the incoming supply.</td>
</tr>
</tbody>
</table>

**WARNING**

Dangerous voltage!

2.3.3 Miscellaneous

<table>
<thead>
<tr>
<th>Error condition</th>
<th>Fault finding procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrosion and/or condensation in the motor-drive mechanism cabinet.</td>
<td>Check the function of the heater. Refer to Heater in Maintenence Guide.</td>
</tr>
<tr>
<td>Water in the motor-drive mechanism cabinet.</td>
<td>1. Adjust the hinges on the cabinet door.</td>
</tr>
<tr>
<td></td>
<td>2. Replace the door gasket on the cabinet.</td>
</tr>
<tr>
<td>Oil in the motor-drive mechanism cabinet.</td>
<td>1. Locate the leakage.</td>
</tr>
<tr>
<td></td>
<td>2. Contact ABB.</td>
</tr>
</tbody>
</table>
Fig. 3. Circuit diagram
2 Trouble-shooting

Fig. 4. Contact timing diagram
3. Repairs and adjustments

For **Contact replacement** see Maintenance Guide.
For **Adjustment of Disc Brake** see Maintenance Guide.
For **Replacement of Gasket between on-load tap-changer tank and Transformer tank** see Installation and Commissioning Guide.

### 3.1 Replacement of gasket between insulating board and selector switch unit

#### 3.1.1 General

This instruction guides you how to replace the gasket between the insulating board and the selector switch moulding. The instruction can be used for both **UZE** and **UZF** on-load tap-changers.

**CAUTION**

ABB recommends that only maintenance engineers trained by ABB carry out replacement of gasket between barrier board and selector switch unit.

#### 3.1.2 Tools required

- Pump with connection fitting the oil valve
- Box wrench (19 mm)
- Electric drill, set of drills
- Thread tap M16
- Chisel (as used by a woodworker)
- Dynamometric wrench (up to 42 Nm)
- Tool with a prolonged shaft for square nuts (27 x 27 mm)

#### 3.1.3 Material and spare parts required

- Maintenance Guide
- Clean and empty drums (for oil draining)
- Rags (not cotton waste)
- Rope (approximately 2 m)
- Wooden wedges, made of birch wood or similar, rather hard wood (length approx. 100 mm, width approximately 40 mm, and thickness approximately 20 mm)
- Ethylacetate or similar solvent
- Distance pieces of wood or pressboard (thickness of approximately 9 mm)
- Single-phase diagram valid for the actual on-load tap-changer
- Glue, nitrile rubber adhesive, preferably of type "Pliobond 20" (Good Year)
- Brush for application of adhesive
- Gasket
- Grease for ball-bearings
- Brush for grease
- Polyvinylacetate adhesive (normal glue for wood)
- 18 stud bolts and 18 nuts
- Tools and materials for draining transformer oil according to the transformer documentation.
3.1.4 Procedure

If the transformer is located outdoors the on-load tap-changer must be protected against rain.

1. Lower the oil level in the transformer to a level below the on-load tap-changer. Refer to the documentation for the transformer.
2. Drain the oil from the on-load tap-changer. Use the pump and clean, empty, drums. The on-load tap-changer must be empty before the repair procedure is continued. For information about oil draining, see the Maintenance Guide.
3. Open the front cover by loosening the domed nuts (19 mm).

NOTE: Be careful with the gasket when removing the cover.
4. Wash the tank clean with oil by using a hose and a pump. After washing, the inside of the tank and the phase units should be wiped clean with rags (not cotton waste).
5. Mark the shafts to make it possible to remount them in their right place and so that they will get the ends in the same position as before. Dismantle the shafts on both sides of the phase unit by loosening the screwed couplings on the left hand side of each shaft. Take care of shims, if any.
6. Disconnect the conductors of the transformer side of the phase unit. On UZF through the connection cover on the roof of the tap-changer tank. On UZE through some man-hole on the transformer.
7. Unscrew the nuts of the clamps that holds the phase unit.

