Installation and Commissioning Guide

Load Tap Changers, types UZE and UZF with Motor-Drive Mechanism, type BUF 3
Load Tap Changer, type UZG with Motor-Drive Mechanism, type BUL

ABB Power T&D Company Inc.
Components Division
Renewal Parts

If renewal parts are required, order them through the nearest ABB Power T&D Company Inc. representative. Please provide the item description and the identification numbers (model, style, catalog) from the unit's nameplate.

Technical Support

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Recommended Practices

ABB Power T&D Company Inc. recommends careful consideration of the following factors when installing load tap changers.

Before you install a unit, make sure that the personnel doing the job have read and fully understood the Installation and Maintenance 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

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 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 oil-tight 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.

continued on the next page.
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.

---

**WARNING**
The motor-drive mechanism must not be installed in any explosive atmosphere. The electrical equipment creates sparks which can cause an explosion.

---

**WARNING**
Before any work is carried out on the 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.

---

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

---

**WARNING**
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.

---

**During Drying of the Transformer**

---

**CAUTION**
The load tap changer must not be included in the vapour phase drying process of the transformer. For permissible pressure and temperature at the rear during drying process, see chapter 3.
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.

During Oil Filling

--- WARNING ---
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.

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

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

--- CAUTION ---
The oil level in the oil conservator of the load tap changer should never be above the oil level in the oil conservator of the transformer.

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 airbubbles to disappear.

During Service

--- WARNING ---
Small amounts of explosive gases will always come out from the breathing devices (dehydrating breather or one-way breather). Make sure that no open fire, hot surfaces or sparks occur in the immediate surrounding of the breathing devices.
WARNING
If a failure in power supply occurs during operation, the operation will be completed when the power returns.

WARNING
The hand crank must not be inserted during electrical operation.

WARNING
The motor drive can move suddenly when power is restored after a power failure.

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

CAUTION
The pressure relay is a calibrated monitoring instrument. It must be handled with care and protected against careless handling or any kind of mechanical damage.
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1 Introduction

The on-tank concept of load tap changer, realized by ABB Components Sweden in the UZ range, is unique. The design offers advantages in installation and maintenance. The whole device is delivered installed in a tank that is simply mounted onto the transformer tank. For the UZE and UZF, the motor-drive mechanism is included as a part of the LTC (see fig. 1). For the UZG, the motor-drive is delivered as a separate item and is connected to the LTC by a driving shaft.

Fig. 1. General arrangement of load tap changer UZF

It is easy to access all parts of the load tap changer for maintenance and repair. After draining the oil, you simply unbolt and open the front cover to access any part you may need to inspect or replace.
UZE and UZG requires the transformer conductors to be accessed from the transformer side of the load tap changer.

UZF has an inclined rear wall and a top cover that is removable to provide access to the transformer conductors.

**WARNING**

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

UZE and UZG models are available for use without a separate oil conservator. For example, when used on sealed tank transformers.

### 1.1 Required Tools

- Normal set of screwdrivers
- Normal set of open-end wrenches
- Hexagonal wrench, 8 mm
- Dynamometric wrench (5-85 Nm)
- Air pump with pressure gauge and connection to male thread R 1/8” (0-100 kPa)
- Flexible tube with connection, internal thread R 1/8”
- Tool for opening of oil drums
- Clamping blocks, (only for installation)
- Small brush (width 10 mm, only for installation).

### 1.2 Required Material

- Equipment for oil filling for connection to the oil valve.

- Equipment for connection between the load tap changer and the transformer when filling under vacuum. External thread KR 3/4” on the tap changer.

- Sealing tape

- Glue (ABB 1 3401-608), 0.5 kg (contact adhesive on nitrile rubber base, only for installation)

- Oil as per section 1.3

- Maintenance Guide, for UZE, UZF, and UZG

- Circuit diagram for the motor-drive mechanism.
1.3 Oil

The oil quality should be of Class II according to IEC publication 296.

Table 1. Weight of Oil in kg.

