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Responsible committee: PEL/23/4 Protected type plugs and sockets

Interested committees:

Title: BS IEC 63066 Low-voltage docking connectors for removable energy storage units

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- iii) requires additional national guidance or information

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Responsible Committee Secretary: **Mr Simon Bounds (BSI)**Direct tel: **0208 996 7281**E-mail: simon.bounds@bsigroup.com

Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
------------------	------------------------

1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



23H/541/CD

COMMITTEE DRAFT (CD)

PROJECT NUMBER:

IEC 63066 ED1

DATE OF CIRCULATION:

2023-09-01

CLOSING DATE FOR COMMENTS:

2023-11-24

SUPERSEDES DOCUMENTS:

23H/537/RR

IEC SC 23H : PLUGS, SOCKET-OUTLETS AND COUPLERS FOR INDUSTRIAL AND SIMILAR APPLICATIONS, AND FOR ELECTRIC VEHICLES

SECRETARIAT:

France

SECRETARY:

Mrs Anne Le Guennec

OF INTEREST TO THE FOLLOWING COMMITTEES:

TC 69

PROPOSED HORIZONTAL STANDARD:

☐

Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.

FUNCTIONS CONCERNED:

☐ EMC

☐ ENVIRONMENT

☐ QUALITY ASSURANCE

☒ SAFETY

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TITLE:

Low-voltage docking connectors for removable energy storage units

NOTE FROM TC/SC OFFICERS:

Comments on this CD document will be discussed on the MT11 meeting in Nanjing, China in conjunction with TC69 WG13 meeting planned for 02/2024

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**LOW-VOLTAGE DOCKING CONNECTORS FOR
REMOVABLE ENERGY STORAGE UNITS****FOREWORD**

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IEC 63066 has been prepared by subcommittee 23H: Plugs, socketoutlets and couplers for industrial and similar applications, and for electric vehicles, of IEC technical committee 23: Electrical accessories. It is an International Standard.

This first edition cancels and replaces the first edition of IEC TS 63066 published in 2017. This edition constitutes a technical revision.

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

- a) Introduction of standard sheets;
- b) Alignment with IEC 60309-1:2021
- c) Technical improvements, e.g. short circuit tests according the I2t- methodology.

The text of this International Standard, is based on the following documents:

Draft	Report on voting
XX/XX/FDIS	XX/XX/RVD

192

193 Full information on the voting for its approval can be found in the report on voting indicated in
194 the above table.

195 The language used for the development of this International Standard is English.

196 This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in
197 accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available
198 at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are
199 described in greater detail at www.iec.ch/publications.

200 The committee has decided that the contents of this document will remain unchanged until the
201 stability date indicated on the IEC website under webstore.iec.ch in the data related to the
202 specific document. At this date, the document will be

- 203 • reconfirmed,
- 204 • withdrawn,
- 205 • replaced by a revised edition, or
- 206 • amended.

207

208

INTRODUCTION

209 Pluggable energy storage technology has a large demand and perspective in certain areas.
210 With the advent of electric vehicles, energy storage units for renewable energy and other
211 applications, guidance is needed to ensure safe and reliable operation, interoperability,
212 environmental protection and energy efficiency. The industry needs such a standard to promote
213 the technology development and popularization of pluggable energy storage technology.

214 Compared to other accessories, several specific items are considered. The mating process may
215 not have haptic support by the operator to find the correct position between the two parts of the
216 connector. The mating process may have a mechanical feed which precludes the finding of the
217 correct position between the two parts of the connector. To overcome these issues, the design
218 of the accessories may consist partly of moveable parts to compensate a mechanical feed and
219 tolerances.

220

LOW-VOLTAGE DOCKING CONNECTORS FOR REMOVABLE ENERGY STORAGE UNITS

1 Scope

This document applies to docking connectors (hereinafter referred to as accessories) incorporated in or fixed to electrical equipment, intended to connect removable energy storage units to a dedicated electric power conversion unit, to an energy consuming unit or to another energy storage unit.

These accessories are intended for DC and may include an earth contact and/or optional auxiliary contacts for signaling and data. These accessories have a rated current of up to 2.000 A and rated operating voltages not exceeding 1.500 V DC.