NOTE: If a stud bolt is broken, the rest has to be drilled out and the hole has to be rethreaded (M16).
8. The phase unit now stays in place by the glued gasket. Make some arrangement in order to prevent it from tilting out when coming loose from the board, e.g. by using a rope between the phases.
9. Loosen the phase unit by wedging between the moulding and the board. Use wooden wedges.
   Place wedges, one in each of the upper corners between the gasket and the board, by some light beats. Wet the glued gasket with ethylacetate or similar solvent to dissolve the glue. The epoxy moulding is wedged to come loose by gradual wedging and wetting the glue. Do this carefully and give the solvent time to dissolve the glue. If this is done too quickly, there is a risk of breaking the moulding or the board.
10. Remove the old gasket from the board and the phase unit. Use solvent and a chisel to remove all residues of the gasket and make the surfaces quite free from glue and oil. Also wash the surrounding surfaces with solvent to make sure that the surfaces to be glued will remain dry during the gluing process.
11. Before mounting new stud bolts, (if necessary) brush grease onto 4-5 of thread turns to be screwed into the board.
   Mount the stud bolts. Screw until stop. Don’t use a higher tightening torque than 5 Nm.
12. Test assemble the distance pieces, t = 9 mm, between the clamp screws and the moulding, and fasten them temporarily to the screws with tape. The distance pieces are used for guiding the phase unit when glued to the board.
13. Mount the phase unit in the following way:
   - Clean the surfaces with the solvent immediately before gluing.
   - Glue should be spread over both sides of the gasket at least 8 hours before final gluing.
- The glue is spread over the joint surfaces on the moulding. Then glue is spread over the joint surfaces on the barrier. Thereafter glue is spread once more over the joint surfaces on the moulding.
- The glue is predried 10-30 minutes at 20 °C before the assembly. The glue should be almost dry at assembly.

**CAUTION**

Assemble at room temperature. Glued details must not be moved or removed after assembling.

- After predrying, mount the phase unit to the board. Use the distance pieces (see step 12) to achieve the correct positioning of the phase unit.
- Mount the clamps around the phase unit and brush the outer thread of the stud bolts with polyvinylacetate glue.
- Mount the nuts on the studs and tighten them in the order shown in Fig. 6. Always start with the middle of the three nuts for one clamp. Tighten with 5–15 Nm first and thereafter twice with 22 Nm.

**NOTE:** Do not retighten the nuts.

14. Retighten all the nuts around the edge of the barrier board with a torque of 42 Nm.
15. Put the contact arms in the correct position and remount shafts (in the right position and with the ends in the right position according to marking in point 5) with their couplings and shims, if any. Make sure that both of the outer screws in the couplings are screwed in equally.
16. Check that the contact arms are in equal position and in the position indicated by the motor-drive mechanism, see single-phase diagram. Check all plays shown in Fig. 7 and adjust by adding or removing shims if necessary.
17. Place the gasket for the front cover on the studs of the flange (if loosened).

This gasket is not glued. The gasket surface against the cover is coated with grease to facilitate openings in the future. Use grease as for ball-bearings.

---

**Fig. 6. Mounting of gaskets.**
18. Close the front cover and tighten the domed nuts with a torque of 42 Nm.
19. Reconnect the conductors inside the transformer, loosened in step 7.
20. Refill the transformer with oil. For information about oil filling, refer to the documentation for the transformer.
21. Fill the on-load tap-changer with oil. For information about oil filling, see the Maintenance Guide.

3.2 Replacement of gaskets between barrier board of steel and selector switch unit

3.2.1 General

Follow section 3.1 where applicable and with following exceptions:
- Distance pieces of wood or pressboard thickness approximately 13 mm.
- Polyvinylacetate adhesive is not needed.
- Instead of section 13 e:
  The studs are lubricated with grease for ball bearings. Tighten the M8 nuts with dynamometric wrench 13 Nm, the first time in sequence according to Fig. 6 and the second time without special sequence. Re-tightening of the nuts shall be done earliest 5 hours after the previous tightening with 13 Nm without special sequence.

3.3 Replacement of front cover and top cover gaskets

3.3.1 General

This instruction guides you on how to attend to an oil leakage.

3.3.2 Tools required

- Box wrench (19 mm)
- Pump with connection fitting the oil valve
3.3.3 Material and spare parts required

- Maintenance Guide
- Clean and empty drums
- Rags (not cotton waste)
- Gasket for front cover (UZE/UZF) and/or top cover (UZF)
- Grease as for ball-bearings

3.3.4 Procedure

1. Tighten the domed nuts (19 mm). Tightening torque max 42 Nm. If the oil leakage still remains, the gasket has to be replaced.