<table>
<thead>
<tr>
<th>Type designation</th>
<th>LTC with separate conservator</th>
<th>LTC with expansion volume in the tank</th>
</tr>
</thead>
<tbody>
<tr>
<td>UZE.N, UZE.T, UZG.N, UZG.T</td>
<td></td>
<td></td>
</tr>
<tr>
<td>200/...</td>
<td>500</td>
<td>450</td>
</tr>
<tr>
<td>250/...</td>
<td>500</td>
<td>450</td>
</tr>
<tr>
<td>380/...</td>
<td>950</td>
<td>880</td>
</tr>
<tr>
<td>550/...</td>
<td>1250</td>
<td>1150</td>
</tr>
<tr>
<td>650/...</td>
<td>1250</td>
<td>1150</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type designation</th>
<th>LTC with separate conservator</th>
<th>LTC with built on conservator</th>
</tr>
</thead>
<tbody>
<tr>
<td>UZF.N, UZF.T</td>
<td></td>
<td></td>
</tr>
<tr>
<td>200/...</td>
<td>400</td>
<td>430</td>
</tr>
<tr>
<td>250/...</td>
<td>400</td>
<td>430</td>
</tr>
<tr>
<td>380/...</td>
<td>750</td>
<td>800</td>
</tr>
<tr>
<td>550/...</td>
<td>1050</td>
<td>1120</td>
</tr>
<tr>
<td>650/...</td>
<td>1050</td>
<td>1120</td>
</tr>
</tbody>
</table>

1) The oil for the conservator is not included.

**WARNING**

Do not energize the transformer until oil has been filled as per chapter 6, Oil Filling, in this guide.

1.4 Oil Conservator

The load tap changer is sometimes connected to an oil conservator. ABB recommends the use of a separate conservator for the load tap changer with both oil and air side separated from the main conservator of the transformer.

The volume of the conservator should be such that there is oil left in the conservator even at the lowest oil temperature expected and such that no flooding can occur at the highest oil temperature expected.

A suitable dimension of the tube for connection to the conservator is an inner diameter of approximately 20 mm. The tube should be inclined at least 3 degrees to avoid gas cushions in the tube. A valve in the connection to the conservator is recommended.

The conservator must be equipped with a breathing device that does not allow moist air into the conservator and that allows the gas from the arcs to disappear.

The conservator should also be equipped with an oil level indicator, and an alarm contact for low oil level is recommended.
Fig. 2. UZE with separate oil conservator

Fig. 3. UZE with oil expansion volume in the tank
UZG is similar to this design.

Fig. 4. UZF with built-on oil conservator
1.5 Weights

Table 2 contains the approximate weights of all the models in the UZ range of load tap changers. The weight of the motor-drive mechanism is included in the overall weight except for UZG where it is shown separately.

Table 2. Weights for UZ load tap changers in kg.

<table>
<thead>
<tr>
<th>Load tap changer Type designation</th>
<th>Tap changer without oil(^1)(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UZE.N, UZE.T</td>
<td></td>
</tr>
<tr>
<td>200/...</td>
<td>725</td>
</tr>
<tr>
<td>250/...</td>
<td>700</td>
</tr>
<tr>
<td>380/...</td>
<td>930</td>
</tr>
<tr>
<td>550/...</td>
<td>1100</td>
</tr>
<tr>
<td>650/...</td>
<td>1100</td>
</tr>
<tr>
<td>UZF.N, UZF.T</td>
<td></td>
</tr>
<tr>
<td>200/...</td>
<td>790</td>
</tr>
<tr>
<td>250/...</td>
<td>760</td>
</tr>
<tr>
<td>380/...</td>
<td>950</td>
</tr>
<tr>
<td>550/...</td>
<td>1170</td>
</tr>
<tr>
<td>650/...</td>
<td>1170</td>
</tr>
</tbody>
</table>

1 The weight of the BUF motor-drive mechanism is approximately 110 kg
2 The weight of the UZF includes the weight of the conservator usually delivered with the load tap changer

