

# High Voltage Switchgear and Quench Gas

## Background

Moisture in Sulphur hexafluoride (SF<sub>6</sub>) arc quenching gas can cause rapid and severe deterioration of high-voltage switchgear.

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<sub>6</sub>, used to pressurize such switchgear enclosures, effectively control arc formation. However, the ingress of moisture over time results in electrical discharge, causing the SF<sub>6</sub> 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 vapour, 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<sub>6</sub> in cylinders by industrial gas producers prior to supply and immediately prior to use by the switchgear manufacturer or transmission company - SF<sub>6</sub> cylinders appear to be particularly susceptible to moisture ingress in storage - SF<sub>6</sub> in good condition should have a moisture content of <10 ppm<sub>v</sub> equivalent to dew point <-60°C dew point (at atmospheric pressure).
- Dry gas purging of new switchgear enclosures during the final stage of manufacturer or following internal maintenance works prior to pressuring and sealing with SF<sub>6</sub>. Most commonly, high purity nitrogen or another inert gas from cylinders is used, by repeated pressurisation and venting to atmosphere, until the moisture content within the enclosure have been reduced to <10ppm<sub>v</sub> equivalent to dew point <-60 °C dew point (at atmospheric).
- In service field checks/continuous monitoring to ensure that moisture content in the SF<sub>6</sub> is maintained below the critical level of 100 ppm<sub>v</sub>, -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, including ppm<sub>w</sub> for SF<sub>6</sub> and can 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.



MDM300

### Michell Instruments

48 Lancaster Way Business Park  
Ely Cambridgeshire  
CB6 3NW

Tel: +44 1353 658000  
Fax: +44 1353 658199  
Email: [info@michell.com](mailto:info@michell.com)  
Web: [www.michell.com](http://www.michell.com)