



1ZSE 5492-128 en, Rev. 5

On-load tap-changers, type UZE and UZF Repair guide

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Original instruction

The information provided in this document is intended to be general and does not cover all possible applications. Any specific application not covered should be referred directly to ABB, or its authorized representative.

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Recommended practices

ABB recommends careful consideration of the following factors when installing on-load tap-changers:

Before you install or commission a unit, make sure that the personnel doing the job have read and fully understood the installation and commissioning guide 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.

Safety warnings

The following warnings and notes are used in the manual:

WARNING

WARNING indicates an imminently hazardous situation, which if not avoided will result in death or serious injury. This signal word is to be limited to the most extreme situations.

WARNING also indicates a potentially hazardous situation, which if not avoided could result in death or serious injury.

CAUTION

CAUTION indicates a potentially hazardous situation, which if not avoided may result in minor or moderate injury. It may also be used to alert of unsafe practices.

CAUTION may also indicate property-damage-only hazards.



INFO provides additional information to assist in carrying out the work described and to provide trouble-free operation.

Safety precautions

WARNING

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

WARNING

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

WARNING

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

WARNING

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

NOTE: The motor, contactors and heating element may be energized from separate sources.

WARNING

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, and that only maintenance engineers trained by ABB carry out contact replacement.

During service

WARNING



Small amounts of explosive gases may be emitted from the breathing devices (dehydrating breather or one-way breather). Make sure that no open fires, hot surfaces or sparks occur in the immediate vicinity of the breathing devices.

WARNING



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

WARNING



The hand crank must not be inserted during electrical operation.

WARNING



If the tap-changer is not at 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 "Trip or alarm from supervisory devices" in the user's manual.

During oil handling

WARNING



Unused transformer oil is 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 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 highly flammable. Used transformer oil may well be carcinogenic. Avoid contact with the oil and use oil-tight protective gloves when handling the oil.

First aid:

Skin contact: Wash your hands. Use skin cream to counteract drying.

In the eyes: Rinse your eyes in clean water.

Swallowing: Drink water or milk. Avoid vomiting. Call a doctor.

Collect used oil in oil drums.

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

In the event of fire: Any fires should be extinguished with powder, foam or carbonic acid extinguishing agents.

WARNING



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

WARNING



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



WARNING

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

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



CAUTION

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



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.

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 torques in this guide.

After oil filling



CAUTION

Do not energize the transformer earlier than three hours after oil filling at atmospheric pressure. This waiting period is needed to allow air bubbles to dissipate.

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

1.2 Repair categories

Repairs on the UZ range of 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.

