

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

High-voltage switchgear and controlgear –  
Part 205: Compact switchgear assemblies for rated voltages above 52 kV

Appareillage à haute tension –  
Partie 205: Ensembles d'appareillages compacts de tensions assignées  
supérieures à 52 kV

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IEC 62271-205:2008  
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ELECTROTECHNICAL  
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## HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

**Part 205: Compact switchgear assemblies  
for rated voltages above 52 kV**

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International Standard IEC 62271-205 has been prepared by subcommittee 17C: High-voltage switchgear and controlgear assemblies, of IEC technical committee 17: Switchgear and controlgear.

This standard should be read in conjunction with IEC 62271-1, first edition, 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. Amendments to these clauses and subclauses are given under the same numbering, whilst additional subclauses are numbered from 101.

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

FDIS	Report on voting
17C/418/FDIS	17C/423/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.

A list of all the parts in the IEC 62271 series, 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 publication will remain unchanged until the maintenance result 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

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## HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

### Part 205: Compact switchgear assemblies for rated voltages above 52 kV

#### 1 General

##### 1.1 Scope

This part of IEC 62271 applies to compact switchgear assemblies consisting of at least one switching device directly connected to, or sharing components with, one or more other devices such that there is an interaction between the functions of the individual devices. Such assemblies are made up of devices defined in 1.101 and are designed, tested and supplied for use as a single unit. The interaction between devices may be due to proximity, sharing of components or a combination of both. The assemblies may contain components of air insulated switchgear (AIS) only or a combination of AIS and gas insulated switchgear (GIS), so called mixed technology switchgear (MTS) and may be delivered entirely prefabricated or partially assembled.

It is not possible to define all potential arrangements of compact switchgear assemblies however four examples are shown for information in Annex A.

These compact switchgear assemblies are for indoor and/or outdoor installations in systems having rated voltages above 52 kV and service frequencies of 50 Hz and 60 Hz.

This standard covers the influence on performance of the interactions between devices within compact switchgear assemblies and defines ratings and test procedures for these assemblies.

IEC 62271-1 is applicable if not stated otherwise.

This standard does not apply to switchgear assemblies consisting solely of GIS which are covered by 62271-203.

##### 1.101 Objective

The objective of this standard is to respond to the increasing use of compact switchgear assemblies that perform the functions of a number of separate devices and their controlgear. Numerous arrangements are possible and this standard provides guidance on basic types of assemblies which might be envisaged.

As there are potential interactions between devices within such assemblies, it is necessary to consider the standardization requirements for the assembly in its entirety.

The devices, defined by IEC standards, which may form part of a compact switchgear assembly are listed below:



## Switching devices:

- Circuit-breakers IEC 62271-100
- Disconnectors/Earthing switches IEC 62271-102
- Switches IEC 60265-2
- Disconnecting circuit-breakers IEC 62271-108

## Devices:

- Instrument transformers
  - Current transformers IEC 60044-1, IEC 60044-8
  - Voltage transformers IEC 60044-2, IEC 60044-5, IEC 60044-7
  - Combined transformers IEC 60044-3
- Surge arresters IEC 60099-4
- Bushings IEC 60137
- Insulators IEC 61462, IEC 62155
- Cable connections IEC 62271-209
- Transformer connections IEC 61639

Each switching device, device and their controlgear forming part of a compact switchgear assembly shall comply with the relevant individual standard. If part of the compact switchgear assembly is formed by metal enclosed switchgear devices the requirements of IEC 62271-203 apply.

Compact switchgear assemblies, as defined in this standard, are considered to be a single product with a single serial number and one set of documentation.

## 1.2 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 60044-1, *Instrument transformers – Part 1: Current transformers*

IEC 60044-2, *Instrument transformers – Part 2: Inductive voltage transformers*

IEC 60044-3, *Instrument transformers – Part 3: Combined transformers*

IEC 60044-5, *Instrument transformers – Part 5: Capacitor voltage transformers*

IEC 60044-7, *Instrument transformers – Part 7: Electronic voltage transformers*

IEC 60044-8, *Instrument transformers – Part 8: Electronic current transformers*

IEC 60050-441, *International Electrotechnical Vocabulary – Chapter 441: Switchgear, controlgear and fuses*

IEC 60099-4, *Surge arresters – Part 4: Metal-oxide surge arresters without gaps for a.c. systems*

