



SLOVENSKI STANDARD
oSIST prEN IEC 62271-207:2022
01-junij-2022

Visokonapetostne stikalne in krmilne naprave - 207. del: Seizmična (potresna) kvalifikacija plinsko izoliranih stikalnih sestavov v kovinskih ohišjih in stikalnih sestavov v ohišjih iz trdnih izolacijskih materialov za naznačene napetosti nad 1 kV

High-voltage switchgear and controlgear - Part 207: Seismic qualification for gas-insulated switchgear assemblies, metal enclosed and solid-insulation enclosed switchgear for rated voltages above 1 kV

PREVIEW
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Appareillage à haute tension - Partie 207: Qualification sismique pour les ensembles d'appareillage de commutation à isolation gazeuse, à enveloppe métallique et à isolation solide pour des tensions nominales supérieures à 1 kV

Ta slovenski standard je istoveten z: **prEN IEC 62271-207:2022**

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<input checked="" type="checkbox"/> SUBMITTED FOR CENELEC PARALLEL VOTING Attention IEC-CENELEC parallel voting The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting. The CENELEC members are invited to vote through the CENELEC online voting system.	<input type="checkbox"/> NOT SUBMITTED FOR CENELEC PARALLEL VOTING

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High-voltage switchgear and controlgear - Part 207: Seismic qualification for gas-insulated switchgear assemblies, metal enclosed and solid-insulation enclosed switchgear for rated voltages above 1 kV

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

**Part 207: Seismic qualification for gas-insulated switchgear assemblies,
metal-enclosed and solid-insulation enclosed switchgear for rated
voltages above 1 kV**

FOREWORD

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IEC 62271-207 has been prepared by subcommittee 17C: High-voltage switchgear and controlgear assemblies, of IEC technical committee 17: Switchgear and controlgear. It is an International Standard.

This third edition cancels and replaces the second edition published in 2012 including the corrigendum of January 2013. This edition constitutes a technical revision. It also cancels and replaces through merging the first edition of IEC TS 62271 Part 210: Seismic qualification for metal-enclosed and solid-insulation enclosed switchgear and controlgear assemblies for rated voltages above 1 kV and up to and including 52 kV published in 2013.

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

- a) modification of the minimum voltage rating from 52 kV to above 1 kV in order to include medium voltage equipment previously being within IEC TS 62271-210 scope;
- b) further harmonisation of qualification procedures with the revised IEEE Std 693-2018 Annex A and P including:

- 150 1) matching IEC 62271-207 Required Response Spectra with IEEE Std 693-2018
151 performance level spectra and IEC TS 62271-210 spectra;
- 152 2) addition of a step-by-step procedure assisting the user of the standard to select an
153 appropriate seismic qualification level combining seismic integrity with cost-effective
154 design
- 155 3) addition of analytical earthquake component combination techniques
- 156 4) reference to publicly available accelerograms specially developed to match the
157 IEEE Std 693-2018 spectra for testing and analysis purposes, since IEC 62271-207 and
158 IEC TS 62271-210 spectra are identical in shape with IEEE Std 693 spectra.
- 159 c) Various enhancements of test procedures;
- 160 d) Addition of minimum contents for seismic qualification reports;
- 161 e) Scope extended to cover DC GIS including and above 100 kV according to 17C/837/RQ,
162 the result of Questionnaire 17C/825/Q.
- 163 The text of this International Standard is based on the following documents:

Draft	Report on voting
XX/XX/FDIS	XX/XX/RVD

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

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

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

172 A list of all the parts in the IEC 62271 series, under the general title *High-voltage switchgear*
173 *and controlgear*, can be found on the IEC website.

174 The committee has decided that the contents of this document will remain unchanged until the
175 stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to
176 the specific document. At this date, the document will be

- 177 • reconfirmed,
- 178 • withdrawn,
- 179 • replaced by a revised edition, or
- 180 • amended.

181

182

HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 207: Seismic qualification for gas-insulated switchgear assemblies, metal-enclosed and solid-insulation enclosed switchgear for rated voltages above 1 kV

1 Scope

IEC 62271-207 applies to:

- gas-insulated switchgear (GIS) assemblies
 - for alternating current of rated voltages above 52 kV complying with IEC 62271-203
 - for direct current of rated voltages including and above 100 kVfor indoor and outdoor installations, including their supporting structures.
- metal-enclosed switchgear and controlgear assemblies for rated voltages above 1 kV and up to and including 52 kV complying with IEC 62271-200 for metal-enclosed and IEC 62271-201 for solid-insulation enclosed, ground or floor mounted, intended to be used under seismic conditions.

The seismic qualification of the switchgear assemblies takes into account testing of typical switchgear assemblies combined with methods of analysis. Mutual interaction between directly mounted auxiliary and control equipment and switchgear assemblies is considered.

