



SLOVENSKI STANDARD
oSIST prEN IEC 61109:2024
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Izolatorji za nadzemne vode - Sestavljeni obesni in strižni izolatorji za izmenične sisteme z nazivno napetostjo nad 1 000 V - Definicije, preskusne metode in prevzemna merila

Insulators for overhead lines - Composite suspension and tension insulators for a.c. systems with a nominal voltage greater than 1 000 V - Definitions, test methods and acceptance criteria

Isolatoren für Freileitungen - Verbund-Hänge- und -Abspannisolatoren für Wechselstromsysteme mit einer Nennspannung über 1 000 V - Begriffe, Prüfverfahren und Annahmekriterien

Isolateurs pour lignes aériennes - Isolateurs composites de suspension et d'ancrage destinés aux systèmes à courant alternatif de tension nominale supérieure à 1 000 v - Définitions, méthodes d'essai et critères d'acceptation

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TITLE:

Insulators for overhead lines - Composite suspension and tension insulators for a.c. systems with a nominal voltage greater than 1 000 V - Definitions, test methods and acceptance criteria

PROPOSED STABILITY DATE: 2027

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119 INTERNATIONAL ELECTROTECHNICAL COMMISSION

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**INSULATORS FOR OVERHEAD LINES
COMPOSITE SUSPENSION AND TENSION INSULATORS
WITH AC VOLTAGE GREATER THAN
1 000 V AND DC VOLTAGE GREATER THAN 1 500 V –
DEFINITIONS, TEST METHODS AND ACCEPTANCE CRITERIA**

FOREWORD

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161 International Standard IEC 61109 has been prepared by subcommittee 36B: Insulators for
162 overhead lines, of IEC technical committee 36: Insulators.

163 This third edition supersedes and replaces the second edition, published in 2008. This edition
164 constitutes a technical revision.

165 The main technical changes with respect to the previous edition are listed below:

166 – extended to apply both to AC and DC systems

167 – modifications of Terms, definitions and abbreviations;

168 – removal of chapter 7 "Hybrid insulators" from this standard;

169 – modifications of tests procedures recently included in IEC 62217 (Hydrophobicity transfer
170 test; Stress corrosion, Water diffusion test on the core with housing);

171 – modifications on environmental conditions;

172 – modifications on classification of tests and include the relevance of the interfaces;

173 – clarification and modification of the parameters determining the need to repeat design and
174 type tests, Table 1 revised;

175 – revision of electrical type tests;

- 176 – revision of re-testing procedure of sample test;
177 – addition of a new Annex D on electric field control for AC
178 – addition of a new Annex E on typical sketch of for composite insulators assembly
179 – addition of a new Annex F Mechanical evaluation of the adhesion between core and housing
180 – addition of a new Annex G Applicability of design- and type tests for Direct Current (DC)

181

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

FDIS	Report on voting

183

184 Full information on the voting for the approval of this standard can be found in the report on
185 voting indicated in the above table.

186 This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

187 The committee has decided that the contents of this publication will remain unchanged until the
188 maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data
189 related to the specific publication. At this date, the publication will be

- 190 • reconfirmed,
- 191 • withdrawn,
- 192 • replaced by a revised edition, or
- 193 • amended.

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195

INTRODUCTION

196 Composite suspension and tension insulators (in the following the term “composite insulator” is
197 used) consist of fibreglass insulating core, bearing the mechanical load protected by a
198 polymeric housing, the load being transmitted to the core by metallic end fittings. Despite these
199 common features, the materials used and the design and manufacturing details used by
200 different manufacturers may differ.

201 Some tests have been grouped together as "Design tests", to be performed only once on
202 insulators which satisfy the same design conditions. For all design tests of these composite
203 insulators, the appropriate common clauses defined in IEC 62217 are applied. As far as
204 practical, the influence of time on the electrical and mechanical properties of the components
205 (core material, housing, interfaces etc.) and of the complete composite insulators has been
206 considered in specifying the design tests to ensure a satisfactory lifetime under normally known
207 stress conditions of transmission lines. Explanation of the principles of the damage limit, load
208 coordination and testing are presented in Annex A.

