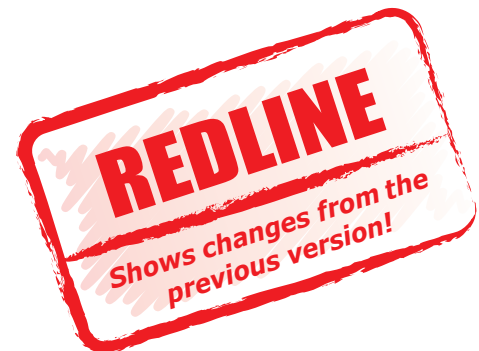


IEEE Standard for Metal-Enclosed Interrupter Switchgear (1 kV–38 kV)

IEEE Power and Energy Society

Sponsored by the
Switchgear Committee



IEEE
3 Park Avenue
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USA

IEEE Std C37.20.3™-2013
(Revision of
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IEEE Standard for Metal-Enclosed Interrupter Switchgear (1 kV–38 kV)

Sponsor

Switchgear Committee
of the
IEEE Power and Energy Society

Approved 11 December 2013

IEEE-SA Standards Board

Abstract: Metal-enclosed interrupter (MEI) switchgear assemblies containing, but not limited to, such devices as interrupter switches; selector switches; power fuses; circuit breakers; control, instrumentation and metering devices; and protective equipment are included in this standard. It includes, but is not specifically limited to, equipment for the control and protection of apparatus used for distribution of electrical power.

Keywords: IEEE C37.20.3™, MEI, metal-enclosed interrupter switchgear, metal-enclosed power switchgear, switchgear, switchgear assembly

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Jerry Baskin
Eldridge Byron
Larry Farr
Douglas H. Giraud
Dave Gohil
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Albert Livshitz
Steven Meiners
M. J. Orosz
Raghunath Parthasarathi
Amit Patel
Robert J. Puckett

Carl Schneider
James E. Smith
Paul B. Sullivan
Chandrakant Tailor
John Toney
Walt VonMiller
Larry E. Yonce

The following members of the individual balloting committee voted on this standard. Balloters may have voted for approval, disapproval, or abstention.

Charles Ball
Paul D. Barnhart
Ted Burse
Ray Davis
Randall Dotson
Douglas Edwards
Rabiz Foda
Douglas H. Giraud
Randall Groves
David Horvath
Danny Hoss
Harry W. Josten
Laszlo Kadar

Chad Kennedy
Yuri Khersonsky
Jim Kulchisky
Benjamin Lanz
Michael Lauxman
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Peter Meyer
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Introduction

This introduction is not part of IEEE Std C37.20.3-2013, IEEE Standard for Metal-Enclosed Interrupter Switchgear (1 kV–38 kV).

This standard has been revised to reflect needed technical changes since the last revision (2001) was published. The standard has been harmonized with IEEE Std C37.100.1-2007. Substantial changes have also been made to recognize the growing use of circuit breakers as a component of metal-enclosed interrupter switchgear.

This publication is one of a series covering switchgear assemblies as follows (see Figure a):

IEEE Std C37.20.1™, IEEE Standard for Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear

IEEE Std C37.20.2™, IEEE Standard for Metal-Clad Switchgear

IEEE Std C37.20.3™, IEEE Standard for Metal-Enclosed Interrupter Switchgear

IEEE Std C37.20.4™, IEEE Standard for Indoor AC Switches Rated Above 1 kV through 38 kV for Use in Metal-Enclosed Switchgear

IEEE Std C37.20.6™, IEEE Standard for 4.76 to 38 kV Rated Ground and Testing Devices Used in Enclosures

