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metal-clad and
station-type cubicle switchgear

ANSI/IEEE C37.20.2-1987



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**IEEE Standard for Metal-Clad and
Station-Type Cubicle Switchgear**

Sponsor

**Switchgear Committee of the
IEEE Power Engineering Society**

Secretariat

**Institute of Electrical and Electronics Engineers
National Electrical Manufacturers Association**

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Corrected Edition
July, 1987

Foreword

(This Foreword is not a part of ANSI/IEEE C37.20.2-1987, IEEE Standard for Metal-Clad and Station-Type Cubicle Switchgear.)

This standard includes only the requirements for metal-clad and station-type cubicle switchgear. These requirements were previously a part of ANSI/IEEE C37.20-1969 (R 1981), IEEE Standard for Switchgear Assemblies including Metal-Enclosed Bus (1974 Consolidated Edition). Other types of equipment previously included in ANSI/IEEE C37.20-1969 (R 1981) will now be incorporated in separate publications.

ANSI/IEEE C37.20 has for many years covered all switchgear assemblies including metal-enclosed bus. Standards committees of IEEE Switchgear Assemblies Subcommittee and NEMA Power Switchgear Assemblies Technical Committee recommended that the document be further developed and, where appropriate, the various sections be identified with their own standards. This approach also identifies with the Conformance Test Procedure Standards.

This edition was prepared by the Power Switchgear Assemblies Technical Committee, National Electrical Manufacturers Association (NEMA). NEMA is responsible for Section 4, Ratings and Section 6, Construction.

The Switchgear Assemblies Subcommittee of the IEEE Switchgear Committee is responsible for Section 2, Definitions; Section 3, Service Conditions; Section 5, Tests; Section 7, General Application Conditions; and Section 8, Handling, Storage, and Installation.

A Working Group of the NEMA Power Switchgear Assemblies Technical Committee revised ANSI/IEEE C37.23-1970, IEEE Guide for Calculating Losses in Isolated-Phase Bus, to include ANSI/IEEE C37.20 Section 8. The document updates the material for metal-enclosed conductors including cable bus. The IEEE Switchgear Assemblies Subcommittee refined and expanded the document.

The following documents were developed for each product type based on ANSI/IEEE C37.20 (see Fig A).

C37.20.1	Metal-Enclosed Low-Voltage Power Circuit-Breaker Switchgear (1000 V and Below)
C37.20.2	Metal-Clad and Station-Type Cubicle Switchgear (Above 1000 V)
C37.20.3	Metal-Enclosed Interrupter Switchgear (Above 1000 V)
C37.21	Control Switchboards
C37.23	Metal-Enclosed Bus and Guide for Calculating Losses in Isolated Phase Bus.

Through this joint effort over the many years, the switchgear assemblies standards have been of extreme value to the industry and further suggestions for improvement gained in the use of this standard will be welcomed.

The Standards Committee on Power Switchgear, C37, which reviewed and approved this standard, had the following personnel at the time of approval:

