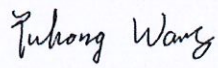
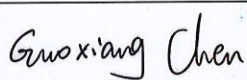




Test Report issued under the responsibility of:



TEST REPORT IEC 61643-31 Low-voltage surge protective devices – Part 31: Requirements and test methods for SPDs for photovoltaic installations	
Report Number.....	CN252X5Z 001
Date of issue.....	2025-11-12
Total number of pages	42
Name of Testing Laboratory preparing the Report	Guangdong LNP Electrical Testing Technology Co., Ltd.
Applicant's name	Guangdong Yada Electronics Co., Ltd.
Address.....	YADA Industrial Park, Gaopugang, Heyuan city 517000 Guangdong, P.R. China
Test specification:	
Standard	IEC 61643-31:2018
Test procedure	CB Scheme
Non-standard test method	N/A
TRF template used.....	IECEE OD-2020-F1:2021, Ed.1.4
Test Report Form No.	IEC61643_31D
Test Report Form(s) Originator	VDE Prüf- und Zertifizierungsinstitut GmbH
Master TRF	Dated 2021-11-12
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Test item description..... :	Surge Protective Device	
Trade Mark..... :		
Manufacturer..... :	Guangdong Yada Electronics Co., Ltd.	
Model/Type reference..... :	1) YDF40-1200YPV, 2) YDF40-1000YPV 3) YDF40-1200YPV FM, 4) YDF40-1000YPV FM 5) YDF40-1200YPV (FM), 6) YDF40-1000YPV (FM)	
Ratings..... :	U_{CPV} : 1)3)5) 1200V DC, 2)4)6) 1000V DC; Class II I_n : 20kA; I_{max} : 40kA; U_P : 1)3)5) 4.5kV, 2)4)6) 4.0kV; I_{SCP} : 20A; I_{Total} : 40kA (8/20); 5%~95%; -40°C~+85°C; Indoor; IP20.	
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
☒ CB Testing Laboratory:	Guangdong LNP Electrical Testing Technology Co., Ltd.	
Testing location/ address..... :	No. 101, Building B, Xinyongsheng Technology Park, Wenquan South Road No. 70, Xinwei Village, Shilong Town, Dongguan City, Guangdong Province, China.	
Tested by (name, function, signature)..... :	Yuhong Wang / Test Engineer	
Approved by (name, function, signature)... :	Guoxiang Chen / Authorized Signaturer	
☐ Testing procedure: CTF Stage 1:	/	
Testing location/ address..... :	/	
Tested by (name, function, signature)..... :	/	/
Approved by (name, function, signature)... :	/	/
☐ Testing procedure: CTF Stage 2:	/	
Testing location/ address..... :	/	
Tested by (name, function, signature)..... :	/	/
Witnessed by (name, function, signature).. :	/	/
Approved by (name, function, signature)... :	/	/
☐ Testing procedure: CTF Stage 3:	/	
☐ Testing procedure: CTF Stage 4:	/	
Testing location/ address..... :	/	
Tested by (name, function, signature)..... :	/	/
Witnessed by (name, function, signature).. :	/	/
Approved by (name, function, signature)... :	/	/
Supervised by (name, function, signature) :	/	/

