



Predictive maintenance for SF6 gas circuit breakers



Please visit : www.ogauge.io



SF6 GAS DENSITY SWITCH



A boon for SF6 Gas Circuit breaker Manufacturers

Monitors SF6 leakage :

Kyoto Protocol and Article 5 of EU regulation 517/2014 mandates to monitor leakage of fluorinated greenhouse gases.

Reduce inventory :

Use the same gauge for all equipment

Flexibility :

Configure your setpoints at site

Automate Service requests :

Cloud based app can integrate service request into your ERP

Universal :

Can be adapted for Novec 4710™ / Novec 5110™ / N₂ / CO₂

PRESSURE GAUGE | SWITCH | TRANSMITTER | DATALOGGER

Operation and Maintenance of a Gas Insulated Substation

A major difference between conventional air insulated substations (AIS) and the gas insulated substations (GIS) is that the SF₆ gas insulated electrical components are placed within an earthed, pressurized metallic container. This is a significant change in operating the switchgear with circuit breakers, disconnectors, and earth switches because there is no direct observation or visual contact of the open or closed disconnect switch gap or the open or closed earthing switch status

It would be extremely beneficial if one could introduce digital features for predictive maintenance for Gas Insulated switchgear.

A standalone system with desired features is explained below.

Gas Insulated Switchgear: Digital Features for Predictive Maintenance

- A. As a predictive maintenance solution for an O&M team of users, there needs to be an automatic and real time status update feature integrated within the switchgear. This feature should offer following capabilities and monitoring of parameters digitally on the laptop / tablet / mobile phone of O&M users (authorised by the purchaser) on real time basis, duly complying with latest cyber security norms.
 - i. SF₆ gas density -> Actual value, and email/SMS notification on the threshold value set by user.
 - ii. Ambient temperature actual value
 - iii. Cubicle temperature of Circuit Breaker
 - iv. CB operating position (ON / OFF)
 - v. Readiness to switch ON the CB (based on Spring charged position and sufficient Gas pressure)
 - vi. No. of CB operations performed.
 - vii. Fleet view (GPS based mapping of GIS location)
 - viii. Weather information (web based)
- B. Towards the predictive maintenance approach, the standalone system can also additionally provide below trending parameters (based on the historical operational statistics), enabling user to plan the maintenance activities proactively in most economical way and avoid any unwanted outage.
 - i. SF₆ gas density > Predicted time to next alarm.
 - ii. Circuit Breaker mechanical life -> prediction of remaining life, before major overhauling.
- C. This data can be available on real time basis, and also downloadable with historical logging of above referred KPIs.
- D. Above functionalities can be factory tested during the Routine testing/ Customer inspection, and be ready to operate at site.

Gas Monitoring Devices

Pressure gauges or density monitor can have temperature compensated pressure (gas-density continuous monitoring) switches (4 hard relays) with 4-20mA analogue output. Analog signals can be available on IEC 61850 protocol for reporting to SCADA. Additional hardware for converting 4-20mA signal to IEC61850 protocol for reporting to SCADA can be offered separately.

Gas density or pressure monitoring device should ideally be provided for each gas compartment. The device can provide continuous and automatic monitoring of the state of the gas. The SF₆ gas monitoring device ideally should have two supervision and alarm settings. These are usually set so that, an advanced warning can be given that the gas density/pressure is reducing to an unacceptable level. After an urgent alarm, operative measures can be taken to immediately isolate the particular compartment electrically by tripping circuit breakers and opening disconnectors. It can be ensured that there is no chance of the gas liquefying at the lowest ambient temperature. The gas monitoring device can monitor at least the following, locally and on remote.

- i. "Gas Refill" Level- This will be used to announce the need for gas refilling.
- ii. "Breaker Block" Level- This is the minimum gas density at which the manufacturer can guarantee the rated fault interrupting capability of the breaker. At this level the device contact shall trip the breaker and block the closing circuits.
- iii. Over pressure alarm level- This alarm level can be provided to indicate abnormal pressure rise in the gas Compartment. An additional manifold enables, to test all gas monitoring relays without de-energizing the primary equipment and without reducing pressure in the main section.

The manifold provided can be used for test purposes. Isolating the O-gauge and using the test port to air pressure can help test the contact operation independently.

IIoT based gas density monitoring system

O-gauge gas density switches can be used as standalone monitoring system for all the above parameters. Connecting it to the internet can help achieve all the desired features above.

It can also be retrofitted to all the existing breakers, and all setpoints can be configured individually at site.

A comparison of features of existing density monitoring devices vis a vis O-gauge is given on following pages.



SF6 GAS DENSITY SWITCH

| Features | Ogauge | Other competitors |
|--|---|---|
| Full scale LED bargraph | 270 Deg arc | Smaller arc |
| Two modes | | |
| Filling mode | Shows compensated pressure | Prefilled |
| Monitoring mode | Displays actual pressure and compensated pressure | Only pressure / compensated pressure |
| Dial Size | Full 100 mm dial | 63 mm |
| Difference from lowest to highest switchpoint | 100 % within range | About 2 bar |
| Relays | 4 independant on board relays | Two or four as per order |
| Relay configurability | Onsite | Preordered |
| Relay hysteresis | Configurable onsite | As is |
| Sector limits and colour | Configurable onsite | Preconfigured by supplier |
| Safety | | |
| Reference chamber (internal to instrument filled with SF6) | Nonexistent (improved reliability) | Needs leakage monitoring |
| Tampering of instrument | Role based access, so safer | Anyone can change |
| Onsite Remote monitoring | Possible, through mobile app | NA |
| Offsite Remote monitoring | Through a cloud based dashboard | NA |
| Analogue output | Two outputs (configurable) provided | No analogue outputs, separate instrument needed |
| Datalogging | Inbuilt datalogger | NA |
| Gauge | Inbuilt OLED display | Separate gauge needed |
| Integration with ERP | Possible from dashboard | NA |
| Auto generated Service requests | Possible from dashboard | NA |
| Breaker Asset monitoring | Possible from dashboard | NA |
| Remote filling automation | Possible using another gauge | NA |
| Data Analysis to improve performance | Possible using dashboard data | NA |

Note : As efforts are made constantly to improve both design and method of manufacture, the apparatus supplied may differ in detail from illustration and data printed. Please check the specifications while ordering



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