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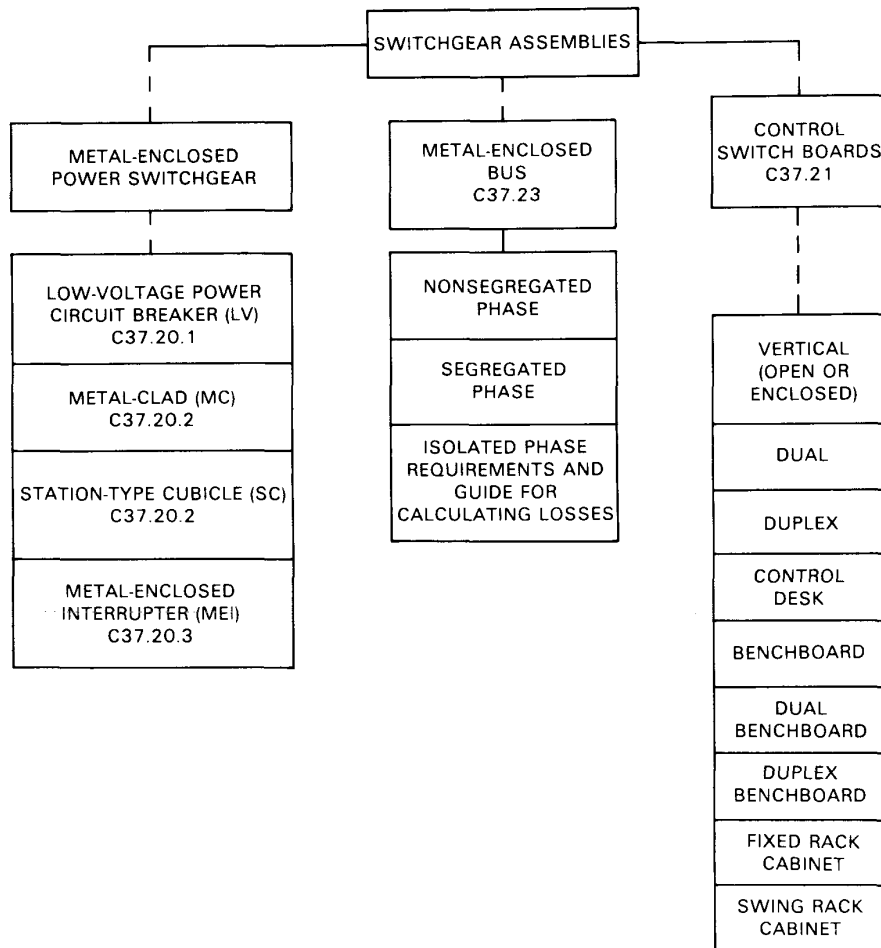


Fig A
Types of Switchgear Assemblies

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An American National Standard

IEEE Standard for Metal-Clad and Station-Type Cubicle Switchgear

Corrections are indicated by vertical bars in the margins opposite the areas of change.

1. Scope and References

1.1 Scope. This standard covers metal-clad and station-type cubicle switchgear containing but not limited to such devices as power circuit breakers, other interrupting devices, switches, control, instrumentation and metering, and protective and regulating equipment. It includes, but is not specifically limited to, equipment for the control and protection of apparatus used for power generation, conversion, and transmission and distribution.

This standard is concerned with enclosed, rather than open, switchgear assemblies rated above 1000 V. It includes equipments that are part of primary and secondary unit substations. It does not include gas insulated substation equipments.

In this standard metal-clad switchgear shall be called MC switchgear and station type cubicle switchgear shall be called SC switchgear. Whenever the data covers both types of equipments, then they shall be called ME switchgear.

1.2 References

[1] ANSI C2-1987, National Electrical Safety Code.¹

[2] ANSI C37.11-1979, American National Standard Requirements for Electrical Control for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis and a Total Current Basis.²

[3] ANSI Z35.1-1972, American National Standard Specification for Accident Prevention Signs.

[4] ANSI Z55.1-1967 (R 1973), American National Standard Gray Finishes for Industrial Apparatus and Equipment.

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² ANSI publications are available from the Sales Department, American National Standards Institute, 1430 Broadway, New York, NY 10018.

[5] ANSI/IEEE C37.04-1979 (R 1982), IEEE Standard Rating Structure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis.³

[6] ANSI/IEEE C37.010-1979, IEEE Standard Application Guide for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis.

[7] ANSI/IEEE C37.2-1979, IEEE Standard Electrical Power System Device Function Numbers.

[8] ANSI/IEEE C37.24-1971 (R 1984), IEEE Guide for Evaluating the Effect of Solar Radiation on outdoor Metal-Clad Switchgear.

[9] ANSI/IEEE C37.100-1981, IEEE Standard Definitions for Power Switchgear.

[10] ANSI/IEEE C57.13-1978 (R 1986), IEEE Standard Requirements for Instrument Transformers.

