

Low-voltage switchgear and controlgear —

Part 6-1: Multiple function equipment — Transfer switching equipment

The European Standard EN 60947-6-1:2005 has the status of a
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National foreword

This British Standard is the official English language version of EN 60947-6-1:2005. It is identical with IEC 60947-6-1:2005. It supersedes BS EN 60947-6-1:1992 which is withdrawn.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/17/2, Low voltage switchgear, 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 UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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Part 6-1: Multiple function equipment –
Transfer switching equipment
(IEC 60947-6-1:2005)**

Appareillage à basse tension
Partie 6-1: Matériels à fonctions multiples -
Matériels de connexion de transfert
(CEI 60947-6-1:2005)

Niederspannungsschaltgeräte
Teil 6-1: Mehrfunktionsschaltgeräte -
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Foreword

The text of document 17B/1418/FDIS, future edition 2 of IEC 60947-6-1, prepared by SC 17B, Low-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 60947-6-1 on 2005-10-01.

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The following dates were fixed:

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This part of EN 60947 shall be used in conjunction with EN 60947-1:2004 (IEC 60947-1:2004), General rules.

The provisions of the general rules dealt with in IEC 60947-1 are applicable to this part of EN 60947, where specifically called for. Clauses and subclauses, tables, figures and annexes of the general rules thus applicable are identified by reference to IEC 60947-1 (e.g. 1.2.3 of IEC 60947-1, Table 4 of IEC 60947-1 or Annex A of IEC 60947-1, etc.).

This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and covers essential requirements of EC Directive 89/336/EEC. See Annex ZZ.

Annexes ZA and ZZ have been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60947-6-1:2005 was approved by CENELEC as a European Standard without any modification.

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LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 6-1: Multiple function equipment – Transfer switching equipment

1 Scope and object

This part of IEC 60947 applies to transfer switching equipment (TSE) to be used in power systems with interruption of the supply to the load during transfer, the rated voltage of which does not exceed 1 000 V a.c. or 1 500 V d.c.

It covers:

- manually operated transfer switching equipment (MTSE);
- remote operated transfer switching equipment (RTSE);
- automatic transfer switching equipment (ATSE).

It covers TSE provided with or without an enclosure.

Devices necessary for the control (e.g. control switches, etc.) and the protection (e.g. circuit-breakers, etc.) of a TSE are covered by the relevant IEC standards.

NOTE TSE used only for emergency lighting may be subject to specific rules and/or legal requirements and are not, therefore, covered by this standard.

The object of this part of IEC 60947 is to state:

- 1) The characteristics of the equipment:
 - a) specific equipment;
 - b) equipment the main part of which being devices covered by other IEC 60947 product standards.
- 2) The conditions of the equipment with respect to:
 - a) operation for which the equipment is intended;
 - b) operation and behaviour in case of specified abnormal conditions, for example, short-circuit;
 - c) dielectric properties.
- 3) The tests intended to confirm that these conditions have been met and the methods for performing these tests.
- 4) The data to be marked on the equipment and provided by the manufacturer.

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 60695-11-10:1999, *Fire hazard testing – Part 11-10: Test flames – 50 W horizontal and vertical flame test methods*
Amendment 1 (2003)

IEC 60947-1:2004, *Low-voltage switchgear and controlgear – Part 1: General rules*

IEC 60947-2:2003, *Low-voltage switchgear and controlgear – Part 2: Circuit-breakers*

IEC 60947-3:1999, *Low-voltage switchgear and controlgear – Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units*
Amendment 1 (2001)

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)

IEC 60947-4-2:1999, *Low-voltage switchgear and controlgear – Part 4-2: Contactors and motor-starters – AC semiconductor motor controllers and starters*
Amendment 1 (2001)

IEC 60947-4-3:1999, *Low-voltage switchgear and controlgear – Part 4-3: Contactors and motor-starters – AC semiconductor controllers and contactors for non-motor loads*

IEC 60947-6-2:2002, *Low-voltage switchgear and controlgear – Part 6-2: Multiple function equipment – Control and protective switching devices (or equipment) (CPS)*

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 61000-4-3:2002, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*
Amendment 1 (2002)

IEC 61000-4-4:1995, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*
Amendment 1 (2000)
Amendment 2 (2001)

