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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.

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UK Vote

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Template for comments and secretariat observations

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



23K/80/CD

COMMITTEE DRAFT (CD)

PROJECT NUMBER: IEC 63445 ED1	
DATE OF CIRCULATION: 2022-11-18	CLOSING DATE FOR COMMENTS: 2023-02-10
SUPERSEDES DOCUMENTS: 23K/64/NP, 23K/67A/RVN	

IEC SC 23K : ELECTRICAL ENERGY EFFICIENCY PRODUCTS	
SECRETARIAT: France	SECRETARY: Mr Philippe Vollet
OF INTEREST TO THE FOLLOWING COMMITTEES: TC 8,TC 64,SC 121A	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:
System referencing conductor switching device

NOTE FROM TC/SC OFFICERS:
SC23K officers support this IEC 63445 CD circulation, and encourage each NC to comment.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

SYSTEM REFERENCING CONDUCTOR SWITCHING DEVICE

FOREWORD

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

Draft	Report on voting
23K/64/NP	XX/XX/RVN

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

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

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

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

- 235 • reconfirmed,
- 236 • withdrawn,
- 237 • replaced by a revised edition, or
- 238 • amended.

239

INTRODUCTION

IEC 60364-8-82 has the objective to ensure that the low-voltage electrical installation is compatible with the existing and future ways to deliver safely and functionally the electrical energy to current-using equipment wherever the electrical energy comes from the DSO or local generation. IEC 60364-8-82 provides requirements and recommendations that apply to low-voltage electrical installations connected or not to a distribution network able to operate:

- with local power supplies, and/or
 - with local storage units,
- and that monitors and controls the energy from the locally connected sources delivering it to:
- current-using equipment, and/or
 - local storage units, and/or
 - distribution networks.

Such electrical installations are designated as prosumer's electrical installations (PEIs). To realise such an PEI IEC 60364-8-82 specifies some parts. In case of an islandable PEI (principle overview out of IEC 60364-8-82: Figure 1 – Example of islandable PEI architecture) there is a “System referencing conductor switching device” (SRCSD), identified as device 5 in Figure 1.

