High-voltage switchgear and controlgear –
Part 200: AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV
CONTENTS

FOREWORD .............................................................................................................................. 6
INTRODUCTION .......................................................................................................................... 9
1 Scope ...................................................................................................................................... 10
2 Normative references ............................................................................................................ 10
3 Terms and definitions .......................................................................................................... 11
  3.1 General terms and definitions .......................................................................................... 11
  3.2 Assemblies of switchgear and controlgear ...................................................................... 13
  3.3 Parts of assemblies ........................................................................................................... 13
  3.4 Switching devices ............................................................................................................. 13
  3.5 Parts of switchgear and controlgear ................................................................................ 13
  3.6 Operational characteristics of switchgear and controlgear .......................................... 16
  3.7 Characteristic quantities ................................................................................................. 18
  3.8 Index of definitions ......................................................................................................... 19
4 Normal and special service conditions .............................................................................. 20
5 Ratings .................................................................................................................................... 21
  5.1 General .............................................................................................................................. 21
  5.2 Rated voltage \(U_r\) ............................................................................................................. 21
  5.3 Rated insulation level \(U_d, U_p, U_s\) .................................................................................. 21
  5.4 Rated frequency \(f_r\) ......................................................................................................... 21
  5.5 Rated continuous current \(I_r\) .......................................................................................... 21
  5.6 Rated short-time withstand currents \(I_k, I_{ke}\) ................................................................. 21
  5.7 Rated peak withstand currents \(I_p, I_{pe}\) ....................................................................... 22
  5.8 Rated durations of short-circuit \(I_k, I_{ke}\) ....................................................................... 22
  5.9 Rated supply voltage of auxiliary and control circuits \(U_{da}\) ........................................... 23
  5.10 Rated supply frequency of auxiliary and control circuits ............................................ 23
  5.11 Rated pressure of compressed gas supply for controlled pressure systems ................. 23
  5.101 Classification of earthing function through main switching device ......................... 23
  5.102 Rated cable test voltages \(U_{ct\ (AC)}, U_{ct\ (DC)}\) ............................................................. 23
  5.103 Ratings of the internal arc classification \(IAC\) .............................................................. 23
6 Design and construction ...................................................................................................... 25
  6.1 Requirements for liquids in switchgear and controlgear .............................................. 25
  6.2 Requirements for gases in switchgear and controlgear ................................................... 25
  6.3 Earthing of switchgear and controlgear ......................................................................... 25
  6.4 Auxiliary and control equipment and circuits ............................................................... 26
  6.5 Dependent power operation ............................................................................................ 26
  6.6 Stored energy operation ................................................................................................... 26
  6.7 Independent unlatched operation (independent manual or power operation) ............... 26
  6.8 Manually operated actuators ........................................................................................... 26
  6.9 Operation of releases ....................................................................................................... 26
  6.10 Pressure/level indication ................................................................................................. 27
  6.11 Nameplates .................................................................................................................... 27
  6.12 Locking devices ............................................................................................................. 28
  6.13 Position indication .......................................................................................................... 29
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.14</td>
<td>Degrees of protection provided by enclosures</td>
<td>29</td>
</tr>
<tr>
<td>6.15</td>
<td>Creepage distances for outdoor insulators</td>
<td>30</td>
</tr>
<tr>
<td>6.16</td>
<td>Gas and vacuum tightness</td>
<td>30</td>
</tr>
<tr>
<td>6.17</td>
<td>Tightness for liquid systems</td>
<td>30</td>
</tr>
<tr>
<td>6.18</td>
<td>Fire hazard (flammability)</td>
<td>30</td>
</tr>
<tr>
<td>6.19</td>
<td>Electromagnetic compatibility (EMC)</td>
<td>30</td>
</tr>
<tr>
<td>6.20</td>
<td>X-ray emission</td>
<td>30</td>
</tr>
<tr>
<td>6.21</td>
<td>Corrosion</td>
<td>30</td>
</tr>
<tr>
<td>6.22</td>
<td>Filling levels for insulation, switching and/or operation</td>
<td>30</td>
</tr>
<tr>
<td>6.101</td>
<td>General requirements for assemblies</td>
<td>31</td>
</tr>
<tr>
<td>6.102</td>
<td>Metal enclosure</td>
<td>31</td>
</tr>
<tr>
<td>6.103</td>
<td>High-voltage compartments</td>
<td>33</td>
</tr>
<tr>
<td>6.104</td>
<td>Removable parts</td>
<td>37</td>
</tr>
<tr>
<td>6.105</td>
<td>Provisions for dielectric tests on cables</td>
<td>37</td>
</tr>
<tr>
