QUALITY TESTING FOR INSULATING FLUIDS

PREVENTIVE MAINTENANCE BY TESTING INSULATING FLUIDS

PREVENTATIVE MAINTENANCE

To ensure safety, continuity of service and efficient low-cost maintenance, it is desirable to monitor the condition of insulating fluids with a program of physical, chemical, and electrical testing. In all, **WEIDMANN** DIAGNOSTIC SOLUTIONS INC. performs over 25 analytical tests on insulating fluids. Whether the fluid is mineral oil, silicone, less flammable hydrocarbons, natural esters, or Askarel, **WEIDMANN** offers technical support and industry guidelines for all of the tests performed.

DETERIORATION OF INSULATING FLUIDS

The ability of an insulating fluid to serve as an effective insulator and a coolant is adversely affected by deterioration. The deterioration of insulating fluids can be attributed to the following key variables:

- Oxidation – Transformer fluids react with oxygen to form organic acids, esters and phenolic compounds. Ultimately, oxidation leads to the formation of sludge. Not only will sludge adversely affect the dielectric property of the fluid but it will also interfere with the dissipation of heat within the transformer.

- Contamination – The dielectric properties of insulating fluids are adversely affected by contaminants. Moisture is a common contaminant. In addition, cellulose fibers and metals, both particulate and dissolved, can contribute to a deterioration of the dielectric properties.

- Elevated Temperature – High temperatures from increased load and/or environmental conditions will increase the rate of decomposition of the insulating fluid.

A SAMPLE OF FLUID QUALITY TESTS OFFERED BY **WEIDMANN** DIAGNOSTIC SOLUTIONS INC.

Dielectric Breakdown Voltage, ASTM D-877, ASTM D-1816:
The dielectric breakdown voltage is the voltage at which an insulating fluid begins to conduct. This voltage denotes the electrical stress that an insulating fluid can withstand without failure. A low dielectric value is indicative of the presence of contaminants in the insulating fluid.

Water in Insulating Liquids (Karl Fischer Method), ASTM D-1533B:
The presence of water can adversely affect the dielectric strength of an insulating fluid. WEIDMANN Diagnostic Solutions utilizes microprocessor controlled Karl Fischer coulometric titrimeters to determine the level of moisture present in the insulating fluid.

Acid Number, ASTM D-974:
Oxidation of insulating fluids and/or additives in the fluid results in the production of acidic compounds. The periodic measurement of acidity provides a means of monitoring the progress of oxidation. The buildup of acidic compounds precedes the formation of sludge in the transformer which is the end-product of oxidation.

Interfacial Tension of Oil Against Water by the Ring Method, ASTM D-971:
Determining the presence of polar contaminants in insulating oil is accomplished by measuring the tension of oil against water. The interfacial tension of an oil is sensitive to the presence of oxidation by-products and can be used, together with acidity measurements, as an indicator to monitor sludge development. It should be noted that foreign substances such as dissolved varnishes and other organic coating materials can also affect the IFT.

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Color Number, Visual Examination and Sediment, ASTM D-1524, D-1500:
Monitoring the color and visual appearance of an insulating oil provides a rapid assessment of oil quality. The color number of a sample tends to increase as the oil darkens due to oxidation and/or the presence of contamination. Visual examination, which includes an exam for sediment, provides an assessment of undesirable materials suspended in oil.

Specific Gravity, ASTM D-1298:
The specific gravity of an oil is the ratio of the weights of equal volumes of oil and water at the same temperature. The specific gravity is not significant in determining the quality of the oil, but is applicable in determining suitability for use in a specific situation.

Power Factor (Dissipation Factor), ASTM D-924:
Power Factor is a measure of the dielectric losses in an insulating fluid due to heat dissipation when the fluid is placed in an electrical AC field. A low dissipation factor indicates low dielectric losses. Power factor is a means of evaluating the quality of the insulating fluid. When used in conjunction with other oil quality tests, the power factor can be useful in complementing the description of the state of the fluid insulation.

Oxidation Inhibitor, ASTM D-2668:
Inhibitors can be added to oil in prescribed amounts to increase the service life of the oil. The determination of inhibitors in a new electrical insulating oil measures the amount of this material that has been added to the oil as protection against oxidation. For oil in service, this test measures the amount remaining after oxidation has reduced its concentration.

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