These accessories are not suitable for mating or unmating under load. These accessories are intended to be installed by instructed persons (IEC 60050-195:1998, 195-04-02) or skilled persons (IEC 60050-195:1998, 195-04-01) only.

The list of preferred ratings is not intended to exclude other ratings.

This document applies to accessories for use under environmental conditions as described in Clause 32.

These accessories are intended to be connected to current carrying parts in copper or copper alloy only, plated or not plated.

This document also applies to accessories intended to be used at extra-low voltage.

In locations where special conditions prevail, for example on board vehicles, additional requirements may apply.

These accessories are intended to be used with a specific charging system.

NOTE For conditions other than operation, additional requirements could be applicable, for instance IEC 62133 and the UN Recommendations on the Transport of Dangerous Goods section 38.338.3.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

Clause 3 of IEC 60309-1 ED5 applies, except as follows:

Addition of the following new references:

IEC 60068-2-1, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-2, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*

IEC 60068-2-14, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature*

IEC 60068-2-30, *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

- 258 IEC 60068-2-38, *Environmental testing – Part 2-38: Tests – Test Z/AD: Composite*
259 *temperature/humidity cyclic test*
- 260 IEC 60068-2-52, *Environmental testing – Part 2: Tests – Test Kb: Salt mist, cyclic (sodium*
261 *chloride solution)*
- 262 IEC 60068-2-60, *Environmental testing – Part 2-60: Tests – Test Ke: Flowing mixed gas*
263 *corrosion test*
- 264 IEC 60309-1:2021, *Plugs, fixed or portable socket-outlets and appliance inlets for industrial*
265 *purposes - Part 1: General requirements*
- 266 IEC 60352 (all parts), *Solderless connections*
- 267 IEC 60417, *Graphical symbols for use on equipment* (available at [http://www.graphical-](http://www.graphical-symbols.info/equipment)
268 [symbols.info/equipment](http://www.graphical-symbols.info/equipment))
- 269 IEC 61140:2016, *Protection against electric shock – Common aspects for installation and*
270 *equipment*
- 271 IEC 61373:2010, *Railway applications – Rolling stock equipment – Shock and vibration tests*
- 272 IEC 62262:2002, *Degrees of protection provided by enclosures for electrical equipment against*
273 *external mechanical impacts (IK code)*
- 274 ISO/IEC TR 29106:2007, *Information technology – Generic cabling – Introduction to the MICE*
275 *environmental classification*
276 *ISO/IEC TR 29106:2007/AMD1:2012*
- 277 **IEC 62840-2:2016** *Electric vehicle battery swap system - Part 2: Safety requirements*

278 **3 Terms and definitions**

279 For the purposes of this document, the terms and definitions given in IEC 60309-1:2021 and
280 the following apply.

281 **3.1**

282 **docking connector**

283 accessory where the two complementary accessories are equipped with guiding means allowing
284 their connection without the haptic support of an operator

285 **3.2**

286 **unmated condition**

287 position of the accessory without any contact between both parts

288 **3.3**

289 **mated condition**

290 service condition and position where the two parts of the accessory are in a position as
291 described in the relevant standard sheet

292 **3.4**

293 **guiding means**

294 mechanical structure intended to ensure the proper alignment of the two complementary
295 accessories before their mating

3.5**energy storage unit**

unit, which includes accessories, multiple batteries or other chargeable cells arranged in a way to store electrical energy

Note 1 to entry: This may also include supporting means for charging, storage, interlocking and discharging.

3.6**RESU****removable energy storage unit**

energy storage unit, which can be easily detached and inserted into a rack to establish the electrical connection with an accessory

3.7**ESE****Energy supply equipment**

Equipment which supplies electrical energy to the RESU

3.8**rack**

mechanical structure intended to incorporate one or more removable energy storage units

3.9**electric power conversion unit**

device converting electric energy from one form to another, converting between AC and DC, or changing the voltage or frequency, or a combination of these

3.10**shutter**

movable part incorporated into an accessory arranged to automatically shield at least the live contacts when the complementary accessory is withdrawn

[SOURCE: IEC 60884-1:2002/AMD2:2013, 3.27, modified – 'socket-outlet' and 'plug' are replaced by 'accessory', 'automatically' is deleted and 'complementary' is added]

3.11**superordinate system**

overall technical system as a set of components or systems with relationships between the components or systems and between their attributes

Note of the convenors - Discussion on terms to be performed in TC69-WG13 first, then adopt or modify the terms here as appropriate.