<td>6.106</td>
<td>Internal arc fault</td>
<td>38</td>
</tr>
<tr>
<td>7</td>
<td>Type tests</td>
<td>38</td>
</tr>
<tr>
<td>7.1</td>
<td>General</td>
<td>38</td>
</tr>
<tr>
<td>7.2</td>
<td>Dielectric tests</td>
<td>39</td>
</tr>
<tr>
<td>7.3</td>
<td>Radio interference voltage (RIV) test</td>
<td>43</td>
</tr>
<tr>
<td>7.4</td>
<td>Resistance measurement</td>
<td>43</td>
</tr>
<tr>
<td>7.5</td>
<td>Continuous current tests</td>
<td>43</td>
</tr>
<tr>
<td>7.6</td>
<td>Short-time withstand current and peak withstand current tests</td>
<td>45</td>
</tr>
<tr>
<td>7.7</td>
<td>Verification of the protection</td>
<td>47</td>
</tr>
<tr>
<td>7.8</td>
<td>Tightness tests</td>
<td>47</td>
</tr>
<tr>
<td>7.9</td>
<td>Electromagnetic compatibility tests (EMC)</td>
<td>48</td>
</tr>
<tr>
<td>7.10</td>
<td>Additional tests on auxiliary and control circuits</td>
<td>48</td>
</tr>
<tr>
<td>7.11</td>
<td>X-radiation test for vacuum interrupters</td>
<td>48</td>
</tr>
<tr>
<td>7.101</td>
<td>Verification of making and breaking capacities</td>
<td>48</td>
</tr>
<tr>
<td>7.102</td>
<td>Mechanical operation tests</td>
<td>50</td>
</tr>
<tr>
<td>7.103</td>
<td>Pressure withstand test for gas-filled compartments</td>
<td>51</td>
</tr>
<tr>
<td>7.104</td>
<td>Tests to verify the protection of persons against dangerous electrical effects</td>
<td>52</td>
</tr>
<tr>
<td>7.105</td>
<td>Internal arc test</td>
<td>53</td>
</tr>
<tr>
<td>8</td>
<td>Routine tests</td>
<td>57</td>
</tr>
<tr>
<td>8.1</td>
<td>General</td>
<td>57</td>
</tr>
<tr>
<td>8.2</td>
<td>Dielectric test on the main circuit</td>
<td>57</td>
</tr>
<tr>
<td>8.3</td>
<td>Tests on auxiliary and control circuits</td>
<td>57</td>
</tr>
<tr>
<td>8.4</td>
<td>Measurement of the resistance of the main circuit</td>
<td>58</td>
</tr>
<tr>
<td>8.5</td>
<td>Tightness test</td>
<td>58</td>
</tr>
<tr>
<td>8.6</td>
<td>Design and visual checks</td>
<td>58</td>
</tr>
<tr>
<td>8.101</td>
<td>Partial discharge measurement</td>
<td>58</td>
</tr>
<tr>
<td>8.102</td>
<td>Mechanical operation tests</td>
<td>58</td>
</tr>
<tr>
<td>8.103</td>
<td>Pressure tests of gas-filled compartments</td>
<td>59</td>
</tr>
<tr>
<td>8.104</td>
<td>Tests after erection on site</td>
<td>59</td>
</tr>
<tr>
<td>8.105</td>
<td>Measurement of fluid condition after filling on site</td>
<td>59</td>
</tr>
<tr>
<td>9</td>
<td>Guide to the selection of switchgear and controlgear (informative)</td>
<td>59</td>
</tr>
<tr>
<td>9.1</td>
<td>General</td>
<td>59</td>
</tr>
<tr>
<td>9.2</td>
<td>Selection of rated values</td>
<td>60</td>
</tr>
<tr>
<td>9.3</td>
<td>Cable-interface considerations</td>
<td>60</td>
</tr>
</tbody>
</table>
9.4 Continuous or temporary overload due to changed service conditions .................. 60
9.5 Environmental aspects ......................................................................................... 60
9.101 Selection of design and construction ............................................................... 60
9.102 Ratings related to earthing circuits .................................................................. 64
9.103 Internal arc fault ............................................................................................... 65
9.104 Summary of technical requirements, ratings and optional tests ...................... 71
10 Information to be given with enquiries, tenders and orders (informative) .............. 73
  10.1 General ............................................................................................................... 73
  10.2 Information with enquiries and orders ............................................................... 73
  10.3 Information with tenders .................................................................................. 74
11 Transport, storage, installation, operating instructions and maintenance .............. 75
  11.1 General ............................................................................................................... 75
  11.2 Conditions during transport, storage and installation ........................................ 75
  11.3 Installation ......................................................................................................... 75
  11.4 Operating instructions ....................................................................................... 75
  11.5 Maintenance ..................................................................................................... 76
12 Safety ..................................................................................................................... 76
  12.101 Procedures .................................................................................................... 76
  12.102 Internal arc aspects ....................................................................................... 76
13 Influence of the product on the environment .......................................................... 77
Annex A (normative) Internal arc fault – Method to verify the internal arc classification (IAC) .............................................................. 78
  A.1 Room simulation ............................................................................................... 78
  A.2 Indicators (for assessing the thermal effects of the gases) ................................ 80
  A.3 Tolerances for geometrical dimensions of test arrangements ......................... 82
  A.4 Test parameters ............................................................................................... 82
  A.5 Test procedure ................................................................................................. 83
Annex B (normative) Partial discharge measurement ............................................... 95
  B.1 General ............................................................................................................... 95
  B.2 Application ....................................................................................................... 95
  B.3 Test circuits and measuring instruments ............................................................ 95
  B.4 Test procedure ................................................................................................. 96
  B.5 Maximum permissible partial discharge quantity ............................................ 97
Annex C (informative) List of notes concerning certain countries ............................... 101
Annex D (normative) Flowchart categorization procedure for LSC for a given functional unit FU1 with connection compartment ....................... 102
Bibliography ............................................................................................................. 103

