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Date: 28 May 2019

Origin: International

Latest date for receipt of comments: 16 July 2019

Project No. 2015/00653

Responsible committee: PEL/23 Electrical accessories

Interested committees:

Title: Draft BS EN IEC 62991 Particular requirements for Source-Switching Equipment (SSE).

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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/46/CD

COMMITTEE DRAFT (CD)

PROJECT NUMBER:

IEC 62991 ED1

DATE OF CIRCULATION:

2019-05-24

CLOSING DATE FOR COMMENTS:

2019-08-16

SUPERSEDES DOCUMENTS:

23K/10/NP, 23K/18/RVN

IEC SC 23K : ELECTRICAL ENERGY EFFICIENCY PRODUCTS

SECRETARIAT:

France

SECRETARY:

Mr Philippe Vollet

OF INTEREST TO THE FOLLOWING COMMITTEES:

TC 23, TC 64

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:

Particular requirements for Source-Switching Equipment (SSE)

NOTE FROM TC/SC OFFICERS:

SC23K officers support this IEC 62991 CD circulation, and encourage each NC to comment. SC23K officers and WG1 experts agreed to rename this IEC 62991 "PARTICULAR REQUIREMENTS FOR SOURCE-SWITCHING EQUIPMENT (SSE)" instead of "Particular requirements for switching equipment to control power sources (SECPS)" for more consistency SC23K other future publications.

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**PARTICULAR REQUIREMENTS FOR
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International Standard IEC 62962 has been prepared by subcommittee 23K: Electrical Energy Efficiency products, of IEC technical committee 23: Electrical accessories.

The text of this standard is based on the following documents:

FDIS	Report on voting
23K/XX/FDIS	23K/XX/RVD

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

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

In this standard, the following print types are used:

- *conformity statements: in italic type.*

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

- 379 • reconfirmed,
- 380 • withdrawn,
- 381 • replaced by a revised edition, or
- 382 • amended.

383

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386

INTRODUCTION

387 Historically, utilities were managing the public transmission and distribution network from the
388 point of view of having a central production adapted to demand variation, a top-down energy
389 flow, a production/consumption balance done by integrated utility companies and with rather
390 passive users.

391 The following key factors are pushing the public electricity network to change:

- 392 – the increasing number of electric devices used daily and the growing needs as well as
393 future needs (e.g. charging electric vehicles) will result in the structural growing of
394 electricity consumption;
- 395 – the mediated pressure on climate change results in pressure on CO₂ emissions reduction;
- 396 – the electricity market is also quickly changing due mainly to its unbundling and
397 deregulation, and to the greater number of intermittent renewable energy sources (global
398 and local);
- 399 – users' expectations are also evolving as a result of an increasing need for better public
400 networks reliability and quality, the search for better economic performance and the
401 willingness to pro-actively manage their energy;
- 402 – technological evolution should also be considered as information and communication
403 technology (ICT) is affordable and new energy storage solutions are emerging;

404 All stakeholders directly involved in the electricity generation, transmission, distribution and
405 consumption have new expectations:

- 406 – customers are willing to reduce electrical energy costs in order to meet environment
407 targets (renewable energy, energy efficiency) but also wish to benefit from the quality of
408 electricity supply;
- 409 – suppliers wish to limit customer churn rate with price and service management;
- 410 – producers expect to maximize their yield of assets, to optimize their investments and to
411 take profit from energy trading;
- 412 – the aggregator wants to create conditions suitable for new market emergence;
- 413 – the transmission system operator (TSO) aspires to a robust transmission public network
414 and to meet regulation objectives (price and level of services), while the distribution
415 system operator (DSO) wants to meet regulation objectives (price and level of services),
416 to reduce costs by productivity (including meter) and to have a flexible network;
- 417 – suppliers wish to limit customer churn rate with price and service management;
- 418 – finally, governments and regulators are willing to create a competitive and sustainable
419 energy market.

420 In household and similar applications, an installation owner may consider independently the
421 supervision and the control of different power supplies connected to the low-voltage electrical
422 installation in order to supply in efficient and cost-effective ways all the electrical loads
423 connected to this low-voltage electrical installation.

424 Local production of electricity may be used locally or may be sent back through the public
425 network. In such a case the local consumer is to be considered as a traditional consumer of
426 electrical energy and as a producer of electrical energy.

427 The optimization of the use of electricity is based on the use of an electrical energy
428 management system (EEMS) based on the price of electricity, electrical consumption, energy
429 availability (from public network and local production or storage) and real-time adaptation
430 (See Figure 1).

431

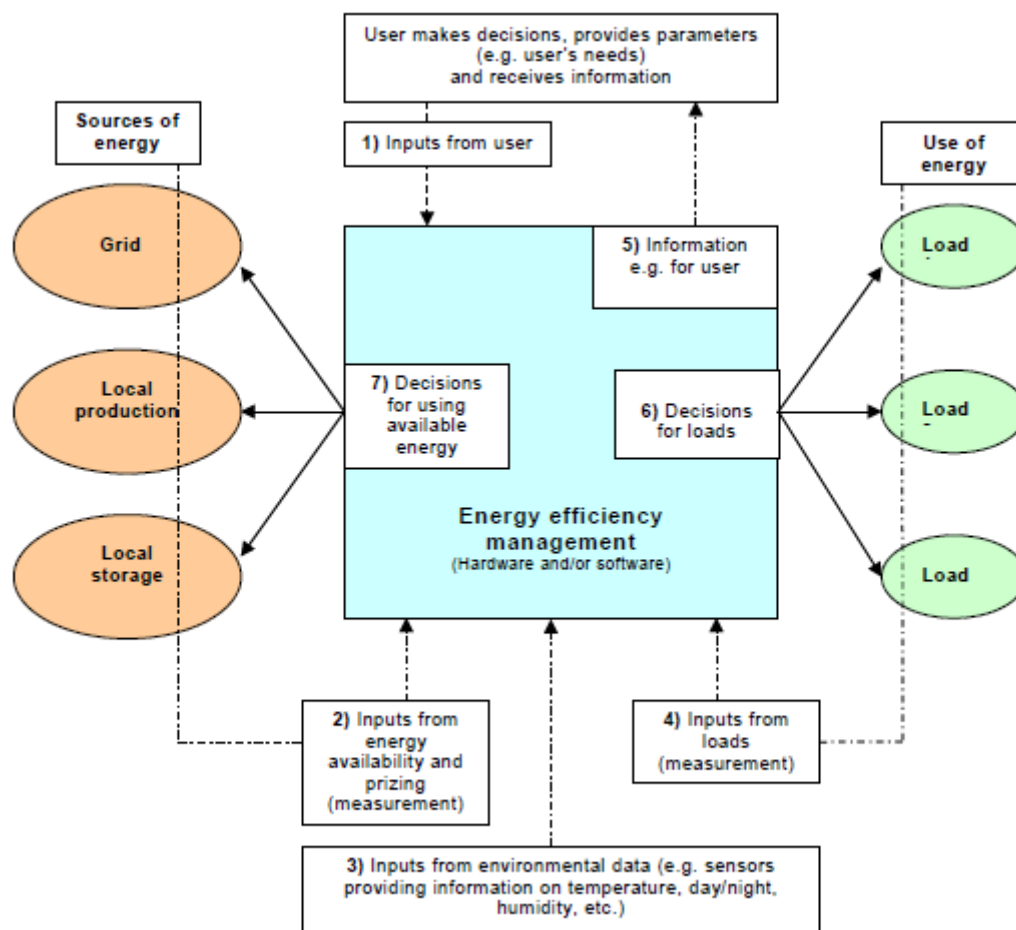


Figure 1 – Energy Efficiency Management System (EEMS)

The objective of this document is to specify the requirement for the Source Switching Equipment (See Figure 2):

- to make transparent to the end-user the energy sources;
- taking into account the generation/storage;
- to optimize the electrical energy either from the public network or from other local sources/storage.

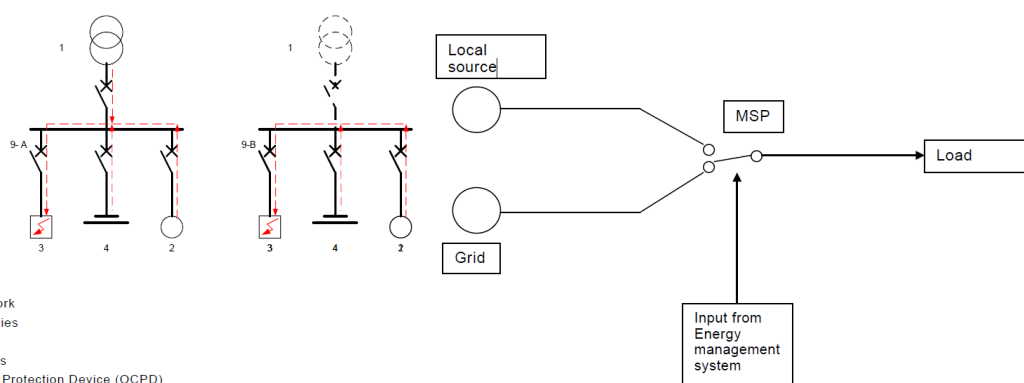


Figure 2 – Principle of management of 2 sources with a Source Switching Equipment (SSE)

446 Note: figure is to be modified not to indicate protection devices.

447 NOTE Examples of use of SSE are given Annex B.

448 The main operating modes presented in this document are the following:

- 449 – direct feeding mode: corresponding to the normal supply from the public network. Storage
450 units can supply current-using-equipment or be charged by public network or local power
451 supplies;
- 452 – autonomous mode: Supplying of load by local source and storage units, disconnected from
453 the public network;
- 454 – reverse feeding mode: corresponding to the supply of public network. Storage units can
455 supply current-using-equipment and/or public network or be charged by local power
456 supplies.