List of Attachments (including a total number of pages in each attachment): Attachment 1: Equipment List (2 pages) Attachment 2: Photo Documentation (4 pages)	
Summary of testing: This report is for 1) YDF40-1200YPV, 2) YDF40-1000YPV, 3) YDF40-1200YPV FM, 4) YDF40-1000YPV FM, 5) YDF40-1200YPV (FM), 6) YDF40-1000YPV (FM). The products are family product SPD. The type test was performed on the YDF40-1200YPV FM. Test on Model YDF40-1200YPV FM which can represent Model YDF40-1200YPV, YDF40-1000YPV, YDF40-1000YPV FM, YDF40-1200YPV (FM) and YDF40-1000YPV (FM). The products YDF40-1200YPV FM, YDF40-1000YPV FM, YDF40-1200YPV (FM), YDF40-1000YPV (FM) are same products with indicator, with auxiliary switch. Only product model, U_{CPV} and U_P are different. The products YDF40-1200YPV and YDF40-1000YPV are same products with indicator, without auxiliary switch. Only product model, U_{CPV} and U_P are different.	
Tests performed (name of test and test clause): For YDF40-1200YPV FM Test sequence 1: Identification and marking 6.1.1/6.1.2/7.3 Mounting 6.3.1 Terminals and connections 6.3.2/6.3.3 Testing for protection against direct contact 6.2.1 Environment IP code 6.4 Residual current 6.2.2/7.4.1/7.4.1.2 Operating duty test 6.2.4/7.4.2 Thermal stability 6.2.5.3/7.4.3.2 Air clearances and creepage distances 7.5.1 Ball pressure test 6.4 Resistance to abnormal heat and fire 6.4 Tracking resistance 6.4 Test sequence 2: Voltage protection level 6.2.3 Test sequence 3: Insulation resistance 6.2.6 Dielectric withstand 6.2.7/7.4.5 Mechanical strength 6.3.5 Temperature withstand 6.2.5/7.4.3.1 Test sequence 4: Heat resistance 6.4 Test sequence 5: SPD failure mode test 6.2.5.4/7.4.4 Test source DC3 is used for 10A, I_{scpv} and 2.7 times I_{scpv} Test sequence 6: Live test under damp heat 7.6.1 Test sequence 7: Total discharge current test for multipole SPDs 6.2.9	Testing location: Guangdong LNP Electrical Testing Technology Co., Ltd. No. 101, Building B, Xinyongsheng Technology Park, Wenquan South Road No. 70, Xinwei Village, Shilong Town, Dongguan City, Guangdong Province, China.

Summary of compliance with National Differences (List of countries addressed):

☐ The product fulfils the requirements of _____ (insert standard number and edition and delete the text in parenthesis, leave it blank or delete the whole sentence, if not applicable)

Use of uncertainty of measurement for decisions on conformity (decision rule):

☒ No decision rule is specified by the IEC standard, when comparing the measurement result with the applicable limit according to the specification in that standard. The decisions on conformity are made without applying the measurement uncertainty ("simple acceptance" decision rule, previously known as "accuracy method").

☐ Other: (to be specified, for example when required by the standard or client, or if national accreditation requirements apply)

Information on uncertainty of measurement:

The uncertainties of measurement are calculated by the laboratory based on application of criteria given by OD-5014 for test equipment and application of test methods, decision sheets and operational procedures of IECEE.

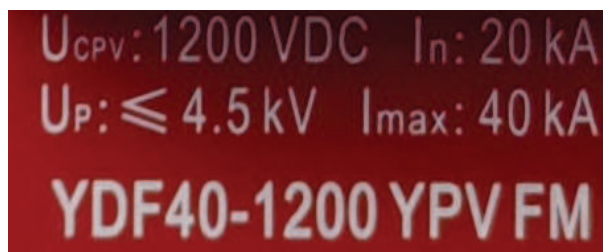
IEC Guide 115 provides guidance on the application of measurement uncertainty principles and applying the decision rule when reporting test results within IECEE scheme, noting that the reporting of the measurement uncertainty for measurements is not necessary unless required by the test standard or customer.

Calculations leading to the reported values are on file with the NCB and testing laboratory that conducted the testing.

Copy of marking plate:

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.