<table>
<thead>
<tr>
<th>Load tap changer Type designation</th>
<th>Tap changer without oil without motor-drive</th>
<th>BUL motor-drive mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>UZG.N, UZG.T</td>
<td></td>
<td></td>
</tr>
<tr>
<td>200/...</td>
<td>685</td>
<td>75</td>
</tr>
<tr>
<td>250/...</td>
<td>660</td>
<td>75</td>
</tr>
<tr>
<td>380/...</td>
<td>890</td>
<td>75</td>
</tr>
<tr>
<td>550/...</td>
<td>1060</td>
<td>75</td>
</tr>
<tr>
<td>650/...</td>
<td>1060</td>
<td>75</td>
</tr>
</tbody>
</table>

1.6 Tightening Torque

The following tightening torques are recommended:

<table>
<thead>
<tr>
<th>Size</th>
<th>Torque (Nm)</th>
<th>±10 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>M6</td>
<td>10</td>
<td>±10 %</td>
</tr>
<tr>
<td>M8</td>
<td>24.5</td>
<td>±10 %</td>
</tr>
<tr>
<td>M10</td>
<td>49</td>
<td>±10 %</td>
</tr>
<tr>
<td>M12</td>
<td>84</td>
<td>±10 %</td>
</tr>
</tbody>
</table>

unless otherwise stated in this guide.
2 Receiving

2.1 Unpacking

Check that all pieces are free from transport damage. If there is visible damage a careful investigation must be carried out.

Lift the load tap changer and the motor drive BUL if included, using the lifting eyes on the top.

2.2 Inspection upon Receiving

1. Check that there is no visible damage.

2. Open the door of the cabinet of the motor-drive mechanism and check that the motor-drive mechanism is free from damage.

3. If transport damage is found, and it is adjudged that correct operation of the load tap changer is not possible, a damage report should be sent to the insurance company. It is also recommended that photographs be taken of the damaged details. Mark the photos with the serial number of the load tap changer and send them to ABB for comments.

4. Check that the quantity delivered, the type designation and the serial number agree with the delivery documents, e.g. the packing list or ABB’s ordering acknowledgement. The serial number is stamped on the rating plate.

5. Remove the drying agent (placed according to Fig. 5), before the load tap changer is taken into service.

6. If the packing material seems to be wet (e.g. the plastic is coated with moisture), the load tap changer must be dried at least 24 hours at a temperature of max. 70 °C (158 °F) before it is fitted to the transformer. See chapter 3, Drying.

---

Fig. 5. Inspection on receipt
2.3 Temporary Storage before Assembly

If the load tap changer is not to be installed on the transformer immediately, once the delivery has been approved the load tap changer must be kept warm and dry. Let the unit be kept in its plastic enclosure and leave the drying agent until assembly.

3 Drying

Drying of the load tap changer is normally not required, see section 2.2, step 6.

The following temperatures and pressures between the load tap changer tank and the transformer tank are allowed when drying:

<table>
<thead>
<tr>
<th>Pressure</th>
<th>Standard Load Tap Changer</th>
<th>Load Tap Changer with reinforced barrier¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zero</td>
<td>Up to 115 °C (239 °F) on the transformer side. Up to 90 °C (194 °F) inside the tank.</td>
<td>Up to 115 °C (239 °F) on the transformer side. Up to 90 °C (194 °F) inside the tank.</td>
</tr>
<tr>
<td>Up to 100 kPa</td>
<td>Up to 60 °C (140 °F).</td>
<td>Up to 90 °C (194 °F).</td>
</tr>
<tr>
<td>100–150 kPa</td>
<td>Not allowed.</td>
<td>Up to 60 °C (140 °F).</td>
</tr>
</tbody>
</table>

¹ For use on sealed tank transformers

The temperature inside the motor drive cabinet must not exceed 70 °C (158 °F).

