

High-voltage switches —

Part 1: Switches for rated voltages above 1 kV and less than 52 kV

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British Standard

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National foreword

This British Standard is the English language version of EN 60265-1:1998. It is identical with IEC 60265-1:1998. It supersedes BS 5463-1:1991 which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee PEL/17, Switchgear, controlgear, and HV-LV co-ordination, to Subcommittee PEL/17/1, High voltage switchgear and controlgear, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
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From 1 January 1997, all IEC publications have the number 60000 added to the old number. For instance, IEC 27-1 has been renumbered as IEC 60027-1. For a period of time during the change over from one numbering system to the other, publications may contain identifiers from both systems.

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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 38, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Amendments issued since publication

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English version

High-voltage switches

Part 1: Switches for rated voltages above 1 kV and less than 52 kV

(IEC 60265-1:1998)

Interrupteurs à haute tension
Partie 1: Interrupteurs pour tensions
assignées supérieures à 1 kV et
inférieures à 52 kV
(CEI 60265-1:1998)

Hochspannungs-Lastschalter
Teil 1: Hochspannungs-Lastschalter
für Nennspannungen über 1 kV und
unter 52 kV
(IEC 60265-1:1998)

This European Standard was approved by CENELEC on 1998-04-01. 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, Czech Republic, 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 document 17A/512/FDIS, future edition 3 of IEC 60265-1, prepared by SC 17A, High-voltage switchgear and controlgear, of IEC TC 17, Switchgear and controlgear, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60265-1 on 1998-04-01.

This European Standard supersedes HD 355.1 S3:1995.

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) 1999-01-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2001-01-01

This standard refers to EN 60694:1996, which is applicable unless otherwise specified in this standard. In order to simplify the indication of corresponding requirements, the same numbering of clauses and subclauses is used as in EN 60694. Amendments to these clauses and subclauses are given under the same references whilst additional subclauses are numbered from 101.

Annexes designated “normative” are part of the body of the standard.

In this standard, Annex ZA is normative.

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60265-1:1998 was approved by CENELEC as a European Standard without any modification.

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1 General

1.1 Scope

This part of IEC 60265 is applicable to three-phase, alternating current switches and switch-disconnectors having making and breaking current ratings, for indoor and outdoor installations, for rated voltages above 1 kV and less than 52 kV and for rated frequencies from 16 ⅔ Hz up to and including 60 Hz.

This standard is also applicable to the operating devices of these switches and to their auxiliary equipment.

Switch-disconnectors are also covered by IEC 60129.

General principles and provisions of this standard may also be applicable to single pole switches intended for application in single-phase systems. The requirements for dielectric tests and making and breaking tests should be in accordance with the requirements of the specific application.

NOTE 1 Except where special clarification is required, the term “switch” is used to refer to all kinds of switches and switch-disconnectors within the scope of this standard.

NOTE 2 Earthing switches are not covered by this standard. Earthing switches forming an integral part of a switch are covered by IEC 60129.

NOTE 3 This standard is not applicable to switching devices attached as an accessory to a high-voltage fuse assembly or its mounting and operated by opening and closing the fuse assembly.

1.2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60265. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 60265 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60050(441):1984, *International Electrotechnical Vocabulary (IEV) — Chapter 441: Switchgear, controlgear and fuses*.

IEC 60056:1987, *High-voltage alternating-current circuit-breakers*.

IEC 60059:1938, *IEC standard current ratings*.

IEC 60071-1:1993, *Insulation coordination — Part 1: Definitions, principles and rules*.

IEC 60129:1984, *Alternating current disconnectors and earthing switches*.

IEC 60420:1990, *High-voltage alternating current switch-fuse combinations*.

IEC 60694:1996, *Common specifications for high-voltage switchgear and controlgear standards*.

IEC 61233:1994, *High-voltage alternating current circuit-breakers — Inductive load switching*.

1.101 General requirements

The main purpose of this standard is to establish requirements for general purpose switches used in distribution systems.

General purpose switches shall comply with the following service applications:

- carrying normal current continuously;
- switching of mainly active loads;
- switching of distribution line closed-loop circuits;
- switching of no-load transformers;
- switching of the charging current of unloaded cables and overhead lines;
- carrying short-circuit currents for a specified time;
- making short-circuit currents.

