

Low-voltage switchgear and controlgear —

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

ICS 29.130.20

National foreword

This British Standard is the UK implementation of EN 60947-6-1:2005+A1:2014. It is identical to IEC 60947-6-1:2005, incorporating amendment 1:2014. It supersedes BS EN 60947-6-1:2005 which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. 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.

The UK participation in its preparation was entrusted to Technical Committee PEL/17, Switchgear, controlgear and HV-LV co-ordination, to Subcommittee PEL/17/2, Low voltage switchgear and controlgear.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 1 February 2006

© The British Standards Institution 2014. Published by BSI Standards Limited 2014

ISBN 978 0 580 77522 2

Amendments/corrigenda issued since publication

Date	Comments
31 July 2014	Implementation of IEC amendment 1:2013 with CENELEC endorsement A1:2014

Low-voltage switchgear and controlgear
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 -
Netzumschalter
(IEC 60947-6-1:2005)

This European Standard was approved by CENELEC on 2005-10-01. 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, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, 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 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.

This European Standard supersedes EN 60947-6-1:1991 + A1:1994 + A2:1997.

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) 2006-07-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2008-10-01

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.

Foreword to amendment A1

The text of document 17B/1830/FDIS, future IEC 60947-6-1:2005/A1, 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 approved by CENELEC as EN 60947-6-1:2005/A1:2014.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2014-10-17
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2017-01-17

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For the relationship with EU Directive(s) see informative Annex ZZ, which is an integral part of this document.

This standard covers the Principle Elements of the Safety Objectives for Electrical Equipment Designed for Use within Certain Voltage Limits (LVD - 2006/95/EC).

Endorsement notice

The text of the International Standard IEC 60947-6-1:2005/A1:2013 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

- | | | |
|---------------------|------|--|
| IEC 60364-1:2005 | NOTE | Harmonised as HD 60364-1:2008 (modified). |
| IEC 60364-5-56:2009 | NOTE | Harmonised as HD 60364-5-56:2010 (modified). |

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60695-11-10 A1	1999 2003	Fire hazard testing - Part 11-10: Test flames - 50 W horizontal and vertical flame test methods	EN 60695-11-10 A1	1999 2003
IEC 60947-1 A1	2007 2010	Low-voltage switchgear and controlgear - Part 1: General rules	EN 60947-1 A1	2007 2011
IEC 60947-2 A1 A2	2006 2009 2013	Low-voltage switchgear and controlgear - Part 2: Circuit-breakers	EN 60947-2 A1 A2	2006 2009 2013
IEC 60947-3 A1	2008 2012	Low-voltage switchgear and controlgear - Part 3: Switches, disconnectors, switch- disconnectors and fuse- combination units	EN 60947-3 A1	2009 2012
IEC 60947-4-1 A1	2009 2012	Low-voltage switchgear and controlgear - Part 4-1: Contactors and motor-starters - Electromechanical contactors and motorstarters	EN 60947-4-1 A1	2010 2012
IEC 60947-4-2 A1	1999 2001	Low-voltage switchgear and controlgear - Part 4-2: Contactors and motor-starters -AC semiconductor motor controllers and starters	EN 60947-4-2 A1	2000 2002
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	EN 60947-4-3	2000
IEC 60947-6-2 A1	2002 2007	Low-voltage switchgear and controlgear - Part 6-2: Multiple function	EN 60947-6-2 A1	2003 2007

		equipment - Control and protective switching devices (or equipment) (CPS)		
IEC 61000-4-2 A1 A2	1995 1998 2000	Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test	EN 61000-4-2 A1 A2	1995 1998 2001
IEC 61000-4-3 A1	2002 2002	Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test	IEC 61000-4-3 A1	2002 2002
IEC 61000-4-4 A1 A2	1995 2000 2001	Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test	EN 61000-4-4 A1 A2	1995 2001 2001
IEC 61000-4-5 A1	1995 2000	Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test	EN 61000-4-5 A1	1995 2001
IEC 61000-4-6 A1	2003 2004	Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields	EN 61000-4-6	2007
IEC 61000-4-13 A1	2002 2009	Electromagnetic compatibility (EMC) - Part 4-13: Testing and measurement techniques – Harmonics and interharmonics including mains signalling at a.c. power port, low frequency immunity tests	EN 61000-4-13 A1	2002 2009
CISPR 11 A1	2009 2010	Industrial scientific and medical (ISM) radio-frequency equipment - Electromagnetic disturbance characteristics - Limits and methods of measurement	EN 55011 A1	2009 2010
IEC 60417 (Data base)	-	Graphical symbols for use on equipment	-	-

Annex ZZ (informative)

Coverage of Essential Requirements of EU Directives

This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and within its scope the standard covers protection requirements of Annex I Article 1 of the EU Directive 2004/108/EC.

Compliance with this standard provides presumption of conformity with the specified essential requirements of the Directives concerned.

NOTE: Other requirements and other EU Directives may be applicable to the products falling within the scope of this standard.