IEC 61000-4-5:1995, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*
Amendment 1 (2000)

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)

CISPR 11:2003, *Industrial, scientific and medical (ISM) radio-frequency equipment – Electromagnetic disturbance characteristics – Limits and methods of measurement*
Amendment 1 (2004)

3 Terms and definitions, symbols and abbreviations

For the purpose of this part of IEC 60947 the relevant terms and definitions given in Clause 2 of IEC 60947-1 and the following additional definitions shall apply:

	Reference
A	
Alternative position	3.3.2
Automatic transfer switching equipment (ATSE)	3.1.4
C	
Contact transfer time	3.2.5
D	
Derived transfer switching equipment (derived TSE)	3.1.5
F	
Frequency supply deviation	3.2.4
M	
Manually operated transfer switching equipment (MTSE)	3.1.2
Monitored supply deviation of ATSE	3.2.2
N	
Normal position	3.3.1
O	
Off position	3.3.3
Off-time	3.2.9
Operating sequence of ATSE	3.2.1
Operating transfer time	3.2.6
R	
Remotely operated transfer switching equipment (RTSE)	3.1.3
Return transfer time	3.2.8
T	
Total operating time	3.2.7
Transfer switching equipment (TSE)	3.1.1
V	
Voltage supply deviation	3.2.3

3.1 Switching devices

3.1.1

transfer switching equipment

TSE

equipment containing one or more switching devices for disconnecting load circuits from one supply and connecting to another supply

3.1.2

manually operated transfer switching equipment

MTSE

transfer switching equipment operated manually

3.1.3**remotely operated transfer switching equipment
RTSE**

transfer switching equipment operated remotely

NOTE RTSE may have an optional feature for local operation.

3.1.4**automatic transfer switching equipment
ATSE**

self-acting transfer switching equipment

NOTE 1 ATSE normally includes all necessary devices for monitoring and transferring operations.

NOTE 2 ATSE may have an optional feature for manual operation.

3.1.5**derived transfer switching equipment
derived TSE**

TSE in which the main part are device(s) fulfilling requirements of other IEC 60947 product standards

NOTE 1 For convenience, derived TSE may be called derived ATSE, derived MTSE or derived RTSE.

NOTE 2 For convenience, parts other than main parts (e.g. those intended to control the TSE: control switches, mechanical interlocking devices, ...) are called other parts.

3.2 Operation of TSE**3.2.1****operating sequence of ATSE**

automatic transfer of a load from the normal supply to an alternative supply in the event of a monitored supply deviation with an automatic return of the load to the normal supply when restored

NOTE 1 The transfer may be with or without a predetermined time delay and may include an off position.

NOTE 2 In the case of both the normal and the alternative supplies being present, the ATSE assumes the normal supply position.

3.2.2**monitored supply deviation of ATSE**

variation in the power supply characteristics which signals the ATSE to operate when a deviation from the specified limits occurs

EXAMPLE Abnormal changes in voltage or frequency of the supply are supply deviations.

3.2.3**voltage supply deviation**

change or loss of voltage of the normal power supply

3.2.4**frequency supply deviation**

change in frequency from the normal operating frequency of the normal supply

3.2.5**contact transfer time**

time measured from the parting of one set of main contacts from one power supply to the closing of a second set of main contacts on an alternative power supply

3.2.6

operating transfer time

time measured from the instant of the monitored supply deviation to the closing of main contacts on an available alternative supply source, exclusive of any purposely introduced time delay

3.2.7

total operating time

sum of operating transfer time and any purposely introduced time delay

3.2.8

return transfer time

time from the instant when the normal supply is fully restored to the instant when the set of main contacts is closed on the normal supply, plus any purposely introduced time delay

3.2.9

off-time

time measured during transfer from the instant of final arc extinction, under the conditions producing the longest arcing time, in all poles to the closing of main contacts on another supply

NOTE Any purposely introduced time delay would be included within the off-time.

3.3 Main contact positions

3.3.1

normal position

contact position of the equipment when there is no deviation of the normal supply

3.3.2

alternative position

contact position of the equipment when the load circuit is switched on the alternative (emergency) supply in the event of a monitored supply deviation of the normal supply

3.3.3

off position

contact position of the equipment when the load circuit is not switched on any supply

NOTE This position results from either automatic tripping caused by a fault in the load circuit or intentional interruption of the automatic transfer function.

