On-load tap-changers, type UC
User’s manual
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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Manufacturer's declaration

The manufacturer ABB AB
Components
SE-771 80 LUDVIKA
Sweden

Hereby declares that

The products On-load tap-changers, type **UC**
with motor-drive mechanisms, types **BUE and BUL**

comply with the following requirements:

By design, the machine, considered as a component of a mineral oil filled power transformer, complies with the requirements of

- Machinery Directive 89/392/EEC (amended 91/368/EEC and 93/44/EEC) and 93/68/EEC (marking) provided that the installation and the electrical connection are correctly realized by the manufacturer of the transformer (e.g. in compliance with our Installation Instructions) and
- EMC Directive 89/336/EEC regarding the intrinsic characteristics to emission and immunity levels and

Certificate of Incorporation:

The machines above must not be put into service until the machinery into which they have been incorporated has been declared in conformity with the Machinery Directive.

Date 2013-02-15

Signed by .................................................................
Hans Linder

Title Manager Tap-Changers, Local Product Group Unit Components
Introduction
The UC range of on-load tap-changers manufactured by ABB has been developed over many years to provide maximum 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, the insulating oil and the motor-drive mechanism.

The design allows ready access to all parts, making inspection and maintenance quick and simple.

The tap-changers are housed in the transformer tank. The motor-drive mechanism, type BUE or BUL, is attached to the transformer tank and connected to the tap-changer by means of drive-shafts and a bevel gear.

The same motor-drive can operate one, two or three units on the same transformer. Those units are then considered as one tap-changer.

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**

Personnel operating and inspecting the tap-changer must have good knowledge of the apparatus and must be aware of the risks pointed out in this manual.

Personnel making electrical connections in the motor-drive mechanism have to be certified.

**WARNING**

Small amounts of explosive gases might 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 surroundings of the breathing devices.

**CAUTION**

After a trip from a supervisory device, an inspection must be made by a specialist. The diverter switch housing must be drained and the diverter switch lifted and carefully investigated before the transformer is reenergized.
Operation

**WARNING**
The handcrank must not be inserted during electrical operation.

**WARNING**
If the tap-changer is not in the exact position and the handcrank is pulled out, the motor-drive mechanism will start and go to the exact position if the power supply is on.

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

- The position indicator shows the actual tap-position.
- The draghands show the max. and min. tap-position between which the tap-changer has been operating since last resetting.
- **For BUE:** The tap-change in progress indicator shows POSITION in service position, RAISE when operating in a raise operation and LOWER when operating in a lower direction.
- **For BUL:** The tap-change in progress indicator shows RED during operation and WHITE when the tap-changer is in service position.
- For resetting of the emergency stop, turn the knob clockwise and switch on the motor protective switch.
- The LOCAL/REMOTE switch. In position LOCAL the tap-changer can be operated by the RAISE/LOWER switch. In position LOCAL remote operation is rendered impossible. In position REMOTE the tap-changer is operated from the control room or by a voltage regulator. Local operation is not possible in remote position.
- In case of a failure in power supply for the motor-drive mechanism, it is possible to handcrank the tap-changer. Put the handcrank on the shaft. Make sure it has entered the slot in the shaft. Crank in the desired direction as per the information plate above the shaft. The number of turns for one step is also shown on the rating plate. When the handcrank is inserted all electrical operations are impossible. Continue cranking until the tap-changer in progress indicator shows POSITION for BUE or white colour for BUL.
- Thermostat for extra heater (option). We recommend a setting at +5 °C.
- Hygrostat for extra heater (option). We recommend a setting at approximately 60 %.
- Outlet (option) with earth fault protector.

Normally the tap-changer is controlled by a voltage regulator and no manual operation of the tap-changer and the motor-drive mechanism is needed.
Maintenance schedule

CAUTION

To maintain the high reliability of the tap-changer it is important that the rules for maintenance given below are followed.

The maintenance schedule given on the rating plate should always be followed. The statement on the rating plate is maintenance after a certain amount of operations or after a certain time, whichever comes first. In addition to that, an annual inspection should be carried out.

Maintenance of the tap-changer consists of three steps:

– Inspection to be carried out by the site personnel once a year.

– Overhaul to be carried out by a specialist at intervals stated on the rating plate.

– Contact replacement to be carried out by a specialist. The possible need for replacement is decided during overhaul.

In addition to these three steps, oil samples according to IEC 60422, 2005-10, should be taken at regular intervals of 2-6 years for those tap-changers having a maintenance interval exceeding 7 years.

Breakdown voltages according to IEC 60156, 1995-07, should be carried out. The test should be performed as soon as possible after sampling in order to do the test at almost the same oil temperature as in the tap-changer.

The following values should be fulfilled:

<table>
<thead>
<tr>
<th>Tap-changer¹</th>
<th>Dielectric strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>All star point and all BIL 380 kV</td>
<td>≥ 30 kV/2.5 mm</td>
</tr>
<tr>
<td>Others</td>
<td>≥ 40 kV/2.5 mm</td>
</tr>
</tbody>
</table>

¹) Star point is denoted N, the fifth letter in the type designation. The BIL value is the first numerical digit in the type designation on the rating plate. For instance: UCGR N 380/700.

In case the dielectric strength of the oil is lower than the values given above, proceed as follows:

– Make sure the sample is analysed immediately after sampling in order to do the test at approximately the same oil temperature as in the tap-changer

– Measure at least five times and take an average.

– If the values still do not fulfill the requirements, the oil needs to be treated by filtering. For procedure, see the Maintenance guide.

A specialist is a service engineer from ABB or an authorized person trained by ABB for maintenance work on UC tap-changers.
Inspection

**CAUTION**

Approval should be given by the site engineer in charge for inspection as well as for operating the tap-changer.

It is recommended to inspect the tap-changer once a year. This principally concerns the motor-drive mechanism and refers to a visual inspection inside the BUE/BUL cabinet to check that nothing is loose, and that the heater is functioning.

In the motor-drive mechanism a counter registers every tap-change operation. During inspection the counter is read and noted. If possible, motor and counter are to be tested by operating one step and then back.

If the tap-changer has its own oil conservator, the breather and the oil level indicator on the oil conservator are to be checked according to the instructions from the transformer manufacturer.

The inspection is to be carried out while the transformer is in service.

On the conservator the following are to be checked:
- Oil level
- Breather

In the motor-drive mechanism the following items are to be checked:
- Motor and counter
- Emergency stop
- Heater
- Earth fault protector for the outlet (option)

If the tap-changer is equipped with an oil filter unit, the pressure drop over the filter is to be checked.

**Required tools**
The following equipment is required for the inspection:
- Set of screwdrivers
- Pen and note pad

Procedure

**WARNING**

Checking of the breather and the oil level must be carried out from ground level since the transformer is energized.

1. **Checking of the breather**

**WARNING**

The breathers and the tube from the conservator might contain explosive gases. No open fire, hot surfaces or sparks may be present when removing the breather.

Check the breather according to the instructions for the transformer.

2. **Checking of the oil level in the conservator**

The oil level in the conservator should be according to the instructions in the transformer documentation.

3. **Checking of the motor and the counter**

Open the motor-drive cabinet door and turn the selector-switch to the LOCAL position. Then turn the control switch to the RAISE (LOWER) position.

Check that the motor works properly, the position indicator increases (decreases) one step, and the counter advances one step for each operation. Record the counter’s value. The counter shows the number of operations performed by the tap-changer (the overhaul schedule can be determined with the help of this information).

Turn the control switch to the LOWER (RAISE) position. Check that the motor also works properly in that direction, the position indicator decreases (increases) one step and the counter advances one step more.

Reset the draghands. Read the counter and note the reading.

4. **Checking of the emergency stop**

Press the emergency stop and the protective motor switch shall switch off. Reset the emergency stop by turning the knob clockwise and set the protective motorswitch to ON.
5. Checking of the earth fault protector (option)
If the motor-drive mechanism is equipped with an outlet, the earth fault protector should be tested by pressing the test knob on the outlet on BUE or on the separate earth fault protector on BUL.

6. Checking of the heater

**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.

Disconnect the incoming auxiliary power.

Open the control panel (BUE only).

Check by feeling with a finger on the protection plate that the heater has been functioning.

Close the control panel (BUE only). Reconnect the incoming auxiliary power.

Complete the inspection by turning the selector-switch to the REMOTE position and close the cabinet door.

7. Checking of the oil filter unit (option)
If the tap-changer is equipped with an oil filter unit from ABB:

- Read the pressure gauge. Check according to the oil filter manual.
- Note the reading so the change from year to year can be seen.

If moisture is suspected to have come into the tap-changer compartment, the filter insert should be replaced.

If a filter insert replacement is needed, call a specialist.

Also check for leakages. All leakages should be repaired!

8. Trip or alarm from supervisory devices

A tap-changer might be equipped with several different supervisory devices, such as pressure relay, oil flow relay and pressure relief device. Every tap-changer will be equipped with at least one of these devices. Even two or all of these might be installed. The pressure relay and/or the oil flow relay will trip the transformer in case their set points are reached. The pressure relief device might be set to an alarm only or trip as well.

In case of an alarm but no trip, we recommend blocking the tap-changer for further operations and call a specialist for consultation as soon as possible. Plan for a possible outage to check the diverter switch.

In case of a trip of the transformer, immediately call a specialist and do not try to energize the transformer again until a proper inspection of the diverter switch has been carried out. Prepare for a diverter switch lift.

In both scenarios, collect the following information before calling the specialist:

- Serial number of the tap-changer
- Counter reading of the motor-drive mechanism
- If the trip/alarm came during switching. If so, between which positions.
- The load at the time of the trip/alarm
- Which devices have given the trip/alarm
- In case there are more than one tap-changer unit, try to figure out which one has tripped/alarmed.
- Any special service conditions at the time of the trip/alarm, such as overload, thunderstorms, etc.

Before a specialist arrives, prepare for a lift of the diverter switch by making sure that a safe disconnection and grounding of the transformer is done.

In case no local specialist is available, contact the after sales department. The contact information is found on the last page of this manual.
1. Bevel gears
2. Horizontal drive shaft with protective tubes
3. Oil valve
4. Pressure relay
5. Top section
6. Vertical drive shaft with protective tubes
7. Rating plate
8. Motor-drive mechanism
9. Diverter switch housing
10. Tap selector
1. Locking device prepared for padlock
2. Emergency stop
3. Air vent
4. LOCAL/REMOTE switch
5. RAISE/LOWER switch
6. Outgoing shaft
7. Lamp (40 W socket E27)
8. Lifting eye
9. Counter
10. Tap-change in progress indicator
11. Position indicator with drag hands for max. and min. position
12. Shaft for hand crank
13. Protective motor switch
14. Door-operated switch for lamp
15. Hand crank
16. Descriptions and circuit diagram

Cabinet layout of motor-drive mechanism, type BUE.
1. Position indicator with drag hands for max. and min. position
2. Tap-change in progress indicator
   (Red: in progress, White: in position)
3. Counter
4. Outgoing shaft with multi-hole coupling half
5. Shaft for hand crank
6. Locking device prepared for padlock
7. (Option) Outlet
8. Emergency stop
9. RAISE/LOWER switch
10. LOCAL/REMOTE switch
11. Protective motor switch
12. Air vent
13. Door-operated switch for lamp
14. Lamp
15. Descriptions and circuit diagram
16. Hand crank

Cabinet layout of motor-drive mechanism, type BUL2.
Contact us

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