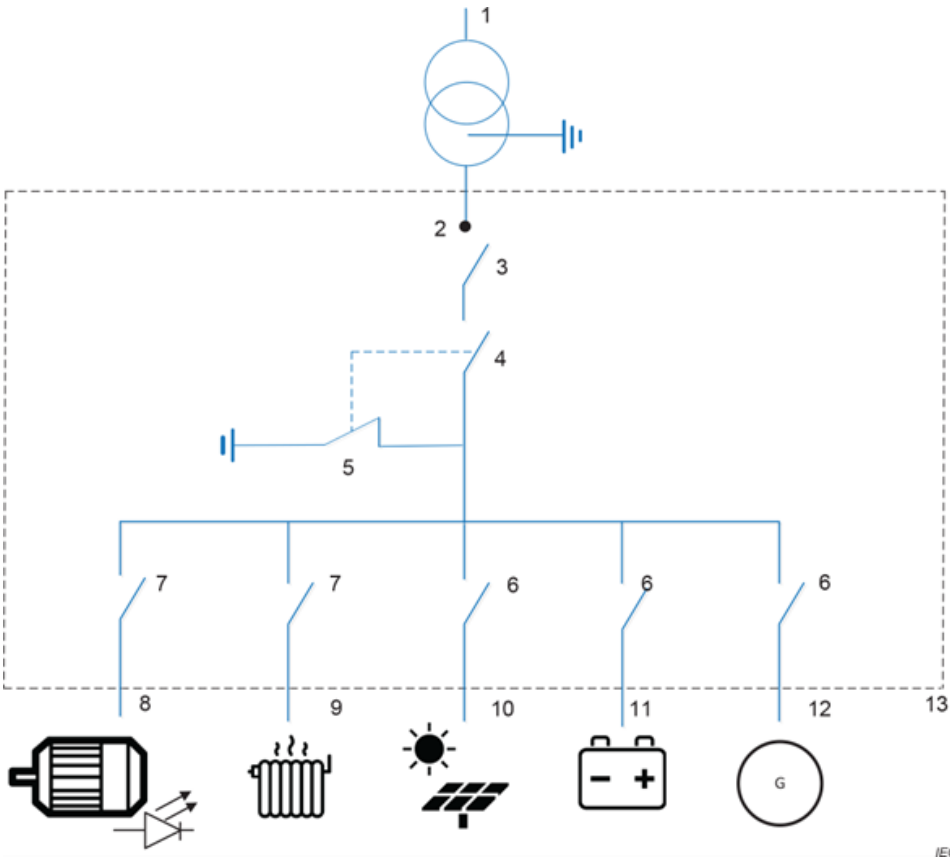


Figure 1 – Example of islandable PEI architecture

Key	
1	Distribution network
2	Point of connection (POC)
3	Main switching device
4	Switching device for islanding (SDFI)
5	System referencing conductor switching device
6	Source switching device
7	Load switching device
8	Non-sheddable loads (sensitive loads)
9	Sheddable loads (adjustable loads)
10	Solar generator
11	Electrical energy storage system
12	Other generator (wind, etc.)
13	Main distribution board

258 The objective of this document is to define the functionality and requirements of a System
259 referencing conductor switching device (SRCSD) which is in line with the specification given in
260 IEC 60364-8-82.

261

SYSTEM REFERENCING CONDUCTOR SWITCHING DEVICE

1 Scope

This standard applies to a system referencing conductor switching devices (SRCSD) for household and similar uses within a Prosumer's Electrical Installations (PEI).

A PEI is intended for operating either being connected to a distribution network or being disconnected from the distribution network (islanding mode).

Intentional disconnection from and connection to the distribution network relies on the local earthing system being switched by the SRCSD in addition unintentional loss of distribution network is covered.

The SRCSD is utilized for the conductor connecting one live conductor of the power system to an earthing arrangement.

The switching device for the system referencing conductor is interlocked with switching device for islanding (SDFI) of a Prosumer electrical installation.

NOTE: SRCSD can be integrated together with a SDFI in one device.

NOTE: see also IEC 60364-8-82 ED1

This standard applies to SRCSD for operation in AC single phase 230 V and multiphase circuits with rated voltages not exceeding 230/440 V AC, frequencies of 50 Hz, 60 Hz or 50/60 Hz.

NOTE: SRCSD for DC operations is under consideration

The requirements of this document apply for standard environmental conditions. They are applicable to SRCSD intended for use in an environment with pollution degree 2 and overvoltage categories III according to IEC 60664-1:2020. SRCSD have at least a degree of protection IP 20 according to IEC 60529. Additional requirements can be necessary for devices used in locations having more severe environmental conditions.

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.

To be added

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1**System referencing conductor switching devices (SRCSD)**

Device connected between the system referencing conductor and the local earthing arrangement of the PEI.

3.2**prosumer's electrical installation PEI**

low-voltage electrical installation connected or not to a distribution network able to operate:

- with local power supplies, and/or
- with local storage units,

and that monitors and controls the energy from the connected sources delivering it to:

- current-using equipment, and/or
- local storage units, and/or
- distribution networks...

[SOURCE: IEC 60364-8-82:2022, 82.3.7]

3.3**System referencing conductor**

conductor that connects one live conductor of the power system to an earthing arrangement

Note 1 to entry: The live conductor connected is the neutral or the mid-point if existing, or a line conductor when not existing.

[SOURCE: IEC 60364-8-82:2022, 82.3.19]

3.4**Switching device for islanding (SDFI)**

Device dedicated to change from connected mode to island mode and from island mode to connected mode for an islandable PEI

Note 1 to entry: In IEC TS 62786 the term used for switching device for islanding is "interface switch".

3.5**Connected mode**

operating mode in which the PEI is connected to the distribution network

[SOURCE: IEC 60364-8-82:2022, 82.3.12, modified – removed the Example]

3.6**Island mode**

operating mode in which the PEI is disconnected from the distribution network

Note 1 to entry: An island mode can be either the result of the action of automatic protections or the result of a deliberate action.

[SOURCE: IEC 60050-617:2017, 617-04-12, modified – The definition has been adapted to the PEI (IEC 60364-8-82, 82.3.13.)]

