Moisture Measurement for Transformer Drying Vacuums Using Cooled Mirror Hygrometers

Application Background

Many high voltage transformers, especially those switching many thousands of kVA (such as the types found in power-plant sub-stations) are filled completely with a refined mineral oil. This serves several purposes; most importantly the oil must act as a main part of the transformer's insulation, though it also serves to cool the transformer.

Over time, the oil will interact with the cellulose paper which forms the other (contact) element of the insulation system, and create byproducts that will decompose them, reducing their insulating properties. These byproducts will also increase moisture levels inside the enclosure and create an environment that will overheat the transformer, which will eventually lead to its failure.

As a preventative measure, the transformer oil is replaced at regular intervals, and great lengths are taken to ensure that the water vapour content inside the transformer is as low as possible. The reasoning behind this is that moisture inside transformers adversely affects the dielectric and insulating properties of the oil.

A vacuum is applied to the transformer body for a prolonged period of time following the draining of the oil. This is a common practice in the industry, with the intent of drawing out any moisture which may have absorbed into the inner surfaces of the transformer before the new oil is introduced.

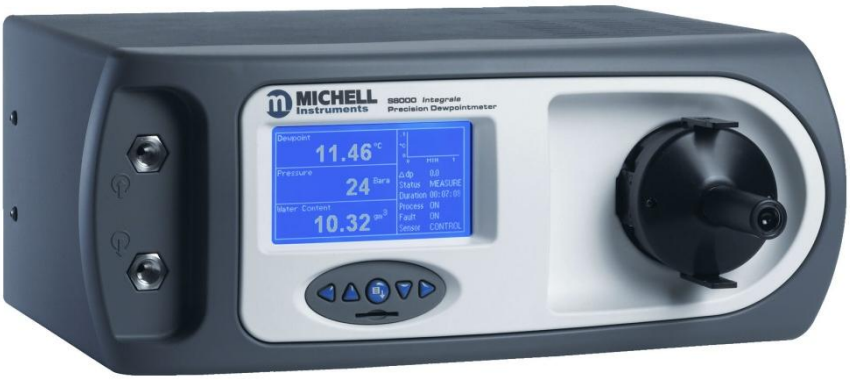
It is crucial to ensure that the transformer is sufficiently dry before re-filling, as trapped moisture can cause coronas, arcing and premature degradation of the transformer.

Measurement Technique

Optimal dryness is desirable at this critical stage and a reliable, accurate dew-point measurement is accordingly required during the vacuum pumping process. The Michell Instruments' S8000 hygrometer is suitable for taking these measurements. It uses the fundamental cooled mirror technique to measure dew points in vacuums of up to 0.05 mbar, making it unique in its category.

Much attention has been put into the design of the sensor head to ensure the best sealing capabilities both under high pressure and low (vacuum) pressure. As a result manufacturers as well as end users, when oil refilling, can monitor the efficiency of the vacuum pumping process and rest assured of transformers retaining their optimal operations throughout their working lives.

Due to the natural build up of moisture in the transformer, the S8000 offers the opportunity for continued monitoring throughout the transformers' life cycle, and can equally be used whenever another insulation technique, such as SF_6 gas is employed.



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