[11] ANSI/IEEE Std 1-1986, IEEE Standard General Principles for Temperature Limits in the Rating of Electric Equipment and for the Evaluation of Electrical Insulation.

[12] ANSI/IEEE Std 4-1978, IEEE Standard Techniques for High-Voltage Testing.

[13] ANSI/IEEE Std 100-1984, IEEE Standard Dictionary of Electrical and Electronics Terms.

[14] ANSI/IEEE Std 141-1986, IEEE Recommended Practice for Electric Power Distribution for Industrial Plants.

[15] ANSI/IEEE Std 241-1983, IEEE Recommended Practice for Electric Power Systems in Commercial Buildings.

[16] ANSI/IEEE Std 242-1986, IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.

³ ANSI/IEEE publications are available from the Institute of Electrical and Electronics Engineers, Service Center, 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08854-1331. Copies are also available from the Sales Department, American National Standards Institute, 1430 Broadway, New York, NY 10018.

- [17] ANSI/IEEE Std 344-1975 (R 1980), IEEE Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations.
- [18] ANSI/IEEE Std 446-1987, IEEE Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications.
- [19] ANSI/NFPA 70-1987, National Electrical Code.⁴
- [20] ANSI/UL 486A-1982, Lugs for Use with Copper Conductors Wire Connectors and Soldering.⁵
- [21] ASTM B117-85, Standard Method of Salt Spray (FOG) Testing.⁶
- [22] ASTM D229-82, Standard Method of Testing Rigid Sheet and Plate Materials Used for Electrical Insulation.
- [23] ASTM D1535-80, Standard Method by Specifying Color by The Munsell System.
- [24] ASTM D714-80, Standard Method of Evaluating Degree of Blistering of Paints.
- [25] ASTM D1654-79a, Standard Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
- [26] ASTM D2303-85, Standard Test Method for Liquid-Contaminant, Inclined-Plane Tracking of Erosion of Insulating Materials.
- [27] ASTM G21-70 (R 1980), Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- [28] NEMA CC1-1984, Electrical Power Connectors for Substations.⁷

⁴The National Electrical Code is published by the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269. Copies are also available from the Sales Department, American National Standards Institute, 1430 Broadway, New York, NY 10018.

⁵ANSI/UL publications are available from the Underwriters Laboratories Inc, Publication Stock, 333 Pfingsten Road, Northbrook, IL 60062. Copies are also available from the Sales Department, American National Standards Institute, 1430 Broadway, New York, NY 10018.

⁶ASTM publications are available from the American Society for Testing and Materials, 1916 Race St, Philadelphia, PA 19103.

⁷NEMA publications are available from the National

- [29] NEMA LI1-1983, Industrial Laminated Thermosetting Products.
- [30] NEMA WC5-1973 (R 1985), Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy. (ICEA S-61-402 3rd Ed).
- [31] NEMA WC7-1982, Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (ICEA S-66-524).
- [32] NEMA 260-1982, Safety Labels for Pad-mounted Switchgear and Transformers Sited in Public Areas.
- [33] NEMA Bulletin No 77-1973 (R 1975), Guide Lines for Warning Labels.
- [34] Federal Specification UU-T-111.⁸

2. Definitions

The definitions of terms contained in this standard, or in other standards referred to in this standard are not intended to embrace all legitimate meanings of the terms. They are applicable only to the subject treated in this standard.

If a term is not defined in this standard, the definition in ANSI/IEEE C37.100-1981 [9]⁹ applies. An asterisk (*) following a definition indicates that the definition in this standard is not contained in ANSI/IEEE C37.100-1981 [9]; while a dagger (†) indicates the definition differs from that in ANSI/IEEE C37.100-1981 [9].

2.1 switchgear. A general term covering switching and interrupting devices and their combination with associated control, instruments, metering, protective and regulating devices, also assemblies of these devices with associated interconnections, accessories, and supporting structures used primarily in connection with the generation, transmission, distribution, and conversion of electric power.