IEEE Std C37.21™, IEEE Standard for Control Switchboards

IEEE Std C37.23™, IEEE Standard for Metal-Enclosed Bus

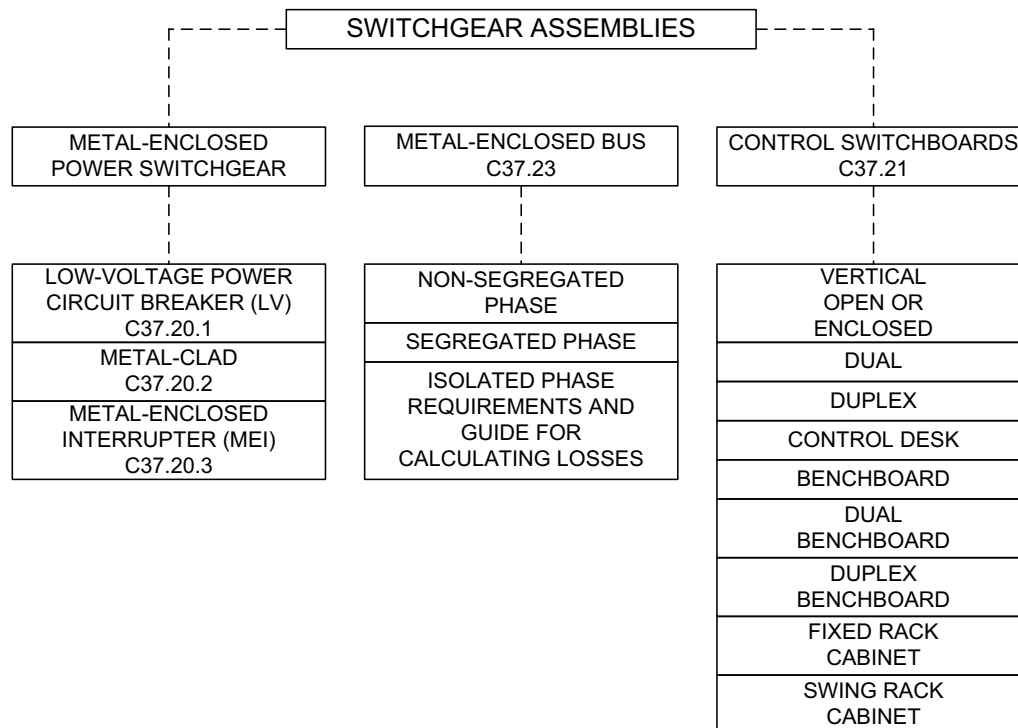


Figure a—Publications about switchgear assemblies

Contents

1. Overview	1
1.1 Scope	1
1.2 Purpose	1
2. Normative references.....	2
3. Definitions	4
4. Normal (usual) and special (unusual) service conditions	5
4.1 Normal (usual) and special (unusual) service conditions	5
4.2 Special (unusual) service conditions for both indoor and outdoor switchgear	6
5. Ratings.....	7
5.1 General	7
5.2 Voltage and insulation levels	7
5.3 Rated power frequency (f_r)	8
5.4 Rated continuous (normal) current and temperature rise	8
5.5 Rated short-time withstand current (I_k)	10
5.6 Rated peak withstand current (I_p)	10
5.7 Rated duration of short circuit (t_k)	11
5.8 Current transformer ratings.....	11
5.9 Voltage transformers	11
6. Tests	12
6.1 Grouping of tests	12
6.2 Dielectric tests	13
6.3 Radio influence voltage (RIV) test	17
6.4 Measurement of resistance of circuits.....	17
6.5 Temperature-rise tests.....	18
6.6 Short-time withstand current and peak withstand current tests	20
6.7 Verification of the degrees of protection provided by enclosures	22
6.8 Tightness tests.....	23
6.9 Electromagnetic compatibility tests	23
6.10 Additional tests on auxiliary and control circuits	23
6.11 X-Radiation procedure for vacuum interrupters	23
6.12 Mechanical endurance tests	23
6.13 Insulating materials.....	24
6.14 Bus-bar insulation.....	24
6.15 Coatings qualification test	24
6.16 Rain test for outdoor MEI switchgear.....	26
6.17 Production test	26
6.18 Conformance tests	28
6.19 Field dielectric tests	28
7. Construction	28
7.1 Buses and primary connections	28
7.2 Grounding and bonding	30
7.3 Control and secondary circuits and devices	30
7.4 Miscellaneous	34
7.5 Materials and finish	36
7.6 Precautionary labels.....	37
7.7 Barriers	37

7.8 Shutters	37
7.9 Interlocks	37
7.10 Enclosure categories	39
7.11 Circuit breaker open/close position indication	39
8. Application guide for MEI switchgear	39
8.1 Unusual service conditions	39
8.2 System characteristics—voltage and frequency	42
8.3 Overvoltage considerations—insulation levels.....	43
8.4 Continuous current rating and overload capability	43
8.5 Short-circuit considerations	43
8.6 Nuclear power plant application	44
8.7 Exposed circuits.....	44
8.8 Surge arresters in switchgear assemblies.....	44
8.9 Protection and isolation of switchgear connected to other switching equipment	44
8.10 Current transformer accuracies	44
9. Guide for handling, storage, and installation	44
9.1 Handling	45
9.2 Pre-operation check	46
9.3 Interrupters	47
9.4 Interlocks	47
9.5 Energization.....	47
Annex A (normative) Guide for enclosure categories and related requirements	48
A.1 Scope	48
A.2 Enclosure categories	48
A.3 Enclosure requirements.....	49
Annex B (normative) Flame-resistance tests for applied insulation	55
B.1 Test apparatus	55
B.2 Preparation of sample.....	56
B.3 Test procedure.....	56
B.4 Analysis	57
Annex C (informative) Bibliography.....	58

IEEE Standard for Metal-Enclosed Interrupter

Switchgear ([1 kV-38 kV](#))

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1. [Overview](#)

1.1 Scope

This standard covers metal-enclosed interrupter (MEI) switchgear assemblies containing, but not limited to, such devices as interrupter switches; selector switches; power fuses; [circuit breakers](#); control, instrumentation and metering devices; and protective equipment. It includes, but is not specifically limited to, equipment for the control and protection of apparatus used for distribution of electrical power.

