# SLOVENSKI STANDARD
# SIST EN 60269-6:2011/oprA1:2018

**01-marec-2018**

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**Nizkonapetostne varovalke - 6. del: Dopolnilne zahteve za taljive vložke za zaščito sončnih fotonapetostnih energijskih sistemov**

Low-voltage fuses - Part 6: Supplementary requirements for fuse-links for the protection of solar photovoltaic energy systems

Niederspannungssicherungen - Teil 6: Zusätzliche Anforderungen an Sicherungseinsätze für den Schutz von solaren photovoltaischen Energieerzeugungssystemen



Fusibles basse tension - Partie 6: Exigences supplémentaires concernant les éléments de remplacement utilisés pour la protection des systèmes d'énergie solaire photovoltaïque



**Ta slovenski standard je istoveten z:** **EN 60269-6:2011/prA1:2018**

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**ICS:**

| | | |
|---|---|---|
| 29.120.50 | Varovalke in druga medtokovna zaščita | Fuses and other overcurrent protection devices |

**SIST EN 60269-6:2011/oprA1:2018** **en,fr,de**

# 32B/673/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

| | |
|---|---|
| PROJECT NUMBER: **IEC 60269-6/AMD1 ED1** | |
| DATE OF CIRCULATION: **2018-01-19** | CLOSING DATE FOR VOTING: **2018-04-13** |
| SUPERSEDES DOCUMENTS: **32B/672/CC,32B/672/CC** | |

| | |
|---|---|
| IEC SC 32B : LOW-VOLTAGE FUSES | |
| SECRETARIAT: Germany | SECRETARY: Mr Michael Altenhuber |
| OF INTEREST TO THE FOLLOWING COMMITTEES: TC 64,TC 82 | PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary. |
| FUNCTIONS CONCERNED: ☐ EMC ☐ ENVIRONMENT ☐ QUALITY ASSURANCE ☐ SAFETY | |
| ☒ SUBMITTED FOR CENELEC PARALLEL VOTING | ☐ NOT 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. | |



This document is still under study and subject to change. It should not be used for reference purposes.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

TITLE:

**Low-voltage fuses - Part 6: Supplementary requirements for fuse-links for the protection of solar photovoltaic energy systems**

PROPOSED STABILITY DATE: 2021

NOTE FROM TC/SC OFFICERS:

*Page 6*

*1.1* **Scope and object**

*Replace the sentences:*
These supplementary requirements apply to fuse-links for protecting PV strings and PV arrays in equipment for circuits of nominal voltages up to 1 500 V d.c.
Their rated voltage may be up to 1 500 V d.c.

*By:*
These supplementary requirements apply to fuse-links for protecting PV strings and PV arrays in equipment for circuits of nominal voltages up to 1 500 V d.c., and also, in so far as they are applicable, for circuits of higher nominal voltages.

*Page 7*

**1.2 Normative references**

*Delete the dates after*

IEC 60269-1

IEC 60269-2

Add:

*2.2* **General terms**

*Add after the title*

Photovoltaic = PV



*Replace 2.2.101 by*

**2.2.101 PV fuse-link**



**2.2.101.1 PV fuse-link**
fuse-link capable of breaking, under specified conditions, any current value within the breaking range

NOTE A PV fuse-link operates under two main conditions:

- Short-circuit in a string (see IEC 62548 and IEC 60634-7-712 or in an array or sub-array (see IEC 62548 and IEC 60634-7-712) which leads to a very low over-current.
- Short-circuit current supplied by the discharge of the PV inverter through a very low inductance. This short-circuit condition leads to a very high rate of rise of current equivalent to a low value of time constant, corresponding to Table 104.

**2.2.101.2 string fuse-link**

Fuse-link for the short-circuit and overload protection in a string

**2.2.101.3 sub-array or array or array field fuse-link**
Fuse-link for the short-circuit and cable overload protection in an sub-array or array or array field

**2.2.101.4 functional earthing fuse-link**
Fuse-link for earthing circuit protection of the photovoltaic (or PV) arrays. Functional earthing fuse-link arrangement can be found in IEC 60364-7-712 and IEC 62548.