IEC 60137, *Insulated bushings for alternating voltages above 1 000 V*

IEC 60265-2, *High-voltage switches – Part 2: High-voltage switches for rated voltages of 52 kV and above*

IEC 62271-209, *High-voltage switchgear and controlgear – Part 209: Cable connections for gas-insulated metal-enclosed switchgear for rated voltages above 52 kV – Fluid-filled and extruded insulation cables – Fluid-filled and dry-type cable-terminations*

IEC 61462, *Composite hollow insulators – Pressurized and unpressurized insulators for use in electrical equipment with rated voltage greater than 1 000 V – Definitions, test methods, acceptance criteria and design recommendations*

IEC/TR 61639, *Direct connection between power transformers and gas-insulated metal-enclosed switchgear for rated voltages of 72,5 kV and above*

IEC 61936-1, *Power installations exceeding 1 kV a.c. – Part 1: Common rules*

IEC 62155, *Hollow pressurized and unpressurized ceramic and glass insulators for use in electrical equipment with rated voltages greater than 1 000 V*

IEC 62271-1, *High-voltage switchgear and controlgear – Part 1: Common specifications*

IEC 62271-100, *High-voltage switchgear and controlgear – Part 100: High-voltage alternating-current circuit-breakers*

IEC 62271-102, *High-voltage switchgear and controlgear – Part 102: Alternating current disconnectors and earthing switches*

IEC 62271-108, *High-voltage switchgear and controlgear – Part 108: High-voltage alternating current disconnecting circuit-breakers for rated voltages of 72,5 kV and above*

IEC 62271-203, *High-voltage switchgear and controlgear – Part 203: Gas-insulated metal-enclosed switchgear for rated voltages above 52 kV*

## 2 Normal and special service conditions

Clause 2 of IEC 62271-1 is applicable.

## 3 Terms and definitions

For the purposes of this document, the terms and definitions of IEC 60050 (441), IEC 62271-1 and the publications mentioned in 1.2 apply.

### 3.1 General terms

#### 3.1.101 connected position (of a removable part)

position of a removable part in which it is fully connected for its intended function

[IEV 441-16-25]

### 3.1.102 disconnected position (of a withdrawable part)

position of a withdrawable part in which an isolating distance or segregation is established in all the circuits of the withdrawable part, that part remaining mechanically attached to the assembly

[IEV 441-16-28]

NOTE 1 The auxiliary circuits may not be disconnected in this position.

NOTE 2 This position may not be one in which it is safe to work on the withdrawn (moved) part.

## 3.2 Compact switchgear assembly

*Subclause 3.2 of IEC 62271-1 is applicable with the following addition:*

A compact switchgear assembly consists of at least one switching device directly connected to, or sharing components with, one or more other devices such that there is an interaction between the functions of the individual devices.

NOTE 1 A compact switchgear assembly may be mounted on one or more structures but it is only intended for installation and operation as a single, complete unit.

NOTE 2 Interaction is the transfer of stresses (e.g. electrical, mechanical and thermal) between the individual devices.

## 4 Rating

*Clause 4 of IEC 62271-1 is partly applicable with the following distinctive features:*

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The rating of a compact switchgear assembly and its controlgear comprise the following :

- a) rated voltage ( $U_r$ );
  - b) rated insulation level;
  - c) rated frequency ( $f_r$ );
  - d) rated normal current ( $I_r$ ) (for main circuits);
  - e) rated short-time withstand current ( $I_k$ ) (for main and earthing circuits);
  - f) rated peak withstand current ( $I_p$ ) (for main and earthing circuits);
  - g) rated duration of short-circuit ( $t_k$ );
- and as applicable
- h) rated values of the devices of the compact switchgear assembly, including their operating devices (supply voltage and frequency), auxiliary and control equipment.

The ratings of the compact switchgear assembly shall be assigned to ensure that operation of the assembly within its assigned ratings does not expose any individual device to conditions which are outside its rated capabilities.

### 4.1 Rated voltage ( $U_r$ )

*Subclause 4.1 of IEC 62271-1 is applicable with the following addition:*

The compact switchgear assembly shall be demonstrated to be suitable for the rated voltage.

NOTE 1 Devices forming part of the compact switchgear assembly may have individual values of rated voltage in accordance with the relevant standards.

NOTE 2 For the purposes of this standard, the rated voltage ( $U_r$ ) defined in IEC 62271-1 is the rated voltage of the compact switchgear assembly ( $U_r$ ).