This standard is concerned with enclosed (rather than open), indoor and outdoor switchgear assemblies rated above 1 kV. It includes equipment that is part of primary and secondary unit substations. It does not include gas-insulated substation equipment or switching devices mounted integrally within a transformer enclosure.

1.2 Purpose

The purpose of this standard is to provide the usual service conditions, definition of ratings, preferred ratings, design and production tests, construction requirements, an application guide, and a guide for handling, storage, and installation for MEI switchgear.

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.

~~This standard shall be used in conjunction with the following publications.~~

Accredited Standards Committee C2-~~1997~~ [2012](#), National Electrical Safety Code® (NESC®).¹

ANSI C37.57-~~1990~~ American National Standard for Switchgear—Metal-Enclosed Interrupter Switchgear Assemblies—Conformance Test Procedures.²

¹ The NESC is available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, Piscataway, NJ08854, USA (<http://standards.ieee.org/>).

² ANSI publications are available from the Sales Department, American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036, USA (<http://www.ansi.org>).

~~ANSI C37.06-2000, American National Standard for Switchgear—AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis—Preferred Ratings and Related Required Capabilities.~~

~~ANSI C37.22-1997, American National Standard Preferred Ratings and Related Required Capabilities for Indoor AC Medium Voltage Switches Used in Metal Enclosed Switchgear.~~

~~ANSI C37.47-1981 (R1988), American National Standard Specifications for Distribution Fuse Disconnecting Switches, Fuse Supports, and Current Limiting Fuses.~~

~~ANSI C37.58-1990, American National Standard for Switchgear—Indoor AC Medium Voltage Switches for Use in Metal Enclosed Switchgear—Conformance Test Procedures.~~

ANSI Z535.4-1998, American National Standard for Product Safety Sign and Label.

ASTM B117-97 Standard Practice for Operating Salt Spray (Fog) Apparatus.³

ASTM D229-96, Standard Test Methods for Rigid Sheet and Plate Materials Used in Electrical Insulation.

ASTM D714-87 (2000),_L Standard Test Method for Evaluating Degree of Blistering of Paints.

ASTM D1535-97, Standard Practice of Specifying Color by the Munsell System.

ASTM D1654-92 (2000),_L Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.

³ 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/>).

ASTM D2303-~~97~~, Standard Test Methods for Liquid-Contaminant, Inclined-Plane Tracking and Erosion of Insulating Materials.

ASTM G21-~~96~~, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

~~IEEE Std 1-1986 (Reaff 1992), IEEE Standard General Principles for Temperature Limits in the Rating of Electric Equipment and for the Evaluation of Electrical Insulation⁴~~

IEEE Std 4-~~1978~~TM-1995, IEEE Standard Techniques for High-Voltage Testing^{4,5}

[IEEE Std 4ATM-2001, Amendment to IEEE Standard Techniques for High-Voltage Testing.](#)

~~NOTE—The 1978 Standard is used instead of the current standard because of the need for several correction factors that were omitted in the revised document.~~

IEEE Std 141-~~1993~~TM, IEEE Recommended Practice for Electric Power Distribution for Industrial Plants (IEEE Red Book).

IEEE Std 142-~~1991~~TM, IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems (IEEE Green Book).

IEEE Std 241-~~1990~~TM, IEEE Recommended Practice for Electric Power Systems in Commercial Buildings (IEEE Gray Book).

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IEEE Std 242-~~1986 (Reaff 1991)~~,TM, IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems (IEEE Buff Book).

IEEE Std 344TM-~~1987 (Reaff 1993)~~, IEEE Recommended Practices for Seismic Qualification of Class IE Equipment for Nuclear Power Generating Stations.

IEEE Std 446TM-~~1995 (Reaff 2000)~~, IEEE Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications (IEEE Orange Book).

IEEE Std C37.04-TM1999, 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 Voltages Above 1000 V.](#)

IEEE Std C37.2-~~1996~~,TM, IEEE Standard Electrical Power System Device Function Numbers and Contact Designations.

IEEE ~~PC37. Std C37.20.4/D5a~~,TM, IEEE ~~Draft~~ Standard for Indoor AC Switches Rated Above 1 kV Through 38 kV for Use in Metal-Enclosed Switchgear-~~P~~.

IEEE Std C37.24-~~1986 (Reaff 1998)~~,TM, IEEE Guide for Evaluating the Effect of Solar Radiation on Outdoor Metal-Enclosed Switchgear.

[IEEE Std C37.47TM, IEEE Standard Specifications for High-Voltage \(> 1000 V\) Distribution Class Current-Limiting Type Fuses and Fuse Disconnecting Switches.](#)

~~IEEE Std C37.90.1-1989 (Reaff 1994), IEEE Standard Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems.~~

[IEEE Std C37.48TM-2005, IEEE Guide for the Application, Operation, and Maintenance of High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories.](#)

~~IEEE Std C37.90.2-1995, IEEE Standard Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers.~~

IEEE Std C37.100-~~1992~~TM, IEEE Standard Definitions for Power Switchgear.