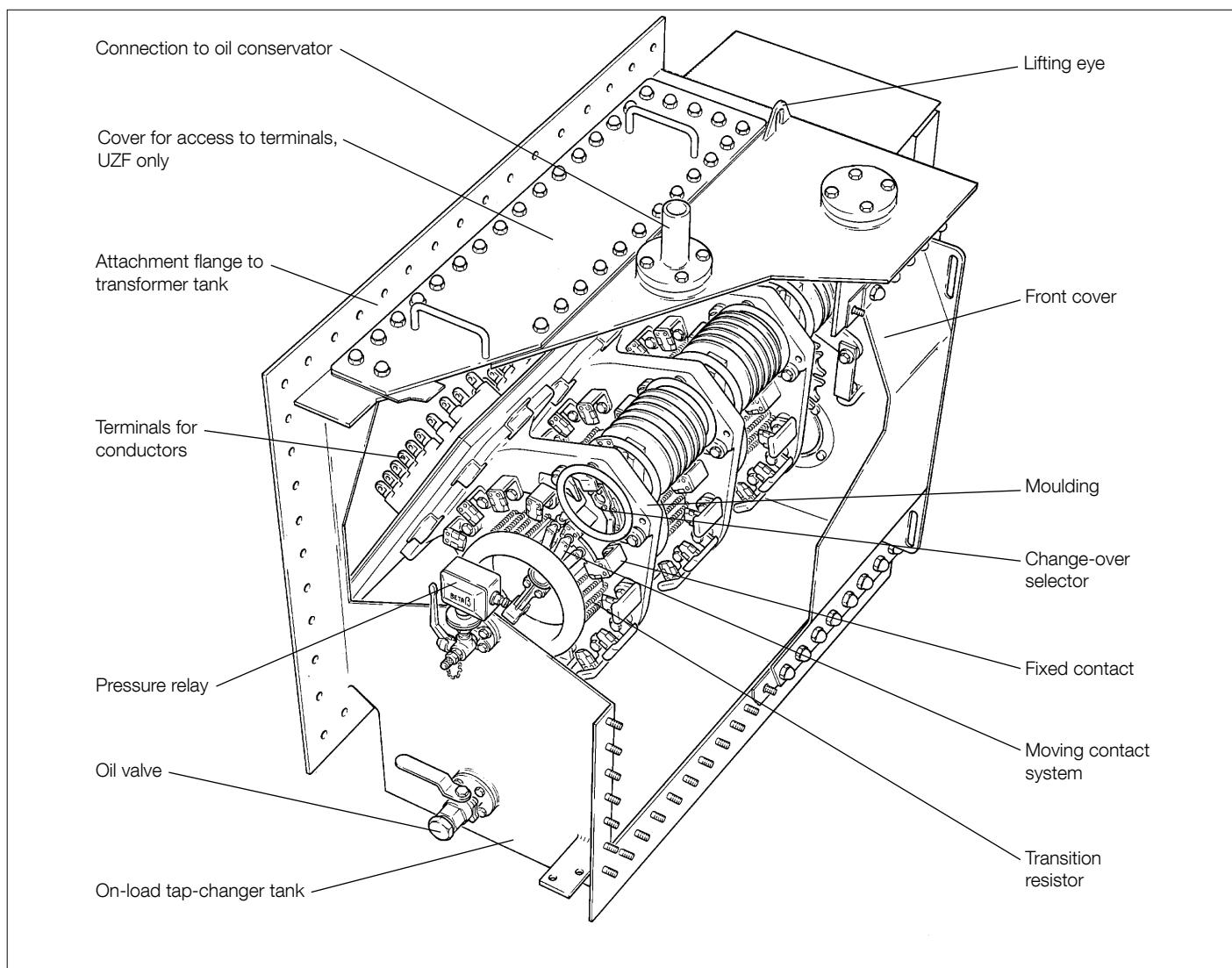


Fig. 1. On-load tap-changer.

1.3 Serial number

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

If the 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).



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. 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 tap-changer, as well as contact replacement, is carried out according to the instructions in the maintenance guide 1ZSE 5492-123.

1.6 Tightening torque

The following tightening torques are recommended unless otherwise stated in this installation guide:

M6	10 Nm	$\pm 10\%$	(7.4 lbf x ft)
M8	24.5 Nm	$\pm 10\%$	(18 lbf x ft)
M10	49 Nm	$\pm 10\%$	(36 lbf x ft)
M12	84 Nm	$\pm 10\%$	(62 lbf x ft)

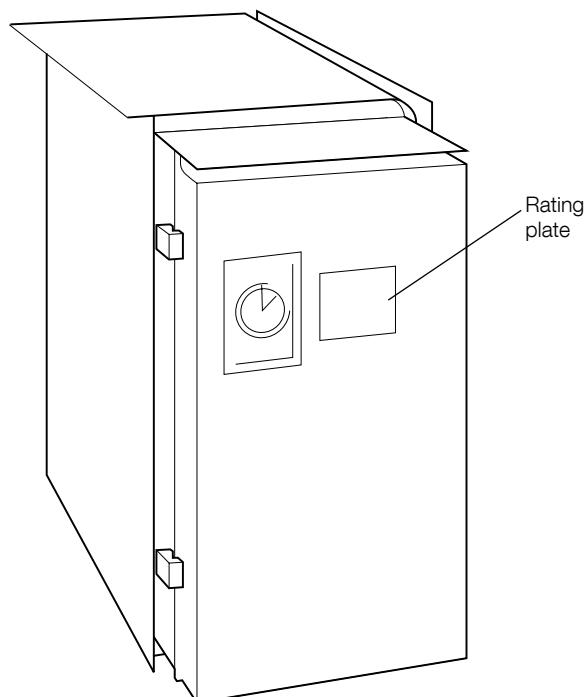


Fig. 2. Location of rating plate.

