

IEEE Guide for the Application of Gas-Insulated Substations 1 kV to 52 kV

IEEE Power & Energy Society

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Substations Committee

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IEEE Guide for the Application of Gas-Insulated Substations 1 kV to 52 kV

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Abstract: The technical requirements for the design, fabrication, testing, and installation of indoor gas-insulated substations (GIS) 1 kV up to 52 kV are covered. Parameters to be supplied by the purchaser are suggested and technical requirements for the design, fabrication, testing, and installations to be furnished by the manufacturer are established.

Keywords: IEEE C37.122.2, gas-insulated substation, GIS, GIS design, GIS equipment, GIS installation, GIS testing, SF₆, sulfur hexafluoride

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Introduction

This introduction is not part of IEEE Std C37.122.2-2011, IEEE Guide for the Application of Gas-Insulated Substations 1 kV to 52 kV.

IEEE Std C37.122TM-1983 IEEE Standard for Gas-Insulated Substations was initiated in the early 1970s when the first gas-insulated substations (GIS) were introduced. Approved in 1983, 1993, and reaffirmed in 2002, it contains standards, recommended practices, and guides. Circumstances beyond the control of the responsible Technical Committees delayed its availability to users until late 1988. Simultaneous to its publication, the Gas-Insulated Substations Subcommittee of the IEEE Power & Energy Society Substations Committee began work on the necessary update and revision of the document.

IEEE Std C37.122.1TM Guide for Gas-Insulated Substations was approved in 1993. That guide focused on the technical requirements for the design, fabrication, testing, and installation of a GIS in general 52 kV and above. Parameters to be supplied by the purchaser are suggested and technical requirements for the design, fabrication, testing, and installation to be furnished by the manufacturer is established.

During the Working Group and Subcommittee deliberations on the update, it was recognized that users would be better served if the original documents IEEE Std C37.122-1993 (a standard) and IEEE Std C37.122.1-1993 (a guide) were supplemented with a guide for equipment rated 1 kV to 52 kV. The third document became IEEE Std C37.122.2TM-2011 IEEE Guide for the Application of Gas-Insulated Substations 1 kV to 52 kV. The three documents can be referred to individually or jointly depending on the purpose of the referral.

IEEE Std C37.122.2 is also based on GIS of the same voltage range covered by IEC 62271-200.

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1. Overview

1.1 Scope

This guide provides information regarding the planning, specification, testing, installation, operation, and maintenance of indoor gas-insulated substations (GIS) and equipment.

2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

ASTM D2472, Standard Specification for Sulfur Hexafluoride.¹

CIGRE 276, Guide for the preparation of customised “Practical SF₆ handling instructions.”

¹ ASTM publications are available from the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, USA (<http://www.astm.org/>).

IEC 60376, Specification and acceptance of new sulfur hexafluoride.²

IEC 61243-5, Live working—Voltage detectors—Part 5: Voltage detecting systems (VDS).

IEC 61634, High-voltage switchgear and controlgear—Use and handling of sulfur hexafluoride in high-voltage switchgear.

IEC 62271-1, High-voltage switchgear and controlgear—Part 1: Common specifications.

IEC 62271-100, High-voltage switchgear and controlgear—Part 100: High-voltage alternating-current circuit-breakers.

IEC 62271-102, High-voltage switchgear and controlgear—Part 102: Alternating current disconnect switches and earthing switches.

IEC 62271-200, High-voltage switchgear and controlgear—Part 200: AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV.

IEEE Std 80TM, IEEE Guide for Safety in AC Substation Grounding.^{3, 4}

IEEE Std 142TM, IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems (Green Book).

IEEE Std 344TM, IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations.

IEEE Std 693TM, IEEE Recommended Practices for Seismic Design of Substations.

IEEE Std C37.04TM, IEEE Standard Rating Structure for AC High-Voltage Circuit Breakers.

IEEE Std C37.06TM, IEEE Standard for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis—Preferred Ratings and Related Required Capabilities for Voltage Above 1000 V.

IEEE Std C37.09TM, IEEE Standard Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis.

IEEE Std C37.98TM, IEEE Standard for Seismic Testing of Relays.

IEEE Std C37.122TM, IEEE Standard for Gas-Insulated Substations.

IEEE Std C37.122.1TM, IEEE Guide for Gas-Insulated Substations.

IEEE Std C37.20.2TM, IEEE Standard for Metalclad Switchgear.

² IEC publications are available from IEC Sales Department, Case Postale 131, 3 rue de Varembe, CH-1211, Geneva 20, Switzerland/Suisse. IEC publications are also available in the United States from the Sales Department, American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036, USA.

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3. Definitions

For the purposes of this document, the following terms and definitions apply. The *IEEE Standards Dictionary: Glossary of Terms and Definitions*⁵ should be consulted for terms not defined in this clause.

assembly (gas-insulated substation [GIS]): A collection of GIS components that are interconnected and ready for insertion as a subassembly in a GIS, such as a breaker panel shipping assembly. The term is also used to describe a complete GIS.

auxiliary circuits: All control, indicating, and measuring circuits.

compartment (gas-insulated substation [GIS]): Any gas section of the gas-insulated equipment assembly between the gas barrier insulators.

continuous enclosure: A bus enclosure in which the consecutive sections of the enclosure are electrically bonded together to provide a continuous current path through the entire enclosure length.

continuous monitoring: The process of sampling the state of some phenomenon at a time interval shorter than the time constant of the phenomenon.

design pressure (working pressure): The maximum steady-state gas pressure to which a gas-insulated equipment enclosure is subjected under normal operating conditions.

disconnect switch: The term used to identify a switch used to open or isolate a circuit.

grounding (earthing): In relation to IEC standards and guides, earthing should be understood as grounding.

enclosure currents: Currents that result from the voltages induced in the metallic enclosure by effects of currents flowing in the enclosed conductors.

gas barrier insulator: A spacer insulator specifically designed to prevent passage of gas from one gas compartment to another.

gas density, minimum: The minimum operating gas density at which the gas-insulated equipment and its components are designed to meet their assigned electrical ratings.

gas density, nominal: The manufacturer's recommended operating gas density (usually expressed as a pressure at 20 °C).

gas-insulated substation (switchgear): A compact, multi-component assembly, enclosed in a grounded metallic housing in which the primary insulating medium is a compressed gas, and that normally consists of buses, switchgear, and associated equipment.

gas leakage: Loss of insulating gas from the pressurized compartment.

main circuit: All the conducting parts of the gas-insulated substation assembly included in or connected to the circuits that its switching devices are designed to close or open.

malfunction: The loss of capability to initiate or sustain a required function, often a protective action, or the initiation of undesired spurious action.

⁵IEEE Standards Dictionary: Glossary of Terms and Definitions is available at <http://shop.ieee.org>.