4 General

Clause 4 of IEC 60309-1 ED5 applies, except as follows:

4.1 General requirements

Replacement of the fourth paragraph with:

Accessories shall have a minimum degree of protection as indicated in Table 7, test variable TV1.

4.2 General notes on tests

Subclause 4.2 of IEC 60309-1 ED5 applies.

4.3 General construction

Different possibilities for the movement, adjustment and mating of components and accessories are stated in Table 1.

Table 1 – General design and usage of accessories

Case	Accessory Type A		Accessory Type B		Removable energy storage unit
	Possibility of movement relative to the structure of the rack or removable energy storage unit	Self-adjustment to the nominal position of the movable part after disconnecting	Possibility of movement relative to the structure of the removable energy storage unit	Self-adjustment to the nominal position of the movable part after disconnecting	Possibility of movement relative to the rack
1	Not movable	No	Not movable	No	Not movable
2	Not movable	No	Not movable	No	Movable
3	Not movable	No	Movable	No	Not movable
4	Not movable	No	Movable	Yes	Not movable
5	Movable	Yes	Not movable	No	Not movable
6	Movable	No	Not movable	No	Not movable
NOTE Other combinations are not excluded.					

See Standard sheets for implementations of accessories. Annex B shows additional informative accessories.

4.4 Visual examination tests

If required by a test and unless otherwise specified, visual examination tests shall be performed with the naked eye. The following characteristics shall be checked:

- quality of assembling before test;
- marking;
- materials;
- marks of corrosion;
- colour, change of colour after the test;
- impurities, contamination, particles of abrasion after the test;
- damages, holes, cracks;
- damaged and loosened parts;
- status and location of lubrication and glues.

No noticeable problems shall occur which could impair normal operation or show a deviation from this standard.

4.5 Cable to be used

Unless otherwise specified by the manufacturer, the following stranded cable shall be used for the power contacts: H07V.

4.6 Voltage and current for test purposes

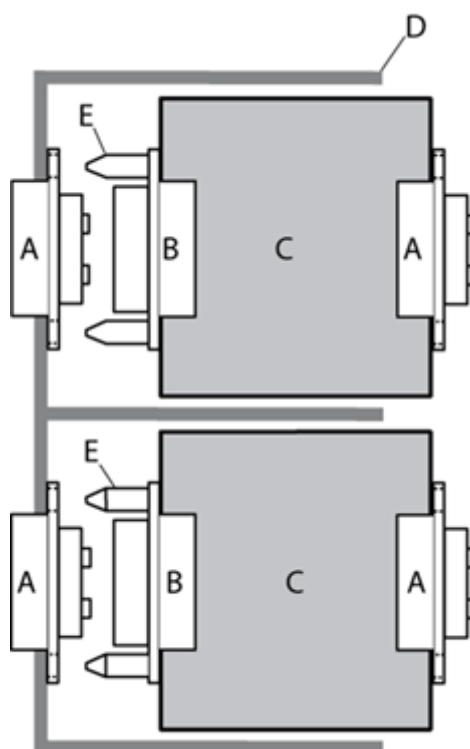
As deviation from the referred test standards, tests may be performed with AC or DC.

4.7 Type of accessories

Requirements mentioned for accessories called plug or inlet are applicable for accessories Type B.

Requirements mentioned for accessories called socket outlet or connector are applicable for accessories Type A.

Figure 1 shows the general arrangement.



Key

- A docking accessories type A
- B complementary docking accessories type B
- C removable energy storage units
- D rack
- E guiding means

Figure 1 – Diagram showing the use of the accessories

5 Standard ratings

Clause 5 of IEC 60309-1 ED5, except as follows:

5.1 Replacement:

Preferred rated currents are given in Table 2.

Table 2 – Preferred rated currents

Rated current A
16
32
63
125
250
315
400
630
800

Additional subclause:

5.3 Ratings for data, communication, and control

Rated current for data, communication and control circuit purposes is 2 A.