3.7**islandable PEI**

PEI intended for operating either being connected to a distribution network or being disconnected from the distribution network

345 Note 1 to entry: An islandable PEI is in a connected mode or an intentionally island mode.

346 [SOURCE: IEC 60364-8-82:2022, 82.3.16]

347 **3.8**

348 **Transition time to close**

349 Time between the order to connect to local earth until the feedback that local earth connection
350 is established

351 **3.9**

352 **Transition time to open**

353 Time between the order to disconnect local earth until the feedback that local earth connection
354 is opened

355 **4 Classification**

356 **4.1 According to method of operation**

- 357 – Controlled switching device which is interlocked with SDFI
- 358 – Manual controlled switching device which is interlocked with SDFI

359 **4.2 Method of interlocking**

- 360 – - electrically
- 361 – - mechanically

362 **4.3 According to the method of mounting**

363 Panel board type SRCSD, also referred to as distribution board type

364 NOTE These types can be intended to be mounted on rails.

365 **4.4 According to the type of terminals**

366 **4.4.1 SRCSD with screw-type terminals for external copper conductors**

367 **4.4.2 SRCSD with screwless type terminals for external copper conductors**

368 **4.4.3 SRCSD with flat quick-connect terminals for external copper conductors**

369 **5 Characteristics of SRCSD**

370 **5.1 Type of Isolation**

- 371 – Suitable for isolation
- 372 – Non-suitable for isolation

373 NOTE: IEC 60364-8-82 ED1 requires isolation for SRCSD

374 **5.2 Rated short-circuit capability**

375 *Values for 5.2.1 and 5.2.2 to be discussed as the fault current relates to the converters used.*

376 **5.2.1 Short-circuit making capability**

377 In case SRCSD is closing to island mode

5.2.2 Short-circuit withstand capability

In case SRCSD is closed when a fault in island mode appears

5.3 Switching sequence

– Transition time to close

– Transition time to open

5.4 Preferred number of Operating cycles

– 6.000,

– 12.000,

– 25.000

The SRCSD shall provide functions as described in clause 82.8.2.2.4 of IEC 60364-8-82 (64/2559/FDIS)

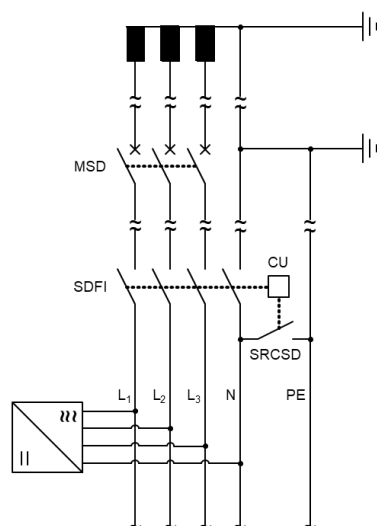
5.5 Operation type

The SRCSD shall have two stable states. After loss of supply the position of the switch shall not change.

5.6 Operation

Operation to switch from connected mode to islanding mode. The SRCSD shall be closed after the SDFI opens.

Operation to switch from islanding mode to connected mode. The SRCSD shall be closed after the SDFI opens.



MSD – Main switching device
SDFI – Switching device for islanding
SRCSD – System referencing conductor switching device
~ – Symbol demonstrate that the cable length is not defined. MSD and SDFI can be separate devices remote from each other

