VIMAP RCID

Power transformers insulation dry out system

Problem

Power transformer lifetime is determined by lifetime of its cellulose insulation. Once cellulose is degraded to unacceptable level it is considered that power transformer should be replaced. Cost of such operation could be enormously high. Depending on power transformer size it can reach hundreds of thousands and millions of dollars. The majority (approximately 85%) of transformers breakdowns are attributed to the failure of the insulating system. Therefore, it is crucial to keep power transformer in reliable operational condition as long as possible.

Moisture content in transformer has a major influence on solid insulation aging rate. According to the world leader insulation material manufacturers, increase of water content in cellulose for 1% doubles the rate of its aging.

Water in power transformers occurs from three sources:

- water left from production
- atmosphere water absorbed through unmaintained breathers and gaskets
- water created by cellulose depolymerization, i.e. thermal degradation

Degree of polymerization (DP) is defined as value of the average chain length of a cellulose molecule.

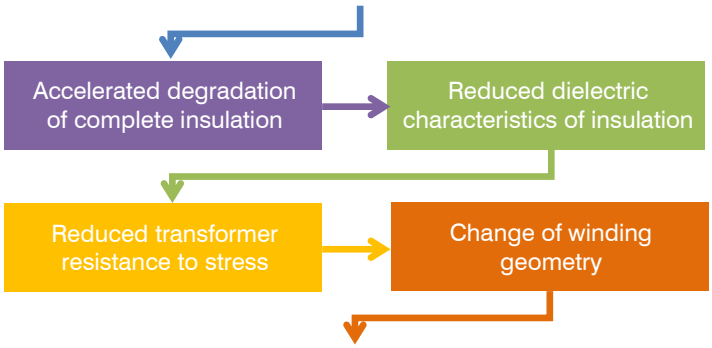
New cellulose has DP value of ca. 1200, while end of cellulose lifetime is reached when DP value decreases to about 200.

When a new transformer leaves the factory, the insulation has a moisture content of up to 0.5% of the dry weight of the insulation.

Being organic matter cellulose insulation starts to degrade the moment transformer is put in operation due to the presence of remained water from production, oxygen and temperature. Together with acids created by oil oxidation this leads to cellulose depolymerization (shortening of cellulose molecules chains) which further leads to creation of more water and more oxidation products. Result is that most of the water in power transformer is chemically created in solid insulation by degradation of cellulose, i.e. cellulose depolymerization.

About 99% of water in power transformer is stored in cellulose insulation while only about 1% is in the oil.

EXCESSIVE WATER IN TRANSFORMER LEADS TO:



DEFINITIVE FAULT OF POWER TRANSFORMER

REDUCED LIFETIME OF POWER TRANSFORMER

Solution

Conventional methods, e.g. oil treatment plants, are agressive and focused on rapid oil drying only, thus securing short term results. Soon after the process is finished water will start to migrate from cellulose into the oil annulling results of such treatment and making it worthless.

Oil-cellulose insulating system tends to create state of equilibrium and therefore water will be divided between oil and cellulose in a definite ratio at any given temperature.

Water migration process is very slow and therefore non-aggressive on line methods are required.

VIMAP RCID is on line dry out system designed for safe continual unattended operation on energized power transformers. Pump draws insulating oil from the lowest point of transformer tank, circulates it through columns with granulated synthetic adsorbents and sends it back to the tank. By this process insulating oil is dried out in a matter of hours or days depending on the oil volume and amount of cellulose in the transformer and oil wetness. However, cellulose insulation drying process is far slower which cannot be significantly influenced by high capacity pumps and expensive vacuum pumps since these cannot contribute to acceleration of this natural process.

Disturbing moisture equilibrium by continuous oil drying VIMAP RCID online dry out system removes moisture from solid insulation. This way permanent diffusion of water from the wet cellulose insulation to already dried oil is possible, slowly removing the moisture from the solid insulation.

Field of application:

- **Preventive maintenance**
  New or previously dried power transformers- continual maintenance of low level of moisture in both oil and cellulose insulation
- **Corrective maintenance**
  Transformers with increased content of moisture- reduction of moisture in complete insulation, improvement of insulation characteristics, increase of power transformers safety and its lifetime

VIMAP

VIMAP RCID

Power transformers insulation dry out system

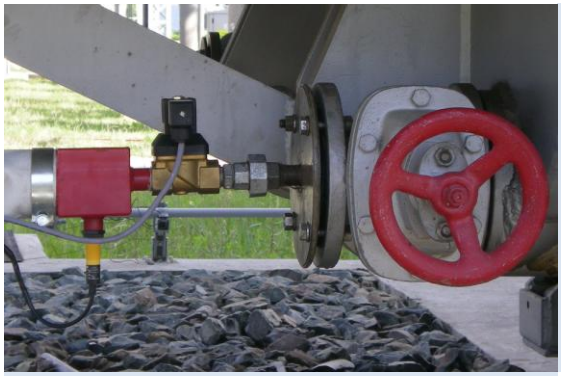
VIMAP RCID - Frame mounted power transformers insulation dry out system

No oil heating - no undesired effects from oil heating on overall oil quality

No oil vacuuming - no other parts to maintain or protect - longer equipment lifetime

No oil inhibitor removed

No dissolved gasses removed for continuous trending of important fault diagnostic gasses



VIMAP RCID inlet line - Connection to power transformer's bottom valve

VIMAP RCID features

- Oil dehydration by water adsorption
- Hanging frame, bolt down stand, cabinet or wheels mounted
- Moisture management system SCADA compatible
- Continual on-line direct reading sensors mounted on both inlet and outlet lines of the system display moisture contents (ppm) and oil temperature (°C) and indicate adsorbents saturation level
- Remote monitoring package Ethernet board– working parameters are available via web browser or via email
- Transferring data to substation automation system confirming to IEC 61850 available as an option
- Safety package with remote alarming
- Oil leakage, air ingress and high pressure sensors shut the system off, isolating it from the transformer, in the event of any malfunction; CMGSM module sends SMS notification in case of unit malfunction
- Control box with front view window containing 7" touch display, PLC, relays, wiring terminations and other ancillary components
- On-site sound and visual alarm
- Various numbers of columns
- Water holding capacity – appx. 5 kg each column
- Electromotor - from 0.2 kW to 1.5 kW
- Pump up to 1200 l/h depending on configuration requirements
- Frequency converter for flow control adjustments
- Particle filter from min 1 μm to max 10 μm available upon order
- Flow indicator or flow meter
- Available in several sizes and configuration to suit all power transformer sizes and conditions
- Custom made designs are available according to specific customer's requirements
- Different power supply configuration available- bespoke to customer field requirements specified during order placement

Adsorbents saturation

Level of adsorbents saturation is monitored by moisture sensors. Comparing inlet and outlet moisture content readings it is easy to determinate efficiency of adsorbents. When the columns are saturated, i.e. when the input ppm is very close to being the same as the output ppm, then the columns can be exchanged.

VIMAP d.o.o.
Braće Jerković 137, 11000 Belgrade, Serbia
Tel: +381 63 257853 • +381 65 4342429 • +381 64 2027420
Fax: +381 11 24 69 724

For additional information about our products and services please contact us at **office@vimap-technics.com** or visit our website **www.vimap-technics.com**

VIMAP