Technical Construction File

EN 60269-1:2007+A2:2014, EN 60269-6:2011
Low-voltage fuses - Part 1: General requirements
Part 6: Supplementary requirements
for fuse-links for the protection of solar photovoltaic energy systems

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Reviewing location.....:	Floor 2nd, Building D-1, No. 128, Shenfu Road, Minhang District, Shanghai, China.
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Factory.....:	The same as Manufacturer
Address.....:	The same as Manufacturer
Standard.....:	☒ EN 60269-1:2007+A2:2014, EN 60269-6:2011
Review Report Form No.....:	60269-1, 60269-6
TRF originator.....:	GTS
Master TRF.....:	Reference No. EN 60269-1:2007+A2:2014, EN 60269-6:2011
Review procedure .....:	GTS
Type of Review object.....:	Fuse-Link
Trademark.....:	/
Model/type reference.....:	MDPVF
Rating.....:	/

Possible review case verdicts: - review case does not apply to the test object..... : N(.A.) - review object does meet the requirement..... : P(ass) - review object does not meet the requirement.....: F(ail)	
General remarks:	
”(see remark #)” refers to a remark appended to the report. ”(see appended table)” refers to a table appended to the report. Throughout this report a comma is used as the decimal separator. The review results presented in this report relate only to the object reviewed. This report shall not be reproduced except in full without the written approval of the third party.	
Testing: Date of receipt of review item: Date(s) of performance of review:	 March 12,2022 March 12,2022 to March 22,2022
General product information: Fuse-Link	
Summary of reviewing: This review report includes: Annex I: 1 page(s) of photo documentation.	
Copy of marking plate	
Fuse-Link, Model MDPVF Mindian Electric Co., Ltd.	Marking

EN 60269-1:2007+A2:2014			
Clause	Requirement- Test	Result - Remark	Verdict
1	General		-
1.1	Scope and object		-
1.2	Normative references		-
2	Terms and definitions		-
2.1	Fuses and their component parts		P
2.2	General terms		P
2.3	Characteristic quantities		P
3	Conditions for operation in service		P
3.1	Ambient air temperature (Ta)		P
3.2	Altitude		P
3.3	Atmospheric conditions		P
3.4	Voltage		P
3.5	Current.		P
3.6	Frequency, power factor and time constant		P
3.7	Conditions of installation		P
3.8	Utilization category		P
3.9	Discrimination of fuse-links		P
4	Classification		P
5	Characteristics of fuses		P
5.1	Summary of characteristics		P
5.2	Rated voltage		P
5.3	Rated current		P
5.4	Rated frequency (see 6.1 and 6.2)		P
5.5	Rated power dissipation of a fuse-link and rated acceptable power dissipation of a fuse-holder		P
5.6	Limits of time-current characteristics		P
5.7	Breaking range and breaking capacity		P
5.8	Cut-off current and I 2t characteristics		P
6	Markings		P
6.1	Markings of fuse-holders		P
6.2	Markings of fuse-links		P
6.3	Marking symbols		P
7	Standard conditions for construction		P
7.1	Mechanical design		P
7.2	Insulating properties and suitability for isolation		P
7.3	Temperature rise, power dissipation of the fuse-link and acceptable power dissipation of a fuse-holder		P
7.4	Operation		P

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Clause	Requirement- Test	Result - Remark	Verdict
7.5	Breaking capacity		P
7.6	Cut-off current characteristic		P
7.7	I^2t characteristics		P
7.8	Overcurrent discrimination of fuse-links		P
7.9	Protection against electric shock		P
7.10	Resistance to heat		P
7.11	Mechanical strength		P
7.12	Resistance to corrosion		P
7.13	Resistance to abnormal heat and fire		P
7.14	Electromagnetic compatibility		P
8	Tests		P
8.1	General		P
8.1.5	**Testing of fuse-links**		P
	This requirement is applicable for all tests which have to be performed at rated voltage.		P
	However, tests which are allowed to be performed at any convenient low voltage are allowed to be conducted, by the agreement of the manufacturer, at d.c. or a.c. 50 or 60 Hz for fuselinks rated dc and/or 50 Hz and/or 60 Hz, providing that the kind of current or frequency does not influence the test results.		P
	The test results are deemed to cover the relevant requirements if it is verified that the temperature rises according to 8.3. for the highest rated current do not differ by more than 2.5 % when tested with dc 50/60 Hz a.c.		P
	Pre-arcing and operating times less than 2 s shall be determined from oscillograms, or other methods meeting the requirements of LTI G2.		P
	The instruments for the measurement of current voltage and internal resistance of the fuselinks shall be at least of Class 0.5 or according to LTI G2 and shall show (or permit to determine) the true r.m.s. value.		P
8.1.5.1	**Complete tests**		P
	Type of current for the internal resistance measurement: dc.		P