*Delete the paragraphs*

2.2.102 photovoltaic cell
2.2.103 photovoltaic module

*delete the words "array field, assembly, generator, panel"*
in paragraph 2.2.104

*Delete the paragraphs*

*2.2.104.2 photovoltaic array field*
*2.2.104.3 photovoltaic assembly*
*2.2.104.4 photovoltaic generator*
*2.2.104.5 photovoltaic panel*

*Change 2.2.104.6 to 2.2.104.2 and*
*Change 2.2.104.7 to 2.2.104.3*

*Delete the paragraphs*

*2.2.105 inverter*
*2.2.106 junction box*
*2.2.106.1 array junction box*
*2.2.106.2 generator junction box*

*Change 2.2.107 to 2.2.105*
*delete [61836,3.2.16]*



*Change 2.2.108 to 2.2.106*

*Delete the paragraphs*



*2.2.109 photovoltaic currents*
*2.2.109.1 load current*
*2.2.109.2 maximum power current*
*2.2.109.3 rated current*

*Delete the entire paragraph 2.2.109.4 and add the following text*

*2.2.107 currents*

*2.2.107.1* ***short circuit current*** *(symbol $I_{SC}$), (unit:A)*
*Electric current at the output terminals of a PV device at a particular temperature and irradiance, when the device output voltage is equal or closed to zero.*

*2.2.107.2* ***maximum overcurrent rating*** $I_{MOD\_MAX\_OCPR}$
PV module maximum overcurrent protection rating determined by IEC 61730-2

*2.2.107.3* ***short circuit current of a PV module*** $I_{SC\ MOD}$
short circuit current of a PV module or PV string at standard test conditions (STC), as specified by the manufacturer

*2.2.107.4* ***Short circuit current of an array*** $I_{SC\ ARRAY}$
short-circuit current of the PV array at standard test conditions (STC), and is equal to
$I_{SC\ ARRAY} = I_{SC\ MOD} \times N_S$
where $N_S$ is the total number of parallel-connected PV strings in the PV array

Note 1: A PV string is a number of PV modules connected in series. The short circuit current of a string is equal to $I_{SC,MOD.}$

115
116 *2.2.107.5* ***Short circuit current of an sub-array*** $I_{SC\ S\text{-}ARRAY}$
117 short circuit current of a PV sub-array at standard test conditions (STC), and equal to
118 $I_{SC\ S\text{-}ARRAY} = I_{SC\ MOD} \times N_{SA}$ where $N_{SA}$ is the number of parallel-connected PV strings in the PV sub-
119 array
120
121 *2.2.107.6* **Maximum reverse current** (symbol ($I_{RM}$) (unit : A)
122 Maximum reverse current accepted by the module or the panel.
123
124
125 *Change 2.2.110 to 2.2.108*
126
127
128 *Delete the paragraphs*
129
130 *2.2.110.1 load voltage*
131 *2.2.110.2 maximum power voltage*
132 *2.2.110.3 maximum power voltage under standard operating conditions*
133 *2.2.110.4 maximum power voltage under standard test conditions*
134
135 *Change 2.2.110.5 to 2.2.108.1 and replace in this paragraph the word "…. output electrical current…"*
136 *by " ……load current……"*
137
138 *Change 2.2.110.6 to 2.2.108.2 and delete the words "[IEC 61836, 3.4.69k]…" by " ……load*
139 *current……"*
140
141 *Delete the paragraph*
142
143 *2.2.110.7 rated voltage*
144
145
146 *Page 10*
147 **2.2.110.5**
148 **open-circuit voltage of PV device**
149 *Replace "output electric current" by " load current " in the sentence (last line)*

150 *Page 12*

151 **Table 101 – Conventional times and currents for "gPV" fuse-links**

152 *Replace Table 101 by the following*

153 **Table 101 – Conventional times and currents for "gPV" fuse-links**

| Rated current<br>*A* | Conventional time<br>*h* | Conventional current | | Fuse type |
|---|---|---|---|---|
| | | Type "gPV" | | |
| | | $I_{nf}$ | $I_f$ | |
| $I_n \leq 63$ | 1 | $1{,}05\ I_n$ | $1{,}35\ I_n$ [1)]<br>2 hours | String fuse-link |
| $32 < I_n \leq 63$ | 1 | $1{,}13\ I_n$ * | $1{,}45\ I_n$ * | Sub-array or array fuse-link |
| $63 < I_n \leq 160$ | 2 | | | |
| $160 < I_n \leq 400$ | 3 | | | |
| $I_n > 400$ | 4 | | | |
| *Note 1): For $I_f = 1{,}35\ I_n$, the operating time = 2 h (The thermal withstand capability of a PV module under reverse current is qualified during a 2 h test specified in the module safety test from IEC 61730 and is specified on the module as the "maximum overcurrent protection" value).* | | | | |



154 * The use of these values for conventional currents is not permitted in North America. String fuse-link
155 conventional current values are permitted for sub-array and array fuse-links



156 Note: A string fuse-link shall interrupt the current in the functional earthing conductor in the event of
157 an earth fault on the DC side. For functional earthing fuse-link the operation is ensured at a
158 fault current of typically 130% to 140% of In and will occur within maximum times of 60 minutes
159 at 135% and 2 minutes at 200%.
160

