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Normal breakdown voltage of transformer oil

Switching to the main content of transformer oil (also known as insulating oil) is a special type of oil that has excellent electrical insulating properties and is stable at high temperatures. Transformer oil is used in oil-filled electrical energy transformers to isolate, stop the arc and coronary discharge and disperse the transformer heat (i.e. act as a coolant). Transformer oil is also used to preserve the transformer core and winding , as they are completely immersed in oil. Another important feature of the insulation oil is its ability to prevent the oxidation of the insulation of pulp-produced paper. Transformer oil acts as a barrier between atmospheric oxygen and cellulose – avoiding direct contact and thus reducing oxidation. The oil level of the transformers is usually measured using MOG (Magnetic Oil Level Guage). Transformer oil typesThere are two main types of transformer oil used in transformers:Paraffin-based transformer oilNaphtha-based transformer oilNaphtha oil is more easily oxidized than paraffin oil. However, the oxidation product , i.e. sludge, is more soluble in methanol oil than paraffin oil sludge. Thus, the oil sludge of the primary gasoline base is not precipitated at the bottom of the transformer. Thus, it does not interfere with the circulation of convection oil, which means that it does not interfere with the cooling system of the transformer. Although the oxidation rate of paraffin oil is lower than that of naphtha oil, the oxidation product (sludge) is insoluble and precipitated at the bottom of the tank. This sludge interferes with the transformer cooling system. Another problem with paraffin-based oil is that dissolved waxes inside can cause a high filling point. Although this is not a problem in warmer climatic conditions (e.g. India). Despite the above shortcomings, paraffin-based oils are still frequently used in many countries (e.g. India) due to high availability. Transformer oil propertiesSome specific properties of insulating oil should be considered as the determination of the suitability of the oil. The characteristics (or parameters) of the transformer oil are: Electrical properties: Dielectric strength, specific resistance, dielectric dispersion factor. Chemical properties: water content, acidity, sludge content. Physical characteristics: Interagency voltage, viscosity, flash point, pour point. Electrical properties transformer OilDielectric strength transformers OilThe dielectric strength of transformer oil is also known as breakdown voltage (BDV) transformer oil. The voltage of the failure is measured by observing the voltage, the shimmering direction between the two electrodes immersed in the oil, separated by a certain space. The low value of BDV indicates the moisture content and the amount of substances in the oil. Transformer oil BDV measurement locally can usually be purchased the BDV measurement kit. In this kit, the oil is stored in a pot where one pair of electrodes is attached in a 2.5 mm space (in some sets it is 4 mm) mm) Them. Now the slow-rising voltage is applied between the electrodes. The rising voltage speed is controlled at 2 KV/s and monitors the voltage from which the spark between the electrodes begins. This means that the dielectric strength of the transformer oil voltage between the electrodes has been broken down. This measurement is measured 3 to 6 times in the same oil sample, and we take the average value of these readings. BDV is an important and popular test of transformer oil because it is a key indicator of oil health and can be easily performed locally. Dry and clean oil gives BDV results better than oil with moisture content and other conductive impurities. The minimum decomposition voltage of the transformer oil or the dielectric strength of the transformer oil in which this oil can be safely applied in the transformer shall be stored at 30 KV. Specific resistance of transformer oilSo is also an important feature of transformer oil. Specific oil resistance is a measure of DIRECT current resistance between two opposite sides of one cm3 block of oil. Its device is omo cm at that temperature. As temperatures rise, the resistance of oil decreases rapidly. As soon as the transformer is charged after a long shutdown, the oil temperature will be at ambient temperature and at full load the temperature will be very high and can be up to 90°C in an overload condition. Thus, the resistance of the insulation oil should be high at room temperature, and it should also have good value at high temperatures. That is why the specific resistance or resistance to transformer oil should be measured at 27oC and 90oC.Minimum standard specific resistance to transformer oils 90oC is 35 × 1012 ohm-cm and 127oC it is 1500 × 1012 ohm-cm. Dielectric dissipation Factor of Tan Delta of Transformer OilDielectric scatter factor also known as loss factor or transformer oil tan delta. When insulating materials are placed between a live and grounded part of the electrical equipment, a leakage current flows. As the insulating material is dielectric in nature, the current through insulation perfectly leads to a voltage of 90o. Here the voltage refers to the instantaneous tension between the live part of the equipment and the ground. However, in reality, no insulating material in nature is perfect dielectric. Thus, the current through the insulator will lead to a voltage with an angle of slightly shorter than 90o. The tangent of the corner at which it is short at 90o is called a dielectric dispersor or simply a delta of transformer oil tan. More clearly, the leakage current during insulation has two components one capacitive or reactive, and the other is resistant or active. Again, it is clear from the above chart that the value δ, which is also called the angle of loss. If the loss angle is low, then the current IR resistance component is small, which indicates a high restrictive feature of the insulation material. High restrictive insulation is a good insulator. So that the loss angle is as low as possible. So we should try to keep the value of the tanδ as low as possible. The high value of this tanδ indicates the contain of contaminants in transformers oil. Thus, there is a clear link between tanδ and insulating oil resistance. If the resistance of the insulation oil decreases, the value of the tanning-delta and the vice verse increase. Thus, the transformer oil resistance and tanning delta test are not usually required for the same piece of