209 It has not been considered useful to specify a power arc test as a mandatory test. The test parameters
210 are manifold and can have very different values depending on the configurations of the network and
211 the supports and on the design of arc-protection devices. The heating effect of power arcs should be
212 considered in the design of metal fittings. Critical damage to the metal fittings resulting from the
213 magnitude and duration of the short-circuit current can be avoided by properly designed arc-protection
214 devices. This standard, however, does not exclude the possibility of a power arc test by agreement
215 between the manufacturer and customer. IEC 61467 [1] gives details of AC power arc testing of
216 complete insulator sets, that shall match their configuration with actual protective and string fittings, to
217 recreate the real electromagnetic field affecting the arc movement.

218 This standard covers both AC and DC composite insulators. Before the appropriate standard for DC
219 applications will be issued, the majority of tests listed in this standard can also be applicable for DC
220 (Annex G). Due to the difference in AC and DC tracking performance, a specific tracking and erosion
221 test procedure for DC applications as a design test shall be developed. The 1000 h AC tracking and
222 erosion test of IEC 62217 can be used only to establish a minimum requirement for the tracking and
223 erosion resistance. This 1000 h salt fog tracking and erosion test is considered as a screening test
224 intended to reject materials in combination with the design which are inadequate. Tracking and
225 erosion tests are not intended to evaluate long term performance of insulators. Such tests, e.g. the 5
226 000 h multiple stress test and wheel test in IEC/TR 62730 or other tests, intended for research or
227 sometimes used as a supplementary design test, are not considered in the present standard.

228 Composite insulators are in general not intended for torsion or other non-tensile loads. However
229 due consideration to non-standard applications (interphase spacers etc.) loads during handling
230 and installation should be considered in the design. Guidance on non-standard loads is given
231 in Annex C.

232 Wherever possible, IEC Guide 111 [5] has been followed for the drafting of this standard.

233

234 **INSULATORS FOR OVERHEAD LINES**
 235 **COMPOSITE SUSPENSION AND TENSION INSULATORS**
 236 **WITH AC VOLTAGE GREATER THAN**
 237 **1 000 V AND DC VOLTAGE GREATER THAN 1 500 V –**
 238 **DEFINITIONS, TEST METHODS AND ACCEPTANCE CRITERIA**
 239
 240
 241

242 **1 Scope and object**

243 This International Standard applies to composite insulators for overhead lines consisting of a
 244 load-bearing cylindrical insulating solid core consisting of fibres – usually glass – in a resin-
 245 based matrix, a housing (surrounding the insulating core) made of polymeric material and metal
 246 end fittings permanently attached to the insulating core.

247 Composite insulators covered by this standard are intended for use as suspension/tension line
 248 insulators, but it should be noted that these insulators can occasionally be subjected to
 249 compression or bending, for example when used as interphase-spacers. Guidance on such
 250 loads is outlined in Annex C.

251 The object of this standard is to

- 252 – define the terms used,
- 253 – prescribe test methods,
- 254 – prescribe acceptance criteria.

255 This standard does not include requirements dealing with the choice of insulators for specific
 256 operating conditions or environments.

257 **2 Normative references**

258 The following referenced documents are indispensable for the application of this document. For
 259 dated references, only the edition cited applies. For undated references, the latest edition of
 260 the referenced document (including any amendments) applies.

261 IEC 60383-1, *Insulators for overhead lines with a nominal voltage above 1 000 V – Part 1: Ceramic*
 262 *or glass insulator units for AC systems – Definitions, test methods and acceptance criteria*

263 IEC 60383-2, *Insulators for overhead lines with a nominal voltage above 1 000 V – Part 2: Insulator*
 264 *strings and insulator sets for AC systems – Definitions, test methods and acceptance criteria.*

265 IEC 60437, *Radio interference test on high-voltage insulators*

266 IEC 61466-1, *Composite string insulator units for overhead lines with a nominal voltage greater than*
 267 *1 000 V – Part 1: Standard strength classes and end fittings*

268 IEC 61467, *Insulators for overhead lines – Insulator strings and sets for lines with a nominal voltage*
 269 *greater than 1 000 V – AC power arc tests*

270 IEC 61284, *Overhead lines- Requirements and tests for fittings*

271 IEC 62217, *Polymeric insulators for indoor and outdoor use with a nominal voltage > 1 000 V –*
 272 *General definitions, test methods and acceptance criteria*

273 ISO 3452 (all parts), *Non-destructive testing – Penetrant testing*

274 **3 Terms, definitions and abbreviations**

275 For the purposes of this document, the following terms, definitions and abbreviations apply.

276 NOTE 1 to entry: Certain terms from IEC 62217 are reproduced here for ease of reference. Additional definitions
 277 applicable to insulators can be found in IEC 60050-471 [6].