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 Tap-changer

Error condition	Fault finding procedure
High oil level alarm	A rising oil level in the tap-changer oil conservator may indicate a leakage between the 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.
Low oil level alarm	A lowering oil level in the 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 re-check some time later.

2.2 Pressure relay

CAUTION

To take the transformer into service after a pressure relay trip without carrying out a careful investigation of the selector switch by lifting it out of the selector switch housing, and repairing faults, if any, may cause severe damages to the tap-changer and the transformer.

CAUTION

It is not permissible to replace only the microswitch within the pressure relay.

Error condition	Fault finding procedure
The pressure relay has tripped during normal operation.	<p>Tools required:</p> <ul style="list-style-type: none">- Air pump- Manometer- Screwdriver- Megger (500–2 000 V) <ol style="list-style-type: none">1. After a pressure relay trip, the tap-changer and the transformer must be carefully investigated. That means that the tap-changer must be drained and the front cover opened. Faults, if any, must be repaired before the transformer is energized. If both the tap-changer and the transformer are functioning properly, continue with the next step.2. Carry out the insulation test of the pressure relay. Proceed as follows:<ul style="list-style-type: none">- 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 shortcircuit from the terminals and reconnect the wires from the control cabinet.- If the pressure relay does not withstand the electrical stress, it should be replaced. See section 3.6, Replacement of pressure relay.3. Carry out the function test. Proceed as follows:<ul style="list-style-type: none">- Set the valve handle to the test position as shown on the information plate.- Connect the air pump and the pressure gauge to the test tap on the pressure relay. (Thread R 1/8").- Raise the pressure until the pressure relay trips the circuit breakers of the transformer.- Read the pressure on the manometer and check against the pressure stated on the information plate. Max. permitted deviation is $\pm 10\%$. If the deviation is greater, the pressure relay should be replaced.- Check that the signal disappears when the pressure is released.- After finishing the check, turn back the valve handle to service position.

2.3 Motor-drive mechanism

2.3.1 Control system

Error condition	Fault finding procedure
LOCAL operation or REMOTE operation is not possible.	LOCAL operation is not possible when the control selector switch is in position REMOTE or "0", and REMOTE operation is not possible in position LOCAL or "0".
The position indicator generates no signal.	<p>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.</p> <p>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.</p> <p>For information about how to adjust the resilience, refer to section Position Transmitter and other Position Switches in Maintenance Guide.</p> <p>3. 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.</p> <p>4. Check that the signal reaches the position indicator.</p>
The tap-changer performs more steps than ordered, or operates towards the end stop.	<p>1. If the 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.</p> <p>2. Check that the flywheel is free from grease. For information about cleaning, see Maintenance Guide.</p> <p>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.</p> <p>4. Check that the raise and lower contactors function properly (see circuit diagram, Fig. 3, and contact timing diagram, Fig. 4).</p> <p>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.</p> <p>6. Check that the maintaining contact functions properly (see circuit diagram and contact timing diagram). Exchange of maintaining contact, see section 3.5.</p>

2.3.2 Power system

Error condition	Fault finding procedure
The three-phase motor runs back and forth without the tap-changer changes position.	Reverse two of the phases of the incoming supply.

2.3.3 Miscellaneous

Error condition	Fault finding procedure
Corrosion and/or condensation in the motor-drive mechanism cabinet.	Check the function of the anti-condensation heater. Refer to Heater in Maintenance Guide.
Water in the motor-drive mechanism cabinet.	<ol style="list-style-type: none">1. Adjust the hinges on the cabinet door.2. Replace the door gasket on the cabinet.
Oil in the motor-drive mechanism cabinet.	<ol style="list-style-type: none">1. Locate the leakage.2. Contact ABB.

