Singapore Standards Council

SS 619 : Part 1 : 2016
IEC 61439-1:2011, MOD
(ICS 29.130.20)

SINGAPORE STANDARD

Low-voltage switchgear and controlgear assemblies

– Part 1 : General rules

[Modified adoption of IEC 61439-1 : 2011]

Published by
Enterprise Singapore

SS 619 : Part 1 : 2016
IEC 61439-1:2011, MOD
(ICS 29.130.20)

SINGAPORE STANDARD

Low-voltage switchgear and controlgear assemblies

– Part 1 : General rules

ISBN 978-981-4726-69-6

This Singapore Standard was approved by the Electrical and Electronic Standards Committee on behalf of the Singapore Standards Council on 6 October 2016.

First published, 2017

The Electrical and Electronic Standards Committee, appointed by the Standards Council, consists of the following members:

		Name	Capacity
Chairman	:	Er. Peter Leong Weng Kwai	*Member, Standards Council*
Deputy Chairmen	:	Mr Cheong Tak Leong	*SPRING Singapore*
		Er. Tan Hak Khoon	*Energy Market Authority*
Advisor	:	Mr Renny Yeo Ah Kiang	*Individual Capacity*
Secretary	:	Mr Jason Low	*SPRING Singapore*
Members	:	Dr Chua Sze Wey	*Agency for Science, Technology and Research*
		Assoc Prof Gooi Hoay Beng	*Nanyang Technological University*
		Er. Hashim Bin Mansoor	*Building and Construction Authority*
		Assoc Prof Ko Chi Chung	*National University of Singapore*
		Mr Koh Liang Hock	*SP PowerGrid Ltd*
		Er. Lim Ah Hee	*Housing & Development Board*
		Er. Lim Say Leong	*Singapore Business Federation*
		Er. Ling Shiang Yun / Er. Kenneth Liu	*Association of Consulting Engineers Singapore*
		Mr Ng Kin Ming	*Singapore Electrical Contractors and Licensed Electrical Workers Association*
		Er. Ong Ser Huan	*Institution of Engineers Singapore*
		Dr Thomas Reindl	*Solar Energy Research Institute of Singapore*
		Mr Sim Geok Seng	*SPRING Singapore*
		Mr Sim Wee Meng	*Land Transport Authority*
		Mr Tan Boon Chong	*Singapore Manufacturing Federation*
		SAC Christopher Tan Eng Kiong	*Singapore Civil Defence Force*
		Mr Alfred Tan Lai Seng	*Singapore Electrical Trades Association*
		Mr Justin Wu	*National Environment Agency*
Co-opted Member	:	Mr Chong Weng Hoe	*Individual Capacity*

The Technical Committee on Power Systems and Utilisation, appointed by the Electrical and Electronic Standards Committee and responsible for the preparation of this standard, consists of representatives from the following organisations:

		Name	Capacity
Chairman	:	Er. Tan Hak Khoon	*Deputy Chairman, Electrical and Electronic Standards Committee*
Deputy Chairman	:	Mr Koh Liang Hock	*SP PowerGrid Ltd*
Secretary	:	Mr Md Johan Jamil	*SPRING Singapore*
Members	:	Mr Chan Chee Hin	*Ngee Ann Polytechnic*
		Mr Chia Song Khoon	*Land Transport Authority*
		Prof Lalit Kumar Goel	*Nanyang Technological University*
		Mr Ken G Jung	*Singapore Electrical Contractors and Licensed Electrical Workers Association*
		Er. Adeline Koh	*Association of Consulting Engineers Singapore*
		Mr Lim Bock Teck	*Singapore Polytechnic*
		Er. Lim Say Leong	*Singapore Electrical Trades Association*
		Mr Seng Chin Chye	*Institute of Technical Education*
		Er. Soh Swee Seng	*Housing & Development Board*
		Mr Tan Boon Chong	*Singapore Manufacturing Federation*
		Er. Tan Chong Poh	*SP Services Ltd*
		Dr Teo Tee Hui / Dr Tan Yen Kheng	*Institution of Engineers Singapore*
		Dr Thomas Reindl	*National University of Singapore*
		Mr Yee Peng Huey	*JTC Corporation*
Co-opted Member	:	Er. Peter Toi	*Individual Capacity*

The Working Group appointed by the Technical Committee to assist in the preparation of this standard comprises of the following experts who contribute in their *individual capacity*:

		Name
Convenor	:	Er. Lim Say Leong
Members	:	Mr P K Srinivasan Iyer
		Er. Timmy Mok Kam-Tim
		Mr Ng Kim Leong
		Mr Ng Kin Ming
		Mr Soh Lo San
		Er. Soh Swee Seng
		Mr Sung Puay Kiang
		Er. Tan Hak Khoon
		Mr Tan Hiok Pheng
		Mr Wong Chee Kian
		Mr James Wong
		Ms Rao Yimin