General purpose switches intended for use in isolated neutral systems or in systems earthed by a high impedance shall be capable of switching under earth fault conditions.

A further object of this standard is to establish requirements for limited purpose and special purpose switches used in distribution systems.

Limited purpose switches shall have a rated normal current, a rated short-time withstand current, and one or more, but not all, of the switching capabilities of a general purpose switch.

Special purpose switches shall have a rated normal current, a rated short-time withstand current, a rated short-circuit making current and, in addition, shall be suitable for one or more of the following applications:

- switching single capacitor banks;
- switching back-to-back capacitor banks;
- switching of closed-loop circuits consisting of large power transformers in parallel;
- switching of motors under steady-state and stalled conditions.

It is assumed that opening and closing operations are performed according to the manufacturer's instructions. A making operation may immediately follow a breaking operation but a breaking operation shall not immediately follow a making operation since the current to be broken may then exceed the rated breaking current of the switch.

2 Normal and special service conditions

IEC 60694 is applicable.

3 Definitions

For the purpose of this part of IEC 60265, the definitions of IEC 60050(441) and IEC 60694 apply. Some of them are recalled hereunder for easier use.

The definitions given below are also applicable. They are classified in accordance with IEC 60050(441). The definitions of IEC 60050(441) are not repeated but reference is made to their specific subclause number. The additional definitions are classified so as to be aligned with the classification used in International Electrotechnical Vocabulary IEC 60050(441).

3.1 general terms

no particular definitions

3.2 assemblies

no particular definitions

3.3 parts of assemblies

no particular definitions

3.4 Switching devices

3.4.101 switch

switching device capable of making, carrying and breaking currents under normal circuit conditions, which may include specified operating overload conditions and also carrying for a specified time currents under specified abnormal circuit conditions, such as those of a short-circuit [IEV 441-14-10, modified]

3.4.102 switch-disconnector

[IEV 441-14-12]

3.4.103 general purpose switch

switch capable of performing, with currents up to its rated breaking currents, all making and breaking operations which may normally occur in distribution systems. The switch shall also be capable of carrying and making short-circuit currents

3.4.103.1

class E1 general purpose switch

general purpose switch suitable for applications in normally continuously fed parts of distribution system and where infrequent switching operations are performed

3.4.103.2

class E2 general purpose switch

general purpose switch designed so as not to require inspection or maintenance of the interrupting parts of the main circuit and only minimal maintenance of its other parts during its expected operating life

NOTE Minimal maintenance may include lubrication, replenishment of gas, and cleaning of external surfaces, where applicable.

3.4.103.3

class E3 general purpose switch

general purpose switch having the capability of frequent switching of higher currents and a higher frequency of making on short-circuits

3.4.103.4

class M1 general purpose switch

general purpose switch suitable for applications requiring a mechanical endurance of 1 000 operations

3.4.103.5

class M2 general purpose switch

general purpose switch suitable for special service applications and for frequent operation having an extended mechanical endurance of 5 000 operations

NOTE Class M2 switches may also be suitable for limited purpose and special purpose switch classifications.

3.4.104

limited purpose switch

switch which has a rated normal current, a rated short-time withstand current, and one or more switching capabilities of a general purpose switch

3.4.105

special purpose switch

switch which has a rated normal current, a rated short-time withstand current, a rated short-circuit making current, and is capable of performing specific service duties for special applications

NOTE 1 Examples of such special requirements are capacitor bank switching, motor switching and parallel power-transformer switching.

NOTE 2 In certain applications, other devices are utilized which will make short circuits or prevent the switch from making on a short circuit. In these applications, a short-circuit making capability is not required. The user should specify accordingly.

3.4.105.1**single capacitor bank switch**

special purpose switch intended for switching of a single capacitor bank with charging currents up to its rated single capacitor bank breaking current

3.4.105.2**back-to-back capacitor bank switch**

special purpose switch intended for breaking capacitor bank charging currents with one or more capacitor banks connected to the supply side of the switch up to its rated back-to-back capacitor bank breaking current. The switch shall be capable of making the associated inrush current up to its rated capacitor bank inrush making current

3.4.105.3**motor switch**

special purpose switch intended for switching of motors under steady-state and stalled conditions

3.4.105.4**parallel power transformer closed-loop switch**

special purpose switch intended for switching a closed-loop circuit consisting of large power transformers in parallel. The switch is typically applied as a medium voltage tie switch on the transformer secondary circuit such that the breaking current is high and the transient recovery voltage (TRV) conditions are severe

3.5**parts of switching devices**

no particular definitions

3.6**operation**

no particular definitions

3.7 Characteristic quantities**3.7.101****breaking capacity**

[IEV 441-17-08]

3.7.102**mainly active load-breaking capacity**

breaking capacity when opening a mainly active load circuit, the power factor of which is at least 0,75, in which the load can be represented by resistors and reactors in parallel

3.7.103**no-load transformer breaking capacity**

breaking capacity when opening a transformer circuit under no-load conditions

3.7.104**closed-loop breaking capacity**

breaking capacity when opening a closed-loop distribution line circuit, or a power transformer in parallel with one or more power transformers, i.e., a circuit in which both sides of the switch remain energized after breaking, and in which the voltage appearing across the terminals is substantially less than the system voltage

3.7.105**cable-charging breaking capacity**

breaking capacity when opening a cable circuit under no-load conditions

3.7.106**line-charging breaking capacity**

breaking capacity when opening an overhead line circuit under no-load conditions

3.7.107**single capacitor bank breaking capacity**

breaking capacity when opening a single capacitor bank circuit connected to a supply that does not include another capacitor bank adjacent to the bank being switched

3.7.108**back-to-back capacitor bank breaking capacity**

breaking capacity when opening a capacitor bank circuit connected to a supply that includes one or more capacitor banks adjacent to the bank being switched

3.7.109**back-to-back capacitor bank inrush making current**

high-frequency and high-magnitude current occurring when closing a capacitor bank circuit onto a supply including one or more capacitor banks adjacent to the bank being switched

NOTE The frequency and magnitude of the inrush current depend upon the values of capacitance and inductance between the capacitor banks.

3.7.110**motor breaking capacity**

breaking capacity when opening a motor under steady-state and stalled conditions

3.7.111**earth fault breaking capacity**

breaking capacity in the faulty phase of an isolated neutral or resonant earthed system when clearing an earth fault on an unloaded cable or overhead line on the load side of the switch

3.7.112**cable- and line-charging breaking capacity under earth fault conditions**

breaking capacity in the sound phases of an isolated neutral or resonant earthed system when switching off an unloaded cable or overhead line, with an earth fault on the supply side of the switch

3.7.113**breaking current**

[IEV 441-17-07]

3.7.114**(peak) making current**

peak value of the first major loop of the current in a pole of a switch during the transient period following the initiation of current during a making operation

NOTE 1 Peak value may differ from one pole to another and from one operation to another as it depends on the instant of current initiation relative to the wave of the applied voltage.

NOTE 2 Where, for a three-phase circuit, a single value of (peak) making current is referred to, it is, unless otherwise stated, the highest value in any phase.

3.7.115**short-circuit making capacity**

[IEV 441-17-10]

3.8 Index of definitions**B**

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Back-to-back capacitor bank inrush making current

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Back-to-back capacitor bank switch

3.4.105.2

Breaking capacity

3.7.101

Breaking current

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Cable- and line-charging breaking capacity under earth fault conditions

3.7.112

Cable-charging breaking capacity

3.7.105

Class E1 general purpose switch

3.4.103.1

Class E2 general purpose switch

3.4.103.2

Class E3 general purpose switch

3.4.103.3

Class M1 general purpose switch

3.4.103.4

Class M2 general purpose switch

3.4.103.5

Closed-loop breaking capacity

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Earth fault breaking capacity

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General purpose switch

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Limited purpose switch

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Mainly active load-breaking capacity

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Motor breaking capacity

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Motor switch

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No-load transformer breaking capacity

3.7.103

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Parallel power transformer closed-loop switch

3.4.105.4

(Peak) making current

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Short-circuit making capacity

3.7.115

Single capacitor bank breaking capacity

3.7.107

Single capacitor bank switch

3.4.105.1

Special purpose switch

3.4.105

Switch

3.4.101

Switch-disconnector

3.4.102

4 Ratings

Clause 4 of IEC 60694 is applicable with the additions and exceptions indicated below.