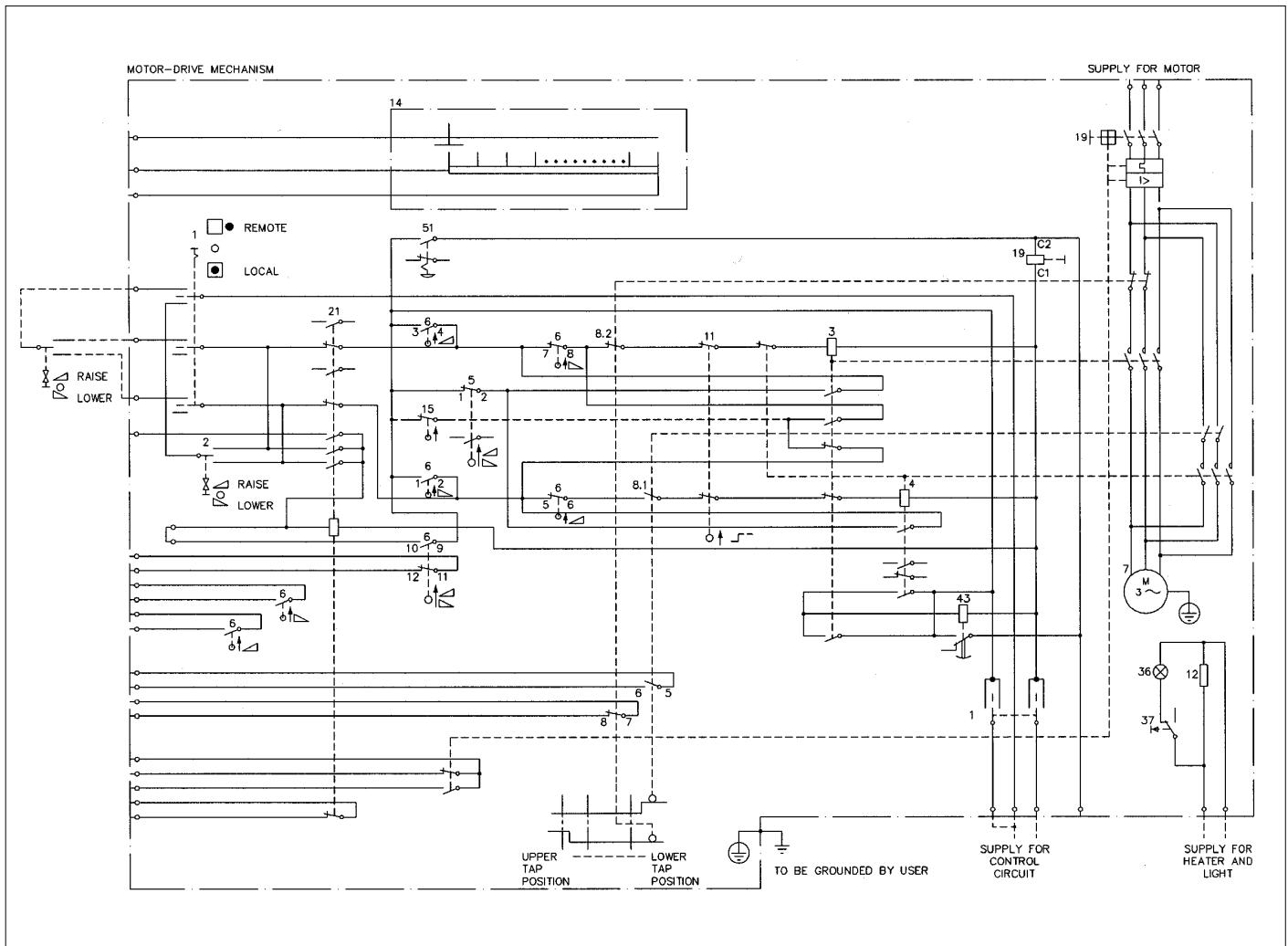


Fig. 3. Circuit diagram.