Figure 1 – LSC1 ........................................................................................................... 63
Figure 2 – LSC2 ........................................................................................................... 63
Figure 3 – LSC2 ........................................................................................................... 63
Figure 4 – LSC2 ........................................................................................................... 64
Figure 5 – LSC2A ........................................................................................................ 64
Figure 6 – LSC2B ........................................................................................................ 64
Figure 7 – LSC2B ........................................................................................................ 64
Figure 8 – LSC1 ........................................................................................................... 64
HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –
Part 200: AC metal-enclosed switchgear and controlgear
for rated voltages above 1 kV and up to and including 52 kV

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.

IEC 62271-200 has been prepared by subcommittee 17C: Assemblies, of IEC technical committee 17: High-voltage switchgear and controlgear. It is an International Standard.

This third edition cancels and replaces the second edition published in 2011. This edition constitutes a technical revision.

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

a) clause numbering aligned with IEC 62271-1:2017, including the adoption of the subclause names of Clause 3;
b) in Clause 3 specific definitions are added for "in service", "normal operating condition" and "normal use";
c) internal arc testing on pole-mounted switchgear is taken out of this document, as it is now covered by the specific standard IEC 62271-214:2019;
d) a more precise description of earthing circuit is given with the inclusion of ratings and test requirements;

e) number of mechanical tests on interlocks is reduced for type testing; a more precise description of forces to apply during type testing is given (refer to 7.102);

f) resistance measuring on main circuit is only needed before continuous current tests (as reference for routine tests) and no longer needed after this continuous current test. Rationale for this deletion is that this measured resistance does not mean anything; as the temperature rise test was just finished, a new temperature rise test will not give new information;