YDF40-1200YPV FM



Test item particulars.....:	
Classification of installation and use.....:	Voltage-limiting / Indoor / Class II / Accessible / Internal disconnecter / Thermal / OCFM / Extended environment / IP20
Supply Connection	Photovoltaic system earthed
Possible test case verdicts:	
- test case does not apply to the test object.....:	N/A
- test object does meet the requirement.....:	P (Pass)
- test object does not meet the requirement.....:	F (Fail)
Testing.....:	
Date of receipt of test item	2025-08-01
Date (s) of performance of tests	2025-08-01to 2025-10-20
General remarks:	
"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report. Throughout this report a ☐ comma / ☒ point is used as the decimal separator.	

Manufacturer's Declaration per sub-clause 4.2.5 of IEC 61643-11:

The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided

☐ Yes
☒ Not applicable

When differences exist; they shall be identified in the General product information section.

Name and address of factory (ies) : Guangdong Yada Electronics Co., Ltd.
 YADA Industrial Park, Gaopugang, Heyuan city
 517000 Guangdong, P.R. China

General product information:

1. Models YDF40-1200YPV FM is PV SPD, installed on the DC side of PV.

2. The voltage limiting functional element of each module is composed of metal oxide varistor. There is an independent release device on each module, and the working principle of the release device is thermal release. This function is achieved by melting the release device at low temperature welding points and utilizing the elastic action of the shrapnel. When the disconnecter is activated, the transparent window of the surge protector will display a red indicator.

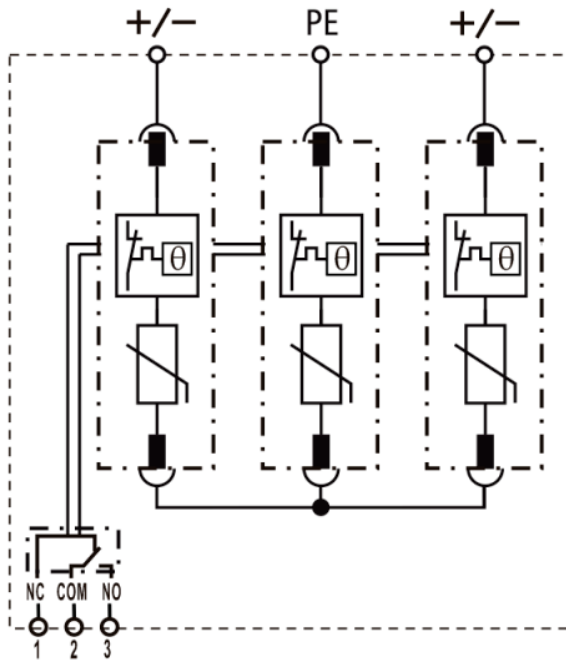
Protected mode is + to PE, - to PE.

Technical Parameter:

I_{Total} : 40kA (8/20); 5%~95%; -40°C~+85°C; Indoor; IP20

Model/Type Reference	Mode of protection	SPD design technology	U_{CPV} (Vdc)	I_n (kA)	I_{max} (kA)	U_P (kV)	I_{SCP} (A)	Remark
YDF40-1200YPV FM	+/- to PE	T2 Voltage-limiting	1200	20	40	4.5	20	with auxiliary switch
YDF40-1000YPV FM	+/- to PE	T2 Voltage-limiting	1000	20	40	4.0	20	
YDF40-1200YPV (FM)	+/- to PE	T2 Voltage-limiting	1200	20	40	4.5	20	
YDF40-1000YPV (FM)	+/- to PE	T2 Voltage-limiting	1000	20	40	4.0	20	
YDF40-1200YPV	+/- to PE	T2 Voltage-limiting	1200	20	40	4.5	20	without auxiliary switch
YDF40-1000YPV	+/- to PE	T2 Voltage-limiting	1000	20	40	4.0	20	