4.1 Rated voltage (U_r)

Subclause 4.1 of IEC 60694 is applicable.

4.2 Rated insulation level

Subclause 4.2 of IEC 60694 is applicable.

4.3 Rated frequency (f_r)

Subclause 4.3 of IEC 60694 is applicable.

4.4 Rated normal current (I_r) and temperature rise

Subclause 4.4 of IEC 60694 is applicable.

4.5 Rated short-time withstand current (I_k)

Subclause 4.5 of IEC 60694 is applicable with the following addition.

The rated short-time withstand current of an earthing switch forming an integral part of a switch shall be equal to the rated short-time withstand current of the switch, unless otherwise agreed to between the manufacturer and the user.

4.6 Rated peak withstand current (I_p)

Subclause 4.6 of IEC 60694 is applicable.

4.7 Rated duration of short-circuit (t_k)

Subclause 4.7 of IEC 60694 is applicable.

4.8 Rated supply voltage of closing and opening devices and of auxiliary and control circuits (U_a)

Subclause 4.8 of IEC 60694 is applicable.

4.9 Rated supply frequency of closing and opening devices and of auxiliary circuits

Subclause 4.9 of IEC 60694 is applicable.

4.10 Rated pressure of compressed gas supply for operation and/or interruption

Subclause 4.10 of IEC 60694 is applicable.

4.101 Rated mainly active load-breaking current (I_1)

The rated mainly active load-breaking current is the maximum mainly active load current that the switch shall be capable of breaking at its rated voltage.

4.102 Rated closed-loop breaking current (I_{2a} and I_{2b})

The rated closed-loop breaking current is the maximum closed-loop current the switch shall be capable of breaking. Separate ratings for distribution line loop breaking current and parallel power transformer breaking current may be assigned.

4.103 Rated no-load transformer breaking current (I_3)

The rated no-load transformer breaking current is the maximum no-load transformer current the switch shall be capable of breaking at its rated voltage.

4.104 Rated cable-charging breaking current (I_{4a})

The rated cable-charging breaking current is the maximum cable-charging current that the switch shall be capable of breaking at its rated voltage.

4.105 Rated line-charging breaking current (I_{4b})

The rated line-charging breaking current is the maximum line-charging current that the switch shall be capable of breaking at its rated voltage.

4.106 Rated single capacitor bank breaking current for special purpose switches (I_{4c})

The rated single capacitor bank breaking current is the maximum capacitor bank current that a special purpose switch shall be capable of breaking at its rated voltage with no capacitor bank connected to the supply side of the switch adjacent to the bank being switched.

4.107 Rated back-to-back capacitor bank breaking current for special purpose switches (I_{4d})

The rated back-to-back capacitor bank breaking current is the maximum capacitor bank current that a special purpose switch shall be capable of breaking at its rated voltage with one or more capacitor banks connected on the supply side of the switch adjacent to the bank being switched.

4.108 Rated back-to-back capacitor bank inrush making current for special purpose switches (I_{in})

The rated back-to-back capacitor bank inrush making current is the peak value of the current that a special purpose switch shall be capable of making at its rated voltage and with a frequency of the inrush current appropriate to the service conditions.

The assignment of a rated back-to-back capacitor bank inrush making current is mandatory for switches that have a rated back-to-back capacitor bank breaking current.

NOTE The frequency of the inrush current for back-to-back capacitor banks may be in the range of 2 kHz to 30 kHz. The specific values are dependent upon the size and configuration of the capacitor bank being switched, the supply side capacitor bank and the inclusion of limiting impedances, if any.

The switch is not necessarily rated to break the inrush making current produced by the back-to-back capacitor bank installation.

4.109 Rated earth fault breaking current (I_{6a})

The rated earth fault breaking current, for an isolated neutral or resonant earthed system, is the maximum earth fault current in the faulted phase that the switch shall be capable of breaking at its rated voltage.

NOTE The TRV of an isolated neutral system is more severe than the TRV of a resonant earthed system, even if detuned; therefore, for test purposes an isolated neutral system is assumed.

4.110 Rated cable- and line-charging breaking current under earth fault conditions (I_{6b})

The rated cable- and line-charging breaking current under earth fault conditions, for an isolated neutral or resonant earthed system, is the maximum current in the sound phases that the switch shall be capable of breaking at its rated voltage.

