

High-voltage switchgear and controlgear —

**Part 207: Seismic qualification for
gas-insulated switchgear assemblies for
rated voltages above 52 kV**

ICS 29.130.10

National foreword

This British Standard is the UK implementation of EN 62271-207:2007. It is identical to IEC 62271-207:2008. It supersedes BS EN 62271-2:2003 which will be withdrawn on 1 October 2010.

The UK participation in its preparation was entrusted by Technical Committee PEL/17, Switchgear, controlgear, and HV-LV co-ordination, to Subcommittee PEL/17/1, High-voltage switchgear and controlgear.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

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**High-voltage switchgear and controlgear -
Part 207: Seismic qualification for gas-insulated switchgear assemblies
for rated voltages above 52 kV
(IEC 62271-207:2007)**

Appareillage à haute tension -
Partie 207: Qualification sismique
pour ensembles d'appareillages
à isolation gazeuse pour des niveaux
de tension assignée supérieurs à 52 kV
(CEI 62271-207:2007)

Hochspannungs-Schaltgeräte
und -Schaltanlagen -
Teil 207: Erdbebenqualifikation für
gasisolierte Schaltgerätekombinationen
mit Bemessungsspannungen über 52 kV
(IEC 62271-207:2007)

This European Standard was approved by CENELEC on 2007-10-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
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Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of document 17C/407/FDIS, future edition 1 of IEC 62271-207, prepared by SC 17C, High-voltage switchgear and controlgear assemblies, of IEC TC 17, Switchgear and controlgear, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 62271-207 on 2007-10-01.

This European Standard supersedes EN 62271-2:2003.

The change from EN 62271-2:2003 is as follows:

- the minimum voltage rating was changed from “72,5 kV” to “above 52 kV”.

The following dates were fixed:

- | | | |
|--|-------|------------|
| – latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement | (dop) | 2008-07-01 |
| – latest date by which the national standards conflicting with the EN have to be withdrawn | (dow) | 2010-10-01 |

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 62271-207:2007 was approved by CENELEC as a European Standard without any modification.

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HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 207: Seismic qualification for gas-insulated switchgear assemblies for rated voltages above 52 kV

1 Scope and object

This International Standard applies to switchgear assemblies for alternating current of rated voltages above 52 kV for indoor and outdoor installations, including their supporting structure rigidly connected to the ground, and does not cover the seismic qualification of live tank circuit breakers. Switchgear assemblies do have typically low centers of gravity, e.g. gas-insulated switchgear (GIS).

For switchgear with higher gravity levels, e.g. live tank circuit breakers, the IEC 62271-300 is applicable.

Where switchgear assemblies are not ground-mounted, e.g. in a building, conditions for applications are subject to agreement between users and manufacturers.

The seismic qualification of the switchgear assemblies takes into account any auxiliary and control equipment either directly mounted or as a separate structure.

This standard provides procedures to seismically qualify ground-mounted switchgear assemblies for rated voltages above 52 kV.

The seismic qualification of the switchgear assemblies is only performed upon request.

This standard specifies seismic severity levels and gives a choice of methods that may be applied to demonstrate the performance of high-voltage switchgear assemblies for which seismic qualification is required.

The final seismic analysis shall be performed by assuming that the switchgear is installed on firm ground.

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 60068-2-47, *Environmental testing – Part 2-47: Test – Mounting of specimens for vibration, impact and similar dynamic tests*

IEC 60068-2-57, *Environmental testing – Part 2-57: Tests – Test Ff: Vibration – Time-history method*

IEC 60068-3-3:1991, *Environmental testing – Part 3: Guidance – Seismic test methods for equipments*

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

IEC 60694, *Common specifications for high-voltage switchgear and controlgear standards*

3 Terms and definitions

For the purposes of this document, the terms and definitions in IEC 60068-3-3, IEC 62271-203 and IEC 60694 apply.

4 Seismic qualification requirements

4.1 General

The seismic qualification shall demonstrate the ability of the switchgear assemblies to withstand seismic stress.

No failure on the main circuits, the control and auxiliary circuit, including the relevant mounting structures, shall occur.

Permanent deformations are acceptable provided that they do not impair the functionality of the equipment. The equipment shall properly operate after the seismic event as defined in 8.2 and 8.3.

NOTE In the USA the evaluation of the seismic qualifications is conducted according to IEEE 693.

4.2 Preliminary analysis

4.2.1 Selection of the representative test-set

Due to practical reasons concerned with the available experimental facilities, the seismic qualification of switchgear assemblies can require the definition and the choice of different sub-sets which still meaningfully represent the whole system for the purpose of structural and functional checks.

Such test-sets shall include the switching devices with their relevant operating mechanism and control equipment, and their electrical and mechanical interfaces.

It is recommended

- to test generic components; to test the worst case components, such as those with the highest load and center of gravity.
- to identify the dynamic behaviour of the plant (natural frequencies and damping ratios) through the experimental activities of Annex A.

4.2.2 Mathematical model of the test-set

On the basis of technical information concerning the design characteristics of the substation, a three-dimensional model of the test-set shall be created. Such a model shall take into consideration the presence of actual compartments and of their supporting structures, and shall have sufficient sensitivity to describe the dynamic behaviour of the test-set in the frequency range being studied.

5 Severities

The severity levels shall be chosen from Table 1.

Table 1 – Seismic qualification levels for switchgear assemblies – Horizontal severities

Qualification level	Required response spectrum (RRS)	Zero period acceleration (ZPA) m/s ²
AF5	Figure 1	5
AF3	Figure 2	3
AF2	Figure 3	2

For vertical severities the direction factor is 0,5 (see IEC 60068-3-3).

NOTE 1 The required response spectrum of qualification level AF5 covers partly, in the range of predominant seismic frequency of 1 Hz to 35 Hz, the following response spectra: Endesa, Edelca, USA/NRC RG 1.60, Newmark Design Response Spectra (scaled to 5 m/s²), Nema (5 m/s² maximum foundation acceleration), Dept. of Water & Power Los Angeles, San Diego SDG & E Imperial Substation.

NOTE 2 Information on the correlation between seismic qualification levels and different seismic scales is given in IEC 60068-3-3.

6 Qualification by test

6.1 Introduction

The test procedure for qualification of a test-set shall be in accordance with IEC 60068-3-3.

The qualification shall be carried out on representative test sets, as described in 4.2.1.

If the auxiliary and control equipment or other parts of the equipment are dynamically uncoupled, they may be qualified independently.

If a test-set cannot be tested with its supporting structure (e.g., due to its size), the dynamic contribution of the structure shall be determined by analysis and accounted for in the test.

The time-history test method is to be preferred, since it more closely simulates actual conditions, particularly if the behaviour of the test-set is not linear. The test method shall be in accordance with IEC 60068-2-57.

6.2 Mounting

The test-set shall be mounted as in service including dampers (if any).

The horizontal orientation of the test-set shall be in the direction of excitation acting along its two main orthogonal axes.

Any fixtures or connections required only for testing shall not affect the dynamic behaviour of the test-set.