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Automatic Gas Filling, Degassing and Vacuum Process for SF₆ Gas Circuit Breaker

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A B S T R A C T

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Keywords: Insulating, Sulfur Hexafluoride (SF₆), Dilo Devices, Air-Insulated Substations

Introduction

Sulphur Hexafluoride (SF₆) gas is extensively used in High-Voltage (HV) switchgear as an insulating and current-breaking medium. SF₆ has good insulating and arc-quenching ability which give reliable act in comparatively compact designs. It is hence optimize to power system use where equipment is often placed in areas with a few present footprint such as densely-populated urban environments, offshore platforms or wind power installations

SF₆ Circuit Breaker

Sulfur hexafluoride circuit breakers safe electrical power stations and distribution systems by intersperse electric currents, when tripped by a safety relay. In place of oil, air, or a vacuum, a sulfur hexafluoride circuit breaker uses sulfur hexafluoride (SF₆) gas to cool and quench the arc on opening a circuit. Pros over other media comprises lower operating noise and no emission of hot gases, and comparatively low upkeep. Established in the 1950s and carry forward, SF₆ circuit breakers are extensively used in electrical grids at transmission voltages up to 800 kV, as

generator circuit breakers, and in distribution systems at voltages up to 35 kV. Sulfur hexafluoride circuit breakers can be utilized as self-contained apparatus in outdoor air-insulated substations or can be placed into gas-insulated switchgear that give permission for compact installations at high voltages.

Current interruption in a high-voltage circuit breaker is retained with the help of distinct two contacts in a medium, such as sulfur hexafluoride (SF₆), that has good dielectric and arc-quenching features. When the contact separation had been completed, current is taken with the help of an arc and is disrupted when this arc is cooled by a gas blast of adequate intensity. SF₆ gas is electronegative and with a strong property to absorb free electrons. The connection of the breaker are opened in a high-pressure flow of sulphur hexafluoride gas, and an arc strike amid them. The gas catches the moving free electrons in the arc to create comparatively immobile negative ions. This loss of conducting electrons in the arc rapidly creates some insulation strength to extinguish the arc.

Some features of SF6 circuit breakers helps to elaborate their fruitfulness:

- easiness of the disrupting chamber which do not require an auxiliary breaking chamber
- Autonomy has by the puffer method
- The chances to take the highest act, up to 63 kA, with a decreased number of interrupting chambers
- Short break time of 2 to 2.5 cycles
- High electrical resolution, permitting at least 25 years of operation without refurbishing
- Possible compact answers when used for gas insulated switchgear or hybrid switchgear
- Integrated closing resistors or synchronized operations to reduce switching over-voltages
- Reliability and availability

SF6 Gas Refilling Device with Electronic Weighing Scales

REFILLING gadget as CYLINDER truck for agreeable on board conveying of a gas bottle. The essential measure of the weight reducer shows the container pressure in bar. The auxiliary measure demonstrates the ideal filling strain to be set effectively by methods for the handle. The container weight can be decreased to the ideal filling pressure by the incorporated weight reducer.

Discharges during the REFILLING procedure are dodged without anyone else shutting couplings. The heaviness of the gas to be topped off can be enlisted effectively by methods for incorporated gauging scales. The weight is demonstrated on a showcase which is turned off naturally if the scales are unused for a more extended time. The past weight sign is reset in the wake of turning on by PRESSING the key.

Devices for SF6 Gas Monitoring

Electronic Bottle Scales

The electronic container scales permit snappy and simple assurance of the filling limit of a gas bottle. The huge gauging stage and the supporting chain give extra security of the gas bottle. The weight is shown on the enlightened presentation which switches off consequently if the scales are not utilized for a specific time. Because of the tare work high accuracy evaluation of gas sources of info and yields is conceivable. The container scales can be collapsed in one stage after use - agreeable and space-sparing.

Weighing Scales

The gauging scales have been Established uniquely for enormous compartments utilized for instance in GIS creation or in huge substations. The gauging scope of the gadget is up to 00 kg. The decided weight is shown on the showcase right away.

The coordinated sequential interface is a unique component permitting information correspondence with other DILLO gadgets. Consequently, not just the weight can be perused on the administration truck, yet the recuperation procedure can likewise be halted by means of the DILLO administration truck in the wake of having arrived at the given filling weight. Besides, the information can likewise be transmitted to the PC or to exceptional observing programming. There is no simpler method of SF6 checking.