[IEEE Std C37.100.1TM-2007, IEEE Standard of Common Requirements for High Voltage Power Switchgear Rated Above 1000 V.](#)

[IEEE Std C37.301TM, IEEE Standard for High-Voltage Switchgear \(Above 1000 V\) Test Techniques-Partial Discharge Measurements.](#)

IEEE Std C57.13-~~1993~~TM-2008, IEEE Standard Requirements for Instrument Transformers.

NEMA CC1-~~1993~~TM, Electric Power Connectors for Substations.⁶

NEMA ~~WC5-1992, Thermoplastic-Insulated Wire and Cable~~[WC 70, Power Cables Rated 2000 V or Less](#) for the ~~Transmission and~~ Distribution of Electrical Energy (ICEA S-~~61-402~~ [95-658](#)).

~~NEMA WC7-1998, Cross-Linked Thermosetting Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (ICEA S-66-524).~~

NEMA LII-~~1998~~ [2012](#), Industrial Laminating Thermosetting Products.

NFPA 70-~~1999~~, National Electrical Code® (NEC®).⁷

⁶ NEMA publications are available from ~~the National Electrical Manufacturers Association, 1300 N. 17th St., Ste. 1847, Rosslyn, VA 22209, USA~~ [Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112, USA \(http://global.ihc.com/\).](#)

⁷ The NEC is available from Publications Sales, National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101, USA (<http://www.nfpa.org>).

UL 94, Tests for Flammability of Plastic Materials for Parts in Devices and Appliance.⁸

UL 486A~~1997-468B~~, Wire Connectors ~~and Soldering Lugs for Use With Copper.~~

3. Definitions

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⁹IEEE Standards Dictionary Online subscription is available at: <http://www.ieee.org/portal/innovate/products/standard/standardsdictionary.html>.

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~~3.1 Qualifying terms—switchgear~~

~~The interrupter switches and power fuses may be stationary or removable (drawout). When removable, automatic shutters (that cover primary circuit elements when the removable element is in the disconnected, test, or removed position) and mechanical interlocks shall be provided for proper operating sequence.~~

~~3.2 Qualifying terms—IEEE 100~~

~~The following qualifying terms are defined in *The Authoritative Dictionary of IEEE Standards Terms*, Seventh Edition; and the user is referred to the definitions (relating to types of enclosures, ventilation methods, etc.) given in that dictionary:~~

~~3.2.1 Accessible~~

~~3.2.2 Enclosed~~

~~3.23 isolated~~

~~32.4 ventilated~~

~~3.3 Qualifying terms IEEE Std C37.100-1992~~

~~The following qualifying terms are defined in IEEE Std C37.100-1992, and the user is referred to the definitions given in that dictionary:~~

~~3.3.1 enclosure~~

~~3.3.2 flame-resistant (retardant)~~

~~3.3.3 indoor~~

~~3.3.4 metal-enclosed~~

~~3.3.5 outdoor~~

~~3.3.6 resistant (suffix)~~

~~3.3.7 secondary~~

~~3.3.8 ventilated enclosure~~

~~3.4 Common or related terms~~

~~The following common or related terms are defined in IEEE Std C37.100-1992, and the user is referred to the definitions given in that dictionary:~~

3.4.1 asymmetrical

3.4.2 auxiliary switch

3.4.3 bus

3.4.4 connected position

3.4.5 continuous current tests

3.4.6 disconnected position

3.4.7 drawout-mounted device

3.4.8 ground bus

3.4.9 main (primary switchgear connections)

3.4.10 normal frequency

3.4.11 primary disconnecting devices

3.4.12 removable element

3.4.13 secondary and control wiring

~~3.4.14 silver surfaced~~

~~3.4.15 stationary mounted device~~

~~3.4.16 symmetrical~~

~~3.4.17 terminal~~

~~3.4.18 terminal block~~

~~3.4.19 test position~~

~~3.5 Definitions of terms~~

ambient air temperature: The temperature of the surrounding air that comes in contact with equipment.

NOTE Ambient air temperature, as applied to enclosed switchgear assemblies, is the average temperature of the surrounding air that comes in contact with the enclosure. See 6.5.4 for method of measurement.¹⁰

conformance tests: Tests made to demonstrate compliance with the applicable standards. The test specimen is normally subjected to all planned production tests prior to initiation of the conformance test program.

The conformance tests may, or may not, be similar to certain design tests. Demonstration of margin (capabilities) beyond the standards is not required.

¹⁰ [Notes in text, tables, and figures of a standard are given for information only and do not contain requirements needed to implement this standard.](#)

design tests: Tests made by the manufacturer to determine the adequacy of the design of a particular type, style, or model of equipment or its component parts to meet its assigned ratings and to operate satisfactorily under normal service conditions or under special conditions if specified. Such tests may be used to demonstrate compliance with applicable standards of the industry

NOTE 1 Design tests are made on representative apparatus or prototypes to verify the validity of design analysis and calculation methods and to substantiate the ratings assigned to all other apparatus of basically the same design. These tests are not intended to be made on every design variation or to be used as part of normal production. The applicable portion of these design tests may also be used to evaluate modifications of a previous design and to ensure that performance has not been adversely affected. These data from previous similar designs may also be used for current designs, where appropriate. Once made, the tests need not be repeated unless the design is changed to modify performance.