During or after drying the load tap changer must not be operated until it has been filled with oil. The motor-drive mechanism should not be included in a vacuum process, as the process would remove the grease necessary for operation.
4 Installation on the Transformer

**CAUTION**
The load tap changer must not be included in the drying process of the transformer.

The load tap changer is either bolted or welded to the transformer tank, see section 4.1. See Appendix B for assembly of shafts and motor-drive BUL for LTC type UZG

4.1 Attaching the Load Tap Changer to the Transformer

4.1.1 Welding

For welding the load tap changer to the transformer tank, use fillet weld with a \( \geq 4 \) mm (Fig. 6).

![Welding detail](image)

*Fig. 6. Welding detail*

4.1.2 Bolting

A set of cork-rubber gaskets is provided to seal against the transformer tank.

When you install the load tap changer, the gasket should be glued as described below. Tighten the bolts by approximately 60 Nm torque.

Ensure that the surfaces being in contact with the gaskets are clean and free from grease and oil.
After cleaning, stick the gaskets to the transformer tank flange (Fig. 7) with ABB glue 1 3401-608, by brushing glue on both the gasket and the flange.

After spreading the glue let it dry at room temperature for a minimum of 10 minutes and a maximum of 30 minutes.

Keep the gaskets in the correct position by using clamping blocks for a minimum of 3 hours.

Glue the inner gasket bands only, both to the load tap changer flange side and to the transformer-tank flange side.

The required amount of glue (ABB 1 3401-608) is 0.5 kg.

Do not glue gaskets at temperatures below 0 °C (32 °F).

NOTE: ABB glue 1 3401-608 is a contact adhesive of nitrile rubber base.
4.1.3 Assembly of Accessories

All details which have been removed for the transport are specified on the packing list. The openings on the load tap changer are then sealed by transport covers.

1. Remove the transport covers.
2. Check the O-rings. Make sure they are pressed into the bottom of the groove on the flanges.
3. Assemble the accessories. Tightening torque for the nuts as per section 1.6.

4.1.4 Retightening

When a gasket is subjected to the pressure from the flange bolts it will change its shape or settle. This reduces the pressure on the bolts, making them loose.

The settling effect will increase at higher temperatures. For this reason retightening is required.

Retighten one day after assembly. Retighten again after the transformer has been in service for about two weeks to let the gaskets settle at service temperature.

The retightening torque should again be approximately 60 Nm.

4.2 Connection of the Regulating Winding of the Transformer, Type UZE and UZG

On UZE and UZG the winding has to be connected from the rear. The cable lugs can be either crimped or brazed. The free distance between the cable lugs for electrically adjacent contacts must be at least 7 mm. Tightening torque is 38 Nm. For star point design, attach the neutral connection as shown in Fig. 8 and the connection diagram.

4.3 Connection of the Regulating Winding of the Transformer, Type UZF

The top cover is intended to be used when connecting the transformer’s regulating winding leads to the load tap changer terminals.

Remove the cover and connect the leads. Tightening torque is 38 Nm. For star-point design, attach the neutral connection as shown in Fig. 8 and the connection diagram. Bolt on the cover. Tightening torque is 42 Nm.

If the oil conservator is to be installed on the top of the load tap changer, connect the regulating winding leads before installing the oil conservator.
Fig. 8. Assembly of the neutral connection
4.4 Connection to the Oil Conservator

See Fig. 9.

Remove the transport cover from the flange for the oil conservator. Check that the O-ring is in place on the flange and connect the pipe to the oil conservator.

In cases where the oil conservator is installed directly on the top of the load tap changer, install the oil conservator directly on the flange with the connection sealed by an O-ring that is left on the flange when the transport cover is removed. After that, the other bracket of the conservator is mounted to the tank.

For UZ with normal barrier, the oil level difference between load tap changer and transformer should be a maximum of 1.2 m. For a reinforced barrier, the oil level difference may be 8 m.

---

**CAUTION**

Where the conservator is common to the transformer and the load tap changer, an oil filter must be placed in the pipe between the load tap changer and the conservator.

---

Filter with housing can be ordered from ABB ordering No. LL 114 004-AP.
5 Pressure Relay

5.1 General

The tank of the load tap changer is supplied with a pressure relay. In the event of overpressure in the tank the relay, if correctly connected, will trip the transformer's main circuit breakers. It is also recommended to connect the pressure relay in the trip circuit of the power supply during testing of the transformer.