Rated voltage for data, communication and control circuit purposes is 30 V or less according to the manufacturer's specification.

6 Classification of accessories

6.1 Accessories are classified according to degree of protection

NOTE: Minimum IP rating is specified by Table 7

6.2 Accessories are classified according to earthing facilities:

- accessories without earthing contact;
- accessories with earthing contact.

6.3 Accessories are classified according to the method of connecting the cable:

- rewirable accessories;
- non-rewirable accessories.

6.4 Accessories are classified according to interlocking facilities:

- accessories without interlock;
- accessories with mechanical interlock (with latching device);
- accessories with electrical interlock (without latching device);
- accessories with latching device and electrical interlock.

6.5 Accessories are classified according to the type of terminals:

- screw type terminals;
- screwless type terminals;
- insulation piercing terminals.

6.6 Accessories are classified according to the type of conductors for screwless type and insulation piercing terminals

- for solid conductors only;
- for rigid (both solid and stranded) conductors only;
- for rigid (both solid and stranded) and flexible conductors.

6.7 Accessories are classified according to accessibility to live parts when unmated:

- accessories providing for less than IPXXB;
- accessories providing for IPXXB;
- accessories providing for IPXXD.

6.8 Accessories are classified according to locking facilities:

- non-lockable accessories;
- lockable accessories.

6.9 Accessories are classified according to the presence of shutter(s):

- accessories without shutter(s);
- accessories with shutter(s).

6.10 Accessories are classified according to their environmental performance class:

- accessories tested for use in environmental performance class C;
- accessories tested for use in environmental performance class O;
- accessories tested for use in environmental performance class I;
- accessories tested for use in environmental performance class X.
- accessories tested for use in environmental performance class R;
- accessories tested for use in environmental performance class T.

6.11 Accessories are classified according to the case of use:

- accessories intended for use in case 1;
- accessories intended for use in case 2;
- accessories intended for use in case 3;
- accessories intended for use in case 4;
- accessories intended for use in case 5;
- accessories intended for use in case 6;
- accessories intended for use in other cases.

6.12 Accessories are classified according to the type:

- accessories of Type A;
- accessories of Type B.

7 Marking**7.1 Accessories shall be marked with:**

- rated current(s) in amperes;
- rated operating voltage(s) or range(s) in volts;
- either the name or trademark of the manufacturer or of the responsible vendor;
- type reference, which may be a catalogue number;
- degree of protection;
- symbol indicating the position of the earthing contact or the means used for interchangeability, if any.

NOTE Optionally, the insulation voltage can be marked.

Compliance is checked by inspection.

7.2 Symbols

When symbols are used, they shall be as follows:

A		amperes	
V		volts	
— — —		direct current	IEC 60417-5031 (2002-10)
	(preferred)	protective earth;	IEC 60417-5019 (2006-08)
		protective ground	
and or			
		earth; ground	IEC 60417-5017 (2006-08)
		Plus; positive polarity	IEC 60417-5005 (2002-10)
		Minus; negative polarity	IEC 60417-5006 (2002-10)
IPXX	(relevant numerals)	degree of protection according to IEC 60529	

Compliance is checked by inspection.

7.3 Vendor marking

The marking for either the name or trademark of the manufacturer or the responsible vendor and the type reference, catalogue number or designation shall also be in a place which is visible before installation of the accessory.

The marking for the maximum rated operating voltage range and rated current shall be in a place which is visible before installation of the accessory. The marking for either the name or trademark of the manufacturer or the responsible vendor and the type reference, catalogue number or designation shall be in a place which is visible before installation of the accessory. It need not be visible after installation.

Compliance is checked by inspection.

7.4 Marking of rewirable accessories

For rewirable accessories, the contacts shall be indicated by the following symbols:

- the symbols + and – and the symbol  for protective earth if any;
- other contacts as indicated in the relevant standard sheet.

These symbols shall be placed close to the relevant terminals; they shall not be placed on screws, removable washers or other removable parts.

Compliance is checked by inspection.

For rewirable accessories, wiring instructions shall be provided.

Compliance is checked by inspection.

