



IEC/TR 61439-0

Edition 2.0 2013-04

TECHNICAL REPORT

**Low-voltage switchgear and controlgear assemblies –
Part 0: Guidance to specifying assemblies**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE **XB**

ICS 29.130.20

ISBN 978-2-83220-787-1

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

| | |
|---|----|
| FOREWORD..... | 5 |
| INTRODUCTION..... | 7 |
| 1 Scope..... | 9 |
| 2 Normative references | 9 |
| 3 Terms and definitions | 10 |
| 4 Application of ASSEMBLIES within the IEC 61439 series | 10 |
| 4.1 General | 10 |
| 4.2 ASSEMBLY design and verification..... | 10 |
| 4.3 Service conditions and interface characteristics | 10 |
| 4.4 Design..... | 11 |
| 5 Electrical system | 11 |
| 5.1 General | 11 |
| 5.2 Earthing system | 11 |
| 5.3 Nominal voltage | 11 |
| 5.4 Transient overvoltages | 12 |
| 5.5 Unusual voltage transients, temporary overvoltages | 13 |
| 5.6 Rated frequency f_n (Hz) | 13 |
| 5.7 Additional on-site testing requirements: wiring, operational performance and function | 14 |
| 6 Short-circuit withstand capability | 14 |
| 6.1 General | 14 |
| 6.2 Prospective short-circuit current at supply terminals I_{cp} (kA)..... | 14 |
| 6.3 Prospective short-circuit current in the neutral..... | 15 |
| 6.4 Prospective short-circuit current in the protective circuit..... | 15 |
| 6.5 Short-circuit protective device (SCPD)..... | 15 |
| 6.6 Co-ordination of short-circuit protective devices including external short-circuit protective device details..... | 16 |
| 6.7 Data associated with loads likely to contribute to the short-circuit current..... | 16 |
| 7 Protection of persons against electric shock | 17 |
| 7.1 General | 17 |
| 7.2 Basic protection (protection against direct contact)..... | 17 |
| 7.2.1 General | 17 |
| 7.2.2 Basic insulation provided by insulating material | 17 |
| 7.2.3 Barriers or enclosures | 17 |
| 7.3 Fault protection (protection against indirect contact)..... | 18 |
| 7.3.1 General | 18 |
| 7.3.2 Requirements for the protective conductor to facilitate automatic disconnection of the supply | 18 |
| 7.3.3 Electrical separation | 19 |
| 7.3.4 Protection by total insulation..... | 19 |
| 8 Installation environment..... | 20 |
| 8.1 General | 20 |
| 8.2 Location type..... | 20 |
| 8.3 Protection against ingress of solid foreign bodies and ingress of water..... | 20 |
| 8.4 External mechanical impact..... | 21 |
| 8.5 Resistance to UV radiation | 21 |
| 8.6 Resistance to corrosion | 21 |

| | | |
|--------|---|----|
| 8.7 | Ambient air temperature | 21 |
| 8.8 | Maximum relative humidity | 21 |
| 8.9 | Pollution degree | 22 |
| 8.10 | Altitude..... | 22 |
| 8.11 | EMC environment..... | 22 |
| 8.12 | Special service conditions | 23 |
| 8.12.1 | General | 23 |
| 8.12.2 | Climatic conditions | 24 |
| 8.12.3 | Protection against ingress of solid foreign bodies and ingress of water | 24 |
| 8.12.4 | Shock, vibration, seismic occurrence and external mechanical impact (IK)..... | 24 |
| 8.12.5 | Fire and explosion hazards..... | 24 |
| 8.12.6 | Exceptional overvoltages | 25 |
| 8.12.7 | EMC environment | 25 |
| 9 | Installation method | 25 |
| 9.1 | General | 25 |
| 9.2 | Assembly type..... | 25 |
| 9.3 | Portability..... | 26 |
| 9.4 | Maximum overall dimensions and weight..... | 26 |
| 9.5 | External conductor type(s)..... | 26 |
| 9.6 | Direction(s) of external conductors | 26 |
| 9.7 | External conductor material..... | 26 |
| 9.8 | External phase conductor, cross-sections, and terminations..... | 27 |
| 9.9 | External PE, N, PEN conductors cross-sections, and terminations | 27 |
| 9.10 | Special terminal identification requirements..... | 27 |
| 10 | Storage and handling | 28 |
| 10.1 | General | 28 |
| 10.2 | Maximum dimensions and weight of transport units | 28 |
| 10.3 | Methods of transport (e.g. forklift, crane)..... | 28 |
| 10.4 | Environmental conditions different from the service conditions | 28 |
| 10.5 | Packing details..... | 28 |
| 11 | Operating arrangements..... | 28 |
| 11.1 | General | 28 |
| 11.2 | Access to manually operated devices | 29 |
| 11.3 | Isolation of load installation equipment items..... | 29 |
| 12 | Maintenance and upgrade capabilities | 30 |
| 12.1 | General | 30 |
| 12.2 | Requirements related to accessibility for inspection and similar operations | 30 |
| 12.3 | Requirements related to accessibility for maintenance in service by authorized persons..... | 30 |
| 12.4 | Requirements related to extension under voltage | 31 |
| 12.5 | Protection against direct contact with hazardous live internal parts during maintenance or upgrade..... | 31 |
| 12.6 | Method of functional units connection..... | 31 |
| 12.7 | Operating and maintenance gangways within an ASSEMBLY | 32 |
| 12.8 | Internal separation | 32 |
| 13 | Current carrying capability..... | 32 |
| 13.1 | General | 32 |

