

Factors Affecting Oil Insulation of Oil Power Transformers and Measures to Eliminate Them

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Abstract:

The presence of power transformers and their reliable operation are important in supplying production enterprises and the population with electricity. The main goal of the proposed work is to analyze the heat processes occurring in operational oil power transformers and to make suggestions for heat reduction.

Keywords: Oil transformer, coil, insulation, active part, ambient temperature, loading, oil cleaning.

After the installation of oil power transformers, the insulation resistance of the coil is measured and the absorption coefficient, insulation $\tan \delta$ is determined, etc. Insulation resistance is determined in factory conditions: $R_{(60)} > 0.7$ should be compared with $R_{(60)_{\text{zav}}}$ for insulation without moisture[1]. Insulation specifications for power transformers with a voltage of up to 35 kV and a capacity of up to 3 MV·A are given in GOST[1] standards. According to the assembly manual and errors were made during the start-up of the transformer, the transformer is checked if the tank is removed or the active part is lifted. General inspection of transformers includes inspection, repair of damaged areas and sealing of active parts. In order to protect the insulation from moisture, it limits the continuous stay of the active parts outside the tank: ambient temperature 0 °C or relative humidity higher than 75% - 12 hours; humidity 65 ÷ 75 % – 16 hours; humidity up to 65% - 24 hours[2]. Testing of transformers is carried out at the temperature of the active part, which is equal to or higher than the ambient temperature. If the ambient temperature is negative, the transformer oil is heated up to 20 °C. If the ambient temperature is higher than 0 °C, the relative humidity is less than 75%, the temperature of the active part is more than 10 °C compared to the ambient temperature, the inspection time is extended by two times [5]. Depending on the power, type of voltage, construction and repair conditions of power transformers, one of the following methods can be used: -lifting the active part from the transformer tank; - inspect the active part in the tank; - lifting the removable part of the transformer tank.

Inspection of the transformer is carried out in a closed building. In this case, the oil is poured into a clean and dry tank, and the active part is installed on a wooden bed. During the inspection, the rigidly connected yoke pins, fastening of couplings, switchgear equipment, and axial pressing of the pulleys are checked.



Figure 1. Burned and damaged cases of the transformer core.

As a result of research, the following factors were identified as factors affecting the insulation of the power transformer circuit:

- Violation of transformer oil content;
- Load exceeding the nominal value;
- Increase in outdoor temperature in the summer season;

These effects lead to an increase in the temperature of the transformer, and as a result, a rapid deterioration of its insulation . A number of measures are proposed to eliminate the factors affecting the insulation of oil transformers and to prevent burns and breakdowns.

1. Continuous monitoring of the condition of the transformer oil, increasing the ability to cool and isolate the transformer oil by cleaning various impurities in the oil;

2. According to Monzinger's rule, increasing the temperature of the transformer by 6 0C reduces the operating time by 2 times . The increase of the load above the specified norm and the increase of the external temperature directly cause the temperature of the transformer to rise, and we can achieve an increase in the reliability of operation by installing an additional cooling device to reduce the temperature of the transformer.

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