CAUTION

After a pressure relay trip follow the instructions under chapter "Pressure Relay" in the Repair Guide.

CAUTION

Taking 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 any faults may cause severe damage to the load tap changer and the transformer.

The pressure relay can easily be tested by applying air pressure, using a pump, to the test tap on the valve. The handle can be padlocked in the service position.

CAUTION

The pressure relay is a calibrated monitoring instrument. It must be handled with care and protected against careless handling or any kind of mechanical damage.

5.2 Installation

Remove the cover from the pressure relay terminal box and connect the cables to the terminal block.

The cable gland includes an O-ring seal between the gland and the pressure relay housing.

If the gland has to be changed to another type, the seal against the housing must be secured by a gasket or sealing liquid (e. g. Loctite 275).

CAUTION

Tighten the cable gland with care, torque max. 5 Nm.
5.3 Checking when Commissioning the Transformer

1. Set the valve handle in the test position as shown on the information plate.
2. Connect the air pump and the pressure gauge to the test tap on the pressure relay.
3. Raise the pressure until the pressure relay trips the circuit breakers for the transformer.
4. Read the pressure on the manometer and check against the pressure stated on the information plate. Max. permitted deviation is ±10%.
5. Check that the alarm signal disappears when the pressure is lowered.
6. After finishing the check, turn the valve handle back to the service position.

Fig. 10. Pressure relay
6 Oil Filling

6.1 Filling Methods and Restrictions

Oil filling can be carried out at atmospheric pressure or under vacuum. The wall between the load tap changer and the transformer tank is designed to withstand vacuum on one side and atmospheric pressure on the other side. Having vacuum on one side and the pressure of an oil column on the other side is not permitted.

UZE and UZG can be delivered with an oil expansion volume in top of the tank. The design of UZF does not allow an oil expansion volume in the tank. Instead, UZF can be delivered with a built-on oil conservator. See also Figs. 2, 3 and 4.

Oil filling may be carried out in different ways depending on what the transformer manufacturer considers convenient, as long as the above rules are complied with and the load tap changer is filled with oil to the correct level.

The methods below are recommended, and if they are followed in detail no pressure limits will be exceeded.

6.2 Filling at Atmospheric Pressure

1. Open the conservator valve, if any.

2. Dismantle the pipe to the breather. Or, if simpler, remove the air relief valve (one way breather) or the dehydrating breather.

3. Connect the pump to the oil valve on the load tap changer tank. For dimension see the dimension drawing. Open the valve and pump in oil to the correct level shown on the oil level indicator. For correct oil level, see section 6.4.

4. Shut the oil valve and disconnect the pump.

5. Reassemble the pipe or the breather. The connections must be airtight; therefore use sealing tape on the threads and O-rings in the flanges.

When the transformer and the load tap changer have a common oil conservator, a filter in the connection between the load tap changer and the conservator is needed.

1. The conservator valve should be shut.

2. Open the air release valve on the oil filter housing.

3. Connect the pump to the oil valve on the load tap changer tank. Open the valve and pump in oil. Stop the pump when oil reaches the air release valve.

4. Shut the oil valve and the air release valve and disconnect the pump.

5. Open the conservator valve.

--- CAUTION ---

Do not energize the transformer earlier than three hours after oil filling in atmospheric pressure. This waiting period is needed to allow airbubbles to disappear.
6.3 **Filling under Vacuum**

Oil filling under vacuum is not necessary. If it is to be carried out, the load tap changer and the transformer tank should be put under vacuum simultaneously.

It is assumed that a vacuum-proof conservator is in use.

