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PROFILE

Transformer Oil Testing Laboratory is situated at O/o. Dy. Chief Engineer (TI&C), MSPGCL, Vidyut Bhavan, Katol Road, Nagpur. This is our pride and honor that Transformer Oil Testing Laboratory is accreditated by National Accreditation Board for Testing and Calibration Laboratories (NABL) for performing tests based on standard for Lab Accreditation ***ISO/IEC 17025 : 2005 "General requirements for the competence of testing and calibration laboratories".*** *NABL is an autonomous body under the aegis of Department of Science & Technology, Government of India, and is registered under the Societies Act 1960. Government of India has authorized NABL as the accreditation body for Testing and Calibration Laboratories. NABL has been granted signatory member status by Asia Pacific Laboratory Accreditation Cooperation (APLAC) and International Laboratory Accreditation Cooperation (ILAC) under their Mutual Recognition Arrangements (MRAs).*

Transformer Oil Testing Laboratory is equipped with highly sophisticated microprocessor based instruments of imported / Indigenous origin which are being used to carry out various tests of Transformer oil samples to assess the condition of the Transformer oil & healthiness of Transformer. On the basis of test results & proper analysis, it is possible to take timely & appropriate action by the respective authorities which results in avoiding inadvertent and catastrophic failures.

The laboratory undertakes testing of Transformer oil samples as per IS : 1866-2000 specifications. Our valuable costumers are MSPGCL, MSEDCL, MSETCL & many more private firms.

It is well known that regular oil analysis is useful in monitoring the condition of transformer oils which is used to insulate transformers and other electrical distribution equipments. The analysis of insulating oils not only provides information about the oil, but also enables the detection of other possible problems, including contact arcing, aging insulating paper and other latent faults.

Transformer maintenance has evolved over the past 20 years as extreme reliability is demanded of electric power distribution, and even though the failure risk of a transformer and other oil filled electrical equipment is small, when failures occur, they inevitably lead to high repair costs, long downtime and possible safety risks. Moreover, transformers are too expensive to replace and must be properly maintained to maximize their life expectancy.

By accurately monitoring the condition of the oil, suddenly occurring faults can be discovered in time and outages can potentially be avoided. Thus probable maintenance can be ascertained based on laboratory results.

Following tests of Transformer oil sample are carried out at our laboratory:

1. **Dissolved Gas Analysis (DGA) :**
   Test method used: IS: 9434-1992 (Reaffirmed 2008)

Dissolved Gas Analysis (DGA) is performed to detect the dissolved gases in transformer oil sample to assess healthiness of transformer. The faults in power transformers such as arcing, overheating, partial discharge, thermal aging of paper, oxidation vapourization, insulation decomposition, breakdown/ thermal degradation of oil and electrolyte action etc. may result in generation of gases such as CO, CH_4, CO_2, C_2H_4, C_2H_6, C_2H_2 and H_2 etc. These gases remain in dissolved condition in the transformer oil. By carrying out DGA the dissolved gases are extracted, separated and identified accordingly. As per concentration of these gases analysis is done and fault is detected. Analysis is carried out on the basis of Roger's Ratio Method, IEC-599 and Key Gas Method. The concentration of gases is expressed in ppm.

2. **Break Down Voltage (BDV) :**
   Test method used: IS: 6792-1992 (Reaffirmed 2003)

Break Down Voltage (BDV) is a characteristic of an insulator that defines the maximum voltage difference that can be applied across the material before the insulator collapses and conducts. Thus Break Down Voltage of insulating oil is the minimum voltage at which insulating property of oil breaks down and causes a portion of the oil to become electrically conductive. BDV is performed to determine the suitability of transformer oil to withstand electric stress. The measurement of BDV, serves to indicate the presence of conductive contaminants and water (moisture) in used and unused transformer oil. The electric strength of insulating oil is expressed in KV.

3. **Moisture Content :**
   Test method used: IS: 13567-1992 (Reaffirmed 2008)

One of the most important functions of transformer oil is to provide electrical insulation. Any increase in moisture content can reduce the insulating properties of the oil, which may result in dielectric breakdown. The moisture content is determined by Karl Fischer Method and it is expressed in ppm.

4. **Dielectric Dissipation Factor (Tan-Delta) :**
   Test method used: IS: 6262-1971 (Reaffirmed 2006)

The Dielectric Dissipation Factor is the ratio of power dissipation in the transformer oil in watts to the product of the effective voltage and current in volt-amperes. It is the tangent of the angle (delta) by which the phase difference between applied voltage and resulting current deviates from $\pi/2$ radian when the dielectric of the capacitor consists exclusively of insulating oil. This test reveals the presence of moisture, soluble polar contaminants, ageing products or colloids, resins, varnishes or their products of oxidation in transformer oil.

5. Resistivity (Specific Resistance) :

Test method used: IS: 6103-1971

The Resistivity (Specific Resistance) in ohm-centimeters of insulating oil, is the ratio of DC - potential gradient in volts per centimeter paralleling the current flow within the specimen, to the current density in amperes per square centimeter at a given instant of time and under prescribed conditions. This is numerically equal to the resistance between opposite faces of a centimeter cube of the liquid. The measurement of Resistivity of insulating oil is a sensitive test & this test reveals the presence of for detection of conducting impurities, concentration of free ions and ion forming particles etc. Resistivity of transformer oil is expressed in Ω-cm.

6. Neutralization Value (Total Acidity) :

Test method used: IS: 1448 P-2 2007

Neutralization Value is the measure of free organic and inorganic acids present together in the transformer oil. It is expressed in terms of the number of milligrams of potassium hydroxide required to neutralize the total free acids in one gram of oil. This test reveals the presence of the acidic constituents or contaminants in the oil, by using principle of titration. Neutralization Value of transformer oil is expressed in mg KOH/gm.

7. Interfacial Tension (IFT) :

Test method used: IS: 6104-1971 (Reaffirmed 2001)

The Interfacial Tension (IFT) is determined by means of Tensiometer, in which force necessary to detach a planar ring of platinum wire from the surface of the liquid of higher surface tension, i.e. upward from the water-oil interface is measured. The Interfacial Tension between oil and water provides a means of detecting soluble polar contaminants and products of deterioration in insulating oil. Interfacial Tension of insulating oil is expressed in mN/m.

8. Flash Point :

Test method used: ASTM D- 93A: 2010

Flash Point is the temperature at which the oil gives off so much of vapour that this vapour, when mixed with air, forms an ignitable mixture and gives a momentary flash on application of pilot flame under the prescribed conditions. Flash Point is the indication of presence of volatile combustible products, low molecular weight hydrocarbons in the insulating oil. Flash Point of transformer oil is expressed in ^{0}C.

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