457 Transfer from/to the Direct feeding mode to Autonomous mode and vice versa can be
458 achieved by the operation of the source switching equipment (SSE); this can be either directly
459 controlled (manually or remotely) or automatically controlled.

460

461

462

PARTICULAR REQUIREMENTS FOR SOURCE-SWITCHING EQUIPMENT (SSE)

1 Scope

This International Standard applies to Source Switching Equipment, hereafter referred to as SSE(s), for household and similar uses intended to be installed in low voltage electrical installations with local production and/or storage of energy to ensure the compatibility with the existing and future ways to deliver the electrical energy to current-using equipment or the public network. SSEs are primarily intended to be used for Energy Efficiency purposes.

Source Switching Equipment enable the loads to be supplied either from local sources, from the public network or both.

SSEs are intended to select and/or combine power sources (grid, local power source, storage units) within an Electrical Energy Management system (EEMS). SSEs may also be used for backup supply.

SSEs are a combination of switching devices and a control unit (controller).

SSEs are part of the fixed electrical installation.

This standard applies to SSE for operation in

- AC single or multiphase circuits with rated voltages not exceeding 440 V AC, frequencies of 50 Hz, 60 Hz or 50/60 Hz and rated currents not exceeding 125 A. They are intended to be used in installations with prospective short circuit current not exceeding 25 000 A, or
- DC circuits¹.

The SSE may be operated:

- manually (M-SSE), or
- remotely (R-SSE), or
- automatically (A-SSE), or
- a combination of the above methods of operation, e.g. manual and remote.

SSEs may be constructed either as a non-combined product, or by combining products such as:

- switches complying with IEC 60669 series, or
- circuit-breakers complying with IEC 60898 series, or
- contactors complying with IEC 61095:2009.

SSEs are intended for use in circuits where protection against electrical shock and over-current according to IEC 60364 series is provided, unless the SSE already contains such protective device.

The requirements of this standard apply for standard environmental conditions as given in clause 7. They are applicable to SSEs intended for use in an environment with pollution degree 2 and overvoltage categories III or IV according to IEC 60664-1:2007. SSEs have at least a degree of protection IP 20. Additional requirements may be necessary for devices used in locations having more severe environmental conditions.

¹ SSE for DC circuits are under consideration.

504 SSEs do not, by their nature, provide an isolation function nor the overcurrent protection.
505 However, the isolation and over current protection functions as covered by relevant product
506 standards may be provided by combined SSE.

507 NOTE SSE with more than two sources of supply are under consideration.

508 2 Normative references

509 The following documents are referred to in the text in such a way that some or all of their
510 content constitutes requirements of this document. For dated references, only the edition
511 cited applies. For undated references, the latest edition of the referenced document (including
512 any amendments) applies.

513 IEC 60050-195:1998, *International electrotechnical vocabulary - Part 195: Earthing and*
514 *protection against electric shock*

515 IEC 60065:2001, "Audio, video and similar electronic apparatus - Safety requirements"

516 IEC 60127, *Miniature fuses - Part 1: Definitions for miniature fuses and general requirements*
517 *for miniature fuse-links*

518 IEC 60212, *Standard conditions for use prior to and during the testing of solid electrical*
519 *insulating materials*

520 IEC 60317-0-1:1997, *Specifications for particular types of winding wires - Part 0-1: General*
521 *requirements - Enamelled round copper wire*

522 IEC 60364 (all parts), *Low-voltage electrical installations*

523 IEC 60364-8-1:2019, *Low voltage electrical installations- Part 8-1: Functional aspects -*
524 *Energy efficiency*

525 IEC 60364-8-2:2018, *Low voltage electrical installations- Part 8-2: Prosumer's low-voltage*
526 *electrical installations*

527 IEC 60384-14:1993, *Fixed capacitors for use in electronic equipment – Part 14: Sectional*
528 *specification – Fixed capacitors for electromagnetic interference suppression and connection*
529 *to the supply mains*

530 IEC 60664-1:2007, *Insulation coordination for equipment within low-voltage systems - Part 1:*
531 *Principles, requirements and tests*

532 IEC 60664-3, *Insulation coordination for equipment within low-voltage systems - Part 3: Use*
533 *of coating, potting or moulding for protection against pollution*

534 IEC 60669-1:2017, *Switches for household and similar fixed-electrical installations - Part 1:*
535 *General requirements*

536 IEC 60695-2-10:2000, *Fire hazard testing - Part 2-10: Glowing/hot-wire based test methods -*
537 *Glow-wire apparatus and common test procedure*

538 IEC 60695-2-11:2000, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods –*
539 *Glow-wire flammability test method for end-products (GWEPT)*

540 IEC 60730, *Automatic electrical controls*

541 IEC 60898-1:2015, *Electrical accessories - Circuit-breakers for overcurrent protection for*
542 *household and similar installations - Part 1: Circuit-breakers for AC operation*

- 543 IEC 60947-1:2014, *Low-voltage switchgear and controlgear - Part 1: General rules*
- 544 IEC 60947-4-1:2018, *Low-voltage switchgear and controlgear - Part 4-1: Contactors and*
545 *motor-starters – Electromechanical contactors and motor-starters*
- 546 IEC 60947-6-1:2016, *Low-voltage switchgear and controlgear - Part 6-1: Multiple function*
547 *equipment – Transfer switching equipment)*
- 548 IEC 61000-2-2, *Electromagnetic compatibility (EMC) - Part 2-2: Environment - Compatibility*
549 *levels for low-frequency conducted disturbances and signaling in public low-voltage power*
550 *supply systems*
- 551 IEC 61000-3-2, *Electromagnetic compatibility (EMC). Part 3-2. Limits. Limits for harmonic*
552 *current emissions (equipment input current 16 A per phase)*
- 553 IEC 61000-4-2, *Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement*
554 *techniques - Electrostatic discharge immunity test*
- 555 IEC 61000-4-3, *Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement*
556 *techniques - Radiated, radio-frequency, electromagnetic field immunity test*
- 557 IEC61000-4-4, *Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement*
558 *techniques - Electrical fast transient/burst immunity test*
- 559 IEC 61000-4-5, *Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement*
560 *techniques - Surge immunity test*
- 561 IEC 61000-4-6, *Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement*
562 *techniques - Immunity to conducted disturbances, induced by radio-frequency fields*
- 563 IEC 61000-4-8, *Electromagnetic compatibility (EMC) - Part 4-8: Testing and measurement*
564 *techniques - Power frequency magnetic field immunity test*
- 565 IEC 61000-4-11, *Electromagnetic compatibility (EMC) - Part 4-11: Testing and measurement*
566 *techniques - Voltage dips, short interruptions and voltage variations immunity tests*
- 567 IEC 61032:1997, *Protection of persons and equipment by enclosures - Probes for verification*
- 568 IEC 61095:2009, *Electromechanical contactors for household and similar purposes*
- 569 IEC 61140:2016, *Protection against electric shock – Common aspects for installations and*
570 *equipment*
- 571 IEC 61558-2-6, *Safety of transformers, reactors, power supply units and similar products for*
572 *supply voltages up to 1 100 V - Part 2-6: Particular requirements and tests for safety isolating*
573 *transformers and power supply units incorporating safety isolating transformers*
- 574 IEC 61916:2016, *Electrical accessories – Harmonization of general rules*
- 575 IEC 62933-1:2018, *Electrical Energy Storage (EES) systems - Part 1: Vocabulary*
- 576 IEC Guide 110:2014, *Home control systems - Guidelines relating to safety*
- 577 CISPR 15, *Limits and methods of measurement of radio disturbance characteristics of*
578 *electrical lighting and similar equipment*
- 579
580 *Provisional list of reference standards*
581 *IEC 60669-2-1*

IEC 60669-2-5
IEV – International Electro-technical Vocabulary

3 Terms and definitions

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

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

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

3.1 General definitions

3.1.1

Electrical Energy Efficiency

EE

system approach to optimize the efficiency of electrical energy use

NOTE 1 to entry Energy efficiency improvement measures take into account the following considerations:

- both the consumption (kWh) and the price of electricity;
- technology;
- environmental impact.

[SOURCE: IEC 60364-8-1:2019, 3.1.7]

3.1.2

electrical energy management system

EEMS

system monitoring, operating, controlling and managing energy resources and loads of the installations

[SOURCE: IEC 60364-8-1:2019, 3.2.1]

3.1.3

Energy Efficiency Manager

EEM

Algorithm to manage the energy resources (sources and loads) in an EEMS (energy efficiency management system). This algorithm may be embedded in a single equipment or shared between multiple equipment.

3.1.4

Operating mode

Description of the type of supply of the electrical installation in respect to the public network, local power supplies, and local storage units

[SOURCE: IEC 60364-8-2:2019, 3.11, modified]

3.1.4.1

Direct feeding mode

Operating mode in which the public network supplies the PEI

NOTE 1 to entry Local storage units can supply current-using equipment or be charged by local power supplies and/or the public distribution network

[SOURCE: IEC 60364-8-2:2019, 3.12]

3.1.4.2**Reverse feeding mode**

Operating mode in which the PEI supplies the public network.

NOTE 1 to entry: Local storage units can supply current-using equipment and/or the public network or be charged by local power supplies

[SOURCE: IEC 60364-8-2:2019, 3.13]

3.1.5**operating sequence of a A-SSE**

automatic transfer of the loads from one supply source to another in the event of a monitored source deviation and/or other predefined conditions

NOTE 1 to entry: Transfer may be with or without a predetermined time delay and may include an OFF-position.