#### 4.2 Rated insulation level

*Subclause 4.2 of IEC 62271-1 and the standards relevant to the components are applicable with the following addition:*

The compact switchgear assembly shall be demonstrated to be suitable for the rated insulation level.

#### 4.3 Rated frequency ( $f_r$ )

*Subclause 4.3 of IEC 62271-1 is applicable with the following addition:*

The compact switchgear assembly shall be demonstrated to be suitable for the rated frequency.

#### 4.4 Rated normal current ( $I_r$ ) and temperature rise

*Subclause 4.4 of IEC 62271-1 is applicable with the following addition:*

The compact switchgear assembly and its connections in the main current path shall be demonstrated to be suitable for the rated normal current.

#### 4.5 Rated short-time withstand current ( $I_k$ )

*Subclause 4.5 of IEC 62271-1 is applicable with the following addition:*

The compact switchgear assembly and its connections in the main current path and the earthing switches shall be demonstrated to be suitable for the rated short-time withstand current.

#### 4.6 Rated peak withstand current ( $I_p$ )

*Subclause 4.6 of IEC 62271-1 is applicable with the following addition:*

The compact switchgear assembly and its connections in the main current path and the earthing switches shall be demonstrated to be suitable for the rated peak withstand current.

#### 4.7 Rated duration of short circuit ( $t_k$ )

*Subclause 4.7 of IEC 62271-1 is applicable with the following addition:*

The compact switchgear assembly and its connections in the main current path and the earthing switches shall be demonstrated to be suitable for the rated duration of short-circuit.

#### 4.8 Rated supply voltage of closing and opening devices and of auxiliary and control circuits ( $U_a$ )

*Subclause 4.8 of IEC 62271-1 and the standards relevant to the devices are applicable.*

#### 4.9 Rated supply frequency of closing and opening devices and of auxiliary circuits

*Subclause 4.9 of IEC 62271-1 and the standards relevant to the devices are applicable.*

## 5 Design and construction

Clause 5 of IEC 62271-1 is applicable with the following addition, unless stated otherwise.

The design of compact switchgear assemblies shall take into account the possible interactions (e.g. electrical, mechanical and thermal) in the performance of the different devices.

In addition to the common clauses listed below, all devices which are part of the compact switchgear assembly shall conform to the design requirements of their relevant IEC standards.

### 5.3 Earthing of switchgear and controlgear

Subclause 5.3 of IEC 62271-1 is applicable with the following addition:

#### 5.101 Earthing of compact switchgear assemblies and their controlgear

The compact switchgear assembly shall have either a common earthing terminal or each device shall have its own earthing terminal.

##### 5.101.1 Earthing of the main circuit compact switchgear assemblies

To ensure safety during maintenance, all parts of the main circuit to which access is required or provided shall be capable of being earthed.

Earthing may be made by

- a) earthing switches; [IEC 62271-205:2008](https://standards.iteh.ai/catalog/standards/sist/6ff848f7-fc8c-4531-97dd-9c195be26261/iec-62271-205-2008)
- b) temporary connections. <https://standards.iteh.ai/catalog/standards/sist/6ff848f7-fc8c-4531-97dd-9c195be26261/iec-62271-205-2008>

##### 5.102 Pressure relief devices

Any pressure relief device shall be designed to minimize the danger to an operator carrying out normal operations on the compact switchgear assembly.

### 5.10 Nameplates

Subclause 5.10 of IEC 62271-1 is applicable with the following addition:

A common nameplate shall be provided to identify the compact switchgear assembly. It shall, as a minimum, detail the ratings listed in Clause 4 of this standard. The common nameplate shall be clearly readable from the position of local operation side.

For each individual device, a nameplate according to its relevant standard is required where ratings are not detailed on the common nameplate.

### 5.12 Position indication

Subclause 5.12 of 62271-1 is applicable with the following additions:

Each position indicator shall clearly indicate the switching device to which it belongs.

#### 5.103 Locking devices for maintenance operation

All switching devices which are intended to be used for earthing purposes shall be lockable in the closed position.

NOTE Temporary locking of circuit-breakers in a closed position prevents the short-circuit interruption function and should be used only when alternative protection is provided.

### 5.104 Movement of pressurized devices

All pressurized devices designed to be moved during normal operation must maintain their original functionality.

