



Construction features

Description

ABB has been manufacturing transformers for about a hundred years. The production is based on the development and research carried out in the design department and at the ABB Research Centre in close cooperation with our customers. This long experience combined with research and development, guarantees high quality, long life and reliability.

Standard features

The transformers are manufactured and tested in accordance with the IEC Publication 76. They are also in compliance with several national standards e.g. BS 171, VDE 0532, SS 4270101 etc.

The transformers can be overloaded in accordance with IEC Publications 354 (1972). The on-load tap-changer and bushings have been chosen so as not to limit the overload capability. The cooling methods are ONAN or ONAN/ONAF.

Construction features

The transformers are of the breathing, conventional type provided with an oil conservator. Two types of transformer are manufactured:

- Transformers with off-load tap changer
- Transformers with on-load tap changer

Oil Type

Large Distribution Transformers

(> 2000 kVA, up to 72.5 kV)

Core

The three legged bolt-less core is constructed of grain oriented steel laminations. The joints between the leg and yoke are mitred at 45° and interleaved. The cross section of the leg is circular.

Windings

The material of the windings is either copper or aluminum. The windings are made of paper insulated rectangular wire in the form of multilayer, disc or helical windings. Transformers provided with on-load tap-changer usually have a separate tap winding.

Off-load tap-changer

The transformers are normally equipped with a 5-position off-load tap-changer on the High Voltage side, with its handle located on the cover. When changing the tap position the transformer has to be un-energized.

Position 1 of the tap-changer (+ position) corresponds with the highest ratio, which gives the lowest voltage on the Low Voltage side. Position 5 of the tap-changer (- position) corresponds with the lowest ratio which consequently gives the highest voltage on the Low Voltage side. Transformers having dual primary (or secondary) voltages are usually equipped with a selector switch with the handle on the cover.

On-load tap-changer

The on-load tap-changer is mounted on the cover of the main transformer tank. The tap-changer works as a selector switch combining the features of a diverter switch and a tap selector. The selector switch is located in a separate oil compartment which is connected to its own conservator. The selector switch is of the high-speed, spring operated type with resistive transition impedances. The tap-changer is equipped with a protective relay. The selector switch can be lifted for inspection and the oil in the compartment can be changed separately.

The on-load tap-changer is provided with a motor drive mechanism for remote and local control. Normally the motor drive is three-phase and the control and the heating circuits are for single phase AC supply. When requested, DC circuits can be supplied.

Insulation oil

The mineral oil used in the transformers complies with IEC 296 and several national standards. The oil slows down the ageing process. Transformers with off-load tap changers can be delivered filled with silicone oil or MIDEL fluid if requested.

Tank

The transformer tank is usually of the rigid type provided with removable radiators connected to the tank by means of a shut-off valve. On request, the tank can be made vacuum proof. Transformers up to 5 MVA can be supplied with a compact tank with corrugated cooling fins.

Painting and surface treatment

Prior to the painting of the tank, the cover and oil conservator are sandblasted. External surfaces are painted immediately after pretreatment with a two-pack epoxy primer coat. The finishing is carried out by applying a two-pack polyurethane paint to a total thickness of 180 µm. The colour of the paint is RAL6013 (rush green).

The inside of the transformer tank is painted with a two-pack epoxy primer to a thickness of approx. 30 µm. The external surfaces of the radiators are hot-dip galvanized to a thickness of approx. 60 µm. Corrugated tanks are flow painted with alkyd primer and acrylic finish to a total thickness of 80 µm. The conservator and the bottom part of the tank are painted internally.

Options and accessories

The transformers are fitted with the following standard accessories:

- *Bushings*
- *Oil conservator with oil level indicator*
- *Filling and drain valves*
- *Oil sampling device*
- *Earthing terminals*
- *Lifting lugs*
- *Jacking pads (radiator tanks)*
- *Rating plate*
- *Silica-gel breather*
- *Buchholz relay*
- *Top oil thermometer*

Additional accessories can be fitted in accordance with the customer's specifications.

Vacuum treatment

Drying and vacuum treatment takes place in a special oven, where the windings are heated electrically while simultaneously the air is evacuated from the oven, reaching an absolute pressure of 1 mbar.

The transformer is filled with oil while it is still under vacuum. In this way moisture and gases are effectively removed from the windings and oil.

Bushings

The bushings are of a solid porcelain type and located on the cover. Bushing insulators can be changed without opening the transformer. The bushings comply with IEC 137.

The terminals can be provided with an air insulated enclosure. The enclosure can be on the primary and/or on the secondary side and may be constructed for cable or bus duct connection. Alternatively the transformers can be provided with plug-in bushings.

Testing

All transformers are manufactured according to ISO 9001 Quality System. The transformers are individually tested according to IEC standards.

1. Routine tests

- 1.1 *Measurement of winding resistance*
- 1.2 *Measurement of voltage ratio and testing of voltage vector relationship*
- 1.3 *Measurement of impedance voltage, short-circuit impedance and load loss*
- 1.4 *Measurement of no-load loss and current*
- 1.5 *Dielectric tests:*
 - 1.5.1 *Separate source voltage withstand test*
 - 1.5.2 *Induced overvoltage withstand test*

Witness type/special tests can be carried out on request.

2. Type tests

- 2.1 *Temperature rise test*
- 2.2 *Dielectric tests:*
 - 2.2.1 *Lightning impulse test*

3. Special tests

- 3.1 *Dielectric tests:*
 - 3.1.1 *PD-test*
 - 3.1.2 *Chopped wave test*
- 3.2 *Measurement of zero-sequence impedance on three phase transformers*
- 3.3 *Short circuit test*
- 3.4 *Measurement of sound level*
- 3.5 *Measurement of harmonics in the no-load current*
- 3.6 *Tests of auxiliary equipment and wiring*
- 3.7 *Tests on load tap-changer*
- 3.8 *Leakage test for transformer tank*