The experts of the Working Group are nominated/recommended by the following organisations:

ABB Pte Ltd
CPG Consultants Pte Ltd
Energy Market Authority
Housing & Development Board
Institution of Engineers Singapore
JTC Corporation
Land Transport Authority
Singapore Electrical Contractors and Licenced Electrical Workers Association
Singapore Electrical Testing Services
Singapore Electrical Trades Association
SP PowerGrid Ltd
Sunlight Electrical Pte Ltd
TUV SUD PSB Pte Ltd

CONTENTS

National Foreword

This Singapore Standard was prepared by the Working Group appointed by the Technical Committee on Power Systems and Utilisation under the direction of the Electrical and Electronic Standards Committee.

This standard is a modified adoption of IEC 61439-1: 2011 'Low-voltage switchgear and controlgear assemblies', published by the International Electrotechnical Commission (IEC). The modifications to suit local context are given as follows:

– References or requirements relating to PEN conductors are to be disregarded as they are currently not permitted for use in Singapore.

– Table D.1 in Annex D is to be replaced by the table in Annex ZA. This modification indicates that a manufacturer's declaration of compliance is accepted in accordance to ISO/IEC 17050-1.

Attention is drawn to the following:

1. Where appropriate, the words 'International Standard' shall be read as 'Singapore Standard'.

2. The reference to the following IEC standards in the text shall be replaced by 'SS CP 5 : 1998 Code of practice for electrical installations and its Amendment 1 : 2008':

   IEC 60364 (all parts)
   IEC 60364-4-41:2005
   IEC 60364-4-44:2007
   IEC 60364-5-52:2009
   IEC 60364-5-53:2001
   IEC 60364-5-54:2011

3. The IEC standard 'IEC 61439 : Part 3' referred to in the text shall be replaced by SS 619-3.

4. The comma has been used throughout as a decimal marker in IEC 61439-1 whereas in Singapore Standards it is a practice to use a full point on the baseline as the decimal marker.

Attention is drawn to the possibility that some of the elements of this Singapore Standard may be the subject of patent rights. Enterprise Singapore shall not be held responsible for identifying any or all of such patent rights.

NOTE

1. *Singapore Standards (SSs) and Technical References (TRs) are reviewed periodically to keep abreast of technical changes, technological developments and industry practices. The changes are documented through the issue of either amendments or revisions.*

2. *An SS or TR is voluntary in nature except when it is made mandatory by a regulatory authority. It can also be cited in contracts making its application a business necessity. Users are advised to assess and determine whether the SS or TR is suitable for their intended use or purpose. If required, they should refer to the relevant professionals or experts for advice on the use of the document. Enterprise Singapore shall not be liable for any damages whether directly or indirectly suffered by anyone or any organisation as a result of the use of any SS or TR.*

3. *Compliance with a SS or TR does not exempt users from any legal obligations.*

INTERNATIONAL ELECTROTECHNICAL COMMISSION

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR ASSEMBLIES –

Part 1: General rules

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61439-1 has been prepared by subcommittee 17D: Low-voltage switchgear and controlgear assemblies, of IEC technical committee 17: Switchgear and controlgear.

This second edition cancels and replaces the first edition published in 2009. It constitutes a technical revision.

This second edition includes the following significant technical changes with respect to the last edition of IEC 61439-1:

- revision of service conditions in Clause 7;
- numerous changes regarding verification methods in Clause 10;

- modification of routine verification in respect of clearances and creepage distances (see 11.3);
- adaption of the tables in Annex C and Annex D to the revised requirements and verification methods;
- revision of the EMC requirements in Annex J;
- shifting of tables from Annex H to new Annex N;
- new Annex O with guidance on temperature rise verification;
- new Annex P with a verification method for short-circuit withstand strength (integration of the content of IEC/TR 61117);
- update of normative references;
- general editorial review.

NOTE It should be noted that when a dated reference to IEC 60439-1 is made in another Part of the IEC 60439 series of assembly standards not yet transferred into the new IEC 61439 series, the superseded IEC 60439-1 still applies (see also the Introduction below).

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

FDIS	Report on voting
17D/441/FDIS	17D/446/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.

In this standard, terms written in small capitals are defined in Clause 3.

The “in some countries” notes regarding differing national practices are contained in the following subclauses:

5.4
8.2.2
8.3.2
8.3.3
8.4.2.3
8.5.5
8.6.6
8.8
9.2
10.11.5.4
10.11.5.6.1
Annex L
Annex M

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

A list of all parts of the IEC 61439 series, under the general title *Low-voltage switchgear and controlgear assemblies*, can be found on the IEC website.

