



TRANSFORMER OIL ANALYSIS IN OUR OWN LABORATORY



NovAcec Services SA



HOW HEALTHY IS YOUR TRANSFORMER ?

Transformers are strategic equipment in a power grid and it is important that they remain operative without interruption and for the longest possible period.

In order to check the status of your transformer, several techniques can be used to estimate its health.

Since insulation oil is a critical part of the insulation system of a transformer, maintaining a good quality of insulation oil is very important. In order to guarantee the quality of this insulating oil, regular testing of its main parameters is highly recommended.

Therefore NovAcec Services can provide these measurements in-house in their own brand new equipment, operated by engineers most experienced in this field of testing and evaluation. These analysis will confirm the quality of the insulation oil and will determine if and when an oil change or reconditioning is necessary.

Our reports are not just computer generated but manually and individually made by our specialists in order to give the customer a tailor-made insight in the status of his transformer. On top of that NovAcec Services keeps the historical data at your disposal for trend analysis.



TRANSFORMER LIABILITY OR RELIABILITY ?

Failure of a transformer always comes with very high costs (transportation, repair costs, long downtime costs and possible safety risks)

A large number of problems, associated with the status of the transformer or its insulating oil, can be detected and determined in an early stage and as such, catastrophic failure can be avoided.

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 REDUCE
 THE RISK OF A MAJOR
 FAILURE SIGNIFICANTLY
 AND ALLOW PREVENTIVE
 MAINTENANCE INSTEAD
 OF TIME-BASED
 MAINTENANCE.
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WHAT IS TO BE TESTED ?

A - Insulation oil quality

Experiences have shown that more than 70% of incipient failures can be detected through oil tests. By measuring degradation and contamination of the oil, it will be possible to check whether the properties of the oil are still acceptable or not. Therefore, several parameters like breakdown voltage, dielectric dissipation factor, DC-resistivity, acidity, water content, color,... will be measured to give a clear idea of the status of the insulation oil and enables the operator to determine if and when an oil change or reconditioning is necessary.

B - Dissolved Gas Analysis (DGA)

By taking oil samples from your transformer, not only the condition of your oil can be monitored, but also the condition of your transformer in general can be evaluated. It is generally acknowledged that today the most powerful technique to achieve this is analyzing the dissolved gases in your oil. The technique is not surprisingly called Dissolved Gas Analysis or DGA. DGA can give an early indication of abnormal behavior of the transformer!

Like testing the blood of a human body, to check the health of a patient, DGA can tell you whether your transformer is healthy and if not what type of "illness" is to be expected.

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 ALL
 THESE TESTS
 CAN NOW BE PERFORMED
 AT NOVACEC SERVICES IN OUR
 NEW LABORATORY AND BY OUR
 SPECIALISTS WITH MORE THAN
 30 YEARS OF EXPERIENCE IN
 THESE ANALYSIS AND
 EVALUATIONS OF
 TRANSFORMERS.
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OIL TESTS

BREAKDOWN VOLTAGE

The breakdown voltage (BDV) is also known as the dielectric strength of the oil. The breakdown voltage of transformer oil is the maximum voltage for which the transformer oil remains its insulating property. Above this BDV, oil will no longer insulate and a breakdown, for instance between two wires, will occur.

The breakdown voltage of the transformer oil is tested using special transformer oil BDV equipment according to IEC 60156.



DIELECTRIC DISSIPATION FACTOR

The dielectric dissipation factor (DDF) of the transformer oil is tangent of the delta angle which shows the dielectric loss of oil. Therefore, the dielectric dissipation factor is also known as tan delta ($\tan \delta$). In an ideal insulating material, the capacitive current must lead the voltage by 90 degree. However, in reality, the current does not lead the voltage by 90°, but lead by something less than 90°. This is due to a very small leakage current. As a result, the phase angle between voltage and current is not exactly 90°. The tangent of this very small angle (difference) between the pure capacitive current and the actual current is the DDF. As such, the DDF also is a measure of power loss in electric insulation.

