

### ELECTRICITY TRANSMISSION SYSTEMS High Voltage Switchgear and Sulfur Hexafluoride

High voltage switchgear which is widely employed on electricity transmission systems uses Sulfur Hexafluoride (SF<sub>6</sub>) as an insulating and arc quenching gas. When the moisture content of this gas exceeds certain limits rapid and severe deterioration of switchgear can happen.

During electrical power distribution at transmission voltages (ranging typically from 100 to 400 kV), power switching or load current interruption result in arcing between contact points. The insulation properties of SF<sub>6</sub>, used to pressurize switchgear enclosures, suppress arc formation. However, the ingress of moisture into these enclosures progressively increases arcing, causing the SF<sub>6</sub> to decompose into its byproducts, such as hydrolysable fluorides.



High voltage switchgear

These fluorides are good dielectrics and their presence does not impair the operational efficiency of the equipment. However, this only applies when the moisture content of the gas within the enclosure is low. In the presence of water vapor, the by-products of arcing include the highly corrosive acid - Hydrogen Fluoride (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 causing further damage. The moisture content of the gas must be kept to a minimum to avoid the formation of this acid.

It is also important to maintain low moisture levels, to avoid condensation within enclosures in cold weather which has the potential to allow leakage current across the surface of insulating parts.

#### Measurement

Moisture measurements are important at the following stages:

- Checking the moisture content of new SF<sub>6</sub> in cylinders supplied by industrial gas producers 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(V) equivalent to dew point of -60C.

- Dry gas purging of new switchgear enclosures during the final stage of manufacturer or following internal maintenance work 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 pressurization and venting to atmosphere, until the moisture content within the enclosure has been reduced to <10ppm(V) equivalent to a dew point of -60°C.
- In service checks and continuous monitoring to ensure that moisture content in the SF<sub>6</sub> is maintained below the critical level of 100 ppm(V), -40°C.

For all of these applications, use the **STORK Instruments DEWRanger** portable hygrometer. This easy to use instrument responds rapidly and displays moisture content in a variety of engineering units. Its data logging feature permits the storage of measured values and the downloading of them to a PC. Further information on this application can be obtained at [giltron@naver.com](mailto:giltron@naver.com).

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