insulator or insulating oil. In one sentence, it can be said that tanδ is a measure of the imperfection of insulating materials, such as oil, dielectric nature. The chemical properties of the transformer OilWater content transformer OilMoisture or water content transformer oil is very undesirable because it affects the dielectric properties of oil negatively. The amount of water in the oil also affects the insulation and windings of the transformer core paper. The paper is very hygroscopic. The paper absorbs the maximum amount of water from the oil, which affects the insulation properties of the paper, as well as reduce its service life. However, in a loaded transformer, the oil becomes hotter, which increases the solubility of water in the oil. As a result, the paper releases water and increases the amount of water in transformers in oil. The oil temperature is therefore critical when sampling. During oxidation, acids are formed in oil, acids cause water solubility in oil. The acid, together with water, further breaks down the oil, which forms more acid and water. This rate of oil degradation is increasing. We measure the water content in oil as ppm (millionths). The water content of the oil is allowed up to 50 ppm as recommended by IS-335(1993). Accurate water measurement at such a low level requires a very complex instrument, such as coulometric Karl Fisher Titrator.Acidity of Transformer OilAcidic transformer oil is a harmful property. If the oil becomes acidic, the water content in the oil becomes more soluble in oil. The acidity of the oil deteriorates the insulation property of the winding paper. Acidity accelerates the oxidation process in oil. Acid also includes iron rusting in the presence of moisture. The acidity test of the transformer oil may be used to measure acidic constituents of pollutants. We express the acidity of the oil in mg KOH, necessary to neutralize the acid in a gram of oil. This is also called neutralization number. The physical properties of the transformer OilInter Face voltage transformer OilInterfacial voltage between the water and oil interface is a way to measure the attractive molecular strength between water and oil. Dyne/cm or mili-Newton/meter. Interphageal voltage is precisely useful in determining the presence of polar contaminants and oil degradation products. Good new oil is usually characterized by high interagency voltage. Oil oxidation contaminants reduce IFT. Flash Point Transformer OilFlash Transformer oil is the temperature at which the oil provides enough steam to produce a flammable mixture with air. This mixture provides an instant flash on the flame under standard conditions. The flash point is important because it indicates the probability of fire hazard in the transformer. So it is desirable to have a very high burst point of transformer oil. Usually it is more than 140o (>10o). Pour Point of Transformer OilIt is the minimum temperature at which the oil begins to flow under standard test conditions. Pour transformer oil point is a valuable feature mainly in places where the climate is icy. If the oil temperature drops below the point of the overflow, the transformer oil stops the convection flow and interferes with cooling in the transformer. Paraffin-based oil has a higher value at the tipping point compared to methanol-based oil, but in India, as in the country, it does not affect the use of Paraffin oil due to its warm climate condition. Pour the point of transformer oil, mainly depends on the amount of wax in the oil. Since paraffin-based oil has more wax content, it has a higher filling point. Viscosity of transformer oilWith a few words the viscosity of transformer oil can be said that viscosity is the resistance of the flow to normal condition. Resistance to the flow of transformers oil means interfering with the convection of oil inside the transformer. Good oil must be low viscous, so that it provides less resistance to the normal flow of oil and therefore does not affect the cooling of the transformer. Low viscosity of transformer oil is necessary, but it is also important that the viscosity of the oil increases as little as possible as possible as the temperature decreases. Each liquid becomes more viscous if the temperature decreases. Transformer oil testingTransformer oil must be tested to ensure that it operates to today's standards. Testing standards and procedures are defined in various international standards, most of which are defined by ASTM. Oil tests shall consist of the measurement of oil degradation voltage and other chemical and physical properties by portable test equipment or laboratory. Proper testing increases the life of the transformer, thus narrowing the need to pay for the change. What factors are TestHere are the most common things to look for when performing a transformer oil test:Standard specification for mineral insulating oils, electrical apparatus (ASTM D3487)Acid number (ASTM D664)Dielectric breakdown voltage (ASTM D877)Liquid power factor (ASTM D924-08)Interphase voltage (A TSTM D971)Specific resistance (ASTM D1169)Corrosive sulphur (ASTM D1275)Visual examination (ASTM D1524)Note : ASTM stands for American Society of Tests and Materials.These tests will help determine , whether the oils are clean and will create a baseline for properties that need to be periodically tested Although there are many tests that are available, they are expensive. So it's best to use them as a diagnostic if you're having problems primary testing. The recommended frequency depends on power and voltage. If the test results show several red flags, the frequency will have to increase. Even if the cost of testing is high, the costs should be compared with the cost of replacing the transformer and the downtime associated with the loss of the transformer. It is important to understand the difference between the excessive and normal gas supply speed. The amount of dissolved gas in transformer oil can be found using the Dissolved Gas Analysis (DGA) test. The gas supply rate will vary depending on loading, insulation material and transformer construction. The most common problems When trying the following table lists the most common issues that may occur when trying transformer oil:FaultKey GasResultsCorona dischargeHydrogenLow energy releases Generate methane and hydrogen and lower amounts of ethylene and ethane. ArcingAcetyleneLarge can be produced in quantities of hydrogen or acetylene or small amounts of ethylene and methane. Overheated celluloseCarbon monoxide If cellulose overheats, then it will produce carbon monoxideHeheheh