Important to know is that impurities or polar molecules increase the resistive leakage current and thus the DDF is a very sensitive parameter for this. Based on this, DDF can be used to check for impurities, deterioration or contamination of oil. The dielectric dissipation factor is measured according to IEC 60247.

SPECIFIC RESISTANCE

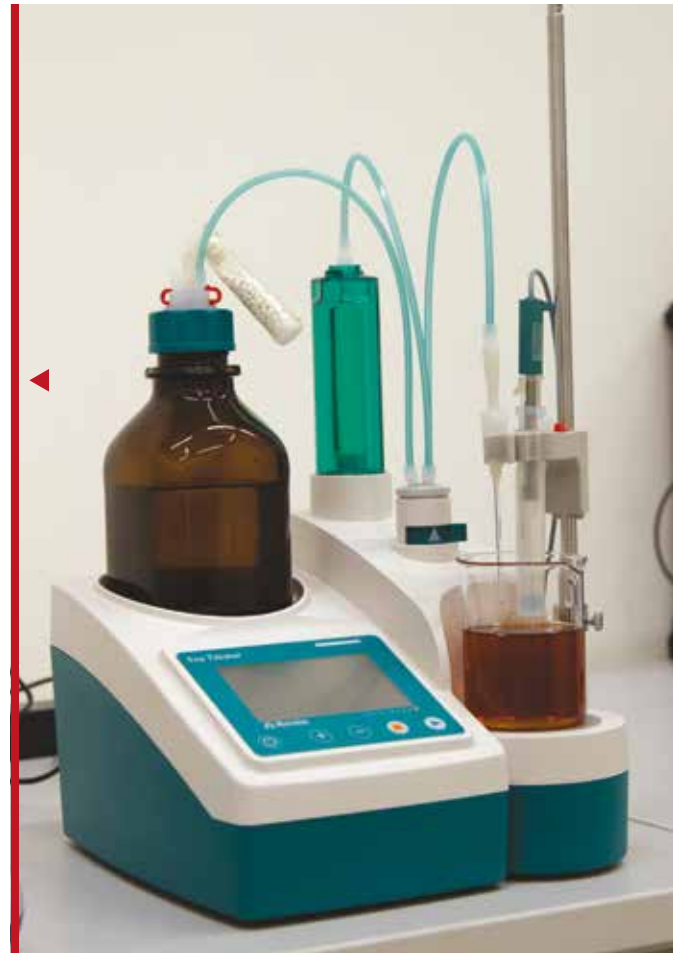
The specific resistance of the transformer oil is measurement of DC resistance between two opposite sides on one cm³ block of oil. High resistivity reflects low content of free ions and ion-forming particles and normally indicates a low concentration of conductive contaminants. These characteristics are very sensitive to the presence in the oil of soluble contaminants and ageing products.

The specific resistance of the transformer oil can be measured using IEC standard 60247

ACIDITY

During the operation of a transformer, insulation oils are oxidized and after a series of oxidation reactions resulting in an increase in acidity and therefore, the acidity of an oil is related to the deterioration of this oil and high acidity will reduce the insulating properties of the oil. High acidities will also accelerate the degradation of the paper insulation and can cause corrosion of the steel tanks. On top of that, further oxidization can result in sludge and varnish deposits.. In the worst-case scenario, this can obstruct the transformer's cooling canals and even block them. The acidity or neutralization value is expressed in mg of KOH required to neutralize 1 gram of transformer oil.

The test is done according to IEC-standard 62021-1 by potentiometric titration.



MOISTURE CONTENT

It is well known that moisture is a major cause of problems in transformers since it has several negative effects on the insulation system of a transformer.

Moisture in the transformer or in the transformer oil will decrease the dielectric strength, increase the risk of bubble formation at high temperature and will increase the aging rate of the solid insulation of a transformer. Due to the latter, the life of the transformer reduces with increased moisture content in the transformer oil.

The moisture content in transformer insulation oil is measured according to IEC 60814 and it is also possible to calculate the water content in the solid insulation by measuring the water content in oil if the temperature of the transformer is known.

