

# Transformers **DIAGNOSIS**

Transforming energy. Adding value.

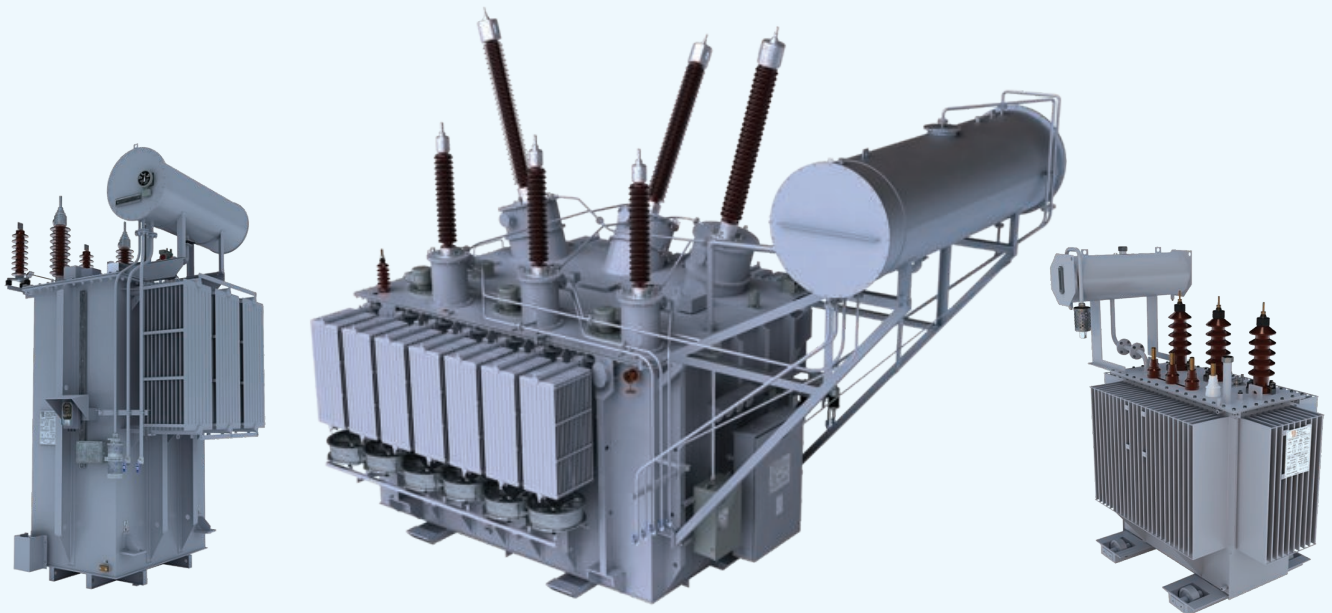
## Diagnosis for transformers maintenance

Transformer preventive maintenance is a strategic tool in the management of electrical transmission and distribution networks. Extreme reliability is demanded of electric power networks, and even though the failure risk of a transformer is small, when failures occur, they inevitably lead to high repair costs and long downtime. On the other hand, transformers are too expensive to replace regularly and must be properly maintained to maximize their life expectancy.

Regular oil analysis is a key factor in monitoring the condition of oil filled transformers. The analysis of insulating oils not only provides information about the oil, but also enables the detection of other possible failure causes and therefore is the cornerstone of any oil filled electrical transformer maintenance program.

Tubos Trans Electric owns a fully equipped laboratory for all types of dielectric oil analysis (mineral, synthetic or vegetable). A team of highly trained chemists and experienced personnel in electric measurements provides a complete physical chemical and dielectric oil analysis, incipient failure diagnosis, and an action plan proposal.

Both internal and external quality controls are carried out, and the laboratory participates in national and international intercomparison exercises as part of a program of quality assurance in results.





The Maintenance Program includes:

- Dissolved Gas Analysis (DGA)** Used for the earliest detection of incipient faults by measuring the concentrations of certain gases in the oil, with gas chromatography. The concentrations and relative ratios of these gases are used to diagnose certain operational problems with the transformer.
- Furfuraldehyde Analysis** It evaluates the status of the cellulose by measuring with liquid chromatography the concentration of furanic compounds produced when cellulose ages as a result of the decomposition of the polymeric structure in paper.
- Dielectric Strength** The measurement of dielectric strength determines the maximum voltage that can be applied across the fluid without electrical breakdown. Any significant reduction in the dielectric strength may indicate that the oil is no longer capable of providing electrical insulation under high electrical fields.
- Particle Content** The presence of particles in oil affects its dielectric strength; its measurement is of vital importance for voltages greater than 220 kV. A small particle's content assures filtration efficiency.
- Water Content** An increase in moisture content reduces the insulating properties of the oil, which may result in dielectric breakdown. Moreover, excessive moisture content can result in the breakdown of insulation paper with a resultant loss in performance.
- Power Factor (Tan Delta Test)** It measures leakage currents through the presence of contaminants in oil and identifies the presence of polar and polarizable contaminants, indicating the loss of the oil's dielectric characteristics.
- Interfacial Tension** Indicative of polar compounds dissolved in oil.

  - Acidity** Indicative of the oil's aging stage. A high acidity level accelerates the degradation of insulation paper.
  - Antioxidant Inhibitor Content** Monitoring the degradation of the antioxidant in transformer insulating oil can assure its protection against oxidation.

## Life Expectancy Estimation

Estimation that enables the identification of those transformers under higher risks in order to develop the right intervention plan. In the evaluation, information regarding constructive features, operational data and diagnosis tests results (electrical measurements and oil analysis) are taken into consideration.