[SOURCE: IEC 60947-6-1 2014, 3.2.1, modified replacing “supply” by “source”]

3.1.6**monitored source deviation**

< of a SSE > variation in the power source characteristics that exceeds predetermined limits

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

[SOURCE: IEC 60947-6-1 2014, 3.2.2, modified replacing “supply” by “source” and removal of note 2]

3.1.7**voltage source deviation**

change in voltage level from the nominal voltage of the monitored source

[SOURCE: IEC 60947-6-1 2014, 3.2.3, modified]

3.1.8**frequency source deviation**

change in frequency from the nominal operating frequency of the monitored source

[SOURCE: IEC 60947-6-1 2014, 3.2.4, modified]

3.1.9**contact transfer time**

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

[SOURCE: IEC 60947-6-1 2014, 3.2.5, modified]

3.1.10**minimum operating transfer time**

time measured from the instant when the transfer conditions are fulfilled to the closing of main contacts on the other source.

Note 1 to entry: Transfer conditions are typically supply deviations and programmed conditions for A-SSE or remote-control commands for R-SSE.

Note 2 to entry: Minimum operating transfer times from source 1 to source 2 and from source 2 to source 1 can be different.

[SOURCE: IEC 60947-6-1 2014, 3.3.2]

3.1.11**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

[SOURCE: IEC 60947-6-1 2014, 3.2.9, modified by removal of the note]

3.1.12**switching position**

< of a SSE > mechanical configuration of the main contacts of a SSE when in position I, position II, or the OFF-position (if applicable)

[SOURCE: IEC 60947-6-1 2014, 3.3.4, modified]

3.1.13**position I**

contact position of the equipment when the its load terminals are connected to source 1 terminals

[SOURCE: IEC 60947-6-1 2019, 3.3.2/CDV, modified]

3.1.14**position II**

contact position of the equipment when its load terminals are connected to source 2 terminals

[SOURCE: IEC 60947-6-1 2019, 3.3.3/CDV, modified]

3.1.15**OFF-position**

contact position of the equipment when its load terminals are connected to neither source 1 nor source 2 terminals

[SOURCE: IEC 60947-6-1 2014, 3.3.3, modified]

3.1.16**Interlock**

system to prevent simultaneous connection of two different power sources

Note 1 to entry: it may be based on electrical or mechanical means, or both.

3.1.17**synchronization**

electrical system allowing the connection of two different power sources in parallel intentionally for a period of time

3.1.18**open transition**

a break before make transfer operation that intentionally disconnects the loads from one source prior to connecting it to the other source

[SOURCE: IEC 60947-6-1 2019/CDV, 3.2.7, modified]

3.1.19**closed transition**

a make before break transfer operation that intentionally connects the loads to a second synchronized source for a short period of time before disconnecting from the first source

706 [SOURCE: IEC 60947-6-1 2019/CDV, 3.2.9, modified]

707 **3.1.20**

708 **utilization category (for a switching device or a fuse)**

709 combination of specified requirements related to the conditions in which the switching device
710 or the fuse fulfils its purpose, selected to represent a characteristic group of practical
711 applications

712 Note to entry: The specified requirements may concern e.g. the values of making capacities (if applicable),
713 breaking capacities and other characteristics, the associated circuits and the relevant conditions of use and
714 behaviour.

715 [IEV, 441-17-19]

716 **3.1.21**

717 **recovery voltage**

718 voltage which appears across the terminals of a pole of a switching device or a fuse after the
719 breaking of the current

720 Note 1 to entry: This voltage may be considered in two successive intervals of time, one during which a transient
721 voltage exists, followed by a second one during which the power-frequency voltage or the steady-state recovery
722 voltage alone exists.

723 Note 2 to entry: This definition applies to a single-pole device. For a multipole device it is the phase-to-phase
724 voltage across the supply terminals of the device.

725 [IEV, 441-17-25]

726 **3.1.22**

727 **operating cycle (of a mechanical switching device)**

728 succession of operations from one position to another and back to the first position through all
729 other positions, if any

730 [IEV, 441-16-02]

731 **3.1.23**

732 **operating sequence (of a mechanical switching device)**

733 succession of specified operations with specified time intervals

734 [IEV, 441-16-03]

735

736 **3.1.24**

737 **ultimate short-circuit breaking capacity**

738 a breaking capacity for which the prescribed conditions according to a specified test sequence
739 does not include the capability of the SSE to carry its rated current continuously

740 **3.1.25**

741 **manual control**

742 control of an operation by human intervention via the use of operating means

743 [441-16-04, modified by adding "via the use of operating means"]

744 **3.1.26**

745 **automatic control**

746 control of an operation without human intervention, in response to the occurrence of
747 predetermined conditions

748 [441-16-05]

3.1.27**local control**

control of an operation at a point on or adjacent to the controlled device

[441-16-06], modified by removing the term “switching”]

3.1.28**remote control**

control of an operation via the use of operating means at a point distant from the controlled device

[441-16-07], modified by removing the term “switching”]

3.1.29**Source Switching Equipment****SSE**

equipment able to select sources when certain conditions are met or following human intervention.

Note 1 to entry: for example, a SSE for back-up applications may contain one or more switching devices and all associated control means for disconnecting load circuits from one source and reconnecting them to another source. when certain conditions are met.

Note 2 to entry: for example, a SSE for islanding applications may contain one or more switching devices and all associated control means for disconnecting load circuits from one normal source while keeping them connected to another source, and reconnecting them to the normal source when certain conditions are met while maintaining the loads always energized.

3.1.30**Combined SSE****C-SSE**

SSE based on the association of switching devices complying with IEC 60669 series, IEC 60898 series or IEC 61095 standards, and with its associated control means for managing the switching operation(s) of the SSE

Note 1 to entry: A combined SSE may be based on individual devices or on devices mechanically assembled together in a dedicated unit (e.g. 2 switches assembled together, 2 switches assembled together with the control unit or parts of the control unit). In the case of assembled devices, assembling may be done by the manufacturer or on site (e.g. by the installer or the panel builder)

Note 2 to entry: SSEs based on switching devices where certain tests are already covered by other product standards may not be required to repeat those tests. Refer to 3.1.5.

3.1.31**Non-combined SSE****NC-SSE**

SSE specifically designed by the manufacturer, with all intended switching means including the associated control means for managing the switching operation(s) of the SSE, but not based on the association of devices complying with IEC 60669 series, IEC 60898 series nor IEC 61095 standards

Note 1 to entry: A non-combined SSE may be based on individual devices or not, e.g. SSE with a remote-control unit (SSE controller).

Note 2 to entry: A non-combined SSE is not supposed to provide overcurrent protection except if it is declared to also comply with a relevant standard for overcurrent protection from 60898 series.

3.1.32**manually operated SSE****M-SSE**

SSE for which switching operations rely on local operating means for manual control

3.1.33**remotely operated SSE****R-SSE**

SSE for which switching operations rely on remote operating means

Note 1 to entry: R-SSE can also have local operating means for manual operations.

Note 2 to entry: Remote control means may include operating means for manual control (e.g. push-bottoms, rotary switches, etc.) and additional features such as remote signalling, etc. They may be located within the same enclosure or not, and controls may be transmitted via any kind of media (wire or wireless).

3.1.34**automatically operated SSE****A-SSE**

self-acting SSE, including all necessary sensing, monitoring, and control logic means for switching operation(s)

Note 1 to entry: A-SSE can also have local operating means for manual operations.

Note 2 to entry: Automatic control means may be located within the same enclosure or not, and controls may be transmitted via any kind of media (wire or wireless).

3.1.35**Switching unit**

< of the SSE > all the part(s) intended for selecting the sources to supply the load circuits

Note 1 to entry: A switching unit may be based on a single device (e.g. NC-SSE), on multiple devices mechanically assembled together in a single switching unit (e.g. C-SSE), on dedicated switches embedded together with the control unit in a single device (e.g. the SSE itself), etc.

3.1.36**control unit**

< of the SSE > All the part(s) intended for managing the operation(s) of the switching unit of the SSE, including the operating means or HMI unit

Note 1 to entry: Depending on the type of SSE, the control unit may include different features such as manual operating means, sensing, interlock, synchronization, control of settings, etc. To the sense of this standard, control means do not include means intended for purposes other than controls, e.g. local or remote signalling.

Note 2 to entry: The control unit may be an integral part of the SSE, a standalone unit (to be associated to a R-SSE or A-SSE) or a dedicated unit which may be part of a broader system (e.g. an Energy Efficiency Management System). It may be based on the use of mechanical means or electric means or both.

Note 3 to entry: Standalone SSE control units (device) and SSE dedicated control unit (device) may be also named SSE control device, SSE controller, etc.

Note 4 to entry: The control unit may be based on the use of devices covered by their own standards, insofar such devices are used for the purposes specified.

3.1.37**Main circuit**

<of a SSE> all the conductive parts of the switching unit included in the circuit which is designed to switch the power sources and to supply the loads

[SOURCE: IEC 60898-1:2015, 3.2.4, modified to be adapted to switching function of a SSE]

3.1.38**control circuit**

<of a SSE> all the conductive parts of the SSE control unit (other than the paths of the main circuit) intended for managing the operation(s) of the switching unit of the SSE

Note 1 to entry: To the sense of this standard, this does not include means intended for purposes other than controls, e.g. local or remote signalling

[SOURCE: IEC 60898-1:2015, 3.2.5, modified to fit with the switching function of a SSE]

3.1.39**control contact**

< of the SSE > contact included in a control circuit of a SSE for managing the operation(s) of the switching unit from remote

Note 1 to entry: SSEs may be provided without control contacts

[SOURCE: IEC 60898-1:2015, 3.3.3, modified to fit with the switching function of a SSE]

3.1.40**island mode**

operating mode in which the PEI that is disconnected from the public distribution system, but remains energized

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

Note 1 to entry: Islanding is the action of disconnecting a PEI from the public distribution system.