1. Open the conservator valve, if any.
2. Dismantle the pipe to the breather, or, if simpler, remove the air relief valve or the dehydrating breather.
3. Connect the transformer to the conservator for the load tap changer or to the top of the load tap changer via the breather.
4. Apply vacuum.
5. Connect the oil filling equipment to the oil valve on the load tap changer tank. Open the valve and let oil into the tank until the correct level is shown on the oil level indicator. For correct oil level see section 6.4.
6. Shut the oil valve and disconnect the filling equipment.
7. When filling of the transformer is completed disconnect the vacuum pump and let air into the conservator or expansion volume.
8. Reassemble the pipe or the breather. The connections must be airtight; therefore use sealing tape on the threads and O-rings in the flanges.

6.4 **Correct Oil Level**

For installations where the load tap changer and the transformer tank have a common oil conservator, the instructions for the transformer should be used.

If possible, the oil levels of the oil conservators of the transformer tank and the load tap changer should be the same. The oil level of the oil conservator of the load tap changer should in no case be higher than the oil level of the transformer oil conservator.

At +25 °C (77 °F), oil is filled to the level where the pointer of the oil level indicator points half-way between MIN and MAX.

For other temperatures than +25 °C (77 °F), proceed as follows:

- For every 10 °C (18 °F) increase of temperature, adjust the oil level upwards a tenth of the scale range of the oil level indicator.
- For every 10 °C (18 °F) decrease of temperature, adjust the oil level downwards a tenth of the scale range of the oil level indicator.
7 Electrical Connection and Testing

7.1 General

Before the transformer is energized, tests have to be carried out to make sure that all mechanical and electrical connections are correct, and to check the proper functioning of the motor-drive mechanism and the load tap changer.

When testing the transformer, the load tap changer can be operated either by the hand crank or electrically. When operating electrically the drive mechanism is connected as per section 7.2.

7.2 Connecting and Testing

For bolted on design, connect the earthing terminal on the load tap changer to the transformer tank.

For the BUL motor-drive, connect the earthing terminal to the transformer tank.

Connect the motor supply and the control supply to the correct terminals in the motor-drive mechanism as shown by the circuit diagram supplied with the load tap changer.

Operate the motor-drive mechanism by means of the hand crank to one of the positions in the middle of the range, but not in a through position (= a position with a letter in).

Turn the control selector-switch to position LOCAL. Then give an impulse for RAISE operation. If the phase sequence (three-phase supply) is wrong, the motor-drive mechanism will start in LOWER direction. The motor-drive mechanism will stop when it has made approximately half of the complete operation and it will operate back and forth without the load tap changer changing position until the control selector switch is turned to position ”0”. If the phase sequence is wrong, reverse two of the motor supply cables in order to get the correct sequence.

---

**WARNING**

Dangerous voltage.

Operate the load tap changer electrically. For UZE/UZF check that the flywheel in the motor-drive mechanism stops with the brake between the outer marks on the flywheel. For any adjustment needed, see Maintenance Guide for UZE/UZF/UZG.

For BUL:

Run the motor-drive mechanism and check that the center of the notch in the cam disc stops within ±2 mm from the center of the roller on the brake arm, see Fig. B4. If it does not stop within the tolerances, adjust the breaking force with the adjusting screw in the lower end of the brake arm. Loosen the lock nut. Tightening the screw (clockwise) makes the stop earlier and loosening the screw (anticlockwise) makes the
stop later. Tighten the lock nut after the adjustment.

Operate the driving mechanism electrically between the end positions. Check the end stops. When trying to operate it electrically beyond the end position, the motor should not start. Check the mechanical end stop by trying to hand crank it beyond the end position. After a couple of turns on the hand crank it should be mechanically stopped. Hand crank back to the end position (where the indicator flag is white). Operate the load tap changer electrically to the other end position and repeat the test procedure above.

--- CAUTION ---

The transformer should in no case be energized with an end stop out of order.

---

7.3 Electrical Tests on Transformer

Acceptance tests on the transformer or commissioning can now be performed.

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7.4 After Energizing

--- WARNING ---

Before any work is carried out on the 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.

---
8 Oil Level during Transport

The following adjustment of the oil level must be carried out when the load tap changer is to be transported.

--- 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.

8.1 Transformer Filled with Oil

8.1.1 Conservator Mounted

The load tap changer should be filled with oil and connected to its conservator.