NOTE 2 Design tests are sometimes called type tests.

disconnecting switch (or isolating switch): A mechanical switching device used for changing the connections in a circuit, or for isolating a circuit or equipment from the source of power.

It is required to carry normal load current continuously, and abnormal or short-circuit currents for short intervals as specified. It is also required to open or close circuits either when negligible current is broken or made, or when no significant change in the voltage across the terminals of each of the switch poles occurs. *Synonym:* isolating switch (IEEE Std C37.100).

field tests ~~(for switchgear)~~ Tests made after the assembly has been installed at its place of utilization.

inorganic coating: A coating that is composed of chemical compounds that do not contain carbon as the principal element (excepting carbonates, cyanides, and cyanates), that is, matter other than plant or animal.

interrupter compartment: The portion of the switchgear assembly that contains one interrupting device (such as an interrupter switch, power fuse interrupter switch combination, a drawout circuit breaker or stationary circuit breaker with an isolating switch) and the associated primary conductors.

metal-enclosed interrupter ~~(MEI)~~ switchgear: Metal-enclosed power switchgear including the following equipment as required:

- a) Interrupter (interrupter switches and/or circuit breakers)
- b) Power fuses (current-limiting or noncurrent-limiting)
- c) Bare bus and connections
- d) Instrument transformers
- e) Control wiring and accessories ~~devices~~
- f) An isolating switch with visible break contacts for stationary circuit breakers (non-drawout)

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 and possibly including control and auxiliary devices. Access to the interior of the enclosure is provided by doors or removable covers

organic coating: A coating (such as paint, lacquer, enamel, or film) in which the principal ingredients are derived from animal or vegetable matter or from some compound of carbon.

production tests: Tests made for quality control by the manufacturer on every device or representative samples, or on required parts or materials, to verify during production that the product meets the design specifications and applicable standards¹.

Certain quality assurance tests on identified critical parts of repetitive high-production devices may be tested on a planned statistical sampling basis.

NOTE Production tests are sometimes called routine tests.

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

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

~~**switch compartment:** The portion of the switchgear assembly that contains one switching device (such as an interrupter switch or power fuse interrupter switch combination) and the associated primary conductors.*~~

NOTE See Figure a in the introduction.

tin-surfaced or equivalent: Metallic materials having satisfactory long term performance that operate within the temperature rise limits established for tin-surfaced electrical contact parts and conduction mechanical joints.

vertical section: That portion of the switchgear assembly between two successive vertical delineation ~~The vertical section~~ and may contain one or more ~~switch compartments~~ interrupters, auxiliary devices, and associated primary conductors.

4. Normal (usual) and special (unusual) service conditions

Clause 2 of IEEE Std C37.100.1-2007 applies.

4.1 Normal (usual) and special (unusual) service conditions

4.1.1 Indoor switchgear

Subclause 2.1.1 of IEEE Std C37.100.1-2007 applies.

4.1.2 Outdoor switchgear

Subclause 2.1.2 of IEEE Std C37.100.1-2007 applies.

4.2 Special (unusual) service conditions for both indoor and outdoor switchgear

Subclause 2.2 of IEEE Std C37.100.1-2007 applies with the following addition: Any unusual service conditions should be specified by the user.

4.2.1 Altitude

Subclause 2.2.1 of IEEE Std C37.100.1-2007 does not apply.

4.2.2 Exposure to excessive pollution

Subclause 2.2.2 of IEEE Std C37.100.1-2007 applies.

4.2.3 Temperature and humidity

Subclause 2.2.3 of IEEE Std C37.100.1 -2007 applies with the following modifications:

~~Standards for the design and performance of MEI switchgear are based on usual service conditions as described in this clause. The selection of equipment for a particular application may be based on the construction and ratings as defined in this standard provided that the following usual service conditions exist:~~

- ~~a) The temperature of the cooling air (ambient air temperature) surrounding the enclosure of the MEI switchgear is within the limits of -30°C and $+40^{\circ}\text{C}$.~~
- ~~b) The altitude of the installation does not exceed 1000 m (3300 ft).~~
- ~~c) The effect of solar radiation is not significant. (The principles stated in IEEE Std C37.24-1986 may be used for guidance.)~~
- ~~d) Unusual service conditions such as outlined in 8.1 do not prevail.~~

When MEI switchgear is applied where the ambient air temperature is higher than 40 °C, the total temperature limits for parts and materials as listed in 5.4.2 shall not be exceeded. Therefore, for the higher ambient, the equipment should be derated to a continuous current value that maintains the total temperature limits.

When MEI switchgear is applied where the ambient air temperature is less than -30 °C space heating and thermal insulation to minimize the effects of such exposure should be considered.

