Dielectric strength of transformer oil

Dielectric strength of transformer oil provides reliable operation of electrical equipment. Dielectric strength of transformer oil, in turn, is mainly determined by the presence of fiber and water, so the mechanical impurities and water in such oils must be completely absent. The dielectric strength of the oil decreases with time.

Dielectric strength of oil - the value is extremely sensitive to its hydration. Under the action of the electric field of the emulsified oil droplets of water are drawn to places where the field strength is particularly high and where, in fact, begins the development of breakdown. Even more dramatically reduced dielectric strength of oil, if it is other than water, fiber contained impurities. Under the influence of the field forces the wet fibers not only drawn in places where the field is stronger, but arranged in the direction of lines of force, which greatly facilitates the breakdown of the oil.

Dielectric strength of transformer oil is also known as breakdown voltage of transformer oil or breakdown voltage of transformer oil. Breakdown voltage is measured by observing at what voltage, sparking strength between two electrodes immerged in the oil, separated by specific gap. Low value of BDV indicates presence of moisture content and conducting substances in the oil.

Dry and clean oil gives BDV results, better than the oil with moisture content and other conducting impurities. Minimum breakdown voltage of transformer oil or dielectric strength of transformer oil at which this oil can safely be used in transformer, is considered as 30 KV.

Dielectric features of oils are mainly determined by the dielectric loss tangent. Dielectric strength of transformer oil is mainly determined by the presence of fiber and water, so the mechanical impurities and water in oils must be completely absent. Low pour point (-45 ° C and below) is necessary for saving their mobility at low temperatures.

Operational properties of transformer oils checked by an electrically insulating and physico-chemical characteristics :

- Determination of the electrical strength of oil;
- Determination of the loss tangent oil;

- Determination of moisture content of oil. The method is based on separation of hydrogen by reacting water in oil located hydride oxygen;

- Determination of the gas content of oil. Performed using absorption meter. The method of determining is by measuring changes in the residual pressure in the vessel after pouring it into a test oil sample;

- Determination of mechanical impurities. Quantitative solids content consists of passing dissolved in gasoline samples of transformer oil through ashless filter paper;

Dielectric loss tangent

Characteristics of transformer oils and methods of their control. Dielectric loss tangent (tgδ)- index of oil quality, sensitive to the presence of various contaminants in the oil (colloidal formations soluble organometallic compounds, and various products of aging oil and solid insulation).

Increasing the dielectric loss in insulating oils occurs due to:

- Asphaltic-resinous substances (form a colloidal solution in oil)
- Soaps
- Water (excluding moisture condition true solution)
- Acids (only affect under heating , not at room temperature)
- Dissolving paints in the transformer oil, which usually leads to acid increasing of acid number.

Colloidal materials may be:

- Components of the windings and varnish old oil sludge;
- Soaps , resulting from the interaction of acidic products of aging transformer oils with transformer metals;
- Muddy-acidic products which don't contain in its structure of the metal, for example:

acids, sparingly soluble in oil, tar, asphalt and other products of oxidation.

Dielectric losses for the fresh oils characterize the quality and the degree of purification on the factory, and in operation - the degree of pollution and oil aging.

The presence of water increases an oil dielectric loss and attaches U-shaped form in dependence on tgδ temperature (temperature at least 50 °C).

There is a threshold concentration of water in the oil for a given temperature and relative air humidity above which tgδ greatly increased.

Test for puncture

To determine the electric strength , transformer oil is periodically tested by means of oil punching apparatus. To test sample, transformer oil is poured into a porcelain vessel in which two disk electrode 8 mm and 25 mm diameters are mounted. Distance between the disks is set to 2.5 mm. a vessel filled with oil and set in oil punch. The oil is allowed to settle for 20 minutes to air out of it. Next one shall gradually raise the voltage at 1 - 2 kV in the second before the onset of breakdown. When testing transformer oil one make 6 breakdowns at 10 minute intervals. The first testing is considered the s trial and its result is ignored. For the value of the breakdown voltage arithmetic average is taken from the five of subsequent breakdowns. In case of unsatisfactory test results re-sample is taken, and then given a final conclusion.