8.1.2 Conservator Dismounted

Drain about 20% of the oil from the load tap changer. Oil weights according to section 1.3.

Close the opening to the conservator with a transport cover.

8.1.3 UZE/UZG with Oil Expansion Volume in the Tank

The load tap changer should be filled with oil.

8.2 Transformer Drained

8.2.1 Conservator Mounted

Drain the oil from the load tap changer. Keep the connections to the conservator.

8.2.2 Conservator Dismounted

Drain the oil from the load tap changer. Close the opening to the conservator with a transport cover.

8.2.3 UZE/UZG with Oil Expansion Volume in the Tank

Drain the oil from the load tap changer.

--- WARNING ---

The motor-drive mechanism must be protected against condensation. Energize the heater when power is available. When not, put drying agent inside the motor drive cabinet and seal the vents.


9 Commissioning

This section describes tasks to be carried out when the transformer is being installed and tested on site.

---

**CAUTION**

The motor-drive mechanism must be protected against condensation.

Energize the heater when power is available. When not available, put drying agent inside the motor-drive cabinet and seal the vents.

---

9.1 Reassembly

Reassemble the conservator and all other accessories which may have been dismantled for the transport. Remember the O-rings in the flanges.

9.2 Oil Filling

See chapter 6.

9.2.1 Dehydrating Breather

If the breather has an oil trap, fill oil to the marked level.

9.3 Electrical Connection and Testing

Do all wiring work and perform the appropriate tests as described in chapter 7.

9.3.1 Motor Protection

The function of the protective motor switch should be checked. For three-phase AC motors, remove one of the phase fuses and check the function time of the protective motor switch by a RAISE or LOWER operation. The protective motor switch should release within 60 seconds at a current setting equal to the rated current of the motor at the actual voltage.

If the protective motor switch does not trip within 60 seconds, adjust the current setting. Repeat the test when the motor is cold.
WARNING
The motor power voltage is dangerous.

Protective motor switches for DC motors or single-phase AC motors are not necessary to test.

9.3.2 Counter
Check that the counter functions upon RAISE and LOWER operations.

9.3.3 Position Transmitter and other Multi-Position Switches
Check the function of the position transmitter and other multi-position switches.

9.3.4 Light
Check that the light is switched on when the door is opened and goes out when the door is closed.

9.3.5 Heater
Switch off all power supplies and feel by hand that the heater has been warmed up during earlier tests. Switch on the power afterwards.

9.3.6 Pressure Relay
Check the function as per section 5.3.

9.4 Putting into Operation
Put the LOCAL/REMOTE switch to REMOTE.
Make sure that no tools or foreign objects are left in the motor drive cabinet. Close the door.
APPENDIX A.
Delivery of Load Tap Changer Without Tank

A1 Introduction

Delivery of the Load Tap Changer Without Tank

The UZ range of load tap changers can be delivered without the tank. In these cases, the transformer manufacturer designs the tank as an integral part of the transformer tank. For such cases, please contact ABB for the appropriate welding and mounting instructions.
APPENDIX B.
Assembly of Shafts between UZG and BUL

B1 Introduction

The load tap changer type UZG does not include a motor-drive mechanism on the main tank. The motor-drive mechanism BUL is a separate unit. Since the BUL does not incorporate the spring battery system, flywheel, and brake, these are mounted in a gear box on the side of the load tap changer tank. The BUL is then connected to the gear box by a shaft.

Note: As the load tap changer and motor drive mechanism are delivered separately, they are locked in the same service position at delivery. These locking plates should be kept in place until the shaft system is being connected.

Figure B1
Positioning of locking plates
### B2 Mounting of the Motor-Drive Mechanism

Proceed as follows:

Mount the motor-drive mechanism onto the transformer.

The mounting holes on the transformer should be leveled within 1 mm to line up with the mounting holes in the motor-drive back plate. If adjustment is needed, shims should be used.

Note: The load tap changer is mounted according to section 4 of the main document.

**WARNING**

Do not energize the transformer before the load tap changer and motor-drive mechanism are correctly assembled.