Note 1 to entry: According to this standard, the concept of islanding may be applied to installations compliant with IEC 60364-8-2 but with or without synchronization.

[SOURCE: IEC 60364-8-2:2018, 3.15, modified, notes 2 and 3 added]

3.1.41**Prosumer's Electrical Installation****PEI**

low voltage electrical installation connected or not to a public 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
- public distribution network.

[SOURCE: IEC 60364-8-2:2018, 3.2].

3.1.42**rated control circuit supply voltage**

U_s

rated voltage applied to energize the power supply terminals of the control circuit

[SOURCE: IEC 60947-1:2014, 2.5.67]

3.1.43**rated control circuit supply current**

I_s

rated current applied to energize the power supply terminals of the control circuit

3.1.44**terminal**

conductive part of a device, provided for re-usable electrical connection to external circuits

[SOURCE: IEC 60898-1:2015, 3.3.12]

3.1.45**screw-type terminal**

terminal for the connection and subsequent disconnection of a conductor or the interconnection of two or more conductors, capable of being dismantled, the connection being made, directly or indirectly, by means of screws or nuts of any kind

[SOURCE: IEC 60898-1:2015, 3.3.12.1]

3.1.46**clamping unit**

part or parts of a terminal necessary for the mechanical clamping and the electrical connection of the conductor(s)

[SOURCE: IEC 60669-1:2017, 3.4]

3.1.47**terminal with screw clamping**

terminal intended for the connection, by clamping only, of (an) external rigid or flexible conductor(s)

[SOURCE: IEC 60669-1:2017, 3.5 modified - term "screw-type terminal" replaced by "terminal with screw clamping"]

3.1.48**pillar terminal**

screw-type terminal in which the conductor is inserted into a hole or cavity, where it is clamped under the shank of the screw(s)

Note 1 to entry: The clamping pressure can be applied directly by the shank of the screw or through an intermediate clamping element to which pressure is applied by the shank of the screw.

Note 2 to entry: Examples of pillar terminals are shown in Figure 23.

[SOURCE: IEC 60050-442:1998, 442-06-22, modified – in the Note 1 to entry, "intermediate clamping element" instead of "intermediate part", and Note 2 to entry has been added]

3.1.49**screw terminal**

terminal in which the conductor is clamped under the head of one or more screws and where the clamping pressure can be applied directly by the head of the screw or through an intermediate part, such as a washer, a clamping plate or an anti-spread device

Note 1 to entry: Examples of screw terminals are shown in Figure 24.

[SOURCE: IEC 60050-442:1998, 442-06-08, modified – Note 1 to entry has been added]

3.1.50**stud terminal**

screw-type terminal in which the conductor is clamped under a nut

Note 1 to entry: The clamping pressure can be applied directly by a suitably shaped nut or through an intermediate part, such as a washer, a clamping plate or an anti-spread device.

Note 2 to entry: Examples of stud terminals are shown in Figure 24.

[SOURCE: IEC 60050-442:1998, 442-06-23, modified – Note 2 to entry has been added]

3.1.51**saddle terminal**

screw-type terminal in which the conductor is clamped under a saddle by means of two or more screws or nuts

Note 1 to entry: Examples of saddle terminals are shown in Figure 25.

[SOURCE: IEC 60050-442:1998, 442-06-09, modified – Note 1 to entry has been added]

3.1.52**lug terminal**

screw terminal or stud terminal, designed for clamping a cable lug or a bar directly or indirectly by means of a screw or nut

Note 1 to entry: Examples of lug terminals are shown in Figure 26.

[SOURCE: IEC 60050-442:1998, 442-06-16, modified – “or stud terminal” and Note 2 to entry have been added]

3.1.53**screwless terminal**

connecting device for the connection and subsequent disconnection of a rigid (solid or stranded) or flexible conductor or the interconnection of two conductors capable of being dismantled, the connection being made, directly or indirectly, by means of springs, parts of angled, eccentric or conical form, etc., without special preparation of the conductor concerned, other than removal of insulation

[SOURCE: IEC 60669-1:2017, 3.6 modified – term “screwless-type terminal” replaced by “screwless terminal”]

3.1.54**screwless-type terminal**

terminal for the connection and subsequent disconnection obtained directly or indirectly by means of springs, wedges or the like

[SOURCE: IEC 60898-1:2015, J.3.2]

3.1.55**tapping screw**

screw manufactured from a material having a greater resistance to deformation when applied by rotary insertion to a hole in a material having a lesser resistance to deformation

Note 1 to entry: The screw is made with a tapered thread, the taper being applied to the core diameter of the thread at the end section of the screw.

Note 2 to entry: The thread produced by application of the screw is formed securely only after sufficient revolutions have been made to exceed the number of threads on the tapered section.

[SOURCE: IEC 60898-1:2015, 3.3.13]

3.1.56**thread-forming screw**

screw having an uninterrupted thread which, by screwing in, forms a thread by displacing material

Note 1 to entry: It is not a function of this thread to remove material from the hole.

Note 2 to entry: Examples of thread-forming screws are shown in Figure 6.

[SOURCE: IEC 60669-1:2017, 3.13, modified – Note 1 to entry has been added]

3.1.57**thread-cutting screw**

screw having an interrupted thread which, by screwing in, forms a thread by removing material

Note 1 to entry: Examples of thread-cutting screws are shown in Figure 7.

[SOURCE: IEC 60669-1:2017, 3.14]

3.1.58**pollution**

any addition of foreign matter, solid, liquid or gaseous that can result in a reduction of electric strength or surface resistivity of the insulation

[SOURCE: IEC 60664-1:2007, 3.11]

3.1.59**pollution degree**

number characterizing the expected pollution of the micro-environment

Note 1 to entry: The pollution degree to which equipment is exposed may be different from that of the macro environment where the equipment is located because of protection offered by means such as an enclosure or internal heating to prevent absorption or condensation of moisture.

[SOURCE: IEC 60664-1:2007, 3.13, modified – Note 1 to entry has been added]

3.1.60**switched neutral pole**

pole only intended to switch the neutral, and not intended to have a short-circuit capacity

[SOURCE: IEC 60898-1:2015, 3.2.7.3]

3.1.61**actuating member**

part which is pulled, pushed, turned or otherwise moved to cause an operation of the SSE

[SOURCE: IEC 60050-442:1998, 442-04-14]

3.1.62**SSE of normal-gap construction**

SSE construction having a clearance between the contacts in the open position of not less than 3 mm

[SOURCE: IEC 60669-1:2017, 3.1.5]

3.1.63**SSE of mini-gap construction**

SSE construction having a clearance between the contacts which is less than 3 mm but is not less than 1,2 mm

[SOURCE: IEC 60669-1:2017, 3.1.6]

3.1.64**SSE of micro-gap construction**

SSE construction having a clearance between the contacts in the open position of less than 1,2 mm

[SOURCE: IEC 60669-1:2017, 3.1.7]

3.1.65**electrical energy storage system****EES System****EES**

grid-connected installation with defined electrical boundaries, comprising at least one electrical energy storage, which extracts electrical energy from an electric power system, stores this energy internally in some manner and injects electrical energy into an electrical power system and which includes civil engineering works, energy conversion equipment and related ancillary equipment SSE construction having a clearance between the contacts in the open position of less than 1,2 mm

Note 1 to entry: The EES system is controlled and coordinated to provide services to the electric power system operators or to the electric power system users.

Note 2 to entry: In some cases, an EES system may require an additional energy source (non electrical) during its discharge, providing more energy to the electric power system than the energy it stored (compressed air energy storage is a typical example where additional thermal energy is required).

Note 3 to entry: "electric power system" is defined in IEC 60050-601: 1985, 601-01-01.

[SOURCE: IEC 62933-1:2018, 3.2]

3.2 Additional definitions for Non-combined SSEs and SSE control units (controllers) of combined SSEs**3.2.1****rated conditional short circuit current** **I_{nc}**

prospective current that an SSE, protected by a specified short-circuit protective device (SCPD) can satisfactorily withstand for the operating time of that device under specified conditions of use and behavior

Note 1 to entry: The text has been referred to SSE assuming that the I_{nc} definition referred to the upstream SCPD complies with IEC 60898-1:2015, 3.5.14.9.

[SOURCE: IEC 60898-1:2015, 3.5.14.8, modified - replacement of "circuit or switching device" by "SSE" and removal of notes and adding a new note]

3.2.2**rated current** **I_n**

value of current, assigned to the SSE by the manufacturer, which the device can carry in uninterrupted duty

3.2.3**rated frequency**

< of an SSE > value of power frequency assigned by the manufacturer for which the SSE is designed

Note 1 to entry: The same device may be assigned a number of rated frequencies.