3.4 Symbols and abbreviations

EMC	Electromagnetic compatibility
I_{cm}	Rated short-circuit making capacity (5.3.6.2)
I_{cn}	Rated short-circuit breaking capacity (5.3.6.3)
I_{cw}	Rated short-time withstand current (5.3.6.1)
I_e	Rated operational current (5.3.2)
I_u	Rated uninterrupted current (5.3.2)
SCPD	Short-circuit protective device
U_e	Rated operational voltage (5.3.1.1)
U_i	Rated insulation voltage (5.3.1.2)
U_{imp}	Rated impulse withstand voltage (5.3.1.3)
U_r	Power frequency or d.c. recovery voltage (Table 2)

4 Classification

Transfer switching equipment is classified according to:

a) their short-circuit capability:

- class PC: TSE that is capable of making and withstanding, but is not intended for breaking short-circuit currents;
NOTE Contactors can be used in class PC if they fulfil the test requirements of class PC.
- class CB: TSE provided with over-current releases and the main contacts of which are capable of making and are intended for breaking short-circuit currents;
- class CC: TSE that is capable of making and withstanding, but is not intended for breaking short-circuit currents. TSE based on devices fulfilling the requirements of IEC 60947-4-1;

b) the method of controlling the transfer:

- manually operated switching equipment (MTSE);
- remote operated switching equipment (RTSE);
- automatic transfer switching equipment (ATSE).

5 Characteristics

5.1 Summary of characteristics

Wherever practicable the characteristics of the TSE shall be stated as follows:

- Type of equipment (5.2).
- Rated and limiting values for the main circuit (5.3).
- Utilization category (5.4).
- Control circuits (5.5).
- Auxiliary circuits (5.6).

Where the TSE uses IEC 60947 products, the relevant characteristics from those standards may also be additionally used.

5.2 Type of equipment

The following shall be stated:

- class and transfer control method of the equipment (see Clause 4);
- number of poles;
- kind of current;
- operating sequence.

5.3 Rated and limiting values for the main circuit

Subclause 4.3 of IEC 60947-1 applies. However, minimum values for 5.3.6.1, 5.3.6.3 and 5.3.6.4 are given in Table 4.

5.3.1 Rated voltages

5.3.1.1 Rated operational voltage (U_e)

Subclause 4.3.1.1 of IEC 60947-1 applies.

5.3.1.2 Rated insulation voltage (U_i)

Subclause 4.3.1.2 of IEC 60947-1 applies.

5.3.1.3 Rated impulse withstand voltage (U_{imp})

Subclause 4.3.1.3 of IEC 60947-1 applies.

5.3.2 Rated operational current (I_e)

The rated operational current of TSE is the rated uninterrupted current (I_u). See 4.3.2.4 of IEC 60947-1.

5.3.3 Rated frequency

Subclause 4.3.3 of IEC 60947-1 applies.

5.3.4 Uninterrupted duty

Subclause 4.3.4.2 of IEC 60947-1 applies.

5.3.5 Rated making and breaking capacities

The rated making and breaking capacities are the values of current, stated by the manufacturer, which the transfer equipment can satisfactorily make and break under specified conditions. Unless stated otherwise, they are given in terms of a steady state current value. During the making operation, the peak value of the current on contact closing may be higher than the peak value of the steady state current depending on the characteristics of the test circuit (load) and the instant of closing on the voltage wave.

The rated making and breaking capacities are stated with reference to the rated operational voltage, the rated operational current and the utilization category according to Table 2.

For a.c., the rated making and breaking capacities are expressed by the r.m.s. value of the a.c. component of the current.

5.3.6 Short-circuit characteristics

5.3.6.1 Rated short-time withstand current (I_{cw})

The rated short-time withstand current is the value of short-time withstand current stated by the manufacturer which the equipment can carry under the test conditions specified in 9.3.4.3.

For a.c., the value of the current is the r.m.s. value of the a.c. component and the highest peak value in any one phase shall be not less than n times this r.m.s. value, the ratio n being given in Table 16 of IEC 60947-1.

The minimum value of the short-time withstand current is given in column 2 of Table 4.