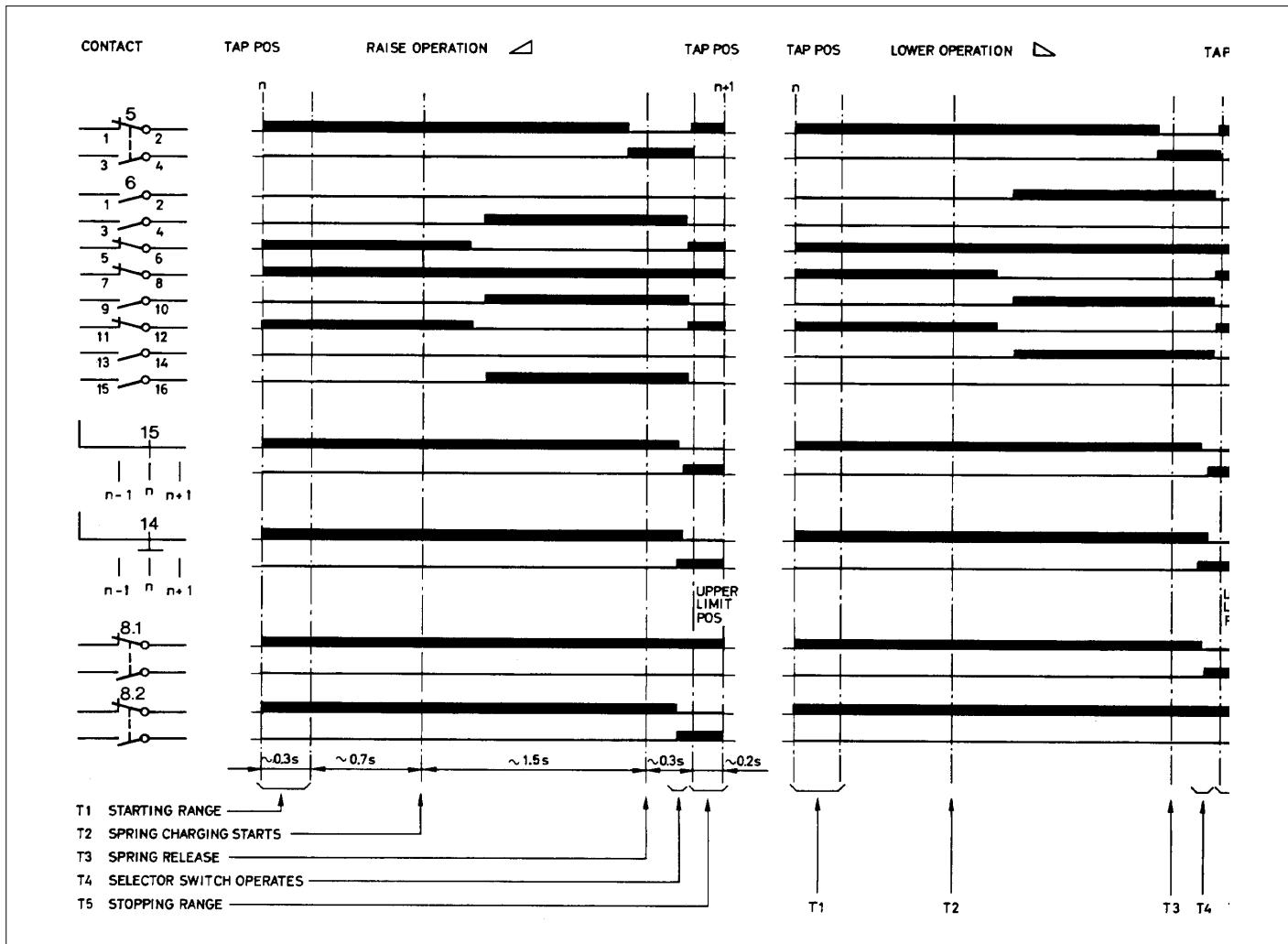


Fig. 4. Contact timing diagram.

