

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Low-voltage switchgear and controlgear –
Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination
units**

**Appareillage à basse tension –
Partie 3: Interrupteurs, sectionneurs, interrupteurs-sectionneurs et combinés-
fusibles**

IEC 60947-3:2008

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –**Part 3: Switches, disconnectors, switch-disconnectors
and fuse-combination units**

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International Standard IEC 60947-3 has been prepared by subcommittee 17B: Low-voltage switchgear and controlgear, of IEC technical committee 17: Switchgear and controlgear.

This third edition cancels and replaces the second edition published in 1999, Amendment 1 (2001) and Amendment 2 (2005). This edition constitutes a technical revision.

The document 17B/1601/FDIS, circulated to the National Committees as amendment 3, led to the publication of the new edition.

This edition includes the following significant technical changes with respect to the previous edition:

- alignment with the fifth edition of IEC 60947-1;
- a switching operation without current allowed between making and breaking operation (Table 3);
- increased number of operations for AC-23 allowed with agreement of the manufacturer (Table 3);

- simplified test procedure amended, f) added to 8.3.2.1.3;
- temperature rise test shall be made at the rated operational current I_e instead of the conventional enclosed thermal current I_{the} (8.3.3.1).

The text of this standard is based on the first edition, its amendment 1, amendment 2 and the following documents:

FDIS	Report on voting
17B/1601/FDIS	17B/1608/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 60947 series can be found, under the general title *Low-voltage switchgear and controlgear*, on the IEC website.

This part is to be used in conjunction with IEC 60947-1. The numbering of the subclauses is sometimes not continuous because it is based on IEC 60947-1.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition; or
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IEC 60947-3:2008

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LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units

1 General

The provisions of the general rules dealt with in IEC 60947-1 are applicable to this part, where specifically called for. Clauses and subclauses, tables, figures and appendices of the general rules thus applicable are identified by reference IEC 60947-1, e.g., 4.3.4.1 of IEC 60947-1, Table 4 of IEC 60947-1, or Annex A of IEC 60947-1.

1.1 Scope and object

This part of IEC 60947 applies to switches, disconnectors, switch-disconnectors and fuse-combination units to be used in distribution circuits and motor circuits of which the rated voltage does not exceed 1 000 V a.c. or 1 500 V d.c.

The manufacturer shall specify the type, ratings and characteristics according to the relevant standard of any incorporated fuses.

This part does not apply to equipment coming within the scope of IEC 60947-2, IEC 60947-4-1 and IEC 60947-5-1; however, when switches and fuse-combination units coming into the scope of this part are normally used to start, accelerate and/or stop an individual motor they shall also comply with the additional requirements given in Annex A.

The requirements for single pole operated three pole switches are included in Annex C.

Auxiliary switches fitted to equipment within the scope of this part shall comply with the requirements of IEC 60947-5-1.

This part does not include the additional requirements necessary for electrical apparatus for explosive gas atmospheres.

NOTE 1 Depending on its design, a switch (or disconnector) can be referred to as "a rotary switch (disconnector)", "cam-operated switch (disconnector)", "knife-switch (disconnector)", etc.

NOTE 2 In this part, the word "switch" also applies to the apparatus referred to in French as "commutateurs", intended to modify the connections between several circuits and *inter alia* to substitute a part of a circuit for another.

NOTE 3 In general, throughout this part switches, disconnectors, switch-disconnectors and fuse-combination units will be referred to as "equipment".

The object of this part is to state

- a) the characteristics of the equipment;
- b) the conditions with which the equipment shall comply with reference to
 - 1) operation and behaviour in normal service;
 - 2) operation and behaviour in case of specified abnormal conditions, e.g. short circuit;
 - 3) dielectric properties;
- c) the tests for confirming that these conditions have been met and the methods to be adopted for these tests;

- d) the information to be marked on the equipment or made available by the manufacturer, e.g. in the catalogue.

1.2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-441:1984, *International Electrotechnical Vocabulary (IEV) – Chapter 441: Switchgear, controlgear and fuses*
Amendment 1 (2000)

IEC 60269 (all parts), *Low-voltage fuses*

IEC 60410:1973, *Sampling plans and procedures for inspection by attributes*

IEC 60417-DB:2000¹, *Graphical symbols for use on equipment*

IEC 60947-1:2007, *Low-voltage switchgear and controlgear – Part 1: General rules*

IEC 60947-2:2006, *Low-voltage switchgear and controlgear – Part 2: Circuit-breakers*

IEC 60947-4-1:2000, *Low-voltage switchgear and controlgear – Part 4-1: Contactors and motor-starters – Electromechanical contactors and motor-starters*
Amendment 1 (2002)
Amendment 2 (2005)

IEC 60947-5-1:2003, *Low-voltage switchgear and controlgear – Part 5-1: Control circuit devices and switching elements – Electromechanical control circuit devices*

IEC 61000-4-2:1995, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*
Amendment 1 (1998)
Amendment 2 (2000)

IEC 61000-4-3:2006, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*
Amendment 1 (2007)

IEC 61000-4-4:2004, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5:2005, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6:2003, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*
Amendment 1 (2004)
Amendment 2 (2006)

CISPR 11:2003, *Industrial, scientific and medical (ISM) radio-frequency equipment – Electromagnetic disturbance characteristics – Limits and methods of measurement*

¹ “DB” refers to the IEC on-line database.

Amendment 1 (2004)
Amendment 2 (2006)

CISPR 22:2005, *Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement*

Amendment 1 (2005)
Amendment 2 (2006)

2 Terms and definitions

For the purposes of this part of IEC 60947, the terms and definitions given in IEC 60050-441, IEC 60947-1 and the following apply.

	Reference
D	
Dependent manual operation (of a mechanical switching device).....	2.13
Disconnecter.....	2.2
Disconnecter-fuse.....	2.7
F	
Fuse-combination unit.....	2.4
Fuse-disconnector.....	2.8
Fuse-switch.....	2.6
Fuse-switch-disconnector.....	2.10
I	
Independent manual operation (of a mechanical switching device).....	2.14
M	
Multiple tip contact system.....	2.12
S	
Semi-independent manual operation.....	2.15
Single pole operated three pole switch.....	2.11
Stored energy operation (of a mechanical switching device).....	2.16
Switch (mechanical).....	2.1
Switch-disconnector.....	2.3
Switch-disconnector-fuse.....	2.9
Switch-fuse.....	2.5

2.1 (mechanical) switch

mechanical 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 short-circuit

NOTE A switch may be capable of making, but not breaking, short-circuit currents.
[IEV 441-14-10]

2.2 disconnecter

mechanical switching device which, in the open position, complies with the requirements specified for the isolating function

[IEV 441-14-05, modified]

NOTE 1 This definition differs from IEV 441-14-05 by referring to isolating function instead of isolating distance.

NOTE 2 A disconnector is capable of opening and closing a circuit when either a negligible current is broken or made, or when no significant change in the voltage across the terminals of each of the poles of the disconnector occurs. It is also capable of carrying currents under normal circuit conditions and carrying for a specified time currents under abnormal conditions such as those of short circuit.

2.3

switch-disconnector

switch which, in the open position, satisfies the isolating requirements specified for a disconnector

[IEV 441-14-12]

2.4

fuse-combination unit

combination of a mechanical switching device and one or more fuses in a composite unit, assembled by the manufacturer or in accordance with his instructions

[IEV 441-14-04]

NOTE (Not included in IEC 441-14-04.) This is a general term for fuse switching devices (see also from 2.5 to 2.10 and Table 1).

2.5

switch-fuse

switch in which one or more poles have a fuse in series in a composite unit

[IEV 441-14-14]

2.6

fuse-switch

switch in which a fuse-link or a fuse-carrier with fuse-link forms the moving contact

[IEV 441-14-17]

2.7

disconnector-fuse

disconnector in which one or more poles have a fuse in series in a composite unit

[IEV 441-14-15]

2.8

fuse-disconnector

disconnector in which a fuse-link or fuse-carrier with fuse-link forms the moving contact

[IEV 441-14-18]

2.9

switch-disconnector-fuse

switch-disconnector in which one or more poles have a fuse in series in a composite unit

[IEV 441-14-16]

2.10

fuse-switch-disconnector

switch-disconnector in which a fuse-link or a fuse-carrier with fuse-link forms the moving contact

[IEV 441-14-19]

2.11

single pole operated three pole switch

device consisting of three individually operable single pole switch disconnecting devices according to this part, rated as a complete unit for use in a three-phase system

NOTE These devices are intended for power distribution systems where switching and/or isolation of an individual phase may be necessary and they should not be used for the switching of the primary circuit of three-phase equipment.