278 **3.1 Terms and definitions**279 **3.2 3.1.1**280 **polymeric insulator**

281 insulator whose insulating body consists of at least one organic based material

282 Note 1 to entry: Polymeric insulators are also known as non-ceramic insulators.

283 Note 2 to entry: Coupling devices may be attached to the ends of the insulating body.

284 [SOURCE: IEC 60050-471:2007, 471-01-13]

285 **3.3 3.1.2**286 **composite insulator**287 insulator made of at least two insulating parts, namely a core and a housing equipped with end
288 fittings289 Note 1 to entry: Composite insulators can consist either of individual sheds mounted on the core, with or without
290 an intermediate sheath, or alternatively, of a housing directly moulded or cast in one or several pieces on to the core.

291 [SOURCE: IEC 60050-471:2007, 471-01-02]

292 **3.4 3.1.3**293 **core of a composite insulator**

294 central insulating part of an insulator which provides the mechanical characteristics

295 Note 1 to entry: The housing and sheds are not part of the core.

296 [SOURCE: IEC 60050-471:2007, 471-01-11]

297 **3.5 3.1.4**298 **insulator trunk**

299 central insulating part of an insulator from which the sheds project

300 Note 1 to entry: Also known as shank on smaller insulators.

301 [SOURCE: IEC 60050-471:2007, 471-01-11]

302 **3.6 3.1.5**303 **housing**304 external insulating part of composite insulator providing the necessary creepage distance and
305 protects the core from the environment

306 Note 1 to entry: An intermediate sheath made of insulating material may be part of the housing.

307 [SOURCE: IEC 60050-471:2007, 471-01-09] [N IEC 61109:2024](https://standards.iteh.ai/catalog/standards/sist/60a922ab-4cfb-4ff8-9322-9bf5c34547c5/osist-pren-iec-61109-2024)308 **3.1.6**309 **shed of an insulator**

310 insulating part, projecting from the insulator trunk, intended to increase the creepage distance

311 Note 1 to entry: The shed can be with or without under-ribs.

312 [SOURCE: IEC 60050-471:2007, 471-01-15]

313 **3.7 3.1.7**314 **interfaces**

315 contact surface between the different materials (see also Annex E)

316 Note 1 to entry: Various interfaces exist in composite insulators, e.g.:

317 - between housing and end fittings;

318 - between various parts of the housing; e.g. between separately manufactured sheds, or between sheath and sheds;

319 - between core and housing.

320 - between sealant and core

321 - between sealant and end fittings

322 **3.8** see Annex E: Principles sketch of for composite insulator assembly, for more details

323

324 [Definition 3.15 of IEC 62217, modified]

325 **3.9 3.1.8**
326 **end fitting**
327 integral component or formed part of an insulator intended to connect it to a supporting
328 structure, or to a conductor, or to an item of equipment, or to another insulator

329 Note 1 to entry: Where the end fitting is metallic, in general the term "metal fitting" is used.

330 Note 2 to entry: standard end fittings are defined in IEC 61466-1

331 [SOURCE: IEC 60050-471:2007, 471-01-06]

332 **3.10 3.1.9**
333 **connection zone**

334 zone where the mechanical load is transmitted between the core and the end fitting

335 [Definition 3.17 of IEC 62217, modified]

336 **3.11 3.1.10**
337 **coupling**

338 part of the end fitting which transmits the load to the accessories external to the insulator

339 [Definition 3.17 of IEC 62217, modified]

340 **3.12 3.1.11**
341 **creepage distance**

342 shortest distance or the sum of the shortest distances along the surface on an insulator between two
343 conductive parts which normally have the operating voltage between them