3. Circuit diagrams:



5	CLASSIFICATION		P
5.1	General		—
	The manufacturer classify the SPDs in accordance with the following parameters.		P
5.2	SPD design:		—
	• Voltage-switching		N/A
	• Voltage-limiting		P
	• Combination		N/A
5.3	Class I, II and III tests		—
	Information required for class I, class II and class III tests is given in Table 2 of IEC 61643-11:2011.	Class II	P
5.4	Location:		—
5.4.1	Indoor		P
	SPDs intended for use in enclosures and/or inside buildings or shelters.		P
	SPDs installed in outdoor enclosures or shelters are considered for indoor use.		N/A
5.4.2	Outdoor		N/A
	SPDs intended for use without enclosures and outside of buildings or shelters.		N/A
5.5	Accessibility		—
5.5.1	Accessible		P
	An SPD which can be fully or partly touched by an unskilled person, without the use of a tool to open any covers or enclosures, once installed.		P
5.5.2	Inaccessible		N/A
	An SPD which cannot be touched by an unskilled person either due to being mounted out of reach or due to being located within enclosures which can only be opened by using a tool, once installed.		N/A
5.6	Disconnectors		—
	Location:		—
	• Internal		P
	• External		N/A
	• Both (internal and external)		N/A
	Protection functions:		P
	• Thermal		P
	• Leakage current		N/A
	• Overcurrent		N/A
5.7	Degree of protection provided by enclosures according to IP-code of IEC 60529		—
5.8	Temperature and humidity range:		—

	Normal	5% to 95%	P
	Extended	-40°C~+85°C	P
5.9	Multipole SPD (yes/no)	Yes	—
5.10	SPD failure mode (OCFM/SCFM)	OCFM	—
5.11	PV earthing system:		P
	Earthed		P
	Unearthed		N/A
	Earthed and Unearthed (both)		N/A
6	REQUIREMENTS		P
6.1	General requirements		—
6.1.1	Identification		—
6.1.1.1	General		—
	The following information provided by the manufacturer.		P
6.1.1.2	Markings which are mandatory on the body, or permanently attached to the body, of the SPD:		P
	1) Manufacturer's name or trade mark and model number	 YDF40-1200YPV FM	P
	2) Maximum continuous operating voltage for PV application U _{CPV} +/PE, -/PE and +/- if applicable (one value for each mode of protection except if all the values are equal)	U _{CPV} =1200V DC	P
	3) The letters "PV" combined with the SPD test class and discharge parameters for each mode of protection declared by the manufacturer and printed next to each other:		P
	• for test class I: "test class I" and "I _{imp} " and the value in kA, and/or "T1" (T1 in a square) and "I _{imp} " and the value in kA (e.g. PV T1 I _{imp} : 10kA);		N/A
	• for test class II: "test class II" and "I _n " and the value in kA, and/or "T2" (T2 in a square) and "I _n " and the value in kA (e.g. PV T2 I _n : 10kA);	PV  I _n : 20kA	P
	• for test class III: "test class III" and "U _{oc} " and the value in kV, and/or "T3" (T3 in a square) and "U _{oc} " and the value in kV (e.g. PV T3 U _{oc} : 6kV);		N/A
	4) Voltage protection level U _P +/PE, -/PE and +/- if applicable (one value for each mode of protection except if all the values are equal);	U _P : 4.5kV	P
	5) Degree of protection provided by the enclosure (IP-code) if > IP20;		N/A