Mass Flow Measuring System

Mass flow measuring system (battery-worked) Battery activity empowers an application autonomous of the force flexibly. With this gadget, gas checking is only that basic. Gas amounts which are filled in and recouped are enlisted and can be moved to a PC. The framework shows the present mass stream just as the all-out mass. It is likewise outfitted with an extra meter which can be reset, include and deduct the gas amount. Along these lines, the SF6 gas checking is exceptionally simple.

- System can be wall or table mounted
- Coupling groove part DN20
- Measuring accuracy for gases: $0.50\% \pm 0.1 \text{ kg/h}$
- PC-Hart modem with PC interface cable (available as option)
- Indication in kg, optionally in lbs.

Weighing unit for SF6 Monitoring Manager

Weighing unit for "SF6 Monitoring Manager" without warm exchange name printer This gauging unit is a valuable instrument for the SF6 gas bottle the board regarding the „SF6 Monitoring Manager“, a uniquely Established database programming. The amount of SF6 put away in gas bottles is definitely controlled by methods for electronic scales, approaching and active gas vessels are distinguished by methods for the incorporated standardized identification scanner. The required scanner tag names can be imprinted nearby with the mark printer (just B195R01). Gas amounts being filled or pulled back are enrolled by the gauging unit and are allotted to the comparing stockpiling area or client area by means of the PC tablet. This unit likewise empowers the enlistment of the gas quality (e. g. new gas or reuse gas).

In filling mode any gas amounts can be pulled back from the jug and moved to different gas vessels. Its distinction is quickly enlisted in the database. Along these lines it is conceivable to overview the gas amounts utilized whenever and any area. This significantly improves yearly revealing as per the CE 1493/2007 order.

Devices for SF6 Gas Monitoring

Estimating instruments are utilized to screen encompassing air, follow spills and to quantify the SF6 nature of electrical working hardware. The SF6 gas should consistently be

unadulterated since mugginess and harmful or destructive disintegration items in circuit breakers hinder the protecting properties of the gas. The gas quality must be checked as per the EC 842/2006 mandate on fluorinated gases.

The IEC 60480 mandate likewise specifies the breaking point esteems for the re-utilization of SF6 gas. It is completely important to know the gas quality before doing support deals with an electrical switch so as to have the option to settle on readiness, re-use or removal of the SF6 gas..

The essential quality criteria for SF6 gas in circuit breakers are as follows:

- Humidity (dew point)
- Decomposition products
- Gas purity in %

The SF6 Multi Analyzer is a client and upkeep inviting gadget which ensures high estimating exactness. Most importantly, the gas is checked for deteriorations items. On the off chance that basic SO₂ values are resolved the estimation can be interfered. If there should be an occurrence of debased SF6 the total estimating gas can be recouped from the inward vessel. Along these lines, any pollution of different sensors is maintained a strategic distance from and the usefulness of the gadget is guaranteed.

SF6 Multi-Analyser

Precise and right outcomes for resulting estimations can be ensured by cleansing the estimating hoses before every estimation. Another large favorable position of the Multi Analyser is its high exactness. SF6 moistness is estimated at working weight. In this way exact outcomes are gotten during a short estimating time even in the basic dew point extend (< - 40 °C). The dew point is determined at surrounding temperature. The gadget is very upkeep benevolent. The remaining lifetime of the SO₂/HF/H₂S/CO electrochemical sensors is demonstrated consequently.

A useful and valuable gadget. Since the gas virtue is critical for the protection properties of SF6 gas, it is totally important to control the most significant parameters routinely. The SF6 Analyser depends on the dew point estimating guideline and scores by its estimating precision. The gadget was explicitly intended for dampness estimations in SF6 switchgear. The gadget is alternatively accessible with a SO₂ sensor. In this manner the SF6 Analyser 973 can decide up to three parameters.

- Moisture concentration (dew / frost point)
- SF6 volume percentage
- SO₂ concentration (optionally)
- Integrated measuring gas return system
- Comfortable operation via touch screen
- User configure display

For both stickiness and virtue estimations precise and solid buildup methods are utilized. Moreover the SF6 Analyser 973 is outfitted with a client configurable full shading dynamic network LCD with coordinated touch screen. The gadget is additionally outfitted with a gas recuperation framework by which the deliberate gas can be put away in an inward tank during the estimation method. After culmination of the estimation, the put away gas might be siphoned back naturally or physically into the first compartment or into another vessel. Also the gas compartment pressure is estimated.