4.2.4 Exposure to abnormal vibration, shock, or tilting

Subclause 2.2.4 of IEEE Std C37.100.1-2007 applies.

4.2.5 Other special (unusual) service conditions

Subclause 2.2.5 of IEEE Std C37.100.1-2007 applies.

4.2.5.1 Exposure to damaging fumes, vapor, steam, oil vapors, salt air, and hot and humid climate

Subclause 2.2.5.1 of IEEE Std C37.100.1-2007 applies.

4.2.5.2 Exposure to excessive dust or abrasive, magnetic, or metallic dust

Subclause 2.2.5.2 of IEEE Std C37.100.1-2007 applies.

4.2.5.3 Exposure to explosive mixtures of dust of gases

Subclause 2.2.5.3 of IEEE Std C37.100.1-2007 applies.

4.2.5.4 Unusual space limitations

Subclause 2.2.5.4 of IEEE Std C37.100.1-2007 applies.

4.2.6 Other parameters

Subclause 2.2.6 of IEEE Std C37.100.1-2007 applies.

5. Ratings

5.1 General

Clause 4 of IEEE Std C37.100.1-2007 applies with the following modifications:

- a) Item 4b should be Rated insulation level ($U_{<j}$), (U_p)
- b) Add the following paragraphs.

The ratings of a switchgear assembly are designations of operating limits under specific conditions of ambient temperature, temperature rise, etc. Where the switchgear assembly comprises a combination of primary and secondary circuits, each may be given ratings.

- c) The ~~designated~~ ratings listed in ~~ANSI C37.22-1987~~ [IEEE Std C37.20.4, IEEE Std C37.06](#), and this standard are preferred, but are not considered to be restrictive.

In addition to these ratings, MEI switchgear may have interrupting or switching capability, which is determined by the rating of the particular interrupting and switching devices that are integral parts of the switchgear assembly. Refer to specific standards for the ratings of these devices: IEEE Std C37.04 (circuit breakers); IEEE Std C37.20.4 (interrupter switches); and IEEE Std C37.47 (fuses).

~~MEI switchgear having primary circuits shall have the following ratings:~~

- ~~a) Rated maximum voltage~~
- ~~b) Rated power frequency~~
- ~~c) Rated insulation levels~~
- ~~d) Rated continuous current~~
- ~~e) Rated short time withstand current~~
- ~~f) Rated short time withstand current duration (when other than 2 s)~~
- ~~g) Rated momentary withstand current~~

5.2 Voltage and insulation levels

The preferred ~~rated~~ maximum voltages and corresponding insulation levels for MEI switchgear are listed in Table 1.

5.2.1 Rated maximum voltage (V) or (Ur]

Subclause 4.1 of IEEE Std C37.100.1-2007 applies with the following modifications:

- a) Rated maximum voltages are 4.76 kV, 8.25 kV, 15 kV, 27 kV, and 38 kV.
- b) Rated maximum voltages for Range I, Series B (245 kV and below) and all of Range II (above 245kV) do not apply.

~~The rated maximum voltage of MEI switchgear is the highest root-mean-square (rms) voltage for which the equipment is designed and is the upper limit for operation.~~

5.2.2 Rated insulation level, Ud, Up

Subclause 4.2 of IEEE Std C37.100.1-2007 applies with the following modifications:

The rated insulation levels of ~~MEI~~ switchgear ~~assembly shall consist of the following two items~~ shall be selected for the values given in Table 1

- a) ~~Power frequency withstand voltage~~
- b) ~~Lightning impulse withstand voltage~~

Table 1 — Voltage and insulation levels for MEI switchgear

Rated maximum voltage (kV) <u>With stress cone type terminations (with IEEE Std 386 type terminations)</u>	Power-frequency withstand (rms) (kV) (U_d)		<u>Impulse withstand (kV)</u> (formerly BIL) (U_p)	~~Reference de- withstand A (kV)~~
	<u>For switchgear with stress cone type terminations</u>	<u>For switchgear with separable insulated connector type terminations per IEEE Std 386</u>		
4.76	19	<u>19</u>	60	~~27~~
8.25	36	<u>34</u>	95	~~50~~
15.0(<u>14.4</u>)	36	<u>34</u>	95	~~50~~
27.0(<u>26.3</u>)	60	<u>40</u>	125	~~b~~
38.0(<u>36.6</u>)	80	<u>50</u>	150	~~b~~

~~NOTE For field test values, see 6.5~~

~~^a—The column head “dc withstand” is given as a reference only for using dc test to verify the integrity of connected cable installations without disconnecting the cables from the switchgear. It represents values believed to be appropriate and approximately equivalent to the corresponding power frequency withstand test values specified for each voltage rating of switchgear. The presence of this column in no way implies any requirement for a dc withstand test on ac equipment or that a dc withstand test represents an acceptable alternate to the power frequency withstand test specified in this standard, either for design test, production test, conformance test, or field test. When making dc tests, the voltage should be raised to the test value in discrete steps and held for 1 min.~~

~~^b—Because of the variable voltage distribution encountered when making dc withstand tests, the manufacturer should be contacted for recommendations before applying dc withstand to switchgear. Voltage transformers above 34.5 kV should be disconnected when testing with dc. See IEEE Std C57.13-1993, Clause 8 and in particular 8.8.2, which reads, “Periodic keatron test should not be applied to transformers of higher than 34.5 kV rating.”~~

5.3 Rated power frequency (fr)

Subclause 4.3 of IEEE Std C37.100.1-2007 applies.