3.2.4**rated making and breaking capacity** **I_m**

RMS value of the AC component of prospective current, assigned by the manufacturer, which an SSE can make, carry or break under specified conditions

3.2.5**rated impulse voltage** **U_{imp}**

impulse withstand voltage value assigned by the manufacturer to the equipment or to a part of it, characterizing the specified withstand capability of its insulation against transient overvoltages

1059 [SOURCE: IEC 60664-1:2007, 3.9.2]

1060 **3.2.6**

1061 **rated insulation voltage**

1062 U_i

1063 value of voltage, assigned by the manufacturer, to which dielectric test voltages and creepage
1064 distances are referred

1065 **3.2.7**

1066 **rated voltage**

1067 value of voltage assigned by the manufacturer to which its performance is referred

1068 Note 1 to entry: The same SSE may have different rated voltages.

1069 **3.2.8**

1070 **rated operational voltage**

1071 U_e

1072 value of voltage assigned by the manufacturer to which its performance (in particular the short
1073 circuit performance) is referred

1074 **3.2.9**

1075 **isolation / isolating function**

1076 function intended to cut off the supply from all or a discrete section of the installation by
1077 separating the installation from every source of electrical energy for reasons of safety

1078 [SOURCE: IEC 60947-1:2007, 2.1.19]

1079 **3.3 Additional definitions dedicated to combined SSE**

1080 For combined SSEs, the following terms and definitions apply in addition to the terms and
1081 definitions of relevant standards.

1082 **3.3.1**

1083 **Class SW-SSE**

1084 SSE capable of making, carrying, and breaking currents under normal circuit conditions
1085 including operating overload conditions and withstanding short circuit currents

1086 Note 1 to entry: This equipment is based upon switches according to IEC 60669 series.

1087 [SOURCE: IEC 60947-6-1 2019, 3.1.6/CDV, modified with referring to SSE]

1088 **3.3.2**

1089 **Class CB-SSE**

1090 SSE capable of making, carrying and breaking currents under normal circuit conditions
1091 including operating overload conditions, and breaking short-circuit currents

1092 Note 1 to entry: This equipment is based upon circuit breakers according to IEC 60898-1.

1093 [SOURCE: IEC 60947-6-1 2019, 3.1.7/CDV, modified with referring to SSE]

1094 **3.3.3**

1095 **Class CT-SSE**

1096 SSE mechanical switching devices having only one position of rest, operating otherwise than
1097 by hand, and capable of making, carrying and breaking currents under normal circuit
1098 conditions including operating overload conditions, but not breaking short-circuit currents

1099 Note 1 to entry: This equipment is based upon contactors according to IEC 61095.

1100 [SOURCE: IEC 60947-6-1 2019, 3.1.8/CDV, modified with referring to SSE]

4 Classification**4.1 According to the method of operation****4.1.1 manually operated SSE: M-SSE****4.1.2 Remotely operated SSE: R-SSE****4.1.3 automatically operated SSE: A-SSE****4.2 According to the construction****4.2.1 combined SSE****4.2.1.1 SSE based on switches (SW-SSE)**

SSE whose switching devices comply to IEC 60669 series.

4.2.1.2 SSE based on circuit-breakers (CB-SSE)

SSE whose switching devices comply to IEC 60898 series.

4.2.1.3 SSE based on contactors (CT-SSE)

SSE whose switching devices comply to IEC 61095:2009.

4.2.2 non-combined SSE**4.3 According to the kind of current****4.3.1 AC use**

For all parts of SSE, the number of phases and the rated frequency shall be specified.

4.3.2 DC use

NOTE SSE for DC circuits are under consideration

- 1120 **4.4 According to the number of switched poles**
- 1121 **4.4.1 single pole SSE**
- 1122 **4.4.2 two-pole SSE**
- 1123 **4.4.3 three-pole SSE**
- 1124 **4.4.4 four-pole SSE**
- 1125 **4.5 According to the type of terminals**
- 1126 **4.5.1 SSE with screw-type terminals for external copper conductors**
- 1127 **4.5.2 SSE with screwless-type terminals for external copper conductors**
- 1128 **4.6 According to the SSE intended application**
- 1129 **4.6.1 islanding**
- 1130 **4.6.2 back-up**
- 1131 **4.7 According to coupling method**
- 1132 **4.7.1 SSE with synchronization**
- 1133 **4.7.2 SSE with interlock**
- 1134 **4.7.2.1 SSE with mechanical interlock**
- 1135 **4.7.2.2 SSE with electrical interlock**
- 1136 **4.7.2.3 SSE with both mechanical and electrical interlocks**
- 1137 **4.8 According to the transition type**
- 1138 **4.8.1 Open transition**
- 1139 For back up only.
- 1140 **4.8.2 Closed transition**
- 1141 For either islanding or back up.
- 1142 **4.9 According to the possibility to select sources**
- 1143 **4.9.1 SSE selecting source 1 or source 2**
- 1144 **4.9.2 SSE allowing several sources to run in parallel**
- 1145 **4.10 According to the suitability for isolation**
- 1146 Under consideration

4.10.1 SSE without isolation function**4.10.2 SSE with isolation function****4.11 According to the utilization category****4.11.1 With utilization category****4.11.2 Without utilization category****4.12 According to the possibility to provide an OFF-position****4.12.1 SSE without OFF-position****4.12.2 SSE with OFF-position****4.13 According to the method of mounting****4.13.1 Surface-type****4.13.2 Flush-type****4.13.3 Panel-type (also referred as panel board type or distribution board)**

NOTE This type is intended to be rail mounted.

4.14 According to the protection against external influences**4.14.1 enclosed-type**

Not requiring an appropriate enclosure.

4.14.2 unenclosed-type

For use with an appropriate enclosure

4.15 According to functional categories**4.15.1 Basic SSE****4.15.2 Backup SSE****4.15.3 Advanced SSE****4.15.4 Smart grid ready**

SSEs are classified according to their functionality. Four classes are defined: basic, backup advanced and smart grid ready.

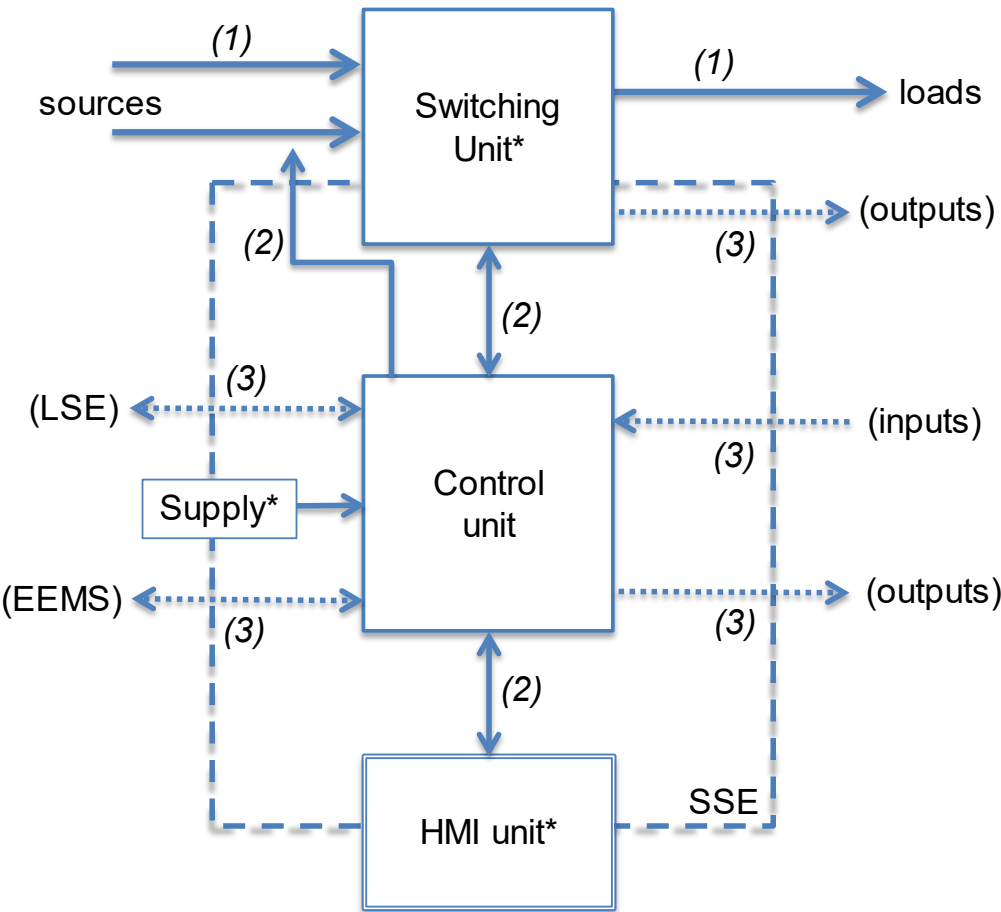
Table 1, the functionalities of each functional class are defined.

Table 1 – Source switching functional categories

Functions	Basic	Backup	Advanced	Smart grid ready
Manual	X	O		
Remote	O			
Automatic		X	X	X
Backup	X	X		
Deviations		O	X	X
Islanding			X	X
Interlock	X	X	O	
Closed transition		O	X	

Synchronization			O	X
EEMS			O	O
Smart grid				X
X: required. O: Optional.				

These functionalities may be embedded in a single unit or in different units. For examples of SSE general architectures, see Figure 3 to Figure 5.