161 *Page 14 Note 1)*

162 **8.3.3 Measurement of power dissipation of the fuse-link**

163 *Add the following sentence at the end of the sub clause:*

164 This test maybe performed with either alternating or direct current.
165

166 *Page 15*

167 **8.4.3.1 Verification of conventional non-fusing and fusing current**

168 *Replace the 1st sentence by:*

169 It is permissible to make the following tests at a reduced voltage and either alternating or direct current.

170 *Replace the sentences in b) by.*

171 The fuse-link is subjected to the conventional fusing current. It shall operate within the conventional time (Table
172 101). For string fuse links it is also acceptable when $I_f = 1{,}35 \cdot In$ when the fuse link operates within $t_c$ = 2hours
173 as specified in table 101, Note 2. The fuse-link shall operate without external effects or damage.
174 Note: If this test arrangement is not applicable, special tests shall be performed according to the manufacturer's instructions and all
175 pertinent data shall be recorded in the test report.
176

177 **8.4.3.2 Verification of rated current**

178 *Replace the sentence by*

179 The test requested in 8.4.3.2 of IEC 60269-1 is replaced by the following. The requirements for safe
180 operation apply from IEC 60 269-1, Clause 8.5.8.

181 a) String fuse-links:

182 Rated current ≤ 32A**:** Three samples are to undergo 3000 repetitions of current cycling where one
183 cycle is represented in Figure 101.

184 This test maybe performed with either alternating or direct current.
185

186 After this test, the resistance of the fuse-link at room temperature shall not have changed by
187 more than 10 %, and tests presented in 8.11.2.4 and Tables 102 and 103 shall be made.

188

189 b) Sub array and Array fuse-links, rated current > 32A (these fuse-links protect cables):

190 The test requested in 8.4.3.2 of IEC 60269-1 is applicable with the following modifications:

191 One fuse-link is submitted to a pulse test for 100 h, in which the fuse-link will be cyclically loaded.
192 Each cycle with an on-period of the conventional time and an off-period of 0,1 of the
193 conventional time, the test current being equal to **0,85** of the rated current of the fuse-link.

194 After the test the fuse-link shall not have changed its characteristics. Verification shall be carried out
195 by the test as described in item a) of 8.4.3.1

196 This test maybe performed with either alternating or direct current.



197

198 *Page 16*

199 **8.5.8 Acceptability of test results**



200 *Delete the entire text of this subclause and replace it by:*

201 Fuse links shall operate in compliance with clause 8.5.8 of part 1

*Page 16*

**Table 104 – Values for breaking capacity tests on "gPV" fise-links**

*Time constant for Test* **No. 5**

*Replace* Inductance ≥ 100 micro Henry ***by*** ≤ 1 ms

Page 18

**Figure 101 – Current of test cycling**

*Replace the figure 101 by the following figure*

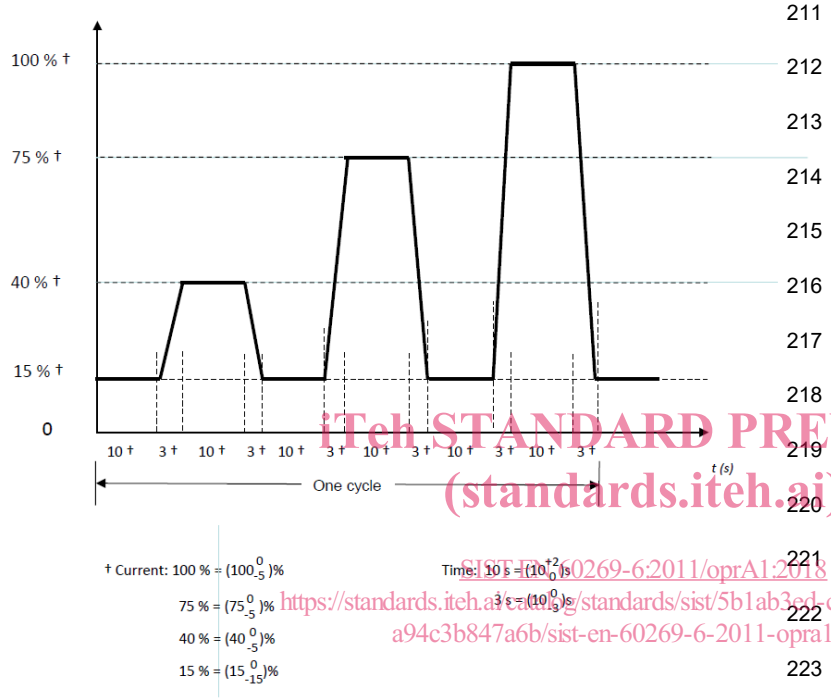




**Figure 101 – Current of test cycling**

*Page 19* **Annex AA**

**AA.1 General**

*Delete the words "French" – "North American" – "DIN" (2 times) respectively after the systems type A – type B - type C - and type D - .*

*Replace the sentence: system of cylindrical fuse-links with long blade contacts, type D – DIN (Figure AA.5) by*

***system of long fuse-links with blade contacts, type D (Figure AA.5)***