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Clause	Requirement- Test	Result - Remark	Verdict
	For some fuses, the maximal allowed measuring current 0.1 In stated in the standard may lead to a temperature rise.		P
	A lower test current value shall then be used, but not lower than 0.05 In for accuracy reason.		P
8.1.5.2	**Testing of fuse-links of a homogenous series.**		P
	If the applicant requests testings of fuse-links of a homogenous series, he must supply to the test station all technical details required by IEC 60269-1, § 8.1.5.2.		P
	The homogenous series is established by the test station under examination of these details.		P
	The arc-extinguishing medium is deemed to be the same if the quality is the same e.g. when using sand of same purity and same grain size.		P
	When the fuse-link contacts differ in a range of ratings and if it is not possible to determine the least favourable contact, the range shall be parted in several series, each corresponding to the same contact.		P
	The Certificate and the TRF shall include the list(s) of the fuses of the homogenous series.		P
8.2	Verification of the insulating properties and of the suitability for isolation		P
8.2.1	**Arrangement of the fuse-holder.**		P
	If the manufacturer asks the certification of a fuse intended to be replaceable while live, he shall supply the device for replacing, or the fuse carrier		P
	. This is for guarantee of the user's safety.		P
8.2.2.3	**Test method**		P
8.2.2.3.2	**Immediately after the humidity treatment** the measurement should be carried out as soon as possible but not more than 15 minutes.		P
8.3	Verification of temperature rise and power dissipation.		P
8.3.1	**Arrangement of the fuse**		P
	When testing rated currents according to R 20 of ISO standard 3 (not mentioned in table 17) the applicable cross-section of the next smaller rated current shall be selected.		P

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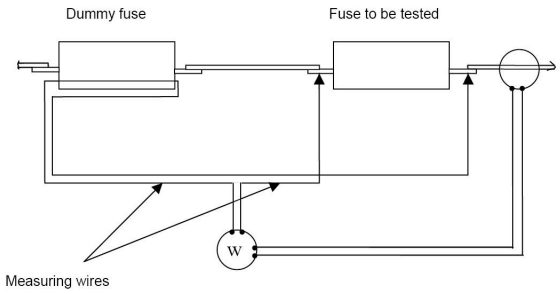
Clause	Requirement- Test	Result - Remark	Verdict
8.3.2	**For ac fuses with Ferro magnetic parts, the test current shall be in a.c.**		P
8.3.3	**Measurement of the power dissipation of the fuse-link**		P
	gives the following test conditions for ac fuse with Ferro magnetic parts:		P
	In ≤ 200 A measurements with :		P
	- either ac wattmeter - or pre-heating in a.c., measurements in d.c. - or the following circuit diagram		P
	In > 200 A: - either pre-heating in a.c., measurements in d.c. - or the following circuit diagram		P
	For d.c. fuses the test current shall be d.c.		P
	Circuit diagram  		P
8.4	Verification of operation		P
8.3.4	**Test method**		P
8.3.4.1	**Temperature rise of fuse-holder**		P
	Tolerance of the power loss of the fuse-link or dummy fuse-link: +5/-0 % of the rated acceptance value.		P
8.4.3	**Test method and acceptability of test results**		P
8.4.3.1	**Fuse-links or dummy fuse-links having the specified power loss shall be supplied by the manufacturer**		P
	a) The tolerance of the r.m.s. equivalent value of the test current over the test shall be +3/-0%.		P
	b) The tolerance of the r.m.s. equivalent value of the test current over the test shall be +3/-0%.		P
	This is to avoid discrepancies because the standard does not prescribe tolerances.		P
8.4.3.2	**Verification of rated current of "g" fuse-links.**		P