Dampness is the most significant measures for the assurance of the gas quality. This gadget has been structured particularly for SF6 dampness estimations. It likewise shows a higher opposition against pollution and SF6 disintegration items than customary dampness sensors and even limits the typical long time floating. The coordinated electronic stream meter bolsters the minimisation of the gas test amount and works freely of its position which is the ideal for gas inspecting from electrical switch. Weight and temperature impacts on the estimating result can be avoided. It is a dependable instrument which is vital.

This gadget serves for estimating the gas immaculateness important to keep up the dielectric property for bend extinguishing in circuit breakers. On account of the speed of sound estimation Established by DILO it gives results right away. The chip introduced changes over the qualities estimated into the SF6 volume rate. Simple flushing after the estimating procedure - and the gadget can be utilized again for another gas compartment right away. The gadget can be conveyed for estimations of unadulterated SF6 gas or SF6 gas blends containing N₂ or CF₄. For this situation we sympathetically request that you contact DILO.

Before upkeep works are completed it is totally important to know the gas quality. This extraordinary hardware permits exact estimation of SO₂ in gas blends. Moreover this gadget is safe against sullying and SF6 decay items and is thusly a solid instrument for every correction of circuit breakers. During the activity of gas protected switchgear disintegration items may happen after a breakdown which negatively affects the gas quality in the electrical switch just as on the protection properties. Thus the estimation of decay items is significant. The estimation can be done effectively by methods for test cylinders and plastic packs.

Gas Leak Detectors

The framework's wear parts are coordinated in a module Smart Sensor which can be traded for upkeep by the administrator inside a couple of moments. Since three Smart Sensors are as of now remembered for the extent of flexibly accessibility of the framework is expanded extensively.

The finish of the sensor lifetime is demonstrated. The framework's wear parts are incorporated in a module Smart Sensor which can be traded for upkeep by the administrator inside a couple of moments. Since three Smart Sensors are now remembered for the extent of flexibly accessibility of the framework is expanded impressively. The finish of the sensor lifetime is shown.

The cordless battery-worked gadget gauges in six affectability levels inside a short reaction time. The gadget switches consequently to the following more significant level of affectability for recognition of bigger holes. It is conceivable to switch over the gadget to the most touchy estimating range by essentially squeezing the comparing key. The SF6 fixation is shown close to the sign of the estimating range by a LED bar show and a perceptible sign.

Room Monitoring Devices

The gadget even identifies littlest SF6 focuses and shows the present estimating values forever. For the working faculty it is completely important to realize that no radioactive source is utilized. Subsequently no extraordinary estimates must be taken during activity.

The SF6 Air Sensor ensures a brisk response time. Moreover, there is no cross affectability to dampness and unaffected by foundation pollution and the estimating result stays consistent. Parameters for cautioning messages and alert stumbling are uninhibitedly configurable. The gadget must be utilized along with the SF6 Network Monitor. It can't be worked independently. The gadget can likewise be associated with different gadgets to the SF6 Network Monitor straightforwardly so as to develop checking focuses for SF6 gas in the room by means of a system for observing.

The SF6 Network Monitor is the focal control unit from up to five SF6 Air Sensors to be associated. Cautioning and alert limits can be set for each SF6 Air Sensor. The fitting and-play working idea makes the taking care of truly agreeable. Estimating qualities can be put away and approached the 5.7" coloured touch screen for each SF6 Air Sensor (3-026-R115) to be associated a force and transport link is essential. The force and transport link leads from the SF6 Network Monitor to the first SF6 Air Sensor and afterward to the following SF6 Air Sensor until the last SF6 Air Sensor is associated.

Accessories

This bag is a straightforward and practical framework for gathering estimating gas in the event that it can't be returned legitimately into the electrical switch. Its taking care of is simple: Connect the sack with the hose remembered for the extent of flexibly to the estimating gadget. The release gas gathering sack permits gathering the SF6 from up to 25 estimations. The gas can be evacuated by methods for any assistance truck.

All DILO estimating gadgets outfitted with a gas return framework can be associated with the release gas gathering pack.

When utilizing gadgets of various development you will be persuaded of this connector pack. It incorporates various connectors to empower the association with more established estimating gadgets just as weight reducers for estimating the gas quality in SF6 bottles. Moreover, this unit contains connectors for retrofitting self-shutting coupling frameworks

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