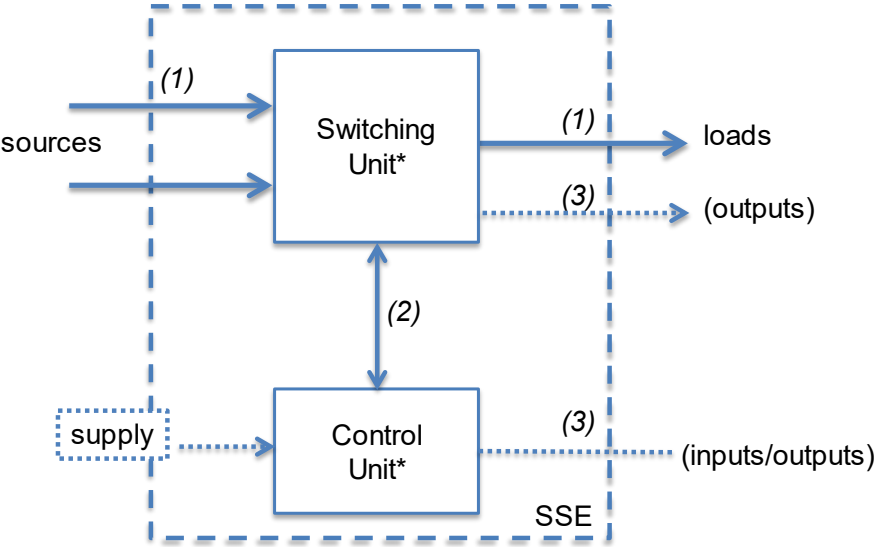


Key

Switching unit: may include a mechanical interlock and local operating means
Control unit: including sensing (2), may include an electrical interlock
HMI unit: hardware, software or both
.... optional
* internal or external to the SSE, may be embedded in a single or different unit(s) within the control unit

(LSE), (EEMS): optional communication interfaces with e.g. LSE, EEMS (CEM, HBES), PCS, Smart Meter (Energy Provider), etc.
(inputs): optional, e.g. sensors
(outputs): optional, e.g. signalling
1 main circuits
2 control circuits (wire or wireless)
3 auxiliary circuits (wire or wireless)

Figure 3 - Example of A-SSE



- Key**
Switching unit: may include a mechanical interlock and local operating means
Control unit: may include an electrical interlock
.... optional
* may be embedded in a single or different unit(s)
- 6 optional power supplies

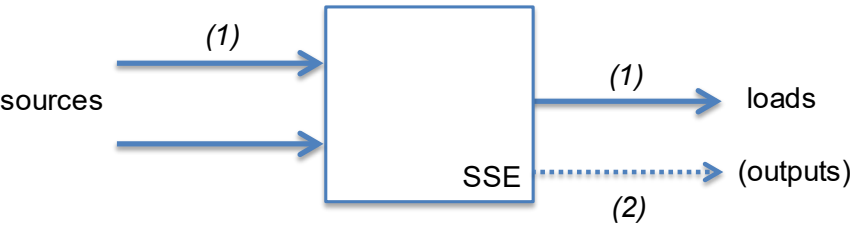
7 optional inputs or outputs, e.g. LSE, EEMS, sensors, signalling, etc.

1 main circuits

2 control circuits (wire or wireless)

3 auxiliary circuits (wire or wireless)

Figure 4 - Example of R-SSE



- Key**
SSE: including switching unit, mechanical interlock and local operating means
(outputs): optional, e.g. signalling
- 1 main circuits

2 auxiliary circuits (wire or wireless)

.... optional

Figure 5 - example of M-SSE

5 Characteristics

5.1 General

Wherever applicable, the characteristics of the SSE shall be stated according to 5.2, 5.3 and 5.4.

In the case of different characteristics for positions I, II and OFF, the manufacturer shall state the characteristics for each position.

5.2 Type and characteristics of the equipment

The SSE shall be declared according to:

- the method of operation (M-SSE, R-SSE, A-SSE);
- the construction (C-SSE or NC-SSE);
- in case of combined SSE, the class of the SSE (class SW-SSE, CB-SSE or CT-SSE);
- the kind of current (AC or DC);
- in case of AC current, the number of phases and the rated frequency;
- the number of switched poles;
- the type of terminals (screw-type or screwless-type);
- the intended application (islanding or backup);
- the coupling method (synchronization or interlock);
- in case of interlock method, the type of interlock (mechanical, electrical or both);
- the transition type (open and/or closed transition);
- the suitability to run sources in parallel or sequentially and the number of switched sources;
- the utilization category;
- the suitability for isolation (with or without isolation);
- the number and the type of main contact positions (2 or 3 positions: I, II and OFF if provided);
- the method of mounting (surface-type, flush-type or panel-type);
- the protection against external influences (enclosed or unenclosed);
- the functional categories (basic, backup, advanced, smart grid ready);
- in case of A-SSE, the operating sequences.

For non-combined SSEs, characteristics are defined according to:

- subclause 5.3.2 for main circuits;
- subclause 5.3.3 for utilization categories;
- subclause 5.3.4 for control circuits, including electrical interlocks;
- subclause 5.3.5 for auxiliary circuits.

For combined SSEs, rated values are defined according to:

- subclause 5.4.2 for main circuits;
- subclause 5.4.3 for utilization categories;
- subclause 5.4.4 for control circuits, including electrical interlocks;
- subclause 5.4.5 for auxiliary circuits.

These circuits may be embedded in different units or devices.

5.3 Characteristics of Non-combined SSEs**5.3.1 General**

Non-combined SSE are normally not intended to provide over-current protective function. If they are declared to provide such a function, they shall also comply with a relevant standard for over-current protection from IEC 60898 series.

5.3.2 Characteristics of main circuits**5.3.2.1 Type of current**

AC, DC or both (DC: under consideration).

5.3.2.2 Rated operational voltage (U_o)

The preferred values of the rated operational voltages are:

- for AC applications: see Table 2;
- for DC applications: under consideration.

Table 2 – Preferred values of rated voltages

SSE type	Circuit supplying the SSE	Rated voltage of SSE for use in 230 V or 230/400 V or 400 V systems V	Rated voltage of SSE for use in 120/240 V or 240 V systems V
Single pole	Single-phase (phase to earthed middle conductor or phase to neutral)	230	120
Two-pole	Single phase (phase to neutral or phase to phase or phase to earthed middle conductor)	230	120
	Single phase (phase to phase)	400	240
	Single phase (phase to phase, 3-wire)		120/240
	Three phase (4-wire) (230/400 V-system phase to neutral or 230 V-system phase to phase)	230	
Three-pole	Three phase (3-wire or 4-wire) (400 V or 230/400 V or 240 V-system)	400	240
Four-pole	Three phase (4-wire) (230/400 V-system)	400	
NOTE 1 In IEC 60038 the network voltage value of 230/400 V has been standardized. This value should progressively supersede the values of 220/380V and 240/415 V. NOTE 2 Wherever in this standard there is a reference to 230 V or 400 V, they may be read as 220 V or 240 V, 380 V or 415 V, respectively. NOTE 3 Wherever in this standard there is a reference to 120 V or 120/240 V or 240 V, they may be read as 100 V or 100/200 V or 200 V, respectively. NOTE 4 Wherever in this standard there is a reference to 240 V three phases, it may be read as 100 V or 120/208 V.			

5.3.2.3 Rated insulation voltage (U_i)

Unless otherwise stated, the rated insulation voltage is the value of the maximum rated voltage of the SSE. In no case shall the maximum rated voltage exceed the rated insulation voltage

5.3.2.4 Rated impulse voltage (U_{imp})

The rated impulse voltage of a SSE shall be equal to or higher than the standard values of the rated impulse voltages of Table 3.

Table 3 – Rated impulse voltage as a function of the nominal voltage of the installation

Rated impulse voltage ^a U_{imp} kV	Nominal voltage of the installation		
	Single phase systems	Single-phase systems with mid-point earthed	Three-phase systems
	V	V	V
2,5	120	120/240	120/208
4	230	120/240, 240	230/400, 400

^a Values for SSEs declared with overvoltage category III. For overvoltage category IV, IEC 60664-1:2007 applies.

1258

1259 **5.3.2.5 Rated current (I_n)**

1260 The preferred values of the rated current are:

- 1261 - AC: 6 A, 8 A, 10 A, 13 A, 16 A, 20 A, 25 A, 32 A, 40 A, 50 A, 63 A, 80 A, 100 A and 125 A;
- 1262 - DC: under consideration.

1263 **5.3.2.6 Maximum values of the rated current (I_n)**

- 1264 - AC: 125 A;
- 1265 - DC: under consideration.

1266 **5.3.2.7 Rated making and breaking capacity (I_m)**

1267 The peak value of the current during the making operation may be higher than the peak value
1268 of the steady state current depending on the characteristics of the test circuit (loads) and the
1269 instant of closing on the voltage wave.

1270 The rated making and breaking capacity shall:

- 1271 - for SSEs classified according to 4.11.1, be defined according to 5.3.3;
- 1272 - for SSEs classified according to 4.11.2, have a rated value corresponding to the worse
1273 conditions defined in 8.6.

1274 For AC, the rated making and breaking capacities are expressed by the RMS value of the AC
1275 component of the rated current.

1276 **5.3.2.8 Rated frequency**

1277 The standard values of the rated frequency are: 50 Hz, 60 Hz or both.

1278 **5.3.2.9 Rated conditional short circuit current (I_{nc})**

1279 For SSEs to be protected by a short-circuit protective device (SCPD), details of the SCPD
1280 shall be indicated by the manufacturer. They shall include the type, rating, characteristics.

- 1281 - Standard values for I_{nc} up to 10 000 A: 1 500 A, 3 000 A, 4 500 A, 6 000 A, 10 000 A;

1282 NOTE The values of 1 000 A, 2 000 A, 2 500 A, 5 000 A, 7 500 A and 9 000 A are also considered as standard in
1283 some countries.

- 1284 - Values for I_{nc} above 10 000 A up to and including 25 000 A: the preferred value is
1285 20 000 A.

1286

1287 **5.3.3 Utilization categories**

1288 Utilization categories define the intended applications of SSEs and are characterized by one
1289 or more of the following service conditions:

- 1290 - current(s) expressed as multiple(s) of the rated current;
- 1291 - voltage(s), expressed as multiple(s) of the rated operational voltage;
- 1292 - the power-factor.