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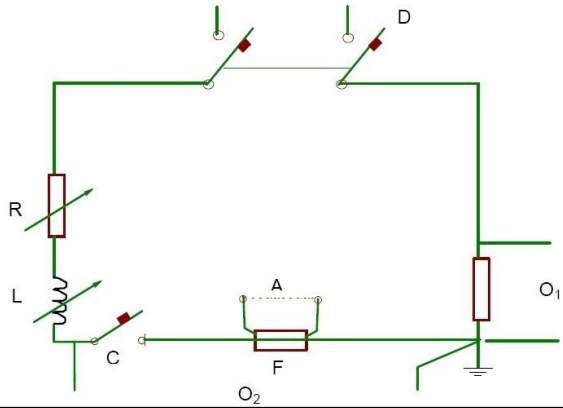
Clause	Requirement- Test	Result - Remark	Verdict
	Same requirement as 8.4.3.1.a).		P
8.4.3.4	**Overload**		P
	The tolerance on the r.m.s. value of the test current measured over the period of 5 s shall not exceed ± 2 %, however momentarily the test current may have a tolerance of ± 5 %.		P
8.5	Verification of the breaking capacity		P
	Test method		P
8.5.5.1	**Tests Nos. 1 and 2**		P
	For a.c., if during test No. 1 the requirements of test No. 2 are met during one or more tests, then these tests need not be repeated as part of test No. 2.		P
	For d.c., if during test No. 1 arcing commences at a current equal to or greater than 0.5 I_1, test No. 2 need not be performed.		P
	For a.c., if the prospective current necessary to comply with the requirements of test No. 2 is greater than the rated breaking capacity, tests Nos. 1 and 2 shall be replaced by a test made with the current I_1, on six samples at six making angles which differ approximately 30° between each test.		P
	The detailed results shall be mentioned in the Test Report.		P
8.5.5.2	**For one of the three tests No. 2 and test No. 4, the voltage shall be maintained:**		P
	- 30 s after operation of fuse-links not containing organic materials, in their body or filler ;		P
	- 5 min. after operation of the fuse-links in all other cases, switching over to another source of supply being permitted after 15 s if the switching time (interval without voltage) does not exceed 0.1 s.		P
	For all other tests, the recovery voltage shall be maintained at the same value for 15 s after operation of the fuse.		P

EN 60269-1:2007+A2:2014			
Clause	Requirement- Test	Result - Remark	Verdict
			P
	O_1 = measurement of current (A_1 , A_2 of figure 6) O_2 = measurement of voltage (B_{00}, B_0, B_1 or B_2 of figure 6)		P
8.5.3	**Measuring instruments**		P
	The frequency response of the measuring circuit shall be minimum 20 kHz in order to measure the breaking overvoltage.		P
8.5.4	**Calibration of test circuit**		P
	For test stations supplied by a generator, it is acceptable for calibration to be carried out at a voltage less than the test voltage.		P
	This proposal allows prospective current tests to be made repeatedly without undue stress to the generator supply.		P
	However, as some short-circuit generators do not exhibit a linear relationship, care should be exercised in application of this procedure to ensure that the rated prospective current is available for the test.		P
	In any case, the prospective test current shall not be made at value less than 75 % of the test voltage relative to the rated value, the linearity characteristic having been predetermined by test at periodic intervals.		P
8.5.8	**Acceptability of test results**		P

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Clause	Requirement- Test	Result - Remark	Verdict
	The statement that the fuse link shall remain in one piece before its removal from the fuse carrier or test rig shall be interpreted as follows: the performance shall be judged unsatisfactory if fragments of the barrel or filler material become detached from the fuse-link prior to its removal from the fuse carrier or test rig.		P
	If there is no doubt regarding the ability of the fuse-link to remain intact during or after removal, the insulation resistance shall be measured in the fuse carrier or test rig.		P
8.6	Verification of the cut-off current characteristics		P
8.7	Verification of I 2t characteristics and overcurrent discrimination		P
8.7	**Verification of I²t characteristic and overcurrent discrimination**		P
8.7.3	**Verification of compliance for gG and gM fuse-links at 0.01 s**		P
	The values of prearcing I²t at 0.01 s to be considered are those announced by the manufacturer (see time-current characteristic).		P
8.11.2.1	**Verification of freedom from season cracking**		P
	The test station decides to make the test from information provided by the manufacturer on the copper rate of current-carrying parts (copper content).		P
8.8	Verification of the degree of protection of enclosures		P
8.9	Verification of resistance to heat		P
8.10	Verification of non-deterioration of contacts		P
8.11	Mechanical and miscellaneous tests		P