7.5 Pre-wired accessories

Pre-wired accessories shall be provided with information to identify the conductors at the loose end.

474 *Compliance is checked by inspection.*

475 **7.6 Instructions**

476 For rewirable accessories, wiring instructions shall be provided.

477 For instructions related to accessories classified less than IPXXB shall be provided

478 *Compliance is checked by inspection.*

479 **8 Dimensions**

480 Clause 8 of IEC 60309-1 ED5 applies, except as follows:

481 **8.3** *Replacement of the last paragraph with the following:*

482 *Compliance is checked by inspection and the following manual test:*

483 *Insertion of the appropriate accessory is tested for 1 min with a force of 150 N for accessories*
484 *with a rated current not exceeding 16 A, or 250 N for other accessories.*

485 *Where the use of elastomeric or thermoplastic material is likely to influence the result of the*
486 *test, it is carried out at an ambient temperature of (50 ± 2) °C, both the accessories being*
487 *conditioned at this temperature.*

488 **9 Protection against electric shock**

489 Clause 9 of IEC 60309-1 ED5 applies except as follows:

490 **9.1** *Replacement:*

491 Live contacts, when they are wired as in normal use, and when they are in partial or complete
492 engagement with the complementary accessories, shall not be accessible.

493 This requirement does not apply to contacts and conductors used for signal, data,
494 communication and control circuits operated according to IEC 61140:2016, 5.2.6.

495 In addition, it shall not be possible to make contact between live contacts and any other
496 conductive part which is accessible. This shall be ensured by the superordinate systems where
497 the accessories are embedded.

498 If the accessory is rated as having accessibility to live parts less than IPXXB, additional
499 measures by the superordinate system according to IEC 61140:2016, 5.2 shall be introduced,
500 except 5.2.6 and 5.2.8.

501 The measures to check the compliance are part of the intended standard for the superordinate
502 system.

503 *Compliance is checked by inspection and, if necessary, by a test on the sample wired as in*
504 *normal use.*

505 *The standard test finger according to IEC 61032 Probe B is applied in every possible position,*
506 *an electrical indicator, with a voltage not less than 40 V, being used to show contact with the*
507 *relevant part.*

508 *There shall be no contact.*

509 **9.2 Replacement:**

510 The contact sequence during the connection process shall be:

- 511 – guiding means (if any),
- 512 – earth contact PE (if any),
- 513 – power, signal, control contacts and screening (if any),
- 514 – the contact which establishes the communication shall mate at the latest in order to release
- 515 the current flow.

516 The unmating process applies in the reversed order.

517 **10 Provision for earthing**

518 Clause 10 of IEC 60309-1 ED5 applies, except as follows:

519 **10.3 Replacement:**

520 *Note of the convenors - Changed to I2t-approach as discussed in Bruxelles*

521 Earthing contacts shall be capable of carrying a sufficient current without overheating. Earthing
522 contacts shall be capable to be terminated with a protective earthing conductor or protective
523 conductor of sufficient cross-sectional area calculated by the I²t-methodology according to the
524 formula in 543.1.2 of IEC 60364-5-54:2011 by using I²tSUM. The I²tA -value used in the
525 calculation, shall be as specified by the manufacturer in his documentation for the accessory
526 Type A. The I²tB -value used in the calculation, shall be as specified by the manufacturer in his
527 documentation for the accessory Type B. The summarized I²t value shall be determined by the
528 equation:

529
$$I^2tSUM = ((I^2tA)^{0,5} + (I^2tB)^{0,5})^2$$

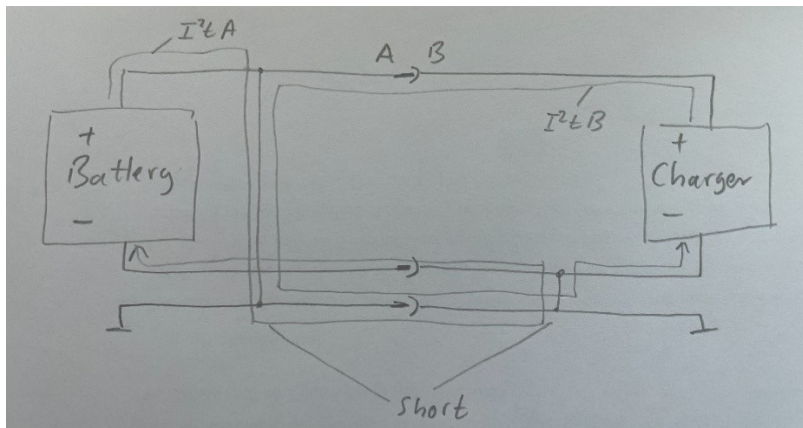
530 *Compliance is checked by inspection and the following test:*

