

Use of Impedance Moisture Transmitters to measure moisture content of High Voltage Switchgear Quench Gas

Application Background

High-voltage switchgear found in power stations or major distribution centers can be severely damaged over a period of time by moisture in the Sulphur hexafluoride (SF_6) gas used to prevent arcing of the contacts.

During electrical power distribution at transmission voltages (ranging typically from 100 to 400 kV), power switching or load current interruption is a major problem as a result of arcing between the two contact points. The insulation properties of SF_6 , used to pressurize such switchgear enclosures, effectively control arc formation. However, the ingress of moisture over time results in electrical discharge, causing the SF_6 to decompose into byproducts, such as hydrolysable fluorides.

These fluorides are good dielectrics and their presence does not impair the operational efficiency of the respective equipment. However, this only applies when the moisture content of the gas or its enclosure is low. In the presence of water vapor, the by-products include the highly corrosive HF, which accelerates switch contact corrosion to the point of physical breakdown. The aggressive nature of HF means that the damage may spread to the surrounding areas of the switchgear enclosure and thus further the extent of damage caused as a result. It is clear that the presence of moisture in the gas must be maintained to a minimum to avoid the formation of this acid.

It is also important to maintain low moisture level, to prevent formation of condensation with the potential for leakage current across the surface of insulating parts.

Measurement Technique

Moisture measurements are important at the following stages:

- Checking the moisture content of new SF_6 in cylinders by industrial gas producers prior to supply and immediately prior to use by the switchgear manufacturer or transmission company - SF_6 cylinders appear to be





particularly susceptible to moisture ingress in storage - SF₆ in good condition should have a moisture content of <10 ppm(v) equivalent to dew point <-60°C dew point (at atmospheric pressure).

- Dry gas purging of new switchgear enclosures during the final stage of manufacture or following internal maintenance works prior to pressuring and sealing with SF₆. Most commonly, high purity nitrogen or another inert gas from cylinders is used, by repeated pressurization and venting to atmosphere, until the moisture content within the enclosure has been reduced to <10ppm(v) equivalent to dew point <-60 °C dew point (at atmospheric).
- In service field checks/continuous monitoring to ensure that moisture content in the SF₆ is maintained below the critical level of 100 ppm(v), - 42 °C dew point (at atmospheric).

For cylinder gas checking and drying of switchgear enclosures prior to filling, use the MDM300 advanced dew-point hygrometer. This portable, wide range instrument provides rapid determination of moisture content displaying in a variety of engineering units, and is also programmed with the molecular weights of a number of gases including SF₆, facilitating accurate ppm_w indication. It is also possible to store up to 10,000 measurement points with its built-in data logging facility, which is accessed via the drop-down menu on the front panel.

Purpose designed sampling kits are also available for this application, with DN8 or DN20 inlet connections, 'no adjustment required' flow control, self-sealing outlet connections, and capture bags. These make SF₆ moisture analysis a quick, straightforward procedure.



MDM300



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