

TRANSFORMER OIL RECLAMATION



Transformer oil on the different stages of its operation is exposed to different impact. Periodic monitoring of transformer oil is an important part of industrial machinery technical maintenance which is carried out on enterprises. Main characteristics of transformer oil, its purity and useful properties determine the performance of transformers. Lifetime of power transformers is a subject of high importance for electric power systems utilities. The decision of replacing, refurbishing or repairing a service in aged power transformer requires considering several factors, especially the cost and time to execute the work. The lifetime of the power transformer being related to the condition of the insulation system; one way of improving the situation is to reclaim insulating oil by Fuller's Earth treatment. This procedure is economically attractive because of increasing prices for both mineral and synthetic transformer coolants, effective cost and environmentally sound. Reclamation rejuvenates the transformer oil by eliminating contaminants. In this paper, a series of experiments has been performed with service aged oils reclaimed in laboratory conditions.

In the process of operation an irreversible process of aging oil is occurred. Oil becomes moistened, contaminated, oxidation products are formed, while oil loses electrical and chemical properties. Sunlight, high operating temperatures, soluble metal salts can cause oxidation. Heat removal is hampered due to aging products that accumulate on the active parts of the transformer. Ageing of oil occurs under exposure on its electric field and the oxygen, which increases its activity in contact with moisture. Existence of water droplets and contamination particles reduce electrical resistance of oil sharply which are located in an electric field.

Oil sampling.

By periodic sampling and laboratory analysis one shall verify the quality of the oil. If it will show a low level of oil quality in comparison with the established norms, measures are being taken to recover it by cleaning, drying and regeneration.

Cleaning and drying of oil.

Cleaning and drying of oils. Purification of oil from moisture and impurities is carried out by centrifugation and filtration through filter paper. There exists zeolites oil drying. In its composition,

they are water or sodium calcium aluminosilicate. Regeneration - the removal of the products of aging and recovering of the oxidized oil.

Oil aging

Aging or deterioration of insulating oil, is usually associated with oxidation. When the oxygen and water appears in the oil, insulating oil oxidizes even under ideal conditions. Pollutions can appear even from transformer solids which is dissolved in the oil. It also effects on the quality of insulating oil.

Reactions occurring in the oil between not stable bicarbonates, oxygen and other catalysts, such as humidity and using accelerators such as heat, lead to the dissolution (oxidation) of oil.

Heat and humidity, along with oxidation, which act as initial boosters, are the main cause of the solid insulation. With proper maintenance of cooling and insulation systems, the age of the insulation system operation can be increased from 40 to 60 years. Unfortunately, it is impossible to eliminate oxidation of the oil , but it can be controlled (slow) through the service process. One of the major provisions in the servicing of transformer oil is an annual examination. Oil analysis allows to view the condition of the transformer insulation system.

Moisture consists of pure water, the water dissolved in the decomposition products of oil, dissolved water and water, which has a chemical bond (a part of the chemical structure in the molecules of glucose and necessary for saving the mechanical strength of the pulp). Completely purification from moisture of cellulose insulation is not possible.

Transformer oil dissolves more moisture at high temperatures than at low temperatures. If the mixture of oil and water to cool, the water goes into the sediment. Rejected water will soak into the insulation, or it is combined with oil breakdown products (water mixed with oil). Humidity will be divided between the paper and oil, but disproportionately. Insulating paper absorbs water from the oil and holds it inside in locations of the high voltage.

Pollution forms under the process of deterioration of the transformer. The acids formed in the process of oxidation attack the cellulose and the metals and create metal soap, an aldehyde, an alcohol, which precipitated as a mud acid (heavy substances) on the insulation of the side walls of the tank, a breathing system, cooling system, etc. Dirt appears faster with heavily loaded, hot and not properly operated transformer. Mud increases viscosity and thereby reduces its cooling capacity, thus reducing the life of the transformer.

Contamination also causes shrinkage of the insulation, leading to the destruction of varnishes and cellulose materials. They are also agents of discharges and currents being hygroscopic and absorb moisture and lead to overheating of the insulation system. Dirt deposited on the winding core, which increases the operating temperature of the transformer.