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Clause	Requirement- Test	Result - Remark	Verdict
4	Classification		-
	IEC 60269-1 applies.		P
5	Characteristics of fuses		-
	IEC 60269-1 applies with the following supplementary requirements.		P
5.1	Summary of characteristics		-
5.1.2	Fuse-links		-
	a) Rated voltage (see 5.2) b) Rated current (see 5.3 of IEC 60269-1) c) Rated power dissipation (see 5.5) d) Time-current characteristics (see 5.6) e)Breaking range (see 5.7.1) f) Rated breaking capacity (see 5.7.2) g) Dimensions or size (if applicable) h) Utilization category (see 5.7.1)		P
5.2	Rated voltage		-
	For voltages up to 750 V, IEC 60269-1 applies; for higher voltages, the values should be selected from R5 series or, where not possible, from the R1 0 series of ISO 3.		P
5.5	Rated power dissipation of the fuse-link		-
	In addition to the requirements of IEC 60269-1 , the manufacturer shall indicate the power dissipation as a function of current for the range contained between 70 % to 1 00 % of the rated current.		P
5.6	Limits of time-current characteristics		-
5.6.1	Time-current characteristics, time-current zones		-
5.6.1.1	General requirements		-
5.6.2	Conventional times and currents		-
5.6.2.2	Conventional times and currents for "gPV"-fuse-links		-
	Table 101 – Conventional times and currents for "gPV" fuse-links Rated current A / Conventional time h / Conventional current Type "gPV": I_{nf} / I_f $I_n \leq 63$ / 1 / 1,13 I_n / 1,45 I_n $63 < I_n \leq 160$ / 2 $160 < I_n \leq 400$ / 3 $I_n > 400$ / 4		-
5.6	Gates		-

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Clause	Requirement- Test	Result - Remark	Verdict
	Not applicable.		-
5.7	Breaking range and breaking capacity		-
	IEC60269-1 applies with the following supplementary requirement.		P
5.7.1	Breaking range and utilization category		-
	The first letter indicates the breaking range: – "g" fuse-links (full-range breaking capacity fuse-link). The following letters indicate the utilization category: – "gPV" indicates fuse-links with a full-range d.c. breaking capacity for photovoltaic energy systems.		P
5.7.2	Rated breaking capacity		-
	The rated breaking capacity is based on type tests performed in a circuit containing linear components with mean value of applied voltage. The minimum value of the rated breaking capacity is 1 0 kA d.c.		P
6	Markings		-
	IEC 60269-1 applies with the following supplementary requirements.		P
6.2	Markings on fuse-links		-
	Subclause 6.2 of IEC 60269-1 applies with the following addition: – utilization category “gPV”		P
7	Standard conditions for construction		-
	IEC 60269-1 applies with the following supplementary requirement.		P
7.5	Breaking capacity		-
	A fuse-link shall be capable of breaking, at rated d.c. voltage, any circuit having a prospective current between the conventional fusing current and the rated breaking capacity with time constant not greater than the values specified in Table 1 04.		P
8	Tests		-
	IEC 60269-1 applies with the following supplementary requirements.		P
8.1	General		-

