

Gas-insulated metal-enclosed switchgear for rated voltages of 72,5 kV and above

The European Standard EN 60517:1996, with the incorporation of amendment A11:1999, has the status of a British Standard

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Committees responsible for this British Standard

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- ASTA Certification Services
- Association of Manufacturers Allied to the Electrical and Electronic Industry (BEAMA Ltd.)
- British Railways Board
- Copper Development Association
- Department of the Environment (Property Services Agency)
- ERA Technology Ltd.
- Electricity Association
- GAMBICA (BEAMA Ltd.)
- Health and Safety Executive
- Transmission and Distribution Association (BEAMA Ltd.)

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

- Association of Consulting Engineers
- British Cable Makers' Confederation
- Engineering Equipment and Materials Users' Association

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National foreword

This British Standard has been prepared by Subcommittee PEL/17/1 (formerly PEL/92/12) and is the English language version of EN 60517:1996, *Gas-insulated metal-enclosed switchgear for rated voltages of 72,5 kV and above*, including amendment A11:1999, published by the European Committee for Electrotechnical Standardization (CENELEC). It is identical with IEC 60517:1990 including amendment 1:1994 and corrigendum 1995 published by the International Electrotechnical Commission (IEC). This British Standard supersedes BS 5524:1987 which is withdrawn.

The CENELEC common modifications have been implemented at the appropriate places in the text. The start and finish of each common modification is indicated in the text by tags [C] [C]. Where a common modification has been introduced by amendment, the tags carry the number of the amendment. For example, the common modifications introduced by CENELEC amendment A11 are indicated by [C11] [C11].

The start and finish of text introduced or altered by amendment is indicated in the text by tags [A1] [A1]. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment 1 is indicated by [A1] [A1].

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index”, or by using the “Find” facility of the BSI Standards Electronic Catalogue.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 37 and a back cover.

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Descriptors: Switchgear, high-voltage switchgear, metal enclosed switchgear, characteristics, tests

English version

Gas-insulated metal-enclosed switchgear for rated voltages of 72,5 kV and above

(includes amendment A11:1999)
(IEC 60517:1990 + corrigendum 1995 + A1:1994)

Appareillage sous enveloppe métallique à isolation
gazeuse de tension assignée égale ou supérieure
à 72,5 kV
(inclut l'amendement A11:1999)
(CEI 60517:1990 + corrigendum 1995 + A1:1994)

Gasisolierte metallgekapselte Schaltanlagen für
Bemessungsspannungen von 72,5 kV und darüber
(enthält Änderung A11:1999)
(IEC 60517:1990 + corrigendum 1995 + A1:1994)

This European Standard was approved by CENELEC on 1995-11-28. Amendment A11 was approved by CENELEC on 1999-09-27. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B-1050 Brussels

Foreword

The text of the International Standard IEC 517:1990 with its corrigendum April 1995 and its amendment 1:1994, prepared by SC 17C, High-voltage enclosed switchgear and controlgear, of IEC TC 17, Switchgear and controlgear, was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 60517 on 1995-11-28 without any modification.

This European Standard supersedes HD 358 S3:1992.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1996-12-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1996-12-01

For products which have complied with HD 358 S3:1992 before 1996-12-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 2001-12-01.

Annexes designated “normative” are part of the body of the standard. Annexes designated “informative” are given for information only. In this standard, Annex BB and Annex ZB are normative and Annex CC and Annex ZA are informative. Annex ZA and Annex ZB have been added by CENELEC.

Foreword to amendment A11

At the request of the Italian electrotechnical committee, a draft for an amendment to EN 60517:1996 was submitted to the CENELEC members for acceptance in July 1999.

The text of the draft was accepted by CENELEC as amendment A11 to EN 60517:1996 on 1999-09-27.

The following dates were fixed:

- latest date by which the existence of the amendment has to be announced at national level (doa) 1999-12-27
- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2000-03-27

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1 Scope

This standard specifies requirements for gas-insulated metal-enclosed switchgear in which the insulation is obtained, at least partly, by an insulating gas other than air at atmospheric pressure, for alternating current of rated voltages of 72,5 kV and above, for indoor and outdoor installation, and for service frequencies up to and including 60 Hz.

For the purpose of this standard the term “switchgear” is used for “gas-insulated metal-enclosed switchgear”.

The gas-insulated metal-enclosed switchgear covered by this standard consists of individual components intended to be directly connected together and able to operate only in this manner.

This standard completes and amends, if necessary, the various relevant standards applying to the individual components constituting gas-insulated metal-enclosed switchgear,

Unless otherwise specified, the gas-insulated metal-enclosed switchgear is designed to be used under normal service conditions.