Electrical Manufacturers Association, 2101 L Street, NW, Washington, DC 20037.

⁸This publication is available from the Federal Specifications Director, US Navy Publications and Printing Service, Eastern Division, 700 Robbins Avenue, Philadelphia, PA 19111.

⁹The numbers in brackets correspond with those of the references in 1.2.

2.1.1 switchgear assembly (see Fig A). An assembled equipment (indoor or outdoor) including, but not limited to, one or more of the following: switching, interrupting, control, instrumentation, metering, protective and regulating devices, together with their supporting structures, enclosures, conductors, electrical interconnections, and accessories.

2.1.2 metal-enclosed power switchgear. A switchgear assembly completely enclosed on all sides and top with sheet metal (except for ventilating openings and inspection windows) containing primary power circuit switching or interrupting devices, or both, with buses and connections. The assembly may include control and auxiliary devices. Access to the interior of the enclosure is provided by doors or removable covers, or both.

2.1.2.1 metal-clad switchgear. Metal-enclosed power switchgear characterized by the following necessary features:

(1) The main switching and interrupting device is of the removable (drawout) type arranged with a mechanism for moving it physically between connected and disconnected positions and equipped with self-aligning and self-coupling primary disconnecting devices and disconnectable control wiring connections.

(2) Major parts of the primary circuit, that is, the circuit switching or interrupting devices, buses, voltage transformers, and control power transformers, are completely enclosed by grounded metal barriers, that have no intentional openings between compartments. Specifically included is a metal barrier in front of or a part of the circuit interrupting device to ensure that, when in the connected position, no primary circuit components are exposed by the opening of a door.†

(3) All live parts are enclosed within grounded metal compartments.

(4) Automatic shutters that cover primary circuit elements when the removable element is in the disconnected, test, or removed position.

(5) Primary bus conductors and connections are covered with insulating material throughout.

(6) Mechanical interlocks are provided for proper operating sequence under normal operating conditions.

(7) Instruments, meters, relays, secondary control devices and their wiring are isolated by grounded metal barriers from all primary circuit elements with the exception of short lengths

of wire such as at instrument transformer terminals.

(8) The door through which the circuit interrupting device is inserted into the housing may serve as an instrument or relay panel and may also provide access to a secondary or control compartment within the housing.

NOTES: (1) Auxiliary vertical sections may be required for mounting devices or for use as bus transition.

(2) The term *metal-clad* (as applied to switchgear assemblies) is correctly used only in connection with switchgear conforming fully to the definition for metal-clad switchgear given in 2.1.2.1. Metal-clad switchgear is metal-enclosed but not all metal-enclosed switchgear can be correctly designated as metal-clad.

2.1.2.2 station-type cubicle switchgear. Metal-enclosed power switchgear characterized by the following required features:

(1) The main switching and interrupting device is of the stationary mounted type, composed of a primary circuit compartment and a secondary or mechanism compartment; arranged with gang-operated isolating switches that are mechanically interlocked with the main switching and interrupting device.

(2) Each phase for the major parts of the primary circuit switching or interrupting devices, buses, and line-to-ground potential transformers are completely enclosed (or segregated) by grounded metal barriers that have no intentional openings between compartments. Specifically included are mechanically interlocked doors in front of or a part of the primary circuit compartment of the circuit switching and interrupting device so that when the group operated isolating switches are closed no primary parts can be exposed by the attempted opening of the interlocked doors.

(3) All live parts are enclosed within grounded metal compartments.

(4) Primary bus conductors and connections are bare.

(5) Mechanical interlocks are provided for proper operating sequence under normal operating conditions.

(6) Secondary control devices and their wiring are isolated by grounded metal barriers from all primary circuit elements with the exception of short lengths of wire such as at instrument transformer terminals.

(7) The doors to the secondary or mechanism compartment of the primary switching or interrupting device are to provide access to the secondary or control equipment within the housing