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Clause	Requirement- Test	Result - Remark	Verdict
8.1.4	Arrangement of the fuse and dimensions		-
	The fuse-link shall be mounted open in surroundings free from draughts and, unless otherwise specified, in a vertical position (see 8.3.1).		N/A
8.1.5	Testing of fuse-links		-
	The following Tables 1 02 and 1 03 replaces Tables 1 1 , 1 2 and 1 3 of IEC 60269-1 .		N/A
8.1.5.1	Complete tests		-
8.1.5.2	Type test exemptions for fuse-links of a homogeneous series		N/A
8.3	Verification of temperature rise limits and power dissipation		-
8.3.1	Arrangement of the fuse-link		-
	The fuse-link shall be mounted vertically in the conventional test arrangement. For special fuse-links that cannot be accommodated in the conventional test arrangement, or for which this test arrangement is not applicable, special tests shall be performed according to the manufacturer’ s instructions and all pertinent data shall be recorded in the test report.		N/A
8.3.3	Measurement of power dissipation of the fuse-link		-
	In addition to 8.3.3 of IEC 60269-1 the following applies. The power dissipation test shall be made successively at least at 70 % and at 1 00 % of rated current.		N/A
8.3.5	Acceptability of test results		-
	The temperature rise of the fuse-link shall not exceed the values specified in Table 5 of IEC 60269-1 The power dissipation of the fuse-link shall not exceed the values specified by the manufacturer		N/A
8.4	Verification of operation		-
8.4.1	Arrangement of fuse-link		-

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Clause	Requirement- Test	Result - Remark	Verdict
	The arrangement of the fuse-link for the verification of operation shall be as described in 8.1 .4 and 8.3.1 .		N/A
8.4.3	Test method and acceptability of test results		-
8.4.3.1	Verification of conventional non-fusing and fusing current		N/A
8.4.3.2	Verification of rated current		-
8.4.3.5	Conventional cable overload protection test		N/A
8.4.3.6	Operation of indicating devices and strikers, if any		N/A
	The correct operation of indicating devices is verified in combination with the verification of breaking capacity (see 8.5.5). For verifying the operation of strikers, if any, an additional test sample shall be tested: − at a current of I 5 (see Table 1 04); − at a recovery voltage of 50 V. The value of the recovery voltage may be exceeded by 1 0 %. The striker shall operate during all tests.		N/A
8.5	Verification of the breaking capacity		-
8.5.1	Arrangement of the fuse		-
	In addition to the conditions of 8.1 .4 and 8.3.1 , the following requirement applies. For breaking-capacity tests, the fuse-link shall be mounted and connected the same way as it would be in service.		N/A
8.5.5	Test method		-
8.5.5.1	In order to verify that the fuse-link satisfies the conditions of 7.5, tests number – 1 , 2 and 5 – shall be made. The number of fuse-links requested in Table 1 02 shall be tested with the values stated in Table 1 04. Test nos. 1 and 2 : If, during test no. 1 , the requirements of test no. 2 are met, then this test need not be repeated as test no. 2. Test nos. 5 – The value of test current is specified in Table 1 04.		N/A

EN 60269-6:2011			
Clause	Requirement- Test	Result - Remark	Verdict
8.5.5.2	For the tests the recovery voltage shall be maintained at a value of 100^{+5}_{0} % of the rated voltage for at least: – 30 s after operation of fuse-links not containing organic materials in their body or filler; – 5 min after operation of the fuse-links in all other cases, switching over to another source of supply being permitted after 1 5 s if the switching time (interval without voltage) does not exceed 0,1 s. In a lapse of time of at least 6 min and maximum 1 0 min after the operation, the resistance between the contacts of the fuse-link shall be measured (see 8.5.8 of IEC 60269-1) and noted. With the manufacturer’ s consent, shorter times are possible if the fuse-link does not contain organic materials in its body or filler.		N/A
8.5.8	Acceptability of test results		-
	Fuse-links shall be deemed not to comply with this standard if, during the tests, one or more of the following failures occur: – ignition of the fuse-link, excluding any paper labels or the like used as indicating devices; – mechanical damage to the test arrangement; – mechanical damage to the fuse-link; NOTE Thermal cracking which leaves the fuse-link in one piece is accepted. – burning or melting of end caps; – significant movement of end caps.		N/A
8.11	Mechanical and miscellaneous tests		-
8.1 1.2.4	Verification of freedom from unacceptable levels of thermally induced drift		N/A
8.1 1.2.5	Verification of functionality at temperature extremes		N/A

- - - End of Test Report - - -

Photo documentation

Type of equipment, model: Fuse-Link ,
MDPVF

Details of:

View:

[X] general

[ ] front

[ ] rear

[ ] right

[ ] left

[ ] top

[ ] bottom

-End of Photo Documentation -