



**SLOVENSKI STANDARD**  
**oSIST prEN IEC 62146-2:2022**  
**01-junij-2022**

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**Kondenzatorji za izravnavo potenciala pri visokonapetostnih odklopnikih za izmenični tok - 2. del: Kondenzatorji TRV**

Grading capacitors for high-voltage alternating current circuit-breakers - Part 2: TRV capacitors

**iTeh STANDARD**

**PREVIEW**

Condensateurs de répartition pour disjoncteurs à courant alternatif haute tension - Partie 2: Condensateurs TTR

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**Ta slovenski standard je istoveten z: prEN IEC 62146-2:2022**

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**ICS:**

31.060.70      Močnostni kondenzatorji      Power capacitors

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33/673/CDV

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SECRETARIAT: Italy	SECRETARY: Mr Stefano Zunino
OF INTEREST TO THE FOLLOWING COMMITTEES: SC 17A	PROPOSED HORIZONTAL STANDARD: <input type="checkbox"/> Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.
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TITLE:

**Grading capacitors for high-voltage alternating current circuit-breakers - Part 2: TRV capacitors**

PROPOSED STABILITY DATE: 2025

NOTE FROM TC/SC OFFICERS:

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**CAPACITORS FOR HIGH-VOLTAGE ALTERNATING CURRENT CIRCUIT-BREAKERS - PART 2: TRV CAPACITORS**

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International Standard IEC 62146-2 has been prepared by IEC Technical Committee 33: Power capacitors and their applications.

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

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

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

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

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

- 124 • reconfirmed,  
125 • withdrawn,  
126 • replaced by a revised edition, or  
127 • amended.  
128

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129 **CAPACITORS FOR HIGH-VOLTAGE ALTERNATING CURRENT CIRCUIT-**  
130 **BREAKERS - PART 2: TRV CAPACITORS**  
131

132 **1 Scope**

133 This part of the IEC 62146 series is applicable to TRV capacitors used on high-voltage  
134 alternating current circuit-breakers with rated voltages above 100 kV with 50 Hz or 60 Hz.

135 TRV capacitors are installed phase to earth, either in parallel to the bushing on dead tank  
136 circuit-breakers, or immersed inside the circuit-breaker, or freestanding close to the circuit-  
137 breaker. Their function is to limit the transient recovery voltage (TRV) and the rate of rise of  
138 recovery voltage (RRRV) on the circuit-breaker. Capacitors in compliance with this standard  
139 can be used as TRV capacitor.

140 This standard applies to TRV capacitors falling into one or both of the following categories for:

- 141 – mounting on or close to air insulated switchgear (AIS) dead tank and live tank circuit-  
142 breakers, or
- 143 – mounting on gas insulated switchgear (GIS) circuit-breakers.

144 The testing for each of the above applications is in some cases different.

145 This standard does not apply to grading capacitors installed in parallel to the chambers of the  
146 circuit-breaker, which are specified in IEC 62146-1.

147 This standard does not apply to capacitors not directly associated with high-voltage alternating  
148 current circuit-breakers.

149 The object of this standard is:

- 150 – to define uniform rules regarding performances, testing and rating
- 151 – to define specific safety rules
- 152 – to provide a guidance for installation and operation

153

154 NOTE 1: The TRV capacitor is a sub-component for the circuit-breaker and shall be specified in accordance with  
155 the circuit-breaker specifications according to IEC 62271-1, IEC 62271-100, and if applicable to IEC 62271-203.

156 NOTE 2: TRV capacitors are commonly built with composite or ceramic housings (insulators). Those insulators shall  
157 follow IEC 61462 or IEC 62155. Other housings can be used if they can sustain applicable type tests according to  
158 IEC 61462 and IEC 62155.

159 **2 Normative references**

160 The following documents, in whole or in part, are normatively referenced in this document and  
161 are indispensable for its application. For dated references, only the edition cited applies. For  
162 undated references, the latest edition of the referenced document (including any amendments)  
163 applies.

164 IEC 60071-1:2019, *Insulation co-ordination – Part 1: Definitions, principles and rules*

165 IEC 60358-1:2012, *Coupling capacitors and capacitor dividers – Part 1: General rules*

166 IEC 60815 (all parts), *Selection and dimensioning of high-voltage insulators intended for use in*  
167 *polluted conditions*

168 IEC 61462:2007, *Composite hollow insulators – Pressurized and unpressurized insulators for*  
169 *use in electrical equipment with rated voltage greater than 1 000 V – Definitions, test methods,*  
170 *acceptance criteria and design recommendations*



171 IEC 62146-1:2013+AMD1:2016, *Grading capacitors for high-voltage alternating current circuit-*  
 172 *breakers – Part 1: General*

173 IEC 62155:2003, *Hollow pressurized and unpressurized ceramic and glass insulators for use in*  
 174 *electrical equipment with rated voltages greater than 1 000 V*

175 IEC 62271-1:2017, *High-voltage switchgear and control gear – Part 1: Common specifications*  
 176 *for alternating current switchgear and control gear*

177 IEC 62271-100:2021, *High-voltage switchgear and control gear – Part 100: Alternating current*  
 178 *circuit-breakers*

179 IEC 62271-203:2011, *High-voltage switchgear and control gear – Part 203: Gas-insulated*  
 180 *metal-enclosed switchgear for rated voltages above 52 kV*