- 531 – An assembly of mating accessories and conductors with a cross-sectional area as
532 calculated above or the next larger standardized cross-sectional area shall carry a current
533 for 1s calculated from I²tSUM.
- 534 – The mating accessories shall be mounted and assembled as intended. A protective earthing
535 conductor of the minimum intended size, not less than 0,6 m long, shall be connected to the
536 protective earthing terminal of each accessory, with the terminals employed to hold the
537 conductor tightened using a torque as specified by the manufacturer. The test current shall
538 be passed through the mating accessories and protective earthing wires in series.
- 539 – After having carried the current, continuity shall exist on the test assembly when measured
540 between the protective earthing conductors. There shall be no melting, cracking, arcing,
541 flashover between poles, contact welding or deformation to the extent that the integrity of
542 the accessory is impaired. Immediately after the test, the accessories shall comply with a
543 dielectric test in accordance with 17.

544 Note: The methodology is transferred from IEC CD 62196-3:ED3

545

Note of the convenors - Explanation just for the CD:



11 Terminals and terminations

Clause 11 of IEC 60309-1 ED5 applies, except as follows:

Additional subclause:

11.8 For other terminations, the relevant tests from IEC 60352 series applies.

12 Interlocks

Clause 12 of IEC 60309-1 ED5 applies.

13 Resistance to ageing of rubber and thermoplastic material

Clause 13 of IEC 60309-1 ED5 applies.

14 General construction

Clause 14 of IEC 60309-1 ED5 applies.

15 Construction of accessories

Clause 15 of IEC 60309-1 ED5 applies to accessories type A, except as follows: Subclauses 15.1 and 15.3 do not apply.

Clause 17 of IEC 60309-1 ED5 applies to accessories type B.

16 Degrees of protection

Clause 18 of IEC 60309-1 ED5 applies with the complementary accessory in engagement.

Accessories shall have the minimum degrees of protection as indicated in Table 7, test variable TV1.

The degree of protection shall apply to accessories in complete engagement only. The requirements for other conditions depend on the superordinate system.

Compliance is checked by the appropriate tests of IEC 60309-1 ED5, Clause 18.

17 Insulation resistance and dielectric strength

Clause 19 of IEC 60309-1 ED5 applies.

18 Mechanical endurance

Accessories shall withstand, without excessive wear or other harmful effect, the mechanical, stress occurring in normal use.

Type A and Type B accessories are mated and unmated at a rate of 7,5 strokes per minute.

After each 500 strokes, contacts pins, if any, are wiped with a piece of dry cloth or the equivalent dry cleaning maintenance operation is performed, as stated in the manufacturer's instructions.

During the test, the contacts of the accessories shall not be adjusted, lubricated or otherwise conditioned.

The number of cycles according to the relevant standard sheet or Annex B applies without load. In other cases, the number of cycles is given in Table 3.

After the test, the samples shall show:

- no wear impairing the further use of the accessory or of its interlock, if any;
- no deterioration of enclosures or barriers;
- no damage to the entry holes of the contacts that might impair proper working;
- no loosening of electrical or mechanical connections;
- no seepage of sealing compound.

The samples shall then withstand a dielectric strength test made in accordance with Clause 17, the test voltage, however, being decreased by 500 V for accessories having an insulation voltage exceeding 50 V.

NOTE The humidity treatment is not repeated before the dielectric strength test of Clause 0.

Table 3 – Mechanical endurance

Rating	Number of cycles
A	
Up to 29	5 000
30 to 59	2 000
60 to 99	2 000
100 to 199	500
200 to 250	250
>250	125

19 Temperature rise

Clause 22 of IEC 60309-1 ED5 applies.