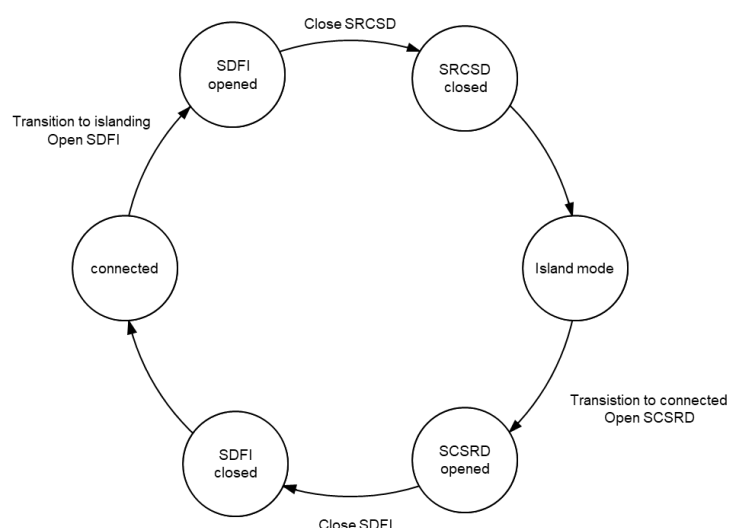


Figure 2 –operation of a SRCSD

The SRCSD operates without a voltage difference but shall be capable to carry and withstand its rated short-circuit capacity

(Secretary note: this value shall be clarified with IEC/TC64 JWG 44 and/or IEC/TC82).

6 Product information

6.1 Nature of information

6.1.1 Identification

- a) manufacturer's name or trade mark;
- b) type designation or serial number;
- c) reference to the product standard.

6.1.2 Classification

- d) Methode of Operation (see 4.1)
- e) Method of interlocking (see 4.2);
- f) Method of mounting (see 4.3);
- g) Type of terminals (see 4.4);

6.1.3 Characteristics

- h) Type of isolation (see 5.1);
- i) Rated short-circuit capability (see 5.2);
- j) Transition time to close (see 5.3);
- k) Transition time to open (see 5.3);
- l) Operating cycles (see 5.4);

6.2 Marking

Identification of SRCSD shall comply with Table 1.

Markings shall be easily legible, durable and indelible. They shall not be placed on screws, washers or other removable parts.

Compliance is checked by inspection and by the tests of 9.3. Markings made by impression, moulding or engraving are not subjected to this test.

7 Standard conditions for operation in service and for installation

7.1 Standard conditions

SRCSD shall be capable of operating under the standard conditions shown in Table 12.

8 Requirements for construction and operation

8.1 Mechanical design

8.1.1 General

A SRCSD shall be designed and constructed so that, in normal use, the use is safe and without danger to the user or to the environment.

8.1.2 Mechanism

The SRCSD shall be designed and constructed so that in case of loss control supply or re-establishment of voltage the position keeps unchanged. The mechanism of SRCSD shall have two rest positions.

Closed position shall be reliable to ensure continuity of the earth connexion in islanded mode.

Indication of closed position shall be reliable (locally and remotely if relevant).

8.1.3 Clearances, creepage distances and solid insulation

8.1.3.1 General

The minimum required clearances and creepage distances are given in Table 3 which is based on the SRCSD being designed for operating in an environment with pollution degree 2.

Parts of PCBs connected to the live parts protected against pollution by the use of a type 2 protection according to IEC 60664-3 are exempt from this verification.

The insulating materials are classified into material groups on the basis of their comparative tracking index (CTI) according to IEC 60664-1.

NOTE 1 The comparative tracking index (CTI) is declared by the manufacturer on the basis of tests carried out on the insulating material.

NOTE 2 Information on the requirements for design of solid insulation is provided in IEC 60664-1.

NOTE 3 For clearances on printed wiring material, Note c in Table F.2 of IEC 60664-1:2020 applies: "For printed wiring material, the values for pollution degree 1 apply except that the value shall not be less than 0,04 mm, as specified in Table F.5. A protection by means of a solder resist of high quality is the minimum requirement to allow this clearance reduction".

NOTE 4 All measurements required in this subclause are carried out in Test Sequence A on one sample. Tests according to 9.7 are carried out in Test Sequence B on three samples.

8.1.3.2 Clearances

For SRCSD suitable for Isolation (5.1) Compliance for item 1 in Table 3 is checked by measurement and by the tests of 9.7.7.3. The test is carried out with samples not submitted to the humidity treatment described in 9.7.1.

For SRCSD non-suitable for Isolation (5.1) Value to be considered.

Compliance for items 2 and 4 in Table 3 is checked by measurement and, if the clearances are reduced, by the tests of 9.7.7.2.