| | | |
|--------|---|----|
| 13.2 | Rated current I_{nA} (A) (maximum current allowable)..... | 32 |
| 13.3 | Rated current of circuits I_{nC} (A)..... | 33 |
| 13.4 | Rated diversity factor (RDF) | 33 |
| 13.5 | Ratio of cross-section of the neutral conductor to phase conductors..... | 33 |
| 13.5.1 | General | 33 |
| 13.5.2 | Phase conductors up to and including 16 mm ² | 33 |
| 13.5.3 | Phase conductors above 16 mm ² | 33 |
| 14 | ASSEMBLY design and routine verification processes | 34 |
| 14.1 | Design verification..... | 34 |
| 14.1.1 | Object..... | 34 |
| 14.1.2 | Methods | 34 |
| 14.1.3 | Records..... | 34 |
| 14.2 | Routine verification..... | 34 |
| 14.2.1 | General | 34 |
| 14.2.2 | Records..... | 35 |
| | Annex A (informative) Cross-section of copper conductors suitable for connection to terminals for external conductors | 36 |
| | Annex B (informative) Forms of internal separation (see 12.8) | 37 |
| | Annex C (informative) Specification guidance for IEC 61439-2..... | 41 |
| | Annex D (informative) Specification guidance for IEC 61439-3..... | 47 |
| | Annex E (informative) Specification guidance for IEC 61439-4..... | 51 |
| | Annex F (informative) Specification guidance for future IEC 61439-5..... | 55 |
| | Annex G (informative) Specification guidance for IEC 61439-6 | 56 |
| | Annex H (informative) Specification guidance for IEC 61439-7..... | 60 |
| | Annex I (informative) List of notes concerning certain countries | 61 |
| | Bibliography..... | 62 |
| | Figure 1 – Required rated impulse withstand voltage | 13 |
| | Figure B.1 – Symbols used in Figures B.2 and B.3..... | 38 |
| | Figure B.2 – Forms 1 and 2 | 39 |
| | Figure B.3 – Forms 3 and 4 | 40 |
| | Table A.1 – Cross-section of copper conductors suitable for connection to terminals for external conductors | 36 |
| | Table B.1 – Forms of internal separation..... | 37 |
| | Table C.1 – Items subject to agreement between the ASSEMBLY manufacturer and the user | 41 |
| | Table C.2 – Examples of optional items subject to agreement between the ASSEMBLY manufacturer and the user | 45 |
| | Table D.1 – Items subject to agreement between the ASSEMBLY manufacturer and the user | 47 |
| | Table E.1 – Items subject to agreement between the ASSEMBLY manufacturer and the user | 51 |
| | Table G.1 – Items subject to agreement between the ASSEMBLY manufacturer and the user | 56 |

INTERNATIONAL ELECTROTECHNICAL COMMISSION

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR ASSEMBLIES –**Part 0: Guidance to specifying assemblies**

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.

The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a technical report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

IEC 61439-0, which is a technical report, 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 2010. It constitutes a technical revision.

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

- alignment with IEC 61439-1:2011;
- alignment of Annex B with Annex AA of IEC 61439-2:2011;
- alignment of Table C.1 with Table BB.1 of IEC 61439-2:2011;

- addition of a new Annex D regarding IEC 61439-3;
- addition of a new Annex E regarding IEC 61439-4;
- addition of a new Annex G regarding IEC 61439-6;
- general editorial review.

The text of this technical report is based on the following documents:

| | |
|---------------|------------------|
| Enquiry draft | Report on voting |
| 17D/458/DTR | 17D/467A/RVC |

Full information on the voting for the approval of this technical report 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.

The reader's attention is drawn to the fact that Annex I lists all of the "in-some-country" clauses on differing practices of a less permanent nature relating to the subject of this Technical Report.

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 web site.

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.

A bilingual version of this publication may be issued at a later date.