COLOR

The color and clarity of transformer oil can be a general indication of quality, aging and the presence of contaminants. As the oil ages, it slowly changes from a pale yellow, transparent color to a deep brown, nearly opaque shade. Therefore, darkened coloration can be a first sign that transformer oil needs to be changed or filtered, making the color of the oil one of the easiest methods to check the general condition of the oil.

INHIBITOR CONTENT

Many mineral transformer insulation oils contain an added oxidation inhibitor to prevent oxygen from reacting with the oil and thus slowing the aging rate of the oil. Nearly all inhibitors used in transformer oils are phenols and can be detected chemically.

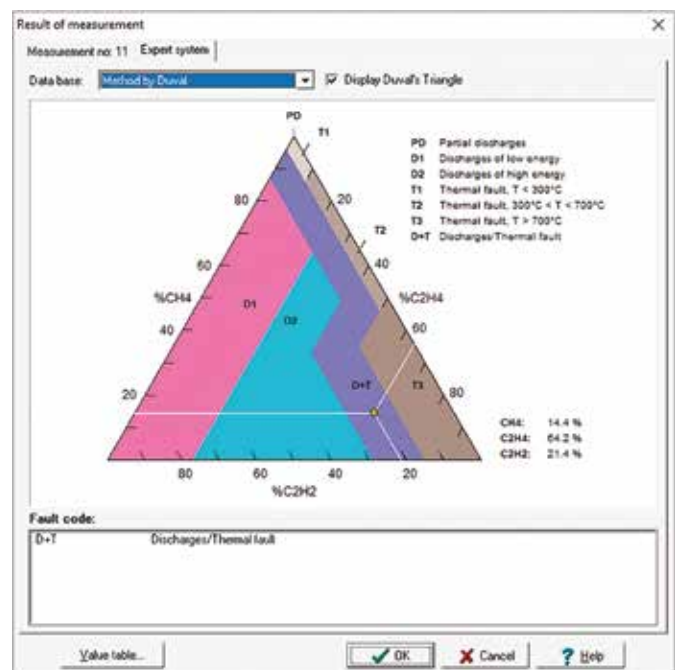
ALL EQUIPMENT IS
BRAND NEW AND USES
STATE-OF-THE-ART
TECHNIQUES.

DISSOLVED GAS ANALYSIS (DGA)

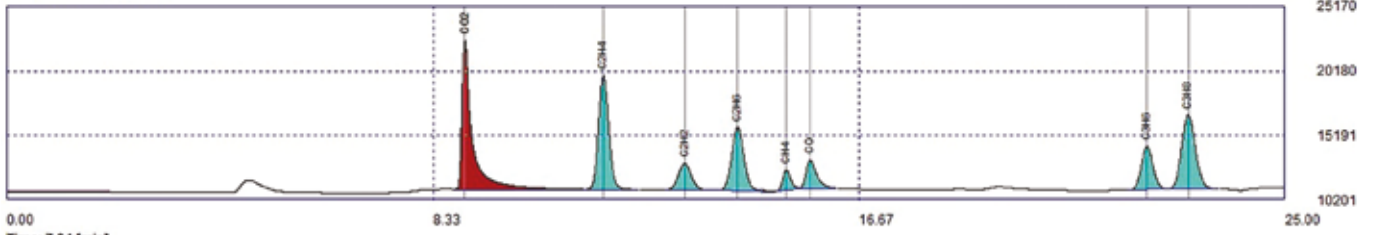
Dissolved Gas Analysis is used to determine the concentrations of certain gases in the oil. The concentrations and relative ratios of these gases can be used to diagnose certain operational problems in the transformer. Therefore, DGA is widely accepted as the most reliable tool for the earliest detection of incipient faults in transformers and tap selector units.



When a thermal or electrical fault develops, dielectric fluid and solid insulation will partially decompose into low molecular weight gases. Analysis of the quantity and ratios of these fault gases allow identification of fault processes such as corona, sparking, excessive aging, overheating and arcing. A DGA is done at NovAcec's in-house lab according to IEC 60567 and ASTM D3612.



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