The clearances of items 2 and 4 (except accessible surface after installation, see the note below) may be reduced provided that the measured clearances are not shorter than the minimum allowed in IEC 60664-1 for homogenous field conditions. In this case, compliance for items 2 and 4 is always checked by the test of 9.7.7.2.

NOTE Accessible surface after installation means any surface accessible by the user when the RCD is installed according to the manufacturer's instructions. The test finger can be applied to determine whether a surface is accessible or not.

Compliance for item 3 in Table 3 is checked by measurement.

8.1.3.3 Creepage distances

Compliance for items 1, 2, 3 and 4 in Table 3 is checked by measurement. (Distinguish between suitable and non-suitable for isolation)

8.1.3.4 Solid insulation

Compliance is checked by the tests according to 9.7.2, 9.7.3, 9.7.4, 9.7.5 and 9.7.7 as applicable.

8.1.3.5 Additional requirements for control circuits connected to the main circuit

Compliance is checked by the test of 9.7.6.

8.1.4 Screws, current-carrying parts and connections

8.1.4.1 Connections

Connections, whether electrical or mechanical, shall withstand the stresses occurring in normal use.

Screws operated when mounting the SRCSD during installation shall not be of the thread-cutting type.

NOTE 1 Screws (or nuts) which are operated when mounting the SRCSD include screws for fixing covers or cover-plates, but not connecting means for screwed conduits and for fixing the base of a SRCSD.

NOTE 2 Screwed connections are also considered to be checked by the tests of 9.8, 9.11, 9.12, 9.13 and 9.17.

Compliance is checked by inspection, by manual test and by the test of 9.4.

8.1.4.2 Screws in engagement with a thread of insulating material

For screws in engagement with a thread of insulating material and which are operated when mounting the SRCSD during installation, correct introduction of the screw into the screw hole or nut shall be ensured.

Compliance is checked by inspection and by manual test.

The requirement with regard to correct introduction is met if introduction of the screw in a slanting manner is prevented, for example by guiding the screw by the part to be fixed, by a recess in the female thread or by the use of a screw with the leading thread removed.

8.1.4.3 Electrical connections

Electrical connections shall be so designed that contact pressure is not transmitted through insulating material other than ceramic, pure mica or other material with characteristics no less suitable, unless there is sufficient resilience in the metallic parts to compensate for any possible shrinkage or yielding of the insulating material.

Compliance is checked by inspection.

NOTE The suitability of the material is considered in respect of the stability of the dimensions.

8.1.4.4 Current-carrying parts

Current-carrying parts and parts intended for protective conductors, if any, shall be made of a metal having, under the conditions occurring in the equipment, mechanical strength, electrical conductivity and resistance to corrosion adequate for their intended use.

Examples of suitable materials are given below:

- copper;
- an alloy containing at least 58 % copper for parts worked cold, or at least 50 % copper for other parts;
- other metal or suitably coated metal, no less resistant to corrosion than copper and having mechanical properties no less suitable.

In case of using ferrous alloys or suitably coated ferrous alloys, compliance to resistance to corrosion is checked by a test of resistance to rusting according to 9.19.

These requirements do not apply to contacts, magnetic circuits, heater elements, bimetals, shunts, electronic components, including printed circuit boards, nor to screws, nuts, washers, clamping plates, similar parts of terminals and parts of the test circuit.

8.1.5 Terminals for external conductors

8.1.5.1 Terminals for external conductors shall be such that the conductors may be connected so as to ensure that the necessary contact pressure is maintained permanently.

Connection arrangements intended for busbar connection are admissible, provided they are not used for the connection of cables.

The terminals shall be readily accessible under the intended conditions of use.

Compliance is checked by inspection, by the tests of 9.5 for screw-type terminals, by specific tests for plug-in or bolt-on SRCSD included in this document, or by the tests of Parts 3-1, 3-2 and 3-3 of IEC 62873, as relevant for the type of connection.

8.1.5.2 SRCSD shall be provided with:

- either terminals which shall allow the connection of copper conductors having nominal cross-sectional areas as shown in Table 7;

NOTE Examples of possible designs of screw-type terminals are given in Annex D.