2 Normal and special service conditions

Refer to clause 2 of IEC 694, with the following modification:

At any altitude the dielectric characteristics of the internal insulation are identical with those measured at sea-level. For this insulation, therefore, no requirements concerning the altitude are applicable

3 Definitions

For the definitions of general terms used in this standard, reference is made to IEC 50(441) and 50(151). The following definitions apply for the purpose of this standard:

3.101

switchgear

a general term covering switching devices and their combination with associated control, measuring, protective and regulating equipment, also assemblies of such devices and equipment with associated interconnections, accessories, enclosures and supporting structures, intended in principle for use in connection with generation, transmission, distribution and conversion of electric energy (IEV 441-11-02)

3.102

metal-enclosed switchgear and controlgear

switchgear and controlgear assemblies with an external metal enclosure intended to be earthed, and complete except for external connections (IEV 441-12-04)

3.103

gas-insulated metal-enclosed switchgear

metal-enclosed switchgear in which the insulation is obtained, at least partly, by an insulating gas other than air at atmospheric pressure (IEV 441-12-05)

NOTE This term generally applies to high-voltage switchgear and controlgear.

3.104

transport unit

a part of gas-insulated switchgear suitable for shipment without being dismantled

3.105

enclosure

a part of gas-insulated metal-enclosed switchgear retaining the insulating gas under the prescribed conditions necessary to maintain safely the rated insulation level, protecting the equipment against external influences and providing a high degree of protection to personnel

3.106

compartment

a part of gas-insulated metal-enclosed switchgear, totally enclosed except for openings necessary for interconnection and control

NOTE A compartment may be designated by the main component contained therein, e.g. circuit-breaker compartment, busbar compartment.

3.107

component

an essential part of the main or earthing circuits of gas-insulated metal-enclosed switchgear which serves a specific function (for example circuit-breaker, disconnecter, switch, fuse, instrument transformer, bushing, busbar, etc.)

3.108

partition

a part of gas-insulated metal-enclosed switchgear separating one compartment from other compartments (IEV 441-13-06)

3.109

bushing

a structure carrying one or more conductors through an enclosure and insulating it there from, including the means of attachment

3.110

main circuit

all the conductive parts of gas-insulated metal-enclosed switchgear included in a circuit which is intended to transmit electrical energy (IEV 441-13-02)

3.111

auxiliary circuit

all the conductive parts of gas-insulated metal-enclosed switchgear included in a circuit (other than the main circuit) intended to control, measure, signal and regulate (IEV 441-13-03)

NOTE The auxiliary circuits of gas-insulated metal-enclosed switchgear include the control and auxiliary circuits of the switching devices.

3.112

rated value

a quantity value assigned, generally by a manufacturer, for a specified operating condition of gas-insulated metal-enclosed switchgear (IEV 151-04-03)

NOTE See clause 4 for individual rated values.

3.113

ambient air temperature (of gas-insulated metal-enclosed switchgear)

the temperature, determined under prescribed conditions, of the air surrounding the external enclosure of gas-insulated metal-enclosed switchgear

3.114

design temperature (of the enclosure)

the highest temperature which can be reached by the enclosure under service conditions

3.115

design pressure (of the enclosure)

the pressure used to determine the thickness of the enclosure

3.116**disruptive discharge**

phenomena associated with the failure of insulation under electric stress, in which the discharge completely bridges the insulation under test, reducing the voltage between the electrodes to zero or almost zero

NOTE 1 The term applies to discharges in solid, liquid and gaseous dielectrics and to combinations of these.

NOTE 2 A disruptive discharge in a solid dielectric produces permanent loss of dielectric strength (non-self-restoring insulation); in a liquid or gaseous dielectric, the loss may be only temporary (self-restoring insulation).

NOTE 3 The term “sparkover” is used when a disruptive discharge occurs in a gaseous or liquid dielectric. The term “flashover” is used when a disruptive discharge occurs over the surface of a solid dielectric in a gaseous or liquid medium. The term “puncture” is used when a disruptive discharge occurs through a solid dielectric.

4 Rating

The rating of gas-insulated metal-enclosed switchgear comprises the following:

- a) rated voltage and number of phases;
- b) rated insulation level;
- c) rated frequency;
- d) rated normal current (for main circuits);
- e) rated short-time withstand current (for main and earthing circuits);
- f) rated peak withstand current (for main and earthing circuits);
- g) rated duration of short-circuit;
- h) rated values of the components forming part of gas-insulated metal-enclosed switchgear, including their operating devices and auxiliary equipment;
- i) rated density of gas for insulation.

The co-ordination of rated voltages, rated short-time withstand currents, rated peak withstand currents and rated normal currents of gas-insulated metal-enclosed switchgear is under consideration.

4.1 Rated voltage

Refer to 4.1 and 4.1.2 of IEC 694 with the addition of the rated value 72,5 kV.

NOTE Components forming part of the switchgear may have individual values of rated voltage in accordance with the relevant standards.

4.2 Rated insulation level

Refer to 4.2 of IEC 694 with the addition of the following supplement:

The switchgear comprises components having a definite insulation level. Although internal faults can largely be avoided by the choice of a suitable insulation level, measures to limit external overvoltages (surge arresters, protective sparkgaps) should be considered.

NOTE 1 Regarding the external parts of bushings (if any), refer to IEC 137.

NOTE 2 The waveforms are accepted lightning impulse and switching impulse shapes, pending the results of studies on the ability of this equipment to withstand other types of impulses.

NOTE 3 The choice between alternative insulation levels for a particular rated voltage should be based on insulation co-ordination studies taking into account also the self-generated transient overvoltages due to switching.