NOTE This applies typically to devices such as withdrawable or rotating circuit-breakers, etc.

### 5.105 Isolating distance for maintenance

Access for maintenance of a compact switchgear assembly may be different from that of a conventional bay in a substation due to the close proximity of the devices. Compact switchgear assemblies should be designed taking account of the guidance presented in IEC 61936-1 for personal protective measures.

## 6 Type tests

Clause 6 of IEC 62271-1 and the relevant type-test clauses of the individual standards of the devices as appropriate to the compact switchgear assembly are applicable, unless stated otherwise.

### 6.1 General

Subclause 6.1 of IEC 62271-1 is applicable with the following addition:

The aim of the type tests on the compact switchgear assembly is to demonstrate the characteristics of the assembly in its entirety. For a compact switchgear assembly made up of separately type-tested single devices the required tests on the assembly are listed in Table 101.

**Table 101 – Type tests on the compact switchgear assembly**

Type test	Subclause
Dielectric tests	6.2
Radio interference voltage (r.i.v.) test	6.3
Measurement of the resistance of the main circuits	6.4.1
Temperature rise tests	6.5
Short-time withstand and peak withstand current test	6.6
Mechanical and environmental tests	6.101

If individual devices have not been separately type-tested they may be type-tested in the compact switchgear assembly according to their relevant standards. Care should be taken to avoid undue stress on other devices of the assembly. On switching devices of compact switchgear assemblies maintenance between the individual type tests is permitted.

NOTE An individual type test need not be repeated for a design modification, if the manufacturer can demonstrate that this change does not influence the result of that individual type test on the compact switchgear assembly.

Compact switchgear assemblies may consist of various devices in numerous arrangements and it is not possible to define the test conditions for each arrangement. Four examples are shown for information only in Clause AA.3, Figures AA.1, AA.2, AA.3 and AA.4.

As far as practicable, type tests shall be made on the complete compact switchgear assembly. When testing of a complete compact switchgear assembly is not practicable due to test plant limitations, partial combinations of devices may be tested provided that the potential interaction between all devices is tested.

When tests are made on partial combinations of devices, the manufacturer shall prove that the stresses on each device during the tests are not less than those applied to the same device when the entire compact switchgear assembly is tested. The influence of the missing components shall be considered.

### 6.1.1 Grouping of tests

*Subclause 6.1.1 of IEC 62271-1 is applicable for the assembly with the following addition:*

Where the individual devices of the compact switchgear assembly are to be tested separately or have been previously tested as allowed in this subclause, then the number of samples is as required by the relevant individual standards. One additional sample of each device may be used for the tests on the complete compact switchgear assembly, including any additional environmental or pollution testing.

### 6.1.3 Information to be included in type-test reports

*Subclause 6.1.3 of IEC 62271-1 is applicable with the following addition:*

- where a compact switchgear assembly is tested, the identification, including serial numbers as appropriate, of all devices of the compact switchgear assembly, shall be recorded together with the identification of the compact switchgear assembly itself;
- details of the mechanical and electrical connection of the tested compact switchgear assembly to the other parts of the test circuit;
- information on the mounting arrangements used.

## 6.2 Dielectric tests

### 6.2.101 Conditions of compact switchgear assemblies during dielectric tests

If the design of the compact switchgear assembly is such that the disconnecting function can be located in different positions for various service applications, the number of test conditions must be adapted to cover all of the different configurations.

Surge arresters may be replaced by a dielectrically equivalent mock-up.

Current transformer secondaries shall be short-circuited and earthed during dielectric tests.

Voltage transformers may be represented by a dielectrically equivalent replica to avoid saturation of the magnetic circuit of the device when testing the combination.

NOTE Voltage transformers can remain connected for the test when saturation of the voltage transformer is prevented, e.g. by using voltage transformers which are designed for the test voltage or by performing the power frequency testing at a frequency, where saturation does not occur.

When performing tests with the increased voltage for the isolating distance undue stress on other devices of the compact switchgear assembly shall be avoided.

When performing dielectric tests connected devices may be subjected to a higher number of tests as specified for the individual device. The additional tests will not affect the criteria to pass the tests of these devices (see 6.2.4 of IEC 62271-1,)

## 6.3 Radio interference voltage (r.i.v.) test

*Subclause 6.3 of IEC 62271-1 is applicable with the following addition:*

The compact switchgear assembly shall be tested with all switching devices closed and separately with each individual switching device open.