TROJAN
DRY-OUT SYSTEMS

Introduction

Power transformers are the most important component in any power system. They are also the most costly and least easy to replace, with lead times for new transformers usually considerable.

In the course of normal operation, oil insulated power transformers will age. The two critical components of transformers insulation and continued effective operation are the cellulose (paper) and oil. Together, the oil / paper insulation system provides:

- A dielectric medium
- A cooling medium
- Protection for the core and coil assembly from chemical attack

The cellulose insulation is the most vulnerable component in a transformer. It is both a source and an accumulator of moisture. Over 98% of the moisture in a transformer is contained in the cellulose insulation. The decline in its aging, as measured by the Depolymerisation Index, is not reversible, and as it deteriorates it produces other compounds which cause further deterioration. The quality of the paper and its water content are the primary indicators of transformer condition. In essence, the life of the cellulose determines the life of the transformer.

The rate at which the paper ages is controlled by several factors:

- Temperature
- Moisture
- Acidity
- Oxygen

The oil is the main vehicle for heat extraction. An increasing moisture content in the oil leads to a steady decrease in the dielectric strength.

Moisture migration between the oil and paper in an oil-paper insulation system is governed by temperature. The higher the temperature of the windings, the higher the rate of movement of water from the paper into the oil. However, when the transformer cools, the water usually returns at a far slower rate due to residual heat retained in the windings, this causes the relative saturation of the oil to increase significantly and the oil dielectric to decrease correspondingly. Under these circumstances, the transformer has an increased risk of failure. High levels of water in the cellulose (> 2%) can cause bubble evolution.

With a good understanding of the dynamics of the insulation system of power transformers, a suitable maintenance program can be put be in place to slow the aging process of both new and aged wet transformers.

An effective program is one that addresses the key issue - the removal of moisture from the cellulose insulation, not just the oil. This does not have to be an expensive process to be effective in reducing the aging process.

Trojan Dry-Out Systems

Trojan Dry Out Systems is a family owned business based in New Zealand that specialise in the manufacture of equipment for the Analysis, Degassing and Removal of water contamination from the oil and cellulose of energised transformers.

Our proprietary technologies have been developed over a number of years and are well proven in the field. Owners and maintainers of transformers find Trojan systems extremely efficient in their ability to remove water from the transformer insulation, and very cost effective in comparison to other water removal methods.

A growing number of power utilities and HV industrial clients from across the globe have embraced our unique, multi purpose systems that both empower and solve the problems associated with water contamination and degassing issues.

Trojan Dry-Out Systems has earned a reputation for developing close working relationships with customers to provide unique solutions, such as the design and manufacture of custom systems to suit customer's unique applications.

The Trojan Methodology to drying out transformers

Removing moisture from the oil and cellulose is key to ensuring the long life of the cellulose insulation (therefore the transformer) and ensuring that it operates safely throughout its life.

Whilst there are quick, and usually expensive methods to clean up the oil quickly, these do not remove the real problem, which is the water contained in the cellulose insulation.

Trojan Dry Out Systems Ltd have developed a number of systems to tackle this particular issue, as well as provide accurate analysis of moisture contamination levels and degassing of the oil, all whilst the transformer remains energized. These systems are specifically designed for very safe online use on all Kv size transformers.

To ensure the safe, unattended operation of the Trojan Dry-Out System, numerous safety features have been incorporated, all of which will shut down the Trojan and isolate the transformer, and alert the key operator via email and / or sms.

Above all, Trojan Dry Out systems aim to provide equipment that is a highly effective, reliable, informative, low cost, and easy to use system for drying out transformer oil and cellulose insulation.

References
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3) Pederson A, IEEE 2004, Paris