



SLOVENSKI STANDARD
oSIST prEN IEC 63177:2023

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Preskusna metoda za ugotavljanje združljivosti gradbenih materialov z elektroizolacijskimi tekočinami

Test method for compatibility of construction materials with electrical insulating liquids

iTeh STANDARD PREVIEW
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ICS:

29.040.01	Izolacijski fluidi na splošno	Insulating fluids in general
29.080.99	Drugi standardi v zvezi z izolacijo	Other standards related to insulation

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en



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OF INTEREST TO THE FOLLOWING COMMITTEES: TC 2,TC 10,TC 14	PROPOSED HORIZONTAL STANDARD: <input checked="" type="checkbox"/> Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.
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- any relevant "in some countries" clauses to be included should this proposal proceed. Recipients are reminded that the enquiry stage is the final stage for submitting "in some countries" clauses. See AC/22/2007.

TITLE:

Test method for compatibility of construction materials with electrical insulating liquids

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NOTE FROM TC/SC OFFICERS:

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TEST METHODS FOR COMPATIBILITY OF CONSTRUCTION MATERIALS WITH ELECTRICAL INSULATING LIQUIDS

FOREWORD

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IEC 63177 has been prepared by subcommittee WG 6: general methods of evaluation of electrical insulation systems, of IEC technical committee 112: evaluation and qualification of electrical insulating materials and systems. It is an International Standard.

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

Draft	Report on voting
112/XX/FDIS	112/XX/RVD

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 <http://www.iec.ch/standardsdev/publications>.

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

- 94 • reconfirmed,
- 95 • withdrawn,
- 96 • replaced by a revised edition, or
- 97 • amended.

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[oSIST prEN IEC 63177:2023](https://standards.iteh.ai/catalog/standards/sist/8e434a12-988a-4689-8d0e-87d5564a6365/osist-pren-iec-63177-2023)

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INTRODUCTION

99 The objective of the standard is to clarify the evaluation methodology for the compatibility
100 between construction materials and electrical insulating liquids. It provides recommendations
101 for manufacturers, who produce liquid-immersed transformers and tap-changers, liquid-
102 impregnated capacitors, and liquid-cooled rotating machines used in electrical vehicles and oil
103 pumps to screen appropriate construction materials for their use with different liquids under
104 different operating conditions and contains tests for aged liquids and aged construction
105 materials.

106 In the past, limited construction materials and liquids based on mineral oil served the industry
107 needs. Since the industry needs have been advanced with new applications and driven by
108 higher flash points and improved reliability of performance for liquid-filled electrical equipment,
109 it is necessary to be able to evaluate high temperature electrical insulation systems, using
110 silicone oils, synthetic esters, natural esters and other potential suitable insulating liquids.

111 At the same time, liquid-cooled rotating machines used in electrical vehicles and oil pumps also
112 increase the possibility for construction materials to be exposed to different liquids, driven by
113 better thermal conductive performance. To avoid mechanical, electrical and sealing failure for
114 construction materials, such as gasket materials, impregnating resins, prefabricates, etc., the
115 test methods described in this standard can be applied for different liquid-immersed electrical
116 equipment, including liquid-immersed transformers and tap-changers, liquid-impregnated
117 capacitors and liquid-cooled rotating machines used in electrical vehicles and oil pumps.

118 The evaluation process specified in this document focuses on the chemical compatibility
119 between construction materials and liquids but does not provide a long-term thermal or aging
120 evaluation. In addition, threshold values for functional parameters of each material are not
121 specified, as they depend on the requirements of the specific application.

122 Clauses 1 to 5 contain definitions and describe the preparation of suitable solid and liquid test
123 samples.

124 Clause 6 describes the test procedure (e.g. temperatures, test duration and cycles) and gives
125 exemplary guidance on characteristic parameters to be evaluated. This allows an estimate of
126 the basic compatibility of typical construction materials with insulating liquids.

127 Application example is given in Annex A.

128 **TEST METHODS FOR COMPATIBILITY OF CONSTRUCTION MATERIALS**
129 **WITH ELECTRICAL INSULATING LIQUIDS**
130
131

132 **1 Scope**

133 This document specifies the test method for the compatibility of construction materials with
134 electrical insulating liquids for use in electrical equipment, such as liquid-immersed
135 transformers and tap-changers, liquid-impregnated capacitors, and liquid-cooled rotating
136 machines used in electrical vehicles and oil pumps. This document is applicable to mineral
137 insulating liquids, natural esters, silicone insulating liquids, synthetic organic esters, modified
138 esters, capacitor fluids based on synthetic aromatic hydrocarbons and e-transmission fluids
139 used in electrical vehicles and oil pumps. The compatibility tests are not sufficient for a full
140 qualification of construction materials for a given application without additional tests requested
141 by the appropriate IEC Technical Committee or equipment manufacturers.