- or screwless type terminals for external copper conductors according to IEC 62873-3-1;
- or flat quick-connect terminals for external copper conductors according to IEC 62973-3-2;
- or terminals for external untreated aluminium conductors and with aluminium screw-type terminals for use with copper or with aluminium conductors according to IEC 62873-3-3.

Compliance for terminals according to first indent, is checked by inspection, by measurement and by fitting, in turn, one conductor of the smallest and one of the largest cross-sectional area as specified in Table 7.

8.1.5.3 The means for clamping the conductors in the terminals shall not serve to fix any other component, although they may hold the terminals in place or prevent them from turning.

Compliance is checked by inspection.

8.1.5.4 Terminals for rated currents up to and including 32 A shall allow the conductors to be connected without special preparation.

Compliance is checked by inspection.

NOTE The term "special preparation" covers soldering of wire of the conductor, use of cable lugs, formation of eyelets, etc., but not the reshaping of the conductor before its introduction into the terminal or the twisting of a flexible conductor to consolidate the end.

8.1.5.5 Terminals shall have adequate mechanical strength.

Screws and nuts for clamping the conductors shall have a metric ISO thread or a thread comparable in pitch and mechanical strength.

Compliance is checked by inspection and by the tests of 9.4 and 9.5.3.

8.1.5.6 Terminals shall be so designed that they clamp the conductor without undue damage to the conductor.

Compliance is checked by inspection and by the test of 9.5.3.

8.1.5.7 Terminals shall be so designed that they clamp the conductor reliably and between metal surfaces.

Compliance is checked by inspection and by the tests of 9.4 and 9.5.3.

8.1.5.8 Terminals shall be so designed or positioned that neither a rigid solid conductor nor a wire of a stranded conductor can slip out while the clamping screws or nuts are tightened.

This requirement does not apply to lug terminals.

Compliance is checked by the test of 9.5.3.

8.1.5.9 Terminals shall be so fixed or located that, when the clamping screws or nuts are tightened or loosened, their fixings do not work loose.

These requirements do not imply that the terminals shall be so designed that their rotation or displacement is prevented, but any movement shall be sufficiently limited so as to prevent non-compliance with the requirements of this document.

The use of sealing compound or resin is considered to be sufficient for preventing a terminal from working loose, provided that

- the sealing compound or resin is not subject to stress during normal use;
- the effectiveness of the sealing compound or resin is not impaired by temperatures attained by the terminal under the most unfavourable conditions specified in this document.

Compliance is checked by inspection, by measurement and by the test of 9.4.

8.1.5.10 Clamping screws or nuts of terminals intended for the connection of protective conductors shall be adequately secured against accidental loosening and it shall not be possible to unclamp them without the use of a tool.

Compliance is checked by manual test.

In general, the designs of terminals of which examples are shown in Annex D provide sufficient resilience to comply with this requirement; for other designs special provisions, such as the use of an adequately resilient part which is not likely to be removed inadvertently, may be necessary.

8.1.5.11 Screws and nuts of terminals intended for the connection of external conductors shall be in engagement with a metal thread and the screws shall not be the thread cutting type

Compliance is checked by inspection.

8.2 Protection against electric shock

SRCS D shall be so designed that, when they are mounted and wired as for normal use, live parts are not accessible.

A part is considered to be "accessible" if it can be touched by the standard test finger (Figure 3).

NOTE The term "normal use" implies that SRCS D be installed according to the manufacturer's instructions.

For SRCS D other than those of the plug-in type, external parts, other than screws or other means for fixing covers and labels, which are accessible when the SRCS D are mounted and

598 wired as in normal use, shall either be of insulating material, or be lined throughout with
599 insulating material.

600 Linings shall be fixed in such a way that they are not likely to be lost during installation of the
601 SRCSD. They shall have adequate thickness and mechanical strength and shall provide
602 adequate protection at places where sharp edges occur.

603 Inlet openings for cables or conduits shall either be of insulating material or be provided with
604 bushings or similar devices of insulating material. Such devices shall be reliably fixed and shall
605 have adequate mechanical strength.

606 For plug-in SRCSD, external parts other than screws or other means for fixing covers, which
607 are accessible for normal use, shall be of insulating material.