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

The purpose of this standard is to harmonize as far as practicable all rules and requirements of a general nature applicable to low-voltage switchgear and controlgear assemblies (ASSEMBLIES) in order to obtain uniformity of requirements and verification for ASSEMBLIES and to avoid the need for verification to other standards. All those requirements for the various ASSEMBLIES standards which can be considered as general have therefore been gathered in this basic standard together with specific subjects of wide interest and application, e.g. temperature rise, dielectric properties, etc.

For each type of low-voltage switchgear and controlgear assembly only two main standards are necessary to determine all requirements and the corresponding methods of verification:

– this basic standard referred to as “Part 1” in the specific standards covering the various types of low-voltage switchgear and controlgear assemblies;
– the specific ASSEMBLY standard hereinafter also referred to as the relevant ASSEMBLY standard.

For a general rule to apply to a specific ASSEMBLY standard, it should be explicitly referred to by quoting the relevant clause or sub-clause number of this standard followed by “Part 1” e.g. “9.1.3 of Part 1”.

A specific ASSEMBLY standard may not require and hence need not call up a general rule where it is not applicable, or it may add requirements if the general rule is deemed inadequate in the particular case but it may not deviate from it unless there is substantial technical justification detailed in the specific ASSEMBLY standard.

Where in this standard a cross-reference is made to another clause, the reference is to be taken to apply to that clause as amended by the specific ASSEMBLY standard, where applicable.

Requirements in this standard that are subject to agreement between the ASSEMBLY manufacturer and the user are summarised in Annex C (informative). This schedule also facilitates the supply of information on basic conditions and additional user specifications to enable proper design, application and utilization of the ASSEMBLY.

For the new re-structured IEC 61439 series, the following parts are envisaged:

a) IEC 61439-1: General rules
b) IEC 61439-2: Power switchgear and controlgear ASSEMBLIES (PSC-ASSEMBLIES)
c) IEC 61439-3: Distribution boards (to supersede IEC 60439-3)
d) IEC 61439-4: ASSEMBLIES for construction sites (to supersede IEC 60439-4)
e) IEC 61439-5: ASSEMBLIES for power distribution (to supersede IEC 60439-5)
f) IEC 61439-6: Busbar trunking systems (to supersede IEC 60439-2)
g) IEC/TR 61439-0: Guidance to specifying ASSEMBLIES.

This list is not exhaustive; additional Parts may be developed as the need arises.

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR ASSEMBLIES –

Part 1: General rules

1 Scope

NOTE 1 Throughout this standard, the term ASSEMBLY (see 3.1.1) is used for a low-voltage switchgear and controlgear assembly.

This part of the IEC 61439 series lays down the definitions and states the service conditions, construction requirements, technical characteristics and verification requirements for low-voltage switchgear and controlgear assemblies.

This standard cannot be used alone to specify an ASSEMBLY or used for a purpose of determining conformity. ASSEMBLIES shall comply with the relevant part of the IEC 61439 series; Parts 2 onwards.

This standard applies to low-voltage switchgear and controlgear assemblies (ASSEMBLIES) only when required by the relevant ASSEMBLY standard as follows:

- ASSEMBLIES for which the rated voltage does not exceed 1 000 V in case of a.c. or 1 500 V in case of d.c.;
- stationary or movable ASSEMBLIES with or without enclosure;
- ASSEMBLIES intended for use in connection with the generation, transmission, distribution and conversion of electric energy, and for the control of electric energy consuming equipment;
- ASSEMBLIES designed for use under special service conditions, for example in ships and in rail vehicles provided that the other relevant specific requirements are complied with;

  NOTE 2 Supplementary requirements for ASSEMBLIES in ships are covered by IEC 60092-302.

- ASSEMBLIES designed for electrical equipment of machines provided that the other relevant specific requirements are complied with.

  NOTE 3 Supplementary requirements for ASSEMBLIES forming part of a machine are covered by the IEC 60204 series.

This standard applies to all ASSEMBLIES whether they are designed, manufactured and verified on a one-off basis or fully standardised and manufactured in quantity.

The manufacture and/or assembly may be carried out other than by the original manufacturer (see 3.10.1).

This standard does not apply to individual devices and self-contained components, such as motor starters, fuse switches, electronic equipment, etc. which will comply with the relevant product standards.