NOTE Additional lower values of short-time withstand current for longer durations may be stated by the manufacturer.

The minimum durations are:

- 3 half-cycles of the rated frequency or 0,025 s for d.c. for rated operational currents up to and including 400 A;
- 3 cycles of the rated frequency or 0,05 s for d.c. for rated operational currents higher than 400 A.

5.3.6.2 Rated short-circuit making capacity (I_{cm})

The rated short-circuit making capacity is the value of short-circuit making capacity assigned by the manufacturer for the rated operational voltage at rated frequency and at a specified power-factor (or time-constant). It is expressed as the maximum prospective peak current.

For class CB TSE and for a.c., the rated short-circuit making capacity shall be not less than highest value of short-circuit breaking capacity, multiplied by the ratio n of Table 16 of IEC 60947-1. The manufacturer may assign a higher value of short-circuit making capacity.

For d.c., the rated short-circuit making capacity shall be not less than its rated short-circuit breaking capacity, on the assumption that the steady-state short-circuit current is constant.

A rated short-circuit making capacity implies that the TSE shall be able to make the current corresponding to that rated capacity at an applied voltage up to and including that corresponding to 105 % of the rated operational voltage.

5.3.6.3 Rated short-circuit breaking capacity (I_{cn})

The rated short-circuit breaking capacity is the value of short-circuit breaking capacity assigned by the manufacturer for the rated operational voltage, at rated frequency and at a specified power-factor (or time-constant).

It is expressed as the value of the prospective breaking current (r.m.s. value of the a.c. component in the case of a.c.).

The minimum value of the rated short-circuit breaking capacity is given in column 2 of Table 4. The manufacturer may assign a higher value of breaking capacity.

A rated short-circuit breaking capacity implies that a Class CB TSE shall be able to break any current up to the rated capacity.

5.3.6.4 Rated conditional short-circuit current

The rated conditional short-circuit current is the value of prospective current, stated by the manufacturer, which the TSE, protected by a specified short-circuit protective device (SCPD), can satisfactorily withstand for the operating time of this device under the test conditions specified in 9.3.4.4.

The minimum value of the prospective current is given in column 2 of Table 4.

Details of the specified short-circuit protective device shall be indicated by the manufacturer. They shall include the type, rating, characteristics and, for current limiting devices, the maximum peak current and the I^2t corresponding to the value of the prospective current.

NOTE 1 For a.c., the rated conditional short-circuit current is expressed by the r.m.s. value of the a.c. component.

NOTE 2 The short-circuit protective device may either form an integral part of the equipment or be a separate unit.

5.4 Utilization category

TSE may be assigned one or more of the standard utilization categories given in Table 1 at one or more rated utilization voltages.

The designation of utilization categories is completed by the suffix A or B, according to the number of operations (see Tables 8, 9 and 10) required by the application.

TSE assigned any utilization category shall comply with the rated making and breaking capacity (Table 2) and the electrical and mechanical operational performance requirements (Table 3) corresponding to the assigned utilization category.

Table 1 – Utilization categories

Nature of current	Utilization category		Typical applications
	Operation A	Operation B	
Alternating current	AC-31A	AC-31B	Non-inductive or slightly inductive loads
	AC-32A	AC-32B	Switching of mixed resistive and inductive loads, including moderate overloads
	AC-33A	AC-33B	Motor loads or mixed loads including motors, resistive loads and up to 30 % incandescent lamp loads
	AC-35A	AC-35B	Electric discharge lamp loads
	AC-36A	AC-36B	Incandescent lamp loads
Direct current	DC-31A	DC-31B	Resistive loads
	DC-33A	DC-33B	Motor loads or mixed loads including motors
	DC-36A	DC-36B	Incandescent lamp load

For TSE for which the main parts are covered by other IEC 60947 product standards, utilization categories defined in these product standards may be used as equivalent as those defined in Table 1, see Annex A.

5.5 Control circuits

Subclause 4.5 of IEC 60947-1 applies with the following additions for monitored supply (see 3.2.2).

5.5.1 Electro-mechanical devices controlling the main circuit

The minimum and maximum values of voltage or voltage and frequency operating limits shall be stated by the manufacturer. These limits shall correspond to the limits for the transfer control devices.