~~The rated power frequency of a device or an assembly is the frequency of the circuit for which it is designed. (Ratings are based on a frequency of 60 Hz.)~~

5.4 Rated continuous (normal) current and temperature rise

5.4.1 Rated continuous (normal) current (lr)

Subclause 4.4.1 of IEEE Std C37.100.1-2007 does not apply.

The rated continuous current of MEI switchgear is the maximum current in rms amperes at rated frequency, which can be carried continuously by the primary circuit components, including buses and connections, without causing temperature rises in excess of specified limits for the following:

- a) Any primary or secondary circuit component
- b) Any insulating medium, or structural or enclosing member

The specified temperature limits applicable to switchgear assemblies are given in 5.4.2 and Table 2.

~~5.4.2 Continuous current ratings~~

The preferred values of rated continuous current ~~-ratings~~ of the main bus in MEI switchgear shall be 600 A, 1200 A, and 2000 A.

The continuous current rating of the individual ~~switch~~ [interrupter](#) compartments shall be equal to the ratings of the switching and interrupting devices used, except as may be modified by lower continuous current ratings for current transformers, power fuses, etc.

5.4.2 Temperature rise

[Subclause 4.4.2 of IEEE Std C37.100.1-2007 does not apply. Subclause 4.4.3 of IEEE Std C37.100.1-2007 applies only where points are referenced in Table 2 of this standard.](#)

[The temperature rise and total temperature of any part of the switchgear shall not exceed the limits specified in Table 2 of this standard under the conditions specified in the test clauses.](#)

[External surfaces not accessible to an operator in the normal course of duties shall have no higher total temperature than 110 °C.](#)

Table 2—Limits of temperature rise for various parts, materials, and dielectrics of high-voltage switchgear a,b,c

Nature of the part of the material and of the dielectric (see items below)		Maximum value	
		Temperature (°C)	Temperature rise at ambient air temperature not exceeding 40 °C (K)
1	Does not apply	—	—
2	Connections, bolted or the equivalent (see point 4) — Bare-copper, bare-copper alloy or bare-aluminum alloy in air — Silver-coated or nickel-coated in air — Tin-surfaced in air	70 105 105	30 65 65
3	All other contacts or connections made of bare metals or coated with other materials	(See point 7)	(See point 7)
4	Terminals for the connection to external conductors by screws or bolts (see point 8) — Bare — Silver, nickel or tin-surfaced — Other coatings	(See point 14) 70 85 (See point 7)	(See point 14) 30 45 (See point 7)
5	Does not apply	—	—
6	Metal parts acting as springs	(See point 11)	(See point 11)
7	Materials used as insulation and metal parts in contact with insulation of the following classes: — Y — A — E — B — F — H — C	(See point 12) 90 105 120 130 155 180 220	(See point 12) 50 65 80 90 115 140 180
8	Does not apply	—	—
9	Accessible parts ^c — Expected to be touched in normal operation — Which need not be touched in normal operation	50 70	—

(New)

^a [This table is based on Table 3 of IEEE Std C37.100.1-2007. Points 1-4, 7, 8, and 14 in 4.4.3 of IEEE Std C37.100.1- 2007 apply. Points 5, 6, 9, 10, 11, 12 and 13 in 4.4.3 of IEEE Std C37.100.1-2007 do not apply. Refer to Annex J in IEEE Std C37.100.1-2007 for a discussion of this table with respect to the comparable table in EC 62271-1:2007 and to the requirements of several relevant equipment standards.](#)

^b [The symbol "K" for the kelvin is used in this standard to refer to a temperature increment. As a temperature increment \(e.g., temperature rise\), the degree Kelvin is equal to the degree Celsius, 1 K= 1 °C= 1.8 °F; as temperature on a scale, 273.15 K = 0 °C = 32 °F and 0 °K is absolute zero. The Kelvin is written as "K" without the "°" degree symbol.](#)

^c [The maximum value temperatures for group 9 are lower than those given in the comparable table in IEC 62271 -1. See Annex J in IEEE Std C37.100.1.](#)

~~5.4.3 Rated momentary withstand current~~

~~The rated momentary withstand current of MEI switchgear is the maximum rms total current that it shall be required to withstand. The current shall be the rms value, including the dc component, at the major peak of the maximum cycle as determined from the envelope of the current wave of the maximum offset phase during a test period of at least 10 cycles. The symmetrical current shall be the rated short time current, and the peak current value shall be 2.6 times its rated short time current at the major peak of the maximum cycle. (This is also referred to as the peak withstand current.)~~