INTRODUCTION

For the purposes of this technical report, the user is the party who specifies or selects the ASSEMBLY characteristics. The user may be the same party as the one who will use and operate the ASSEMBLY, or someone acting on their behalf. The aim of this technical report is to provide the user with guidance on the specification that should be provided in order to achieve the desired design of an assembly. Throughout this technical report, the term ASSEMBLY is used for a low-voltage switchgear and controlgear assembly. The term “manufacturer” refers to the ASSEMBLY manufacturer unless specifically noted otherwise.

The purpose of the IEC 61439 series of standards is to harmonize as far as practicable, all the general rules and requirements that apply to ASSEMBLIES. The series further seeks, in order to obtain uniformity of requirements for ASSEMBLIES, consistency in the verification of ASSEMBLIES and to avoid the need for verification to other standards.

All those requirements for the various ASSEMBLIES that can be considered as general, together with specific subjects of wide interest and application, e.g. temperature rise, dielectric properties, have therefore been gathered in IEC 61439-1 as general rules. For each type of ASSEMBLY only two main standards are necessary to determine all requirements and the corresponding methods of verification:

- 1) the standard giving the general rules and designated “Part 1”, and
- 2) the specific ASSEMBLY standard, hereinafter referred to as the relevant ASSEMBLY standard.

The IEC 61439 series of standards encompasses ASSEMBLIES for a wide variety of uses, some of which have specific needs as dictated by their particular application. In order to define clearly these specific needs, relevant ASSEMBLY standards focussed on a particular type of application have been (or are being) developed. These are identified as IEC 61439-2 to IEC 61439-7, inclusive (see list below). Each relevant ASSEMBLY standard with reference to IEC 61439-1, the general rules, as appropriate, specifies the characteristics and performance required by an ASSEMBLY within its defined scope of application. Each relevant ASSEMBLY standard includes, as an annex, a template for “items subject to agreement between the ASSEMBLY manufacturer and the user” to facilitate the specifying of an ASSEMBLY. These are reproduced and explained in this technical report.

General characteristics of all types of assemblies are considered in this Technical Report. Details of which are applicable to each type of assembly can be determined by reference to the Specification Template in Annex ‘C’ onwards.

Within this technical report, reference to IEC 61439 means the series of ASSEMBLY standards, including:

- IEC 61439-1:2011, *Low-voltage switchgear and controlgear assemblies – Part 1: General rules*
- IEC 61439-2:2011, *Low-voltage switchgear and controlgear assemblies – Part 2: Power switchgear and controlgear assemblies*
- IEC 61439-3:2012, *Low-voltage switchgear and controlgear assemblies – Part 3: Distribution boards intended to be operated by ordinary persons (DBO)*
- IEC 61439-4:2012, *Low-voltage switchgear and controlgear assemblies – Part 4: Particular requirements for assemblies for construction sites (ACS)*
- IEC 61439-5:2010, *Low-voltage switchgear and controlgear assemblies – Part 5: Assemblies for power distribution in public networks*
- IEC 61439-6:2012, *Low-voltage switchgear and controlgear assemblies – Part 6: Busbar trunking systems (busways)*

- IEC 61439-7:2013, *Low-voltage switchgear and controlgear assemblies – Part 7: Assemblies for specific applications such as marinas, camping sites, market squares, electrical vehicles charging stations*¹

A reference to “general rules” means a reference to IEC 61439-1:2011.

A reference to “ASSEMBLY standard” means the relevant part of the IEC 61439 series (e.g. Part 2, 3, etc.).

A reference to “product standard” means the relevant part or parts of the IEC standard for the components used in the ASSEMBLY (e.g. IEC 60947-2 for circuit breakers).

¹ To be published.

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR ASSEMBLIES –

Part 0: Guidance to specifying assemblies

1 Scope

Within the IEC 61439 series of standards for low-voltage switchgear and controlgear assemblies (ASSEMBLIES), there are system and application details that are specified by the user to enable the manufacturer to produce an ASSEMBLY that meets the needs and expectations of the user.

This Part of IEC 61439, which is a technical report identifies, from the user's perspective, those functions and characteristics that should be defined when specifying ASSEMBLIES. It provides:

- an explanation of the ASSEMBLY characteristics and options within the IEC 61439 series;
- a guidance on how to select the appropriate option and to define characteristics so as to meet specific application needs, using a functional approach; and
- an assistance in the specification of ASSEMBLIES.

References within this technical report to the interface characteristics of an ASSEMBLY and the requirements with which they will comply assume that the ASSEMBLY is designed, manufactured, and verified in accordance with the relevant IEC 61439 part.

2 Normative references

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

CISPR 11, *Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement*

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

IEC 60364-6, *Low-voltage electrical installations – Part 6: Verification*

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

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 61439-1:2011, *Low-voltage switchgear and controlgear assemblies – Part 1: General rules*

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