



Talk on Transformer predicted maintenance and diagnostic through insulating Oil

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On 26th January 2019, the Electrical Engineering Technical Division (EETD) has successfully organised a talk on “Sustainable Building- What can an Electrical Engineer do?” The talk was attended by more than 50 participants. The speaker was Mr. Zulfadhly who is the Chairman of the SIRIM Working Group (W3) on Insulation Oils for Electrical Equipment.

There are three types of maintenance namely reactive or unplanned, preventive or planned and condition based maintenance (CBM) with the industry increasingly adopting and preferring CBM. According to Mr Zulfadhly, transformer oil has several advantages over other material as it can provide insulation, cooling and protection of paper insulation from oxygen and moisture. Oil itself has stable electrical properties over time and can act as information carrier. There are several classes of transformer oil namely mineral oil which is the most widely used in Malaysia, silicone oil which is about thrice as expensive as mineral oil hence limiting its use for indoor applications typically, synthetic and natural ester, synthetic hydrocarbon and chlorinated hydrocarbon. High performance oil transformer is highly demanded due to its compactness i.e. having high effect over a given oil volume, higher working temperature as standard operation and overload requires better cooling, more reliable, and non-corrosive.

It is impertinent to monitor and test oil to evaluate condition of transformer. This is to establish the suitability of the in-service oil for further use, check the conformity of new oils and spot check existing approved oil types. By doing all the aforementioned, transformer failure can be prevented and the maintenance cost can be reduced. Mr. Zulfadhly strongly recommended for oil analysis to be conducted during purchase, field acceptance test, pre-energisation, energisation, normal operational life and end of life period. These test and measurement are aptly prescribed in IEC 60296 (before filling), IEC 60422 (after filling) and IEC 60156 (test and measurement method). Tenaga Nasional Berhad (TNB) adopts the said standards albeit with minor modifications.

There are two main types of transformer oil tests namely electrical and chemical. The three main types of analysis are dissolved gas analysis (DGA) to check the transformer’s condition, oil quality analysis to check the oil condition, and furfural analysis to check the paper condition. Of late, there has also a dramatic increase in the installation of online gas monitoring system at the transformer.

The quality of oil is decided by its moisture content, acidity, colour, interfacial tension, dielectric breakdown and power factor.

The speaker mentioned that any form of test is science whereas analysing the test results is an art. This is evident when it comes to interpretation of the DGA results. Online DGA system is a modern tool for diagnosis of fault in power transformer. DGA is a proven and reliable technique and is relatively inexpensive and easy to implement. He pointed out that thermal and electrical fault in transformer have nothing to do with oil quality.

The lifespan of a transformer is highly dependent on the lifespan of the paper insulator as oil can be replaced. The age of paper insulation can be assessed directly by the degree of polymerisation which in turn is a measure of the cellulose length. Newer transformer design tends to have provision for sampling of oil and paper to be tested.

Mr. Zulfadhly concluded his presentation by reiterating the importance of deciding the type of oil test to be performed in order to get a better view of the transformer condition. Figures below summarise the talk.



Figure 1: The speaker



Figure 2: EETD Chair appreciating the speaker