142 **2 Normative references**

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

147 IEC 60296, *Fluids for electrotechnical applications - Mineral insulating oils for electrical*
148 *equipment*

149 IEC 60836, *Specifications for unused silicone insulating liquids for electrotechnical purposes*

150 IEC 60156, *Insulating liquids - Determination of the breakdown voltage at power frequency -*
151 *Test method*

152 IEC 61099, *Specifications for unused synthetic organic esters for electrical purposes*

153 IEC 63012, *Insulating liquids - Unused modified or blended esters for electrotechnical*
154 *applications*

155 IEC 60422, *Mineral insulating oils in electrical equipment - Supervision and maintenance*
156 *guidance*

157 IEC 62975, *Natural esters - Guidelines for maintenance and use in electrical equipment*

158 IEC 60867, *Insulating liquids - Specifications for unused liquids based on synthetic aromatic*
159 *hydrocarbons*

160 IEC 62961, *Insulating liquids - Test methods for the determination of interfacial tension of*
161 *insulating liquids - Determination with the ring method*

162 IEC 62021-1, *Insulating liquids - Determination of acidity - Part 1: Automatic potentiometric*
163 *titration*

164 IEC 62021-2, *Insulating liquids - Determination of acidity - Part 2: Colourimetric titration*

165 IEC 62021-3, *Insulating liquids - Determination of acidity - Part 3: Test methods for nonmineral*
166 *insulating oils*

167 IEC 60050-151, *International Electrotechnical Vocabulary (IEV) - Part 151: Electrical and*
168 *magnetic devices*

169 IEC 60664-2-1, *Insulation coordination for equipment within low-voltage systems - Part 2-1:*
170 *Application guide - Explanation of the application of the IEC 60664 series, dimensioning*
171 *examples and dielectric testing*

- 172 IEC 60247, *Insulating liquids - Measurement of relative permittivity, dielectric dissipation factor*
173 *(tan δ) and d.c. resistivity*
- 174 IEC 60814, *Insulating liquids - Oil-impregnated paper and pressboard - Determination of water*
175 *by automatic coulometric Karl Fischer titration*
- 176 IEC 60851-4, *Winding wires - Test methods - Part 4: Chemical properties*
- 177 IEC 60851-5, *Winding wires - Test methods - Part 5: Electrical properties*
- 178 IEC 60455-2, *Resin based reactive compounds used for electrical insulation - Part 2: Methods*
179 *of test*
- 180 IEC 61033, *Test methods for the determination of bond strength of impregnating agents to an*
181 *enamelled wire substrate*
- 182 ISO 2049, *Petroleum products - Determination of colour (ASTM scale)*
- 183 ISO 1817, *Rubber, vulcanized or thermoplastic - Determination of the effect of liquids*
- 184 ISO 48-4, *Rubber, vulcanized or thermoplastic - Determination of hardness - Part 4: Indentation*
185 *hardness by durometer method (Shore hardness)*
- 186 ISO 868, *Plastics and ebonite - Determination of indentation hardness by means of a durometer*
187 *(Shore hardness)*
- 188 ISO 37, *Rubber, vulcanized or thermoplastic - Determination of tensile stress-strain properties*
- 189 ISO 815-1, *Rubber, vulcanized or thermoplastic - Determination of compression set - Part 1: At*
190 *ambient or elevated temperatures*
- 191 ASTM D971, *Standard Test Method for Interfacial Tension of Insulating Liquids Against Water*
192 *by the Ring Method*
- 193 ASTM D877, *Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids*
194 *Using Disk Electrodes*
- 195 ASTM D1524, *Standard Test Method for Visual Examination of Used Electrical Insulating*
196 *Liquids in the Field*
- 197 ASTM D3039, *Standard Test Method for Tensile Properties of Polymer Matrix Composite*
198 *Materials*
- 199 ASTM D3455, *Standard Test Methods for Compatibility of Construction Material with Electrical*
200 *Insulating Oil of Petroleum Origin*

201 **3 Terms and definitions**

202 **3.1**

203 **insulating liquid**

204 insulating material consisting entirely of a liquid

205 [SOURCE: 212-11-14]

206 **3.2**

207 **mineral insulating oil**

208 insulating liquid obtained by refining, modifying and/or blending of petroleum products and other
209 hydrocarbons

210 [SOURCE: IEC 60296]

211 **3.3**

212 **natural ester**

213 vegetable oils obtained from seeds and oils obtained from other suitable biological materials
214 and comprised of triglycerides

215 [SOURCE: IEC 62770]

216 **3.4**

217 **silicone insulating liquid**

218 liquid organopolysiloxanes whose molecular structure consists mainly of linear chains of
219 alternating silicon and oxygen atoms, with hydrocarbon groups attached to the silicon atoms

220 [SOURCE: IEC 60836]

221 **3.5**

222 **synthetic organic ester**

223 insulating liquid produced from acids and alcohols by chemical reaction

224 [SOURCE: IEC 61099]

225 **3.6**

226 **modified ester insulating liquid**

227 ester insulating liquid which has been made/synthesized or altered by chemical reaction

228 [SOURCE: IEC 63012]

229 **3.7**

230 **blended ester insulating liquid**

231 homogeneous combination of unused natural, synthetic and/or modified esters that are miscible

232 [SOURCE: IEC 63012]

233 **3.8**

234 **compatibility (of materials)**

235 ability of materials to be used together without deleterious changes in any of the materials

236 [SOURCE: 212-14-19]

237 **3.9**

238 **kinematic viscosity**

239 quotient of the dynamic viscosity and the density, both determined at the same temperature

240 [SOURCE: 212-18-04]

241 **3.10**

242 **breakdown voltage**

243 voltage at which electric breakdown occurs under prescribed test conditions, or in use

244 [SOURCE: 212-11-34]

245 **3.11**

246 **dielectric dissipation factor**

247 absolute value of the ratio of the imaginary to the real part of the complex relative permittivity

248 Note 1 to entry: The dielectric dissipation factor is equal to the tangent of the dielectric loss angle.

249 Note 2 to entry: In English the abbreviation DDF is sometimes used to characterize the dielectric loss in insulating
250 materials.

251 [SOURCE: 212-11-29]

252 **3.12**

253 **acidity**

254 quantity of base, expressed in milligrams of potassium hydroxide per gram of sample, required
255 to titrate potentiometrically or calorimetrically a test portion in a specified solvent to the end
256 point

257 [SOURCE: IEC 62021-3]