2. Replacement of front cover gasket: Drain the on-load tap-changer. For information about oil draining, see the Maintenance Guide. Replacement of top cover gasket: Lower the oil level in the transformer according to the transformer documentation.

**WARNING**
The cover for access to conductors on top of UZF tank may be opened only after draining the transformer main tank.

3. Loosen the nuts and remove the front cover/top cover. When removing the top cover, take care of the washer with earthing snag placed on one of the stud bolts.

4. Clean the gasket surfaces. Replace the gasket with a new one.
   - The gasket is not glued. The gasket surface against the cover is coated with grease to facilitate openings in the future. Use grease as for ball-bearings.

5. Mount the front cover/top cover and fasten the domed nuts. Tightening torque 42 Nm. When the top cover is mounted, one of the stud bolts should have a washer with earthing snags against the cover in order to ensure potential connection of the top cover.

6. Restore the oil level. For information about oil filling, and correct oil level. See the Maintenance Guide or the transformer documentation.

3.4 Changing the end stops in motor-drive mechanism

3.4.1 General

This instruction explains how to reduce the regulating range of the on-load tap-changer.

**CAUTION**
The motor-drive mechanism original end stop screws (lower end stop and upper end stop, see Fig. 9) must **not** be moved.

3.4.2 Tools required

- Key for socket head cap screw (width across flats 4 mm)
### 3.4.3 Material and spare parts required

Each end stop consists of:
- One socket head cap screw M5×12
- One lock nut M5

### 3.4.4 Procedure

1. Change the lower end stop in the following way:
   - Operate to the new lowest position +1.
   - Mark up the first hole below the pivoting arm (Fig. 9).
   - Operate the on-load tap-changer to a position where the marked hole is accessible and mount the extra stop screw.
2. Change the upper end stop in the following way:
   - Operate to the new highest position – 1.
   - Mark up the first hole above the pivoting arm (Fig. 10).
   - Operate the on-load tap-changer to a position where the marked hole is accessible and mount another extra stop screw.
3. Operate the motor-drive mechanism using the hand crank and check that the mechanical end stops work and with motor operation that the electrical limit switches work in both lower position (Fig. 11) and upper position (Fig. 12).
3.5 Replacement of maintaining contact

3.5.1 Tools required

- Normal set of screwdrivers
- Electric drill
- Drill Ø 3 mm
- Hammer
- Drift Ø 2.5 mm

3.5.2 Spare parts required

- Maintaining contact (No. 6 according to Circuit diagram)
- Roll pin Ø 3 mm, L = 16 mm

3.5.3 Procedure

1. Loosen the red-white-red indicating flag from the old switch.
2. Mount the indicating flag on the new switch in same position as on the old one.
3. Shift the conductors from the old switch to the new one.
4. Loosen the old switch and mount the new switch.

**CAUTION**
The lever with the roller inside the mechanism should be horizontal. Check before dismounting the old switch.

3.6 Replacement of pressure relay

3.6.1 General

If the pressure relay fails to pass the insulation test and/or the function test (section 2.2), the pressure relay has to be replaced.

**CAUTION**
It is not permissible to replace only the microswitch inside the pressure relay.

3.6.2 Tools required

- Screwdriver
- Open-end wrench (30 mm)
3.6.3 Spare parts required

- Pressure relay
- O-ring (17.1 x 1.6 mm)

3.6.4 Procedure

Replacement of pressure relay:

1. Set the three-way valve handle to the test position (see Fig. 13 and the information plate on the pressure relay for information).
2. Disconnect the cable.

**WARNING**

Disconnect all power sources before any work is carried out. Check that the power is disconnected by using a Voltmeter.

3. Loosen the hexagon-headed connection nut on the quick coupling and remove the pressure relay.
4. Install a new O-ring (17.1x1.6 mm).
5. Lubricate the threads of the connection nut with grease.
6. Mount the new pressure relay. Tightening torque 25 Nm.
7. Carry out the testing procedure according to section 2.2 Pressure Relay.
8. Connect the cable. Tighten with care, max 5 Nm torque. The seal between the cable gland and the pressure relay housing includes an O-ring. If the cable gland has to be changed to another type, the seal against the housing must be secured by a gasket or by gluing.
9. Set the three-way valve handle back to the service position.