h) IEC 62271-107:2019 and IEC IEEE 62271-37-013:2015 are also considered in 7.101.2;

i) a more precise description of LSC category is given with the inclusion of an explanatory flowchart (Annex D);

j) examples not covered by the IAC test are transferred from Clause 6 to 9.103;

k) the term "assembly" is defined in Clause 3 and used as synonym for "metal-enclosed switchgear and controlgear" in this document;

l) "metallic" is replaced by "metal" where applicable;

m) 6.105 is now covered by 7.7;

n) a 1 s rule was introduced for Criterion 4 during IAC tests regarding hot gases versus glowing particles as cause of ignition;

o) a more precise description of internal arc tests for switchgear with protrusions is given in Annex A.

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

<table>
<thead>
<tr>
<th>FDIS</th>
<th>Report on voting</th>
</tr>
</thead>
<tbody>
<tr>
<td>17C/782/FDIS</td>
<td>17C/792/RVD</td>
</tr>
</tbody>
</table>

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

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

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

This document should be read in conjunction with IEC 62271-1:2017, to which it refers and which is applicable unless otherwise specified. In order to simplify the indication of corresponding requirements, the same numbering of clauses and subclauses is used as in IEC 62271-1:2017. Amendments to these clauses and subclauses are given under the same numbering, whilst additional subclauses, are numbered from 101.

The reader’s attention is drawn to the fact that Annex C lists all of the “in-some-country” clauses on differing practices of a less permanent nature relating to the subject of this document.

A list of all parts in the IEC 62271 series, published under the general title High-voltage switchgear and controlgear, can be found on the IEC website.
The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

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

**IMPORTANT –** The "colour inside" logo on the cover page of this document 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

High-voltage (IEC 60050-601:1985, 601-01-27) switchgear refers to rated voltages above 1 kV. However, medium-voltage is commonly used for distribution systems with rated voltages above 1 kV and generally applied up to and including 52 kV; refer to IEC 60050-601:1985, 601-01-28 [1]¹.

Although primarily dedicated to three-phase systems, this document can also be applied to single-phase and two-phase systems.

Switchgear and controlgear assemblies having a solid-insulation enclosure are covered by IEC 62271-201.

¹ Numbers in square brackets refer to the Bibliography.
HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 200: AC metal-enclosed switchgear and controlgear
for rated voltages above 1 kV and up to and including 52 kV

1 Scope

This part of IEC 62271 is applicable to prefabricated metal-enclosed switchgear and controlgear assemblies designed for:
– alternating current;
– rated voltages above 1 kV and up to and including 52 kV;
– service frequencies up to and including 60 Hz;
– indoor and outdoor installation.
The assembly can include air-insulated and/or fluid-filled compartments.

For components installed in a metal-enclosed switchgear and controlgear, this document supplements or even replaces in some cases, the requirements as stated by the individual product standards.

The list of components which can be inside the metal-enclosed switchgear and controlgear is not limited to the ones explicitly cited in this document.

2 Normative references

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


IEC 60060-1:2010, High-voltage test techniques – Part 1: General definitions and test requirements

IEC 60270:2000, High-voltage test techniques – Partial discharge measurements

IEC 60529:1989, Degrees of protection provided by enclosures (IP Code)
IEC 60529:1989/AMD1:1999

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

IEC 62271-1:2017, High-voltage switchgear and controlgear – Part 1: Common specifications for alternating current switchgear and controlgear
For the purposes of this document, the terms and definitions given in IEC 62271-1, IEC 60050-151 and IEC 60050-441, and the following apply.

NOTE The classification system for definitions of IEC 62271-1:2017 is followed. Terms and definitions are referenced and prioritised in the following order:

– Clause 3 of this document;
– IEC 62271-1:2017;
– IEC 60050-441;
– IEC 60050-151.

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

• IEC Electropedia: available at http://www.electropedia.org/
• ISO Online browsing platform: available at http://www.iso.org/obp

3.1 General terms and definitions

The definitions in 3.1 of IEC 62271-1:2017 are applicable, with the following additions and/or modifications: