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TRANSPORT, ERECTION, OPERATION AND MAINTENANCE PROCEDURE FOR DISTRIBUTION TRANSFORMERS

Note: The unit is Pressure free at the Reference Temperature, as indicated on the Test Certificate
– For Hermetically sealed units only –

The intent of the document is to provide an overview during the transportation, assembly, commissioning, and maintenance activities performed once the unit had been released form factory. More detail information can be sourced from our offices on request. Information on Hermitically sealed, sealed with gas cushion, Free Breathing with Conservator and OLTC units is provided below.
Please note that when indicated, where applicable, that the information for the correct transformer type is utilised.

1. General Information (Hermetically sealed units)

   Hermetic transformers are completely sealed and does not have a gas cushion or conservator to adjust to the changes in oil volume caused by temperature changes. The corrugated tank is designed to adjust to changes in volume by the elasticity of the cooling corrugation.
   This unit normally does not have an oil-level indicator since refilling and checking of the cooling and insulating fluids is not required.
   The filling of the tank is performed in such a way that there is no negative or excess pressure existing at a defined oil temperature (defined above in red). This oil temperature, the maximum oil temperature rise, and the gradient between the windings and the oil, is calculated for each type of unit. For this reason, we recommend **NOT** to open the oil filling plug, ventilate, or bleed the bushings after delivery of the transformer.
   For any works which requiring opening of the transformers, e.g., mounting of a pressure relief valve or any other monitoring device, the exchange of bushings and/or gaskets, please observe the instructions given in section 4 ‚Maintenance and Repairs, Section 4.5 and 4.6' when draining and refilling the oil respectively.

2. Transport
   - 2.1 Road transport, use vehicles with compressed-air suspension is preferred.
   - 2.2 On arrival of the goods, any damages incurred during the transport, shall be communicated to the forwarding agent responsible for the delivery.
   - 2.3 Paint damage should be repaired immediately.
   - 2.4 Only use the lifting lugs on top of the cover to lift/offload the transformer.
   - 2.5 The fixing lugs attached to the tank, or the edge of the cover, only serves to secure the transformer during transport, and is **NOT** intended for lifting the complete transformer.

3. Assembly and Commissioning
   - 3.0 The operator is responsible to provide measures to protect against contact with live parts.
   - 3.1 Fix the transport rollers if applicable and move the transformer to designated position.
   - 3.2 If the transformer is fitted with an oil gauge, check the oil level prior to commission, and refill when required.
   - 3.3 In the event of a Free breathing unit, fit the supplied with dehydrating breathers
     - 3.3.1 On arrival ensure that the filling plug on the conservator is closed.
     - 3.3.2 Check the colour of the drying beads inside the breather (orange is satisfactory, if 2/3 of the beads is colourless, exchange the contents).
     - 3.3.3 Fit the breather.
     - 3.3.4 Fill the breather oil bowl to the desired level (oil markings provided).
   - 3.4 Earth the transformer to the grounding screw.

3.5 HV and LV connections:

3.5.1 In order to connect the HV and LV bushings, clean the connectors and use the following torque (without lubricant):

Bolt: M 12: 15.5 Nm
M 20: 52.0 Nm

Connection flag with screw: M 10: 40.0 Nm
M 12: 70.0 Nm
M 16: 110.0 Nm

The torque's and the network connections are to be checked by the assembly firm before and after the connection.

3.5.2 Check and verify the bushing phase connections.

3.5.3 Connect the HV side with plug connectors when cone bushings are fitted. Remove protective cap/cover and check contact area to be clean and dry, plug connector in plug-in bushings and tighten it.

3.5.4 The network connections should be mounted not to introduce additional tension stress on the bushings.

3.5.5 When a cast resin monobloc is used for the LV bushings, use a maximum torque setting of 25Nm to check whether the monobloc is fastened.

3.6 If installed, check and verify the distance between the upper and lower arching horns (typically on Porcelain bushings): Um = 7,2 kV : 60 mm; 12 kV : 85 mm;
Um = 17,5 kV : 115 mm; 24 kV : 155 mm;
Um = 36 kV : 220 mm at mean sea level

3.7 If provided, connect, and check auxiliary devices (controlling devices etc.) alarm and trip signals.

3.8 If transformers are provided with different ratios, the required ratio can be adjusted according to the circuit diagram, the marking, and the rating plate. Ensure that the correct voltage ratio is selected to coincide with the supply voltage.

3.9 For a Non-Hermetically sealed unit, and when fitted, please check, and bleed the Buchholz relay, bushings, and radiators

3.10 Check all shut off devices that they are in the selected position for normal operation.

3.11 Off circuit tap changers can only be operated when the unit is NOT energised.

3.12 On Load tap changer

3.12.1 Check the motor drive and record the number of operations on the on-load tap changer counter.

3.12.2 Compare whether the on-load tap changer position indicator reflects the same position as on the motor drive.

3.12.3 Switch the on-load tap changer through all its tap positions (extreme plus to extreme minus position)

3.12.4 Adjust the on-load tap changer to the preferred tap position corresponding to the rated supply voltage. Switch the transformer on and listen for any unwanted noises.

3.12.5 Operate the on-load tap changer only within the permissible voltage range.

4. Maintenance and Repair

4.1 Check gaskets and sealing of the transformer and, if necessary, retighten screws/bolts slightly.

4.2 If the unit is fitted with an oil gauge, check the oil level at regular interval.

4.3 Please keep insulators clean.

4.4 Remove rust and recoat/repaint the affected areas or surfaces.

4.5 Oil Drainage

If maintenance and repairs require opening of the transformer the following instructions must be followed:

4.5.1 Drain insulation fluid from the oil draining devise, mounted at the bottom of the tank.
In the event of a Hermetically sealed unit, the filling pipe must remain closed. Once no more liquid is flowing from the device, the tank had been pressure compensated.

4.5.2 Open the filling pipe on the cover and drain the insulation fluid to about 50 mm under cover (test with a measuring stick through the filling pipe to determine the correct oil level).

4.6 Refilling of the oil

After the work have been completed, the transformers must be filled.
For Hermetically sealed units use the following steps:

4.6.1 Unscrew the cap on the filling pipe.

4.6.2 Refill the transformers and filling pipe with oil.

4.6.3 Bleed the bushings.

4.6.4. Fill the filling pipe again (to the brim) and close it with cap. Ensure that all other devices are also filled (where required) and seal it.

4.6.5. Adjust the pressure level by draining a predetermined amount of oil, which is influenced by the oil temperature (tolerance 3 K). The necessary information about oil temperature and the quantity of oil to be drained are stipulated on the rating plate. The existing oil temperature can be measured with the thermometer located in the thermometer pocket on the cover. Adjust the oil level with the filling pipe closed/ sealed, by draining the predetermined amount of oil, as stated on the rating plate. Use the oil drain device at the bottom of the tank to drain the oil.

4.7. Please observe the instructions of the protection and control systems.

5. Oil Samples

Occasional tests of oil samples and examination as per BA148 / VDE 0370 are recommended.

Minimum breakdown voltage levels are: New oil: ≥ 50 kV
Operating oil: ≥ 30 kV

Purification of the oil is necessary at levels less than 30 kV.

5.1 Taking Oil Samples at Oil Temperature ≥ Reference Temperature °C

At an oil temperature of ≥ the Reference Temperature the tank operates under excess pressure. An oil sample of approximately 0.2 l is taken from the oil drainage device. The filling pipe must not be ventilated during this procedure.

5.2. Taking Oil Samples at Oil Temperature < Reference Temperature °C

At an oil temperature of < the Reference Temperature the tank operates under negative pressure.
If the oil sample of approximately 0.2 l is to be taken from the drainage device, ventilate the filling pipe and then refill according to the instructions given in section 4.5.

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