	6) Identification of terminals or leads (if not otherwise identified on the devices);	DC+, DC-, PE	P
	7) Rated load current I_L for one-port SPDs with separate input and output terminals.		N/A
	Other remaining required markings appear on the installation instruction.		P
	In such case the manufacturer declares only one protection level, only the highest protection level appear in the marking.		N/A
6.1.1.3	Information which provided with the products to be delivered		P
	1) Location (See 5.4)	Indoor	P
	2) Method of mounting	Fixed	P
	3) Short-circuit current rating I_{SCPV}	20A	P
	4) Ratings and characteristics for external SPD disconnector(s), if required.		N/A
	5) Indication of disconnector operation (if any) or SC-means (if any).	Internal disconnector: Green is ok, Red is fault	P
	6) Orientation for normal installation, if significant	State in user manual	P
	7) Installation instructions	State in user manual	P
	8) type of PV systems (earthed, not earthed)	Earthed	P
	9) intended connection (+/- to ground, + to -)	+ to PE, - to PE, + to -	P
	10) mechanical dimensions, lead lengths, etc.		P
	11) Temperature and humidity range	Humidity: 5% to 95% Temperature: -40°C~+85°C	P
	12) Residual currents IPE AC and DC	0.5mA DC 0.5mA AC	P
	13) SPD failure mode, e.g. OCFM or SCFM	OCFM	P
	14) If the SPD is declared SCFM, clear indication provided that it cannot be installed on non-electrically separated PCE (power conversion equipment)		N/A
	15) I_{max} , (if declared by the manufacturer)	I_{max} : 40kA	P
	16) Continuous current I_{CPV}	0.5mA	P
	17) SPDs for which the manufacturer declares a short-circuit failure mode, require specific measures to ensure that such devices will not endanger the operator during maintenance and replacement due to possible DC arcing		N/A
6.1.1.4	Information which available in a product datasheet		P
	1) Total discharge current I_{Total} for multipole SPDs and the corresponding test class	I_{Total} : Class II: 40kA	P
	2) Information about replaceable parts (indicators, fuses, etc. if applicable)		N/A

	3) Modes of protection (for SPDs with more than one mode of protection)	+ to PE, - to PE, + to -	P
6.1.1.5	Information which provided by the manufacturer for type testing		—
	1) Presence of switching component(s) (see Annex A)		N/A
	2) Follow current to be expected (≤ 5 A or > 5 A: see Annex A)		N/A
	3) If the status indication circuitry does not use certified components operated within their ratings, the manufacturer provide the appropriate testing standards for the specific component to allow it to be tested		N/A
	4) Isolation and dielectric withstand of separate isolated circuits		P
6.1.2	Marking		—
	Markings on the device indelible and legible and not be placed on screws or removable parts.		P
6.2	Electrical requirements		—
6.2.1	Protection against direct contact		—
	For protection against direct contact (inaccessibility of live parts), SPDs designed in such a way that live parts cannot be touched when the SPD is installed for the intended use.		P
	SPDs, except SPDs classified for mounting inaccessible, so designed that, when they are wired and mounted as for normal use, live parts are not accessible, even after removal of parts which can be removed without the use of a tool.		P
	After installation according to the manufacturers installation instructions the protection against touching of live parts for SPDs, which may be accessible for uninstructed persons, at least comply with the requirements for IP2XC according IEC 60529.		P
	The connection between the earthing terminals and all accessible conductive parts of low resistance.		N/A
6.2.2	Residual current I_{PE}		—
	For SPDs with a terminal for the protective conductor, the residual current I_{PE} measured when SPD terminals are connected to a power supply at the maximum continuous operating voltage (U_{CPV}).	Required value: DC: 0.5mA AC: 0.5mA Measured value: DC: 0.007mA AC: 0.30mA	P
6.2.3	Voltage protection level U_p		—