Seismic qualification philosophy includes selection of seismic qualification level (Clause 4), methodologies for qualification by testing (Clause 5) and by combined testing and analysis (Clause 6), acceptance criteria (Clause 7) and seismic qualification documentation (Clause 8).

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

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 60068-2-6, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-47, *Environmental testing – Part 2-47: Tests – 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 60068-2-64, *Environmental testing – Part 2-64: Tests – Test Fh: Vibration, broadband random and guidance*

IEC 60068-3-3 Edition 2.0 2019-08, *Environmental testing - Part 3-3: Supporting documentation and guidance - Seismic test methods for equipment*

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

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

IEC 61869-1 *Instrument transformers - Part 1: General requirements*

226 IEC 62271-1, *High-voltage switchgear and controlgear - Part 1: Common specifications for*
 227 *alternating current switchgear and controlgear*

228 IEC 62271-200, *High-voltage switchgear and controlgear – Part 200: AC metal-enclosed*
 229 *switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV*

230 IEC 62271-201, *High-voltage switchgear and controlgear – Part 201: AC solid-insulation*
 231 *enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including*
 232 *52 kV*

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

235 ISO 2041, *Mechanical vibration, shock and condition monitoring – Vocabulary*

236 **3 Terms and definitions**

237 For the purposes of this document, the terms and definitions given in IEC 60068-3-3,
 238 IEC 62271-1, IEC 62271-200, IEC 62271-201, IEC 62271-203, ISO 2041 and the following
 239 apply.

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

- 242 • IEC Electropedia: available at <http://www.electropedia.org/>
- 243 • ISO Online browsing platform: available at <http://www.iso.org/obp>

244

245 **3.1**

246 **switchgear and controlgear**

247 a general term covering switching devices and their combination with associated control,
 248 measuring, protective and regulating equipment, also assemblies of such devices and
 249 equipment with associated interconnections, accessories, enclosures and supporting structures

250 [SOURCE: IEC Electropedia 441-11-01] 207-2022

251 **3.2**

252 **metal-enclosed switchgear and controlgear**

253 switchgear and controlgear assemblies with an external metal enclosure intended to be earthed,
 254 and complete except for external connections

255 [SOURCE: IEC Electropedia 441-12-04]

256 **3.3**

257 **gas-insulated metal-enclosed switchgear**

258 GIS

259 metal-enclosed switchgear in which the insulation is obtained, at least partly, by an insulating
 260 gas or gas mixture other than air at atmospheric pressure

261 [SOURCE: IEC Electropedia 441-12-05]

262 **3.4**

263 **solid-insulation enclosed switchgear and controlgear**

264 switchgear and controlgear assemblies with an external solid insulating enclosure and
 265 completely assembled, except for external connections

266 [SOURCE: IEC 62271-201]

267 **3.5**
 268 **High Voltage Switchgear (within the scope of this standard)**
 269 HV Switchgear
 270 Gas-insulated switchgear (GIS) assemblies for alternating current of rated voltages above
 271 52 kV complying with IEC 62271-203 for indoor and outdoor installations, including their
 272 supporting structure

273 **3.6**
 274 **Medium Voltage Switchgear (within the scope of this standard)**
 275 MV Switchgear
 276 Metal-enclosed switchgear and controlgear assemblies for rated voltages above 1 kV and up to
 277 and including 52 kV complying with IEC 62271-200 for metal-enclosed and IEC 62271-201 for
 278 solid-insulation enclosed, ground or floor mounted

279 **3.7**
 280 **User (within the scope of this standard)**
 281 The Utility, the Customer, the final Owner of the qualified equipment

282 **3.8**
 283 **brittle material**
 284 A material that experiences limited or no plastic deformation before fracture. Limited
 285 deformation shall be taken as less than 10 % in 5 cm at failure in tension

286 [SOURCE: IEEE Std 693-2018]

287 **3.9**
 288 **ductile material**
 289 Material that experiences considerable plastic deformation before fracture. Considerable plastic
 290 deformation is defined as 10 % or greater in 5 cm at failure in tension

291 [SOURCE: IEEE Std 693-2018]

292 **3.10**
 293 **flexible equipment**
 294 Equipment, structures, and components whose lowest resonant frequency is less than 33 Hz

295 **3.11**
 296 **rigid equipment**
 297 Equipment, structures, and components whose lowest resonant frequency is greater than 33 Hz

298 **3.12**
 299 **Acceleration of gravity**
 300 g
 301 Acceleration due to gravity that is 9,81 m/s²

302 Note 1 to entry: For the purposes of this standard, the value of g is rounded up to the nearest integer, that is
 303 10 m/s².