3. Repairs and adjustments

For **contact replacement**, see the maintenance guide.

For **adjustment of disc brake**, see the maintenance guide.

For **replacement of gasket between tap-changer tank and transformer tank**, see the 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 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 (lint-free)
- 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 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

CAUTION



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

1. Lower the oil level in the transformer to a level below the tap-changer. Refer to the documentation for the transformer.
2. Drain the oil from the tap-changer. Use the pump and clean, empty, drums. The 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).



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 manhole on the transformer.
7. Unscrew the nuts of the clamps that holds the phase unit.

i 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.

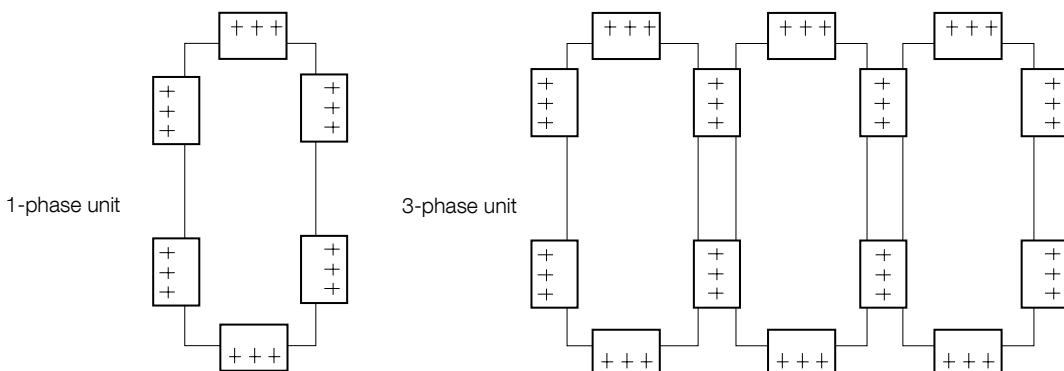


Fig. 6. Mounting of gaskets.

- 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.

i 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.

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 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.

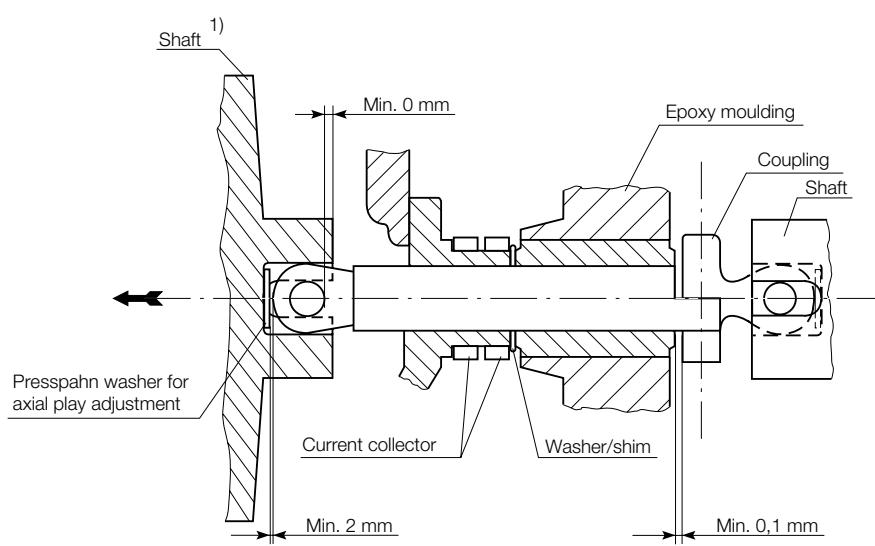


Fig. 7. Play check/adjustment.

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 (lint-free)
- 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 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 Replacement of maintaining contact

3.4.1 Tools required

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

3.4.2 Spare parts required

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

3.4.3 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.

3.5 Pressure relay and other protection devices

Instructions for functional check and replacement of the pressure relay, and other protection devices, are available in instruction 1ZSC000562-AAD.

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