608 Metallic operating means shall be insulated from live parts and their conductive parts which
609 otherwise would be "exposed conductive parts" shall be covered by insulating material, with the
610 exception of means for coupling insulated operating means of several poles.

611 Metal parts of the mechanism shall not be accessible. In addition, they shall be insulated from
612 accessible metal parts, from metal frames supporting the base of flush-type SRCSD, from
613 screws or other means for fixing the base to its support and from metal plates used as support.

614 It shall be possible to replace plug-in SRCSD easily without touching live parts.

615 Lacquer and enamel are not considered to provide adequate insulation for the purpose of this
616 subclause.

617 *Compliance is checked by inspection and by the test of 9.6.*

618 **8.3 Dielectric properties and isolating capability**

619 SRCSD shall have adequate dielectric properties.

620 Control circuits connected to the main circuit shall not be damaged by high DC voltage due to
621 insulation measurements which are normally carried out after SRCSD are installed.

622 SRCSD according to 5.1 suitable for isolation shall ensure isolation.

623 *Compliance is checked by the tests of 9.7.*

624 **8.4 Temperature-rise**

625 **8.4.1 General**

626 The SRCSD shall not suffer damage impairing its functions and its safe use taking into account
627 the ambient air temperature at which they are intended to be used.

628 *Compliance is checked by the tests of 9.8.*

629 **8.4.2 Temperature-rise limits**

630 The temperature-rises of the parts of a SRCSD specified in Table 11, measured under the
631 conditions specified in 9.8.2, shall not exceed the limiting values stated in Table 11.

632 **8.4.3 Ambient air temperature**

633 The temperature-rise limits given in Table 11 are applicable only if the ambient air temperature
634 remains between the limits given in Table 12.

8.5 Mechanical and electrical endurance

SRCS D shall be capable of performing an adequate number of mechanical and electrical operations.

Compliance is checked by the test of 9.10.

8.6 Performance at short-circuit currents

SRCS D shall be capable of performing a specified number of short-circuit operations during which they shall neither endanger the operator nor initiate a flashover between live conductive parts or between live conductive parts and earth.

Compliance is checked by the tests of 9.11.

8.7 Resistance to mechanical shock and impact

SRCS D shall have adequate mechanical behaviour so as to withstand the stresses imposed during installation and use.

Compliance is checked by the test of 9.12.

8.8 Resistance to heat

SRCS D shall be sufficiently resistant to heat.

Compliance is checked by the test of 9.13.

8.9 Resistance to abnormal heat and to fire

External parts of SRCS D made of insulating material shall not be liable to ignite and to spread fire if current-carrying parts in their vicinity, under fault or overload conditions, attain a high temperature. The resistance to abnormal heat and to fire of the other parts made of insulating material is considered as checked by the other tests of this document.

Compliance is checked by inspection and by the test of 9.14.

8.10 Reliability

SRCS D shall operate reliably even after long service, taking into account the ageing of their components.

Compliance is checked by the tests of 9.16 and 9.17.

8.11 Electromagnetic compatibility (EMC)

SRCS D shall operate reliably, even in presence of electromagnetic disturbances, and shall comply with relevant EMC requirements.

Compliance is checked by the tests of 9.18.

9 Tests

9.1 General

The characteristics of SRCS D are checked by means of type tests.

For certification purposes, type tests are carried out in test sequences

669 NOTE The term "certification" denotes:

670 – either manufacturer's declaration of conformity; or

671 – third-party certification, for example by an independent certification body.

672 The test sequences and the number of samples are provided in Annex A.

673 Unless otherwise specified, each type test (or sequence of type tests) is made on SRCSD in a
674 clean and new condition, the influencing quantities having their normal reference values (see
675 Table 12).

676 9.2 Test conditions

677 The SRCSD is mounted individually according to manufacturer's instructions and in free air, at
678 an ambient air temperature equal to 20 °C, unless otherwise specified, and is protected against
679 undue external heating or cooling.

680 SRCSD designed for installation in individual enclosures are tested in the smallest of such
681 enclosures specified by the manufacturer.