2 Normative references

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

IEC 60068-2-2:2007, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*

IEC 60068-2-11:1981, *Basic environmental testing procedures – Part 2-11: Tests – Test Ka: Salt mist*

IEC 60068-2-30:2005, *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 + 12 h cycle)*

IEC 60073:2002, *Basic and safety principles for man-machine interface, marking and identification – Coding principles for indicators and actuators*

IEC 60085:2007, *Electrical insulation – Thermal evaluation and designation*

IEC 60216 (all parts), *Electrical insulating materials – Properties of thermal endurance*

IEC 60227-3:1993, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 3: Non-sheathed cables for fixed wiring*

IEC 60245-3:1994, *Rubber insulated cables – Rated voltages up to and including 450/750 V – Part 3: Heat resistant silicone insulated cables*

IEC 60245-4:1994, *Rubber insulated cables – Rated voltages up to and including 450/750 V – Part 4: Cords and flexible cables*

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

IEC 60364-4-41:2005, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock*

IEC 60364-4-44:2007, *Low-voltage electrical installations – Part 4-44: Protection for safety – Protection against voltage disturbances and electromagnetic disturbances*

IEC 60364-5-52:2009, *Low-voltage electrical installations – Part 5-52: Selection and erection of electrical equipment – Wiring systems*

IEC 60364-5-53:2001, *Electrical installations of buildings – Part 5-53: Selection and erection of electrical equipment – Isolation, switching and control*

IEC 60364-5-54:2011, *Low-voltage electrical installations – Part 5-54: Selection and erection of electrical equipment – Earthing arrangements and protective conductors*

IEC 60439 (all parts), *Low-voltage switchgear and controlgear assemblies*

IEC 60445:2010, *Basic and safety principles for man-machine interface, marking and identification – Identification of equipment terminals, conductor terminations and conductors*

IEC 60447:2004, *Basic and safety principles for man-machine interface, marking and identification – Actuating principles*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*[1]

---

1 There is a consolidated edition 1.1 (2001) that includes IEC 60529 (1989) and its amendment 1 (1999).

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

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

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

IEC 60695-11-5:2004, *Fire hazard testing – Part 11-5: Test flames – Needle-flame test method – Apparatus, confirmatory test arrangement and guidance*

IEC 60865-1:1993, *Short-circuit currents – Calculation of effects – Part 1: Definitions and calculation methods*

IEC 60890:1987, *A method of temperature-rise assessment by extrapolation for partially type-tested assemblies (PTTA) of low-voltage switchgear and controlgear*

IEC 60947-1:2007, *Low-voltage switchgear and controlgear – Part 1: General rules*

IEC 61000-4-2:2008, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3:2006, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio frequency, electromagnetic field immunity test*[2]

IEC 61000-4-4:2004, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5:2005, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6:2008, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-8:2009, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test*

IEC 61000-4-11:2004, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests*

IEC 61000-4-13:2002, *Electromagnetic compatibility (EMC) – Part 4-13: Testing and measurement techniques – Harmonics and interharmonics including mains signalling at a.c. power port, low-frequency immunity tests*[3]

IEC 61000-6-4:2006, *Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments*[4]

---

2 There is a consolidated edition 3.2 (2010) that includes IEC 61000-4-3 (2006) and amendment 1 (2007) and amendment 2 (2010).

3 There is a consolidated edition 1.1 (2009) that includes IEC 61000-4-13 (2002) and its amendment 1 (2009).

IEC 61082-1, *Preparation of documents used in electrotechnology – Part 1:Rules*

IEC 61180 (all parts), *High-voltage test techniques for low-voltage equipment*

IEC/TS 61201:2007, *Use of conventional touch voltage limits – Application guide*

IEC 61439 (all parts), *Low-voltage switchgear and controlgear assemblies*

IEC 62208, *Empty enclosures for low-voltage switchgear and controlgear assemblies – General requirements*

IEC 62262:2002, *Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)*

IEC 81346-1, *Industrial systems, installations and equipment and industrial products – Structuring principles and reference designations – Part 1: Basic rules*

IEC 81346-2, *Industrial systems, installations and equipment and industrial products – Structuring principles and reference designations – Part 2: Classification of objects and codes for classes*

CISPR 11:2009, *Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement*[5]

CISPR 22, *Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement*

ISO 178:2001, *Plastics – Determination of flexural properties*

ISO 179 (all parts), *Plastics – Determination of Charpy impact strength*

ISO 2409:2007, *Paints and varnishes – Cross-cut test*

ISO 4628-3:2003, *Paints and varnishes – Evaluation of degradation of coatings – Designation of quantity and size of defects, and of intensity of uniform changes in appearance – Part 3: Assessment of degree of rusting*

ISO 4892-2:2006, *Plastics – Methods of exposure to laboratory light sources – Part 2: Xenon-arc lamps*

---

4 There is a consolidated edition 2.1 (2011) that includes IEC 61000-6-4 (2006) and its amendment 1 (2010).

5 There is a consolidated edition 5.1 (2010) that includes CISPR 11 (2009) and its amendment 1 (2010).