NOTE The maximum cable- and line-charging current under fault conditions is $\sqrt{3}$ times the cable- and line-charging current occurring in normal conditions. This covers the most severe case, which occurs with individually screened cables.

4.111 Rated motor breaking current for special purpose switches (I_7)

The rated motor breaking current is the maximum steady-state current of a motor the switch shall be capable of opening at its rated voltage. Refer to IEC 61233.

Unless otherwise specified, the breaking current for the condition of a stalled motor is eight times the rated normal current of the motor.

4.112 Rated short-circuit making current (I_{ma})

The rated short-circuit making current is the maximum peak prospective current that the switch shall be capable of making at its rated voltage.

4.113 Rated breaking and making currents for a general purpose switch

A general purpose switch shall have specific ratings for each switching duty as follows:

- rated mainly active load-breaking current equal to the rated normal current;
- rated no-load transformer breaking current equal to 1 % of the rated normal current;
- rated distribution line loop-breaking current equal to the rated normal current;
- rated cable-charging breaking current as shown in Table 1;
- rated line-charging breaking current as shown in Table 1;
- rated short-circuit making current equal to the rated peak withstand current. The switch shall have a capability of closing successfully two or more times at the rated making current.

Switches intended for use in isolated neutral systems or in systems earthed by a high impedance shall have a rated earth fault breaking current and a rated cable and line charging breaking current under earth fault conditions.

The standard values of ratings should be selected from the R10 series specified in IEC 60059.

If an earthing switch, forming an integral part of a switch, has a rated short-circuit making current, this rated current shall be equal to the rated peak withstand current of the switch, unless otherwise agreed to between the manufacturer and user.

NOTE The R10 series comprises the number 1 – 1,25 – 1,6 – 2 – 2,5 – 3,15 – 4 – 5 – 6,3 – 8 and their products of 10^n .

4.114 Ratings for limited purpose switches

A limited purpose switch shall have a rated normal current, a rated short-time withstand current, and one or more, but not all, switching capabilities of a general purpose switch. If other ratings are specified, values from the R10 series should be selected.

4.115 Ratings for special purpose switches

A special purpose switch shall have a rated normal current, a rated short-time withstand current, a rated short-circuit making current and may have one or more switching capabilities of a general purpose switch.

Ratings and capabilities shall be assigned for the specific special service application for which it is applied. The rated values should be selected from the R10 series. One or more of the following ratings and capabilities may be assigned:

- parallel power transformer breaking capacity;
- single capacitor bank breaking capacity;

— back-to-back capacitor bank breaking capacity and inrush making current;

— motor breaking capacity.

A special purpose switch shall have a short-circuit rated making current as stated in 4.112. This short-circuit making current may be less than the rated peak withstand current.

4.116 Ratings for switches backed by fuses

Short-circuit ratings, short-time withstand currents, and making currents of switches may be selected by consideration of the limiting effect on the duration and value of the short-circuit current by fuses. Current limiting fuses and certain other classes of fuses can be utilized. The associated fuse having the highest rated normal current shall be the basis for establishing a rating. Refer to IEC 60420.

5 Design and construction

Clause 5 of IEC 60694 is applicable, with the additions and exceptions indicated below.

5.1 Requirements for liquids in high-voltage switches

Subclause 5.1 of IEC 60694 is applicable.

5.2 Requirements for gases in high-voltage switches

Subclause 5.2 of IEC 60694 is applicable.

5.3 Earthing of high-voltage switches

Subclause 5.3 of IEC 60694 is applicable.

5.4 Auxiliary and control equipment

Subclause 5.4 of IEC 60694 is applicable.

5.5 Dependent power operation

Subclause 5.5 of IEC 60694 is applicable with the following limitation.

Dependent manual operation is allowable only for limited purpose switches not having a short-circuit making capability.

5.6 Stored energy operation

Subclause 5.6 of IEC 60694 is applicable.

5.7 Independent manual operation

Subclause 5.7 of IEC 60694 is applicable.

5.8 Operation of releases

Subclause 5.8 of IEC 60694 is applicable.

5.9 Low- and high-pressure interlocking and monitoring devices

Subclause 5.9 of IEC 60694 is applicable.