682 NOTE 1 An individual enclosure is an enclosure designed to accept one device only.

683 Unless otherwise specified, the SRCSD is wired with the appropriate cable of cross-section S
684 specified in Table 8 and is fixed on a dull black painted plywood board not less than 20 mm
685 thickness, the method of fixing being in compliance with the requirements relating to the
686 indications of the manufacturer concerning mounting.

687 NOTE 2 For AWG copper conductors, see Annex E.

688 Where tolerances are not specified, type tests are carried out at values not less severe than
689 those specified in this document. Unless otherwise specified, tests are carried out at the rated
690 frequency $\pm 5\%$.

691 During the tests, no maintenance or dismantling of the samples is allowed.

692 For the tests of 9.8, 9.9, 9.10, 9.16.2 and 9.17, the SRCSD is connected as follows:

- 693 – the connections are made by means of single-core, PVC-insulated copper cables;
- 694 – the connections are in free air and spaced not less than the distance existing between the
695 terminals;
- 696 – the minimum length of each temporary connection from terminal to terminal is
 - 697 • 1 m for cross-sections up to and including 10 mm²;
 - 698 • 2 m for cross-sections larger than 10 mm².

699 The tightening torques to be applied to the terminal screws are two-thirds of those specified in
700 Table 9.

701 For SRCSD with dependent manual operation, an operating speed of 0,1 m/s $\pm 25\%$ shall be
702 used during actuation for the tests of 9.10 and 9.11. The speed is measured at the extremity
703 when and where the operating means of the test apparatus touches the actuating means of the
704 SRCSD under test. For rotary knobs, the angular velocity shall correspond substantially to the
705 above conditions, referred to the speed of the operating means (at its extremities) of the SRCSD
706 under test.

707 NOTE 3 In Japan, on request of the manufacturer, a different operating speed can be used for tests in 9.10 and
708 9.11.

9.3 Test of indelibility of marking

The test is made by rubbing the marking by hand for 15 s with a piece of cotton soaked with water and again for 15 s with a piece of cotton soaked with aliphatic solvent hexane with a content of aromatics of maximum 0,1 % volume, initial boiling point approximately 65 °C, dry point approximately 69 °C and specific gravity of 0,68 g/cm³.

Aliphatic solvent hexane having both the main composition required by this document and CAS No. 110-54-3 is acceptable

Marking made by impressing, moulding, engraving or laser printing is not subjected to this test.

After this test, the marking shall be easily legible. The marking shall also remain easily legible after all the tests of this document.

It shall not be easily possible to remove labels and they shall show no curling.

9.4 Test of reliability of screws, current-carrying parts and connections

Compliance with the requirements of 8.1.4 is checked by inspection and, for screws and nuts which are operated when connecting the SRCSD, by the following test.

The screws or nuts are tightened and loosened:

- 10 times for screws in engagement with a thread of insulating material;
- 5 times in all other cases.

Screws or nuts in engagement with a thread of insulating material are completely removed and re-inserted each time.

The test is made by means of a suitable test screwdriver or spanner applying a torque as shown in Table 9.

The screws and nuts shall be tightened in one smooth and continuous motion.

The test is made with rigid conductors only, having the largest connectable cross-sectional areas specified in Table 7, solid or stranded, whichever is the more unfavourable. The conductor is moved each time the screw or nut is loosened.

Column I applies to screws without head if the screw, when tightened, does not protrude from the hole, and to other screws which cannot be tightened by means of a screwdriver with a blade wider than the diameter of the screw.

Column II applies to other screws which are tightened by means of a screwdriver.

Column III applies to screws and nuts which are tightened by means other than a screwdriver.

Where a screw has a hexagonal head with a slot for tightening with a screwdriver and the values in columns II and III are different, the test is made twice, first applying to the hexagonal head the torque specified in column III and then, on another sample, applying the torque specified in column II by means of a screwdriver. If the values in columns II and III are the same, only the test with the screwdriver is made.

During the test, the screwed connections shall not work loose and there shall be no damage, such as breakage of screws or deterioration to the head slots, threads, washers or stirrups, that will impair the further use of the SRCSD.

Moreover, enclosures and covers shall not be damaged.