CONTENTS

1	Scope and object.....	9
2	Normative references	10
3	Terms and definitions, symbols and abbreviations	11
3.1	Switching devices	11
3.2	Operation of TSE.....	12
3.3	Main contact positions	13
3.4	Symbols and abbreviations	13
4	Classification.....	14
5	Characteristics	14
5.1	Summary of characteristics	14
5.2	Type of equipment.....	14
5.3	Rated and limiting values for the main circuit.....	15
5.4	Utilization category	17
5.5	Control circuits	17
5.6	Auxiliary circuits	18
6	Product information	18
6.1	Nature of information	18
6.2	Marking	19
6.3	Instructions for installation, operation and maintenance.....	19
7	Normal service, mounting and transport conditions.....	19
8	Constructional and performance requirements.....	19
8.1	Constructional requirements	19
8.2	Performance requirements.....	20
8.3	Electromagnetic compatibility (EMC).....	25
9	Tests.....	25
9.1	Kinds of tests	25
9.2	Compliance with constructional requirements	26
9.3	Performance.....	26
9.4	Routine tests	38
9.5	EMC tests	38
	Bibliography.....	46
	Annex A (normative) – Assignment of utilization categories based on the results of tests	43
	Annex B (informative) – Items subject to agreement between manufacturer and user	45
	Annex ZA (normative) – Normative references to international publications with their corresponding European publications	4
	Annex ZZ (informative) – Coverage of Essential Requirements of EC Directives.....	6
	Figure 1 – Test circuit for connection to normal and alternative supplies	41
	Figure 2 – Test circuit for the verification of making and breaking capacities on three poles	42
	Figure 3 – Test circuit for the verification of making and breaking capacities on two poles	42

Table 1 – Utilization categories	17
Table 2 – Verification of making and breaking capacity – Conditions for making and breaking corresponding to the utilization categories.....	21
Table 3 – Verification of operational performance – Conditions for making and breaking corresponding to the utilization categories.....	22
Table 4 – Value of the test current for the verification of the ability to operate under short-circuit conditions	23
Table 5 – Acceptance criteria	
Table 6 – List of type tests (overall scheme of test sequences)	27
Table 7 – List of type tests (referred to by their subclause numbers) to which a given derived TSE shall be submitted	28
Table 8 – Number and duration of operating cycles for the making and breaking capacity test	32
Table 9 – Number and duration of operating cycles for the electrical and mechanical operational performance tests for operation A utilization categories	34
Table 10 – Number and duration of operating cycles for the electrical and mechanical operational performance tests for operation B utilization categories	34
Table 11 – Value of the test current for the verification of the ability to operate under short-circuit conditions (harmonized table)	24
Table A.1 – Equivalence between utilization categories used in some IEC 60947 product standards	44

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

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

1 Scope and object

A1 This part of IEC 60947 applies to transfer switching equipment (TSE) to be used in power systems for transferring a load supply between a normal and an alternate source with a supply interruption during transfer, the rated voltage of which does not exceed 1 000 V a.c. or 1 500 V d.c. **A1**

It covers:

- manually operated transfer switching equipment (MTSE);
- **A1** remotely **A1** 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.

A1 Note 1 **A1** 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.
A1 Text deleted **A1**
- 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.

A1 NOTE 2 This standard covers also ATSE or RTSE which can be used for safety services as defined in IEC 60364-1 and for which the installation requirements are given by IEC 60364-5-56.

NOTE 3 Other ATSE requirements are under consideration such as closed transition TSE (make before break transfer operation). **A1**

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.

☐^{A1} IEC 60417-DB1, *Graphical symbols for use on equipment* ☐^{A1}

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

☐^{A1} IEC 60947-1:2007, *Low-voltage switchgear and controlgear – Part 1: General rules*
Amendment 1:2010 ☐^{A1}

☐^{A1} IEC 60947-2:2006, *Low-voltage switchgear and controlgear – Part 2: Circuit-breakers*
Amendment 1:2009
Amendment 2:2013 ☐^{A1}

☐^{A1} IEC 60947-3:2008, *Low-voltage switchgear and controlgear – Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units*
Amendment 1:2012 ☐^{A1}

☐^{A1} IEC 60947-4-1:2009, *Low-voltage switchgear and controlgear – Part 4-1: Contactors and motor-starters – Electromechanical contactors and motor-starters*
Amendment 1:2012 ☐^{A1}

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*

☐^{A1} IEC 60947-6-2:2002, *Low voltage switchgear and controlgear – Part 6-2: Multiple function equipment – Control and protective switching devices (or equipment) (CPS)*
Amendment 1:2007 ☐^{A1}

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)

☐^{A1} IEC 61000-4-13:2002, *Electromagnetic compatibility (EMC) – Part 4-13: Testing and measurement techniques – Harmonics and interharmonics including mains signalling at a.c. power port, low-frequency immunity tests*
Amendment 1:2009 ☐^{A1}

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

Ⓐ CISPR 11:2009, *Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement*
Amendment 1:2010 Ⓐ

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
Ⓐ Switching position	3.3.4 Ⓐ
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.

A1 3.3.4

switching position (of a TSE)

mechanical configuration of the main contacts of a TSE regarding the load connexion to a source, which could be either connected to the normal source in the normal position, the alternate source in the alternative position, or disconnected in the off position (if applicable) **A1**

3.4 Symbols and abbreviations

A1 ATSE Automatic transfer switching equipment **A1**

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)

A1 I_q Rated conditional short-circuit current **A1**

I_u Rated uninterrupted current (5.3.2)

A1 MTSE Manually operated transfer switching equipment

RTSE Remotely operated transfer switching equipment **A1**

A1 "r" Minimum short-circuit test current **A1**

SCPD Short-circuit protective device