1293 Utilization categories are defined Table 4. They are characterized by the values of the
1294 currents, voltages, power-factors and other data of Table 9 and Table 12 and by the test
1295 conditions specified in this standard.

1296 SSEs may be assigned one or more of the utilization categories given in Table 4 at one or
1297 more rated operational voltages.

1298 A SSE which is assigned one utilization category or at any combination of parameters (such
 1299 as highest operational voltage and current, etc.) can be assigned another utilization category
 1300 without testing provided that the test currents, voltages, power-factors, number of operating
 1301 cycles, ON and OFF-times given in Table 9 and Table 12 and the test circuit for the assigned
 1302 utilization category are not more severe than those at which the SSE has been tested and the
 1303 temperature-rise has been verified at a current not less than the highest assigned rated
 1304 current.

1305 **Table 4 – Utilization categories**

Type of current ^a	Utilization category	Typical loads
AC	AC-7a	slightly inductive loads
	AC-7b	Motor loads ^b
	AC-7c	Switching of compensated electric discharge lamp control ^c
NOTE 1 categories based on Table 1 of IEC 61095:2009.		
NOTE 2 DC: under consideration.		
^a for specific applications, other utilization categories may be used in which case they shall comply with the requirements and categories defined in IEC 60947 series.		
^b AC-7b category may be used for specific applications with occasional inching (jogging) or plugging for limited time periods; during such limited time periods the number of operations should not exceed 5/min or more than 10 in a 10-minute period. See IEC 61095:2009.		
^c this category is similar to a capacitive switching category AC-6b as defined in IEC 60947-4-1 for the switching of capacitor banks, the characteristic being very dependent on the capacitance value of the lamp circuit.		

1306 5.3.4 Characteristics of control circuits, including electrical interlocks

1308 5.3.4.1 General

1309 Switching of the sources may be based:

- 1310 - on direct monitoring of the sources by the control unit of the SSE itself, and/or
- 1311 - on signals exchanged with control units of other source monitoring systems, e.g. EEMS,
- 1312 EESS, PV inverters, AC/DC storage systems, etc.

1313 When embedded in the SSE, characteristics of control circuits shall be declared, as
 1314 applicable, according to:

- 1315 - The rated voltage source deviation (U_d);
- 1316 - The rated frequency source deviation (f_d).

1317 The rated voltage source deviation and rated frequency source deviation, if any, are the
 1318 values on which the operating and temperature-rise characteristics of the SSE are based.

1319 For the power supply, the following characteristics shall be declared, as applicable:

- 1320 - The rated control circuit supply voltage(s) (U_s);
- 1321 - The rated control circuit supply current(s) (I_s);
- 1322 - The rated control circuit supply frequency(ies): AC or DC or both;
- 1323 - Or, the minimum and maximum values if a range of operation is declared.

1324 Other characteristics may be specified by manufacturers for monitoring the sources, such as:

- 1325 - monitoring of other power quality characteristics of the sources;
- 1326 - signals from DSOs;
- 1327 - signals from an Electrical Energy Management System (EEMS) or other systems.

5.3.4.2 Rated values for power supplies of control circuits

For R-SSEs and A-SSEs, the minimum and maximum values shall be stated by the manufacturer, as applicable, for:

- the rated control circuit supply voltage (U_s);
- the rated control circuit supply current (I_s);
- the rated control circuit supply frequency or DC.

These values shall correspond to the operational limits of the SSE's control unit.

5.3.4.3 Rated voltage source deviation (U_d) and rated frequency source deviation (f_d)

For A-SSE, the manufacturer shall state:

- the voltage source deviations and, if applicable, the frequency source deviations at which switching operations should be initiated;
- the tolerance of voltage deviations and frequency deviations (where applicable) shall be specified by the manufacturer but shall not exceed $\pm 10\%$;
- The nature of the deviations: AC, DC, or both, as applicable.

5.3.4.4 Other monitored source characteristics

If the SSE is able to monitor other characteristics for switching operations of the power sources, the manufacturer shall declare the type of characteristics and, for each characteristic:

- the minimum and maximum values monitored by the control unit corresponding to the limits of the source switching operations of the SSE;
- the deviation values and tolerances at which switching operations may be initiated.

5.3.5 Characteristics of auxiliary circuits

The manufacturer shall state the characteristics of all auxiliary circuits, as applicable, e.g.:

- the kind of circuits;
- the rated voltages, or the minimum and maximum rated values;
- the rated currents, or the minimum and maximum rated values;
- the rated frequencies, or the minimum and maximum rated values, DC, or both;
- e.g. 250V/10 A max. 50/60 Hz AC, 200V/5 A max. DC.

5.4 Characteristics of combined SSEs**5.4.1 General**

The manufacturer shall state the characteristics of main circuits based on the following sub-clauses, as applicable.

5.4.2 Characteristics of main circuits**5.4.2.1 Type of current**

The rated operational voltage shall be specified: AC, DC or both (DC: under consideration).

5.4.2.2 Rated operational voltage (U_e)

The rated operational voltage shall be selected as following:

- for SW-SSEs, according to Clause 6 of a relevant standard of IEC 60669 series;
- for CB-SSEs, according to Clause 5 of a relevant standard of IEC 60898 series;
- for CT-SSEs, according to IEC 61095:2009, Clause 5.

5.4.2.3 Rated impulse voltage (U_{imp})

The rated impulse voltage shall be selected as following:

- for SW-SSEs, according to Clause 6 of a relevant standard of IEC 60669 series;
- for CB-SSEs, according to Clause 5 of a relevant standard of IEC 60898 series;
- for CT-SSEs, according to IEC 61095:2009, Clause 5.

5.4.2.4 Rated current (I_n)

The rated impulse current shall be selected as following:

- for SW-SSEs, according to Clause 6 of a relevant standard of IEC 60669 series;
- for CB-SSEs, according to Clause 5 of a relevant standard of IEC 60898 series;
- for CT-SSEs, according to IEC 61095:2009, Clause 5.

5.4.2.5 Rated making and breaking capacity (I_m)

The rated making and breaking capacity shall be selected as following:

- for SW-SSEs, according to Clause 6 of a relevant standard of IEC 60669 series;
- for CB-SSEs, according to Clause 5 of a relevant standard of IEC 60898 series;
- for CT-SSEs, according to IEC 61095:2009, Clause 5.

5.4.2.6 Rated frequency

The rated frequency shall be selected as following:

- for SW-SSEs, according to Clause 6 of a relevant standard of IEC 60669 series;
- for CB-SSEs, according to Clause 5 of a relevant standard of IEC 60898 series;
- for CT-SSEs, according to IEC 61095:2009, Clause 5.

5.4.2.7 Rated conditional short circuit current (I_{nc})

The rated conditional short circuit current shall be selected as following:

- for SW-SSEs, according to Clause 6 of a relevant standard of IEC 60669 series;
- for CT-SSEs, according to IEC 61095:2009, Clause 5.

For CB-SSEs, the rated conditional short circuit current shall not be considered.

5.4.3 Utilization categories

For CT-SSEs, utilization categories defined Clause 5 of IEC 61095:2009 apply.

NOTE For other classes of SSEs, utilization categories do not apply.

5.4.4 Characteristics of control circuits, including electrical interlocks

The manufacturer shall state the characteristics of control circuits based 5.3.4, as applicable.

5.4.5 Characteristics of auxiliary circuits

The manufacturer shall state the characteristics of all auxiliary circuits as following:

- for auxiliaries of SW-SSEs, according to a relevant standard of IEC 60669 series;
- for auxiliaries of CB-SSEs, according to a relevant standard of IEC 60898 series;
- for auxiliaries of CT-SSEs, according to IEC 61095:2009.
- or based on 5.3.5 of this standard, as applicable.

6 Markings and product information

For non-combined SSE, identification shall comply with Table°5.

For combined-SSEs, Table°5 also applies to control units.

Table 5 – Requirements and position for markings and other product information

	Marking or information item	Position of markings and other product information		
		Visible on product when installed	On the product	In the documentation
a	manufacturer's name or trade mark		X	X
b	type designation, catalogue number or serial number		X	X
c	rated voltage(s) and symbol for the nature of the voltage(s) ^a	X		X
d	rated current(s) (I_N) ^b	X		
e	rated frequency ^c		X	X
f	rated making and breaking capacity in amperes (I_m) ^a		X	X
g	the degree of protection (only if different from IP 20)			X
h	the position of use, if necessary			X
i	wiring diagram, unless the correct connection mode is evident		X	X
j	for A-SSE, the voltage source deviations and, if applicable, the frequency source deviations ^a			X
k	SSE class (SW-SSE, CB-SSE or CT-SSE)		X	X
l	length of insulation to be removed before the insertion of the conductor into the screwless type terminal, if applicable		X	X
m	symbol "r" for the suitability to accept rigid conductors only ^d		X	X
n	the method of operation (M-SSE, R-SSE, A-SSE)			X
o	the indication of switch positions			X
p	the suitability for isolation, if applicable			X
q	SCPD characteristics ^{a, e}			X
r	rated conditional short circuit current (I_{nc}) ^{a, e}			X
s	for R-SSE and A-SSE, the rated control circuit supply voltage(s), rated control circuit supply current(s), rated control circuit supply frequency and symbol for the nature of the supply, as applicable			X
t	the intended application (islanding or backup)			X
u	the coupling method (synchronization or interlock)			X
v	the type of interlock (mechanical, electrical or both)			X
w	the transition type (open or closed transition)			X
x	the suitability to run sources in parallel or sequentially and the number of switched sources			X
y	Utilization categories and corresponding current(s)			X
z	for A-SSE, the operating sequences			X
a	for each main contact position, if relevant.			
b	rated current value of the SSE input(s) and of its outputs, if necessary.			
c	SSEs with more than one rated frequency (e.g. 50/60 Hz) shall be marked accordingly.			
d	terminals with no marking are considered suitable for both rigid and flexible conductors.			
e	for class SW-SSE and CT-SSE.			