### B3 Mounting of Shaft System

#### B3.1 Drive Shaft

The external drive shaft consists of a square tube and shall be connected to the spherical shaft end on the gearbox and motor-drive mechanism by means of two coupling halves. The square shaft and protective tubes must be cut before mounting.

**CAUTION**

Before mounting of shaft and couplings, everything must be cleaned and greased for correct function and to avoid corrosion.

Apply a thin layer of grease, GULF-718EP Synthetic grease or Mobilgrease 28 or SHELL-Aero Shell Grease 22 to all spherical shaft ends.

**CAUTION**

The motor-drive mechanism and load tap changer shall have the same indicated tap position.

The inclination of the shaft (the square tube) must not be more than 4° (=70mm for every 1000 mm shaft length).

**NOTE:** The tubes around the shaft and couplings are for protection.

The arrangement of the driving shaft system is shown in Fig. B2.
Mounting of Drive-Shaft

Figure B2
### B3.2 Mounting of Drive-Shaft

See figure B2

Before starting check that the motor-drive mechanism is in the exact position and the load tap changer is on the same position.

The exact position for the BUL is when the roller on the brake arm is in the notch of the cam disc see fig B4. The position of the load tap changer see B4.2

1. Determine the dimension $K_2$ between the spherical shaft ends.
   - Cut the square tube to the dimension $LA_2 = K_2 - 6\, \text{mm}$, and remove burrs
2. Cut the protective tubes to the dimension $LB_2$ according to the table below.

<table>
<thead>
<tr>
<th>$K_2$</th>
<th>$LB_2$</th>
<th>$K_2 \geq 600, \text{mm}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>190-290,(mm)</td>
<td>$(K_2 + 200)/2$</td>
<td>$(K_2 + 250)/2$</td>
</tr>
<tr>
<td>291-599,(mm)</td>
<td>$(K_2 + 250)/2$</td>
<td>$(K_2 + 500)/2$</td>
</tr>
</tbody>
</table>

**NOTE:** If $K_2 > 600$ the mounted tubes shall overlap each other at least 300 mm. Dismounting and inspection of the couplings shall be possible when one of the tubes is pushed into the other.

3. Mount the coupling halves, screws, and washers, tightening torque 10Nm. Begin with screws A, see Fig B3 on one end of the square shaft, then put two protective tubes (the tube with greater diameter upwards) and hose clips over the square shaft and connect the shaft to the motor-drive.
4. Remove the locking plate on the load tap changer.

5. Mount the coupling halves of the other end of the drive-shaft perpendicular to the couplings already assembled on the shaft, leaving about 2 mm axial play.

6. Mount the protective tubes and clamp them with the hose clips.

7. Remove the locking plate on the motor-drive mechanism.

 NOTE: The locking devices for the gear box and the motor-drive mechanism must be remounted if the shafts are dismounted for transportation.

**B4 Checking Alignment of Load Tap Changer and Motor-Drive Mechanism**

It is important to check that the load tap changer and the motor-drive mechanism are on the same position before operating the motor-drive mechanism. It is also necessary to check that the brake stops the flywheel in the correct position.

---

**WARNING**

Do not energize the transformer with the load tap changer out of alignment!

**B4.1 Preparation**

Open the front cover of the load tap changer, remove the cover plate for the gear box, and open the door to the motor-drive mechanism.

**B4.2 Checking Alignment**

Check the position of the motor-drive mechanism on its indicating plate. Check that the moving arm of the load tap changer and the reversing switch is in the position corresponding to the position of the motor-drive mechanism. This can be seen by looking at the single phase connection diagram.

**B5 Operation Test**

See section 7.

**B6 Closing**

Before closing the front cover of the load tap changer, make sure that no foreign objects, tools, wires, rags, etc., are left in the tank.

Close the front cover of the load tap changer, assemble the cover plate for the gear box. Tightening torque for the dome nuts should be approximately 42 Nm.

**B7 Continuation of Installation**

Continue the installation and commissioning according to the main document.