~~5.4.4 Momentary withstand current ratings~~

~~The momentary withstand current ratings of the individual switch compartments of MEI switchgear shall be equal to one of the following:~~

- ~~a) The momentary withstand rating of the switching device,~~
- ~~b) The fault making rating of the switching device, or~~
- ~~c) The total asymmetrical short-circuit current ratings of the switching devices used.~~

~~NOTE—Instead of a rated momentary withstand current (rms asymmetrical current), some devices have a rated peak withstand current. In this standard, the rated momentary withstand current requires a 10-cycle current duration with a designated peak value. In other standards, the peak withstand current may be different. When applying devices having a rated peak withstand current, the user or manufacturer shall convert the peak rating to asymmetrical current to determine whether the application is appropriate.~~

5.5 Rated short-time withstand current (I_k)

Subclause 4.5 of IEEE Std C37.100.1-2007 applies with the following modifications:

The rated short-time withstand current of the MEI switchgear assembly is the maximum rms symmetrical current that the bus and connections shall be required to carry for the rated duration of short-circuit.

The preferred ratings are given in Table 3.

The short-time withstand current ratings of the individual switch interrupter compartments of the MEI switchgear shall be equal to the short-time withstand ratings of the switching and protective devices used or the short-time rating of the current transformers (see IEEE Std C57.13, IEEE Std C37.04, and IEEE Std C37.20.4).

NOTE Short-time current is the peak withstand current divided by 2.6.

Table 3—Preferred short-time current ratings for MEI switchgear

Line No.	Ratings		Reference Momentary Withstand Current kA, rms (Asymmetrical)
	Rated Short-Time Withstand Current kA, rms (Symmetrical)	Rated Peak Withstand Current kA, peak	
	Col 2	Col 3	Col 4
1	12.5	32.5	20
2	14	36.4	22.4
3	25	65	40
4	38	98.8	61
5	50	130	80

(New)

5.6 Rated peak withstand current (I_p)

Subclause 4.6 of IEEE Std C37.100.1-2007 applies with the following modification: The preferred ratings are given in Table 3.

The peak withstand current ratings of the individual interrupter compartments of MEI switchgear shall be equal to one of the following:

- a) The peak withstand rating of the interrupting device,
- b) The fault-making rating of the interrupter switch or closing and latching for a circuit breaker,
or
- c) The integrated short-circuit ratings of the fused interrupter switching devices used.

NOTE—This rating was previously called the rated momentary current and was an rms asymmetrical current. In other documents this value may also be referred to and can be equated to "peak withstand current." If the peak withstand current rating is 2.6 times the rated short-time symmetrical current and the duration of the test is 10 cycles, then the requirements for "rated momentary withstand current" have been met. The new rated peak withstand current is equivalent to the historic rated momentary current.

5.7 Rated duration of short circuit (t_k)

Subclause 4.7 of IEEE Std C37.100.1-2007 applies with the following modifications: The preferred duration of short-time withstand current is 2 seconds.

The period for the MEI switchgear assembly may be limited to a shorter time by a protective device, switch, or current transformer rating, but shall not reduce the requirement for the bus and connections.

NOTES

~~1— This rated time of 2 s is based on the maximum permissible "Y" tripping time delay for indoor circuit breakers. Refer to IEEE Std C37.04-1999, subclause 5.8.2.3.b.~~

~~2— Short-time current is the momentary withstand (rms asymmetrical) current divided by 1.55.~~

~~5.4.5.1 Rated short-time withstand current duration~~

~~The rated short-time withstand current duration is the maximum time interval that the assembly shall be required to carry the rated short-time withstand current.~~

When the ~~short-time withstand current~~ duration rating of short-circuit of the load interrupter switch is less than the preferred rating of 2 s, then the MEI switchgear assembly shall be assigned a rated short-time withstand current duration rating equal to the rating of the switch and the rating shall be noted on the nameplate. (See 7.4.1.)

This preferred rated time of 2 s is based on the maximum permissible tripping time delay (Y) for indoor circuit breakers. Refer to IEEE Std C37.04-1999, subclause 5.8.2.3.b.

5.4.5.2 Short-withstand current rating

The short time withstand current ratings of the individual switch compartments of the MEI switchgear shall be equal to the short time withstand ratings of the switching and protective devices used or the short time rating of the current transformer (see IEEE Std C57.13-1993 and IEEE Std C37.20.4-2001).

5.5 Temperature limitations

5.5.1 Limiting temperature

The limiting temperature for MEI switchgear is the maximum temperature permitted as follows:

- a) For any component, such as insulation, buses, instrument transformers, and switching and interrupting devices
- b) For air in cable termination compartments
- c) For any noncurrent-carrying structural parts
- d) For air surrounding devices

5.5.2 Temperature limits for insulating materials

The total temperature to which insulating materials are subjected shall not exceed the values listed in Table 2 for the various classes of insulating materials.