1408

1409 If SSEs are provided with embedded functions covered by other standards (e.g. overcurrent
1410 protection), identification of such functions shall comply with the relevant standards. Relevant
1411 standards shall be stated by manufacturers in the technical documentation.

1412 Correct indication of the terminals for the sources and the loads shall be provided.

1413 Terminals intended for the protective conductor, if any, shall be indicated by the symbol 
1414 (IEC 60417-5019).

1415 In case of C-SSEs delivered to the customer unassembled or partially assembled, the
1416 manufacturer shall provide instructions for proper assembly and commissioning of the SSEs
1417 necessary to assure their correct operation.

1418 Markings shall be easily legible, durable and indelible. They shall not be placed on screws,
1419 washers or other removable parts.

1420 *Compliance is checked by inspection and by the tests of 9.2. Markings made by impression,*
1421 *moulding or engraving are not subjected to this test.*

1422 **7 Standard conditions for operation in service**

1423 **7.1 General**

1424 SSEs complying with this standard shall be capable of operating under the following standard
1425 conditions.

1426 For combined-SSEs, Clause 7 also applies except for switching units and auxiliary units
1427 which are already covered by IEC 60669 series (for SW-SSEs), IEC 60898 (for CB-SSEs)
1428 series and IEC 61095:2009 (for SW-SSEs) as relevant. However, this clause applies to the
1429 complete system of C-SSEs for operational performances requirements and tests (see 8.7
1430 and 9.11).

1431 **7.2 Ambient temperature range in normal use**

1432 SSEs are suitable for normal use at ambient temperatures normally not exceeding 40 °C, with
1433 an average value over a period of 24 h not exceeding 35 °C, with a lower limit of the ambient
1434 air temperature of –5 °C.

1435 NOTE 1 This temperature range corresponds to “AA4” of Table 51A of IEC 60364-5-51:2005, part of the
1436 temperature range of IEC 60721-3-3, class 3K5, with the high air temperature restricted to 40 °C.

1437 NOTE 2 In certain cases, special precautions can be necessary. Equipment intended to be used in ambient air
1438 temperatures above +40 °C (particularly in tropical countries) or below –5 °C can either be specially designed or be
1439 used according to the information given by manufacturers in their technical documentation.

1440 **7.3 Relative humidity**

1441 Unless otherwise specified, the maximum relative humidity of air does not exceed 50 % at the
1442 temperature of 40 °C.

1443 Higher relative humidity values are admitted at lower temperatures (for example 90 % at
1444 20°C).

1445 Care should be taken by appropriate means (for example drain holes) of moderate
1446 condensation which may occasionally occur due to variations in temperature.

1447 **7.4 Altitude**

1448 Unless otherwise specified, SSEs are intended to be installed at an altitude not higher than
1449 2 000 m (6 600 ft).

For installations at higher altitudes, it is necessary to take into account the reduction of the dielectric strength and of the cooling effect of the air. Equipment intended to be so used shall be designed specially or used according to an agreement between manufacturer and user. Information by manufacturers in their technical documentation may take the place of such an agreement.

7.5 Conditions of installation

SSEs shall be installed in accordance with the manufacturer's instructions.

7.6 Pollution degree

SSEs complying with to this standard are intended for environment with pollution degree 2, i.e. normally only non-conductive pollution occurs; occasionally, however, a temporary conductivity caused by condensation may be expected.

8 Requirements for construction and operation

8.1 General

SSEs complying with this standard shall be capable of operating under the requirements of this clause. SSEs shall be able:

- to switch sources according to one or more of the following use cases, as declared:

- from direct feeding to islanding mode or to backup mode;
- from islanding mode, or backup mode, to direct feeding mode;
- from direct mode to reverse feeding mode;
- from direct mode to reverse feeding mode;

- and/or to charge batteries from local production sources and/or from the grid.

Based on the declared classification,

- for non-combined SSEs, Clause 8 of this standard applies to all relevant units;

- for combined SSEs, Clause 8 of this standard:

- does not apply, except otherwise stated, to switching units which are already covered by IEC 60669 series (for SW-SSEs), IEC 60898 (for CB-SSEs) series and IEC 61095:2009 (for CT-SSEs);
- applies to control units;
- applies to all other units and to connecting accessories, as applicable and if not already covered by a relevant standard (e.g. interlock means), delivered assembled in the factory or to be assembled on site (e.g. see Figure 3 to Figure 5);
- applies to the complete system whenever stated in relevant clauses, e.g. requirements for operational performance.

NOTE these exceptions for C-SSEs are aimed to prevent conducting new tests on units already covered by a relevant standard as above listed.

8.2 Mechanical design

8.2.1 General

SSE shall not cause danger to the user or surroundings and their use shall be reliable.

Where different ratings are declared for positions I and II, each position shall be tested accordingly.

8.2.2 Constructional requirements

8.2.2.1 Mechanical requirements for insulating means

Insulating linings, barriers and the like shall have adequate mechanical strength and shall be secured in a reliable manner.

Compliance is checked by inspection after the tests of 9.3.1.

8.2.2.2 Installation requirements

SSEs shall be constructed to allow:

- easy and reliable connection of the conductors to the terminals;

NOTE 1 Screw terminals shown in 9.6.1 are considered suitable for reliable connection of the conductors.

- easy installation in enclosures or fixing to a wall.

NOTE 2 This requirement does not imply that the metal parts of the terminals are necessarily protected by insulation barriers or insulating shoulders, to avoid contact, due to incorrect installation of the terminal metal parts, with the insulation of the conductor.

Surface-type SSEs shall be constructed so that the fixing means do not damage the insulation of the cables during the installation.

Compliance is checked by inspection and by an installation test using conductors of the largest cross-sectional area specified, for the relevant ranges of rated currents, in Table 6.

NOTE 3 For surface-type SSEs, mounted on a mounting plate, a wiring channel can be needed to comply with this requirement.

Table 6 – Cross-sectional areas (S) of test copper conductors corresponding to the rated currents

S mm ²	Values of the rated current I_n A
1	$I_n \leq 6$
1,5	$6 < I_n \leq 13$
2,5	$13 < I_n \leq 20$
4	$20 < I_n \leq 25$
6	$25 < I_n \leq 32$
10	$32 < I_n \leq 50$
16	$50 < I_n \leq 63$
25	$63 < I_n \leq 80$
35	$80 < I_n \leq 100$
50	$100 < I_n \leq 125$
NOTE For the correspondence between ISO and AWG copper conductors, see Annex B.	

In addition, for an SSE comprising screwless terminals, the connecting and/or disconnecting means of the screwless terminals cannot be activated by the conductors during and after installation.

NOTE 4 This requirement does not imply that the connecting and/or disconnecting means cannot be touched by the conductors.

NOTE 5 This requirement can be met by the placement of the connecting and/or disconnecting means and/or the use of protective barriers or shoulders placed around the connecting and/or disconnecting means.

1519 *Compliance is checked by inspection and (in case of doubt) by the tests of 9.3.2*

1520 **8.2.2.3 Fixings of covers, cover plates and actuating members**

1521 Covers, cover plates and actuating members or parts of them, which are intended to ensure
1522 protection against electric shock, shall be held in place at two or more points by effective
1523 fixing.

1524 Covers, cover plates and actuating members or parts of them may be fixed by means of a
1525 single fixing, for example by a screw, provided that they are held in place by another means
1526 (for example by a shoulder).

1527 It is recommended that the fixings of covers, cover plates or actuating members be captive.
1528 The use of tight fitting washers of cardboard or the like is deemed to be an adequate method
1529 for securing screws intended to be captive.

1530 NOTE Non-earthed metal parts, separated from live parts in such a way that creepage distances and clearances
1531 have values specified in Table 7, are not considered as accessible if the requirements of this Subclause are met.

1532 *Compliance is checked according 9.3.3.*

1533 **8.2.2.4 Attachment of knobs**

1534 Knobs and the like shall be securely fixed in a reliable manner so that they will not work loose
1535 in normal use, if loosening may result in a hazard. If knobs or the like are used for indication
1536 purposes, it shall not be possible to set them in a wrong position if this may result into a
1537 hazard.

1538 *Compliance is checked by inspection and tests of 9.3.4.*

1539 **8.2.2.5 Mounting means**

1540 Screws or other means for mounting the SSE on a surface or in an enclosure shall be easily
1541 accessible. These means shall not serve any other fixing purpose.

1542 *Compliance is checked by inspection.*

1543 **8.2.2.6 Accessories**

1544 Accessories combined with SSEs or to be used with SSEs, if any, shall comply:

- 1545 - with their relevant standard, or
- 1546 - to this standard as relevant.

1547 **8.2.3 Mechanism and operating means**

1548 **8.2.3.1 General**

1549 Whatever its mode of operation (e.g. direct, reverse or islanding mode), its status (e.g.
1550 automatic mode, remotely controlled or not), its construction (C-SSE or NC-SSE), it shall
1551 always be possible:

- 1552 - to clearly know operating status of the SSE;
- 1553 - to take over any automatic or remote-controlled mode to manually control the SSE locally,
1554 except if they are provided with a basic operating mode.

1555 Status shall be clearly indicated by appropriate dedicated means and be reliable.

1556 Mode status of SSEs in automatic mode and SSEs remotely controlled shall also be provided
1557 with local indication means.