4.3 Rated frequency

Refer to 4.3 of IEC 694 with the addition of the following rated values:

16 $\frac{2}{3}$ Hz and 25 Hz

4.4 Rated normal current and temperature rise

4.4.1 *Rated normal current*

Refer to 4.4.1 of IEC 694 with the addition of the following paragraph:

Some main circuits of gas-insulated metal-enclosed switchgear (e.g. busbars, feeder circuits, etc.) may have different values of rated normal current. They should preferably be selected from the following values:

1 250 A – 2 000 A – 3 150 A – 4 000 A – 6 300 A

4.4.2 *Temperature rise*

Refer to 4.4.2 of IEC 694 with the addition of the following supplement:

The temperature rise of components contained in the switchgear which are subject to standards not covered by the scope of IEC 694 shall not exceed the temperature-rise limits permitted in the relevant standard for those components.

The temperature rise for accessible enclosures shall not exceed 30 K. In the case of enclosures which are accessible but need not be touched during normal operation, the temperature-rise limit may be increased to 40 K.

NOTE When applying a temperature rise equal to or higher than 65 K for parts of the enclosure not accessible to the operator, every precaution is to be taken to ensure that no damage is caused to the surrounding insulating materials.

4.5 Rated short-time withstand current

Refer to 4.5 of IEC 694 with the addition of the following paragraph:

The rated short-time withstand current should preferably be selected from the following values:

25 kA – 31,5 kA – 40 kA – 50 kA – 63 kA – 80 kA – 100 kA

4.6 Rated peak withstand current

Refer to 4.6 of IEC 694.

NOTE In principle, the rated short-time withstand current and the rated peak withstand current of a main circuit cannot exceed the corresponding rated values of the weakest of its series connected components.

4.7 Rated duration of short-circuit

Refer to 4.7 of IEC 694.

4.8 Rated supply voltage of closing and opening devices and auxiliary circuits

Refer to 4.8 of IEC 694.

4.9 Rated supply frequency of operating devices and auxiliary circuits

Refer to 4.9 of IEC 694 with the addition of the following paragraph:

The rated supply frequency of operating devices and auxiliary circuits is the frequency at which the conditions of operation and temperature rise of these devices and circuits are determined.

4.10 Rated pressure of compressed gas supply for operating mechanisms

Refer to 4.10 of IEC 694 with the addition of the following paragraph:

The pressure of the compressed gas supply is understood to be the pressure measured in the reservoir immediately before the operation.

4.101 Rated density of gas for insulation

The rated density of gas for insulation is the density assigned by the manufacturer at which the switchgear is intended to be used in service.

The minimum gas density is the value of the density assigned by the manufacturer at and above which the rated insulation level applies.

Gas-insulated metal-enclosed switchgear may have several rated and minimum gas densities for insulation, differing from one compartment to another.

5 Design and construction

Gas-insulated metal-enclosed switchgear shall be designed so that normal service, inspection and maintenance operations, earthing of connected cables, locating of cable faults, voltage tests on connected cables or other apparatus and the elimination of dangerous electrostatic charges, can be carried out safely, including the checking of phase sequence after erection and extension.

The design of the equipment shall be such that the agreed permitted movement of foundations or thermal effects do not impair the assigned performance of the equipment.

All components of the same rating and construction which may need to be replaced shall be interchangeable.

The various components contained within the enclosure are subject to their relevant standards except where modified by this standard.

5.1 Requirements for liquids in switchgear and controlgear

Refer to 5.1 of IEC 694.

5.2 Requirements for gases in switchgear and controlgear

Refer to 5.2 of IEC 694.

NOTE For checking of sulphur hexafluoride in service, refer to IEC 480.

5.3 Earthing

Refer to 5.3 of IEC 694.

5.3.101 Earthing of the main circuits

To ensure safety during maintenance work all parts of the main circuits to which access is required or provided shall be capable of being earthed. In addition, it shall be possible, after the opening of the enclosure, to connect earth electrodes for the duration of the work.

Earthing may be made by:

- a) earthing switches with a making capacity equal to the rated peak withstand current, if there is no certainty that the circuit connected is not live;
- b) earthing switches without a making capacity or with a making capacity lower than the rated peak withstand current, if there is certainty that the circuit connected is not live;
- c) removable earthing devices, only by agreement between manufacturer and user.

5.3.102 Earthing of the enclosure

The enclosures shall be capable of being connected to earth. All metal parts intended to be earthed, which do not belong to a main or an auxiliary circuit, shall be connected to earth. For the interconnection of enclosures, frames, etc., fastening (e.g. bolting or welding) is acceptable for providing electrical continuity.

The continuity of the earthing circuits shall be ensured taking into account the thermal and electrical stresses caused by the current they may have to carry.

5.4 Auxiliary equipment

Refer to 5.4 of IEC 694.

5.5 Dependent power closing

Refer to 5.5 of IEC 694.

5.6 Stored energy closing

Refer to 5.6 of IEC 694.

5.7 Operation of releases

Refer to 5.7 of IEC 694.