304 **3.13**
 305 **ground acceleration**
 306 The acceleration of the ground resulting from the motion of a given earthquake

307 **3.14**
 308 **peak ground acceleration**
 309 PGA
 310 The peak ground acceleration is the maximum ground acceleration of any component of the
 311 time history

312 **3.15**
 313 **zero period acceleration**
 314 ZPA
 315 The zero period acceleration is the spectral acceleration for frequencies above 33 Hz

316 **3.16**
317 **floor acceleration**
318 acceleration of a particular building floor (or an equipment mounting) resulting from its response
319 to the ground motion of a given earthquake

320 **3.17**
321 **response spectrum**
322 A plot of the maximum response of an array of single-degree-of-freedom (SDOF) identically
323 damped oscillators with different frequencies, all subjected to the same base excitation

324 **3.18**
325 **required response spectrum**
326 RRS
327 Response spectrum that defines the required level of input motion for a given level of
328 qualification

329 **3.19**
330 **floor response spectrum**
331 response spectrum of the floor acceleration history of a building floor (or an equipment
332 mounting)

333 Note 1 to entry: Response acceleration spectra can be calculated for each one of the three components of
334 excitation.

335 **3.20**
336 **superelevation factor**
337 amplification factor accounting for the amplification of seismic loading with respect to ground
338 level due to the response of buildings and structures

339 Note 1 to entry: A superelevation factor is used in lieu of a more accurate estimation of the contribution of the
340 building (or other equipment mounting) response to the response of the qualified equipment.

341 **3.21**
342 **resonant frequency**
343 Frequencies coinciding with the natural frequency of a system (at which the response amplitude
344 is a relative maximum) are known as resonance frequencies. At these frequencies, even small
345 periodic driving forces can produce large amplitude oscillations

346 **3.22**
347 **complete quadratic combination**
348 CQC Method
349 A modal combination method, especially useful for systems with closely spaced frequencies

350 **3.23**
351 **damping**
352 energy dissipation mechanisms in a system

353 Note 1 to entry: In practice, damping depends on many parameters, such as the structural system, mode of
354 vibration, strain, applied forces, velocity, materials, joint slippage.

355 [SOURCE: IEC 60068-3-3 Edition 2.0 2019-08]

356 **3.23.1**
357 **critical damping**
358 minimum viscous damping that will allow a displaced system to return to its initial position
359 without oscillation

360 [SOURCE: IEC 60068-3-3 Edition 2.0 2019-08]

361 **3.23.2**
362 **damping ratio**
363 ratio of actual damping to critical damping in a system with viscous damping

364 [SOURCE: IEC 60068-3-3 Edition 2.0 2019-08]

3.24**direction factor**

factor taking account of the difference in magnitude at ground level that normally exists between the horizontal and vertical accelerations resulting from an earthquake

[SOURCE: IEC 60068-3-3 Edition 2.0 2019-08]

3.25**normal operating load**

Any force, stress, or load resulting from equipment operation that can reasonably be expected to occur during an earthquake

3.26**seismic qualification level**

The qualification level defined as the level of seismic excitation to which equipment shall maintain the seismic qualification objective is dependent upon the seismicity of the region where the equipment will be in service.

Note 1 to entry: Information on comparison between seismic levels for different standards is given in Table 2.

3.27**time history**

recording, as a function of time, of acceleration or velocity or displacement

Note 1 to entry: This definition is not identical to that given in ISO 2041

[SOURCE: IEC 60068-3-3 Edition 2.0 2019-08]

3.28**strong part of time history**

part of time history from the time when the plot first reaches 25 % of the maximum value to the time when it falls for the last time to the 25 % level

[SOURCE: IEC 60068-3-3 Edition 2.0 2019-08]

390

4 Seismic qualification requirements**4.1 Seismic qualification objective**

The seismic qualification shall demonstrate the ability of the switchgear assemblies to withstand seismic stress without impairing the functionality of the equipment during and after seismic events. It may be proved by testing or by a combination of testing and analysis.

4.2 Qualification levels

A seismic qualification level is defined as the magnitude of seismic excitation to which equipment shall maintain the seismic qualification objective. The qualification has to be done on one of the four seismic qualification levels of Table 1: Low, AG2.5, AG5 and AG10.

Qualification levels are associated with ZPA of the required response spectrum. For the low qualification level, the horizontal ZPA is 0,10 g or less. For the AG2.5 qualification level, the ZPA is 0,25 g. For the AG5 qualification level, the ZPA is 0,50 g. For the AG10 qualification level, the ZPA is 1,00 g.

NOTE 1 Seismic qualification level AG10 is a very severe requirement which may need the consideration of special measures such as reinforcement of the gantry / enclosure and application of high-strength insulators, so caution is advised when applying.