



Gas Insulated Substation Definitions And Basics

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GAS INSULATED SUBSTATION DEFINITIONS AND BASICS

DEFINITIONS

This course is based on terms used in IEEE and IEC regulations. Several crucial terms are for better understanding of the presented material.

GIS - There are two terms presented in IEC “Gas Insulated Switchgear” and IEEE “Gas Insulated Substations.”

In IEEE C37.122 - Gas insulated switchgear (GIS): a compact, multicomponent device, enclosed in a grounded metallic case in which the basic insulating medium is SF₆ gas and which typically includes buses, switches, circuit breakers, and other related devices.

In IEC 62271-203 - Metal-enclosed switchgear and control gear: switchgear and control gear devices with an external metal case were planned to be grounded, and complete except for external connections. There is no precise definition of GIS.

Metal-Enclosed Switchgear and Control gear - Switchgear and control gear devices with an external metal case were planned to be grounded and complete except for external connections, as described in IEC 62271-203.

Gas Insulated Metal-Enclosed Switchgear - Metal- enwrapped switchgear in which the insulation is received, at least partially, by an insulating gas other than air at atmospheric pressure, as described in IEC 62271-203. This definition typically relates to high voltage switchgear and control gear. Three-phase enwrapped gas isolated switchgear applies to switchgear with the three phases enwrapped in a common case. Single-phase enwrapped gas insulated switchgear relates to switchgear with each phase closed in a single independent case.

Gas Insulated Switchgear Enclosure - Part of the gas-isolated metal- enwrapped switchgear holding the isolating gas under the dictated conditions essential to keep the greatest isolation level safely, guarding the device against external impacts and giving a high degree of protection to staff, as described in IEC 62271-203. In IEEE C37-122, earthed element of the gas isolated metal-enclosed switchgear device holding the isolating gas under the dictated conditions essential to keep the needed isolation level, guarding the device against external impacts and giving a high degree of protection from an approach to live energized parts.

GIS Compartment - A part of a gas isolated switchgear assembly that is closed except for gaps needed for interconnection gives isolating gas separation from other compartments. A space may be assigned by the main elements in it, for example, circuit breaker space, disconnect switch space, bus space, and so on, as described in IEEE C37.122. A space of GIS as described in IEC 62271-203 as part of a gas isolated metal-cased switchgear, is completely closed except for gaps needed for interconnection and control. A space may be assigned by the main element held therein, for example, circuit breaker space or bus bar space.

Design Pressure of Enclosures - The greatest gas pressure to which a gas isolated switchgear case will be subjected under normal service operation, including the heating impacts of rated continuous current, as described in IEEE C37.122.

Gas Monitoring Systems - Any devices for measuring, signaling, or providing remote warning of the condition or change in condition of the gas in the case, such as pressure, density, moisture level, and so on, as described in IEEE C37.122.

Gas Leakage Rate (Absolute) - The quantity of gas getting away by a time unit showed in units of Pa m³/s, as described in IEEE C37.122.

Gas Leakage Rate (Relative) - The absolute leakage rate associated to the total quantity (mass or volume) of gas in each space at the rated filling pressure (or density). It is defined in percentage per year, as described in IEEE C37.122.

Gas Pass Through Insulator - An internal insulator backing one or more conductors specifically made to provide the passage of gas between adjoining spaces, as described in IEEE C37.122.

Gas Zone - A part of the GIS that may be comprised of one or several gas spaces that have a common gas monitoring system. The case can be single-phase or three-phase, as described in IEEE C37.122.

Local Control Cubicle (or Cabinet) (LCC) - A cubicle or cabinet usually holding secondary devices including control and interlocking, measuring, indicating, alarm, annunciation, and mimic one-line diagrams related with the primary devices. It may also let in protective relays if defined by the user.

Support Insulator - An internal isolator backing one or more conductors, as described in IEC 62271-203.

Partition - Part of an assembly distinguishing one space from other spaces. It gives gas isolation and backing for the conductor (gas barrier isolator), as described in C37.122. A space as described in IEC 62271-203, which is a backing isolator of gas isolated metal enclosed switchgear distinguishing one space from other spaces.

Design Pressure of Cases - Relative pressure utilized to find out the design of the case. It is at least same to the maximum pressure in the case at the greatest temperature that the gas used for insulation can reach under defined maximum service circumstances. The transient pressure happening during and after a breaking procedure (e.g., a circuit breaker) is not to be studied in the decision of the design pressure, as described in IEC 62271-203.

Relative Pressure across the Partition - Relative pressure across the partition is at least same to the greatest relative pressure across the space during maintenance actions. The transient pressure happening during and after a breaking procedure (e.g., a circuit breaker) is not to be studied in the decision of the design pressure, as described in IEC 62271-203.

Operating Pressure of Pressure Relief Element - Relative pressure selected for the opening procedure of pressure relief elements, as described in IEC 62271-203.

Routine Test Pressure of Cases and Partitions - Relative pressure to which all cases and partitions are submitted after production, as described in IEC 62271-203.

Type Test Pressure of Cases and Partitions - Relative pressure to which all cases and partitions are submitted for type test, as described in IEC 62271-203.

Rated Filling Pressure pre - Isolation and/or switching pressure (in Pa), to which the equipment is filled before putting into operation. It is cited to at the standard atmospheric air considerations of +20 °C and 101.3 kPa (or density) and may be showed in relative or absolute conditions, as described in C37.122.

Bushing - An element that enables one or few conductors to go through a space, such as a wall or a tank, and isolate the conductors from it, as described in IEC 62271-203.

Main Circuit - All the conductive elements of gas isolated metal-enwrapped switchgear included in a circuit that is planned to transfer electrical energy, as described in IEC 62271-203.

Auxiliary Circuit - All the conductive elements of gas isolated metal-cased switchgear included in a circuit (other than the major circuit) planned to control, measure, signal, and modulate. The auxiliary circuits of gas isolated metal-cased switchgear include the control and auxiliary circuits of the switching elements, as described in IEC 62271-203.

Design Temperature of Cases – The greatest temperature that the cases can reach under defined maximum service circumstances, as described in IEC 62271-203.

Service Period - The time until a servicing, including opening of the gas spaces, is needed, as described in IEC 62271-203.

Transport Unit - Element of gas isolated metal-cased switchgear intended for shipping without being taken apart, as described in IEC 62271-203.

MIXED SWITCHGEAR TECHNOLOGIES

Mixed switchgear technologies relates to the following combinations:

- AIS in compact and/or mixed arrangement
- GIS in mixed arrangement
- Hybrid IS in compact and/or mixed arrangement

RATINGS

The objective of ratings is to precisely use GIS devices based on an electric system arrangement and features while decreasing the number of technical issues. These ratings give interchangeable answers that are discerned across the industry and decrease cost. The primary ratings are voltage, frequency, short time and peak withstand current, isolation level, current, duration of short circuit and auxiliary voltages and frequencies. In high voltage switchgear assembly, the ratings are described for elements such as circuit breakers and disconnect switches, and connecting conductors/bus, grounding (earthing) switches. Typically, they are addressed in IEEE C37.100.1 or in IEC 62271-1 standards for switchgear devices. For elements of high voltage switchgear like GIS, the ratings in the standards are followed to make criteria and applications in the field. The arrangement of GIS has to consider that the design and production costs of the metallic cases as pressure vessels of the GIS apparatus are huge.



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