181 IEC Guide 109, *Environmental aspects – Inclusion in electrotechnical product standards*

### 182 **3 Terms and definitions**

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

184 ISO and IEC maintain terminological databases for use in standardization at the following  
 185 addresses:

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

188 Clause 3 of IEC 62146-1 is applicable with the following additions:

#### 189 **3.1**

##### 190 **capacitor**

191 two-terminal device characterized essentially by its capacitance

192 [SOURCE: IEC 60050-151:2001, 151-13-28]  
 oSIST prEN IEC 62146-2:2022  
<https://standards.iteh.ai/catalog/standards/sist/68f43cf2-1365-48b4-8179-8284568e78f3/osist-pren-iec-62146-2-2022>

#### 193 **3.2**

##### 194 **TRV capacitor**

195 capacitor for installation on high-voltage circuit-breakers phase to earth, either on circuit-  
 196 breaker bushings or freestanding close to the circuit-breaker to limit TRV or RRRV

197 Note 1 to entry: The TRV capacitors alone are accessories of the circuit-breaker

#### 198 **3.3**

##### 199 **freestanding capacitor**

200 TRV capacitor installed as an accessory to the circuit-breaker and mounted in its proximity

201 Note 1 to entry: the freestanding capacitor does not need to be fixed at the same supporting structure of the circuit-  
 202 breaker.

203 Note 2 to entry: The freestanding TRV capacitors are sometimes named standalone TRV capacitors.

#### 204 **3.4**

##### 205 **ambient air temperature**

206 temperature of the air at the proposed location of the capacitor

#### 207 **3.5**

##### 208 **transient recovery voltage**

##### 209 **TRV**

210 recovery voltage during the time in which it has a significant transient character

211 Note 1 to entry: The transient recovery voltage may be oscillatory or non-oscillatory or a combination of these  
 212 depending on the characteristics of the circuit and the switching device. It includes the voltage shift of the neutral of  
 213 a polyphase circuit.

214 Note 2 to entry: The transient recovery voltages in three-phase circuits are, unless otherwise stated, that across the  
215 first pole to clear, because this voltage is generally higher than that which appears across each of the other two  
216 poles.

217 [SOURCE: IEC 60050-441: 1984, IEC 62271-100:2021]

### 218 3.6

#### 219 rate of rise of recovery voltage

#### 220 **RRRV**

221 first peak transient recovery voltage divided by the total time from zero voltage to peak voltage

222 Note 1 to entry: Level of TRV and the RRRV are key factors in determining whether the fault can be cleared  
223 successfully

### 224 3.7

#### 225 Voltage factor

#### 226 **$F_v$**

227 factor used when the TRV capacitor is composed of several capacitors connected in series  
228 phase to earth

229 Note 1 to entry:  $F_v$  will affect the insulating voltage levels of the individual capacitors to add some safety margin.

## 230 4 Abbreviations

231 Clause 4 of IEC 62146-1 is applicable with the following additions.

$F_v$	voltage factor
TRV	transient recovery voltage
RRRV	rate of rise of recovery voltage

## 232 5 Service conditions

233 For TRV capacitors installed on the circuit-breaker or immersed capacitors, the service  
234 conditions are given in IEC 62146-1 clause 5.

235 For freestanding capacitors, the service conditions are given in IEC 60358-1 clause 4.

## 236 6 Ratings

### 237 6.1 Rated voltage ( $U_{cr}$ )

238 The rated voltage  $U_{cr}$  of a TRV capacitor connected between one phase of a three-phase system  
239 and earth shall be equal or greater than the value of the rated voltage  $U_r$  of the circuit-breaker  
240 divided by  $\sqrt{3}$ .

241 Preferred values for  $U_r$  are given in IEC 62271-1.

242 NOTE:  $U_r$  used in IEC 62271 series and in this standard corresponds to  $U_m$  presented in IEC 60071-1.

243

### 244 6.2 Rated insulation level

245 The choice of the insulation level for equipment shall be made in accordance with the standard  
246 insulation levels, based on its highest voltage for equipment  $U_r$ . Guidance for the choice of the  
247 insulation level is given below.

248 In case of TRV capacitor of an air insulated circuit-breaker installed parallel to the bushing, the  
249 insulation levels are according to IEC 62271-1.

250 In case of TRV capacitor installed in a gas insulated switchgear (GIS and dead tank breaker),  
251 the insulation levels are according to IEC 62271-203.

252 In case of TRV capacitor installed freestanding, the insulation levels are according to Table 1  
 253 and Table 2 (adapted from IEC 60358-1). The rated insulation levels shall be based on the  
 254 rated voltage of the circuit-breaker  $U_r$ .

255 **Table 1 – Standard insulation levels – Range I ( $U_r < 300$  kV)**

Range	Rated voltage of the circuit-breaker ( $U_r$ ) (r.m.s.) kV	Rated power-frequency withstand voltage (r.m.s.) kV	Rated lightning impulse withstands voltage (peak) kV	Rated switching withstand voltage (peak) kV
I	100	185	450	
	123	185	450	
		230	550	
	145	230	550	
		275	650	
	170	275	650	
		325	750	
	245	395	950	
460		1050		

NOTE 1: For exposed installations it is recommended to choose the highest insulation level.  
 NOTE 2: For alternative levels, see IEC 60071-1.

256 (standards.iteh.ai)

257 **Table 2 – Standard insulation levels – Range II ( $U_r \geq 300$  kV)**

Range	Rated voltage of the circuit-breaker ( $U_r$ ) (r.m.s.) kV	Rated power-frequency withstand voltage (r.m.s.) kV	Rated lightning impulse withstands voltage (peak) kV	Rated switching withstand voltage (peak) kV
II	300	395	850	750
			950	
		460	950	850
			1050	
	362	460	950	850
			1050	
		510	1050	950
			1175	
	420	570	1050	850
			1175	
			1175	
		630	1300	950
1300				
1425				
550	630	1175	950	
		1300		
		1300		