2.12

multiple tip contact system

system that consists of more than one contact gap per pole, which can be switched, in series and/or in parallel

2.13

dependent manual operation (of a mechanical switching device)

operation solely by means of directly applied manual energy such that the speed and force of the operation are dependent upon the action of the operator

[IEV 441-16-13]

2.14

independent manual operation (of a mechanical switching device)

stored energy operation where the energy originates from manual power, stored and released in one continuous operation, such that the speed and force of the operation are independent of the action of the operator

[IEV 441-16-16]

2.15

semi-independent manual operation

operation solely by means of directly applied manual energy such that the manual force is increased up to a threshold value beyond which the independent switching operation is achieved unless deliberately delayed by the operator

2.16

stored energy operation (of a mechanical switching device)

operation by means of energy stored in the mechanism itself prior to the completion of the operation and sufficient to complete it under predetermined conditions

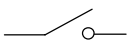
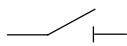
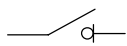
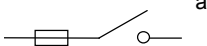
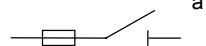
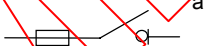
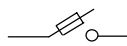

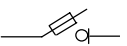
NOTE This kind of operation may be subdivided according to

- a) the manner of storing the energy (spring, weight, etc.);
- b) the origin of the energy (manual, electric, etc.);
- c) the manner of releasing the energy (manual, electric, etc.).

[IEV 441-16-15]

A summary of equipment definitions is given in Table 1.

Table 1 – Summary of equipment definitions

Functions		
Making and breaking current	Isolating	Making, breaking and isolating
Switch 2.1 	Disconnecter 2.2 	Switch-disconnector 2.3 
Fuse-combination units 2.4		
Switch-fuse 2.5  ^a	Disconnecter-fuse 2.7  ^a	Switch-disconnector-fuse 2.9  ^a
Fuse-switch 2.6 	Fuse-disconnector 2.8 	Fuse-switch-disconnector 2.10 
NOTE 1 All equipment may be single-break or multi-break. NOTE 2 Numbers are subclause references of the relevant definitions. NOTE 3 Symbols are based on IEC 60617-7.		
^a The fuse may be on either side of or in a stationary position between the contacts of the equipment.		

3 Classification

3.1 According to the utilization category

See 4.4.

3.2 According to the method of operation of manually operated equipment

- dependent manual operation (see 2.13);
- independent manual operation (see 2.14);
- semi-independent manual operation (see 2.15).

NOTE The method of operation on closing may be different from the method for opening.

3.3 According to suitability for isolation

- suitable for isolation (see 7.1.7 of IEC 60947-1 and 7.1.7.1);
- not suitable for isolation.

3.4 According to the degree of protection provided

See 7.1.12 of IEC 60947-1.

4 Characteristics

4.1 Summary of characteristics

The characteristics of the equipment shall be stated in terms of the following as applicable:

- type of equipment (see 4.2);
- rated and limiting values for the main circuit (see 4.3);
- utilization category (see 4.4);
- control circuits (see 4.5);
- auxiliary circuits (see 4.6);

4.2 Type of equipment

The following shall be stated.

4.2.1 Number of poles

4.2.2 Kind of current

Kind of current (a.c. or d.c.) and, in the case of a.c., number of phases and rated frequency.

4.2.3 Number of positions of the main contacts (if more than two)

4.3 Rated and limiting values for the main circuit

Rated values are assigned by the manufacturer. They shall be stated in accordance with 4.3.1 to 4.3.6.4 but it may not be necessary to establish all the rated values listed.

4.3.1 Rated voltages

An equipment is defined by the following rated voltages.

4.3.1.1 Rated operational voltage (U_e)

Subclause 4.3.1.1 of IEC 60947-1 applies.

4.3.1.2 Rated insulation voltage (U_i)

Subclause 4.3.1.2 of IEC 60947-1 applies.

4.3.1.3 Rated impulse withstand voltage (U_{imp})

Subclause 4.3.1.3 of IEC 60947-1 applies.

4.3.2 Currents

An equipment is defined by the following currents.

4.3.2.1 Conventional free air thermal current (I_{th})

Subclause 4.3.2.1 of IEC 60947-1 applies.

4.3.2.2 Conventional enclosed thermal current (I_{the})

Subclause 4.3.2.2 of IEC 60947-1 applies.