344 [SOURCE: IEC 60050-471:2007, 471-01-04]

345

346 **3.13 3.1.12**
347 **arcing distance**

348 shortest distance in the air external to the insulator between the metallic parts which normally
349 have the operating voltage between them

350 Note 1 to entry – The term "dry arcing distance" is also used.

351 [IEV 471-01-01]

352 **3.14 3.1.13**
353 **specified mechanical load**
354 **SML**

355 load, specified by the manufacturer, which is used for mechanical tests in this standard

356 **3.15 3.1.14**
357 **routine test load**
358 **RTL**

359 load applied to all assembled composite insulators during a routine mechanical test

360 **3.16 3.1.15**
361 **mechanical failing load**

362 maximum load that is reached when the insulator is tested under the prescribed conditions

363 **3.17** [IEV 471-01-12]

364

365 **3.18 3.1.16**
366 **insulator set**

367 assembly of one or more insulator strings suitably connected together, complete with end fittings and
368 protective devices as required in service

369 Note 1 to entry – The terms "arcing and field grading devices" is also used for protective devices.

370 [IEV 471-03-02]

371 **3.19 3.1.17**
372 **string insulator unit**

373 cap and pin insulator or long rod insulator of which the end fittings are suitable for flexible attachment
374 to other similar string insulator units or to connecting accessories

375 Note 1 to entry – cap and pin insulators are not composite insulators and are not part of this document.

376 [IEV 471-03-08]

377 **3.20 3.1.18**

378 **sealing**

379 method for providing the ability of a component to resist the ingress of contaminants

380 [IEV 581-23-16]

381 Note 1 to entry – contaminants include pollution and moisture.

382 **3.21 3.1.19**

383 **sealant (sealing-agent)**

384 Additional material used for sealing, typically RTV-silicones are used for composite insulators

385 Note 1 to entry: see sealant in Annex E: Typical principles sketch for composite insulators assembly

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388 **3.22 Abbreviations**

389 The following abbreviations are used in this standard:

390 E1, E2 Sample sets for sample tests

391 M_{AV} Average 1 min failing load of the core assembled with fittings

392 RTL Routine test load

393 SML Specified mechanical load

394 **4 Identification**

395 In addition to the requirements of IEC 62217, each insulator shall be marked with the SML.

396 It is recommended that each insulator be marked or labelled by the manufacturer to show that
397 it has passed the routine mechanical test.398 **5 Environmental conditions**

399 Table 1 is copied from IEC 62217 for reader's convenience.

400 The normal environmental conditions to which insulators are submitted in service are defined
401 according to Table 1. Terms are defined as follows:

402

403 • Indoor environment: installation within a building or other construction where the insulators are
404 protected against wind, rain, snow, periodical fast-built pollution deposits, abnormal
405 condensation, ice and hoar frost.406 • Outdoor environment: installation in open air outside any building or shelter, where the
407 insulators are submitted to wind, rain, snow, periodical fast-built pollution deposits, high
408 condensation, ice and hoar frost.409 If service conditions of polymeric insulators deviate significantly from the parameters in Table 1, the
410 insulator is to be designed or evaluated according to agreement between the customer and manufacturer.
411 Alternatively, if positive service experience is available for a specific environment and specific insulator
412 design (including material and profile), the insulator can be used for this specific environment,
413 deviating from normal conditions.

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<https://standards.iteh.ai/catalog/standards/sist/60a922ab-4cfb-4ff8-9322-9bf5c34547c5/osist-pren-iec-61109-2024>414 **Table 1 – Normal environmental conditions**

416

	Indoor insulation	Outdoor insulation
Maximum ambient air temperature ^a	Does not exceed 40 °C and its average value measured over a period of 24 h does not exceed 35 °C	
Minimum ambient air temperature ^b	-25 °C	-40 °C
Maximum ambient air temperature ^a	Does not exceed 40 °C and its average value measured over a period of 24 h does not exceed 35 °C	
Minimum ambient air temperature ^b	-25 °C	-40 °C
Vibration	Negligible vibration due to causes external to the insulators or to earth tremors ^c .	
Solar radiation ^d	Not applicable	Up to a level of 1 120 W/m ²