	The measured limiting voltage(s) of the SPD not exceed the voltage protection level that is specified by the manufacturer.	Required value: 4.5kV Measured value: Class II: 3.78kV	P
6.2.4	Operating duty		—
	The SPD capable of withstanding specified discharge currents during application of the maximum continuous operating voltage U_{CPV} , without unacceptable changes in its characteristics.	$U_{CPV}=1200V$ DC	P
	In addition voltage-switching SPDs or combination SPDs able to interrupt any follow current up to the short-circuit current rating (I_{SCP}).		N/A
6.2.5	Disconnectors and status indicators		—
6.2.5.1	Disconnectors		—
	SPDs with OCFM failure mode have disconnectors (which can be either internal, external or both). Their operation indicated by a corresponding status indicator.	Internal disconnector	P
6.2.5.2	SC-means		N/A
	SPD with SCFM failure mode have a SC-means. Its operation indicated by a corresponding status indicator.		N/A
6.2.5.3	Thermal protection		P
	SPDs protected against overheating due to degradation or overstress.		P
	This test is not performed on PV SPDs containing only voltage-switching components and/or ABD devices.		N/A
6.2.5.4	SPD failure mode		P
	An SPD fail without causing a hazardous condition or withstand the declared I_{SCP} which may occur during an SPD failure.	I_{SCP} : 20A	P
	This test is not applied to SPD mode(s) of protection that contains voltage-switching components only.		N/A
	Due to possible hazard to people and property resulting from the DC arcing during replacement, plug-in Short-Circuit Mode (SCFM) SPDs (which can be replaced without a tool) require appropriate means for disconnection which declared by the manufacturer.		N/A
6.2.5.5	Status indicators		P
	The manufacturer provide information about the function of the indicator and the actions to be taken after change of status indication.		P

	A status indicator may be composed of two parts (one of which is not replaced when e.g. a plug module is changed), linked by a coupling mechanism which can be mechanical, optical, audio, electromagnetic, etc. The part of the status indicator which is not replaced (e.g. base part of socket) capable of operating at least 50 times.		P
	The action of the coupling mechanism which operates the non-replaced part of the status indicator may be simulated by means other than operation of the section within the replaced part of the SPD, e.g. a separate electromagnet or a spring.		P
	Where there is an appropriate standard for the type of indication used, this met by the non-replaced part of the status indicator, with the exception that the indicator need only be tested for 50 operations.		N/A
6.2.6	Insulation resistance		P
	The insulation resistance of the SPD sufficient with respect to leakage current and protection against direct contact.	$R=7.28M\Omega$	P
6.2.7	Dielectric withstand		P
	The dielectric withstand of the housing of the SPD sufficient with respect to insulation breakdown and protection against direct contact.	Test voltage: 5.8kV DC	P
6.2.8	Continuous current I_{CPV}		P
	The current flowing through the plus and minus terminals of the SPD measured when energized at the maximum continuous operating voltage UCPV, and connected according to the manufacturer's instructions.	Required value: 0.5mA Measured value: 0.001mA	P
6.2.9	Total discharge current I_{Total} (for multipole SPDs)		P
	Compliance is checked by the test given in Subclause 8.7.1 of IEC 61643-11:2011.		P
	Test class I		N/A
	Test class II	I_{Total} : 40kA	P
6.3	Mechanical requirements		—
6.3.1	Mounting		P
	SPDs provided with appropriate means for mounting that will ensure mechanical stability.		P
	Mechanical coding/interlock provided to prevent incorrect combinations of plug-in SPD modules and sockets.		P
6.3.2	Screws, current carrying parts and connections		P
	The screws are tightened and loosened: (IEC 61643-11:2011)		—
	- ten times for screws in engagement with a thread of insulating material		N/A
	- five times in all other cases		P

	Screw thread diameters and applied torques (table 10)		—
	Nominal diameter of thread	Screw terminals:5.71mm	P
	Torque	Screw terminals:2.5Nm	P
6.3.3	External connections		P
	The terminations and connection methods listed in Table 2 meet the requirements of this standard.	Pulling force: 100N	P
	Other terminations and connection methods tested in accordance with the relevant standards to ensure adequate performances.		N/A
6.3.4	Air clearances and creepage distances		P
	The SPD have sufficient air clearances and creepage distances.		P
6.3.5	Mechanical strength		P
	All parts of the SPD relating to the protection against direct contact have sufficient mechanical strength.	Ordinary accessory: Striking parts: A, 5 times Striking parts: D, 4 times	P
6.4	Environmental and material requirements		—
6.4.1	General		—
	SPDs operate satisfactorily under the service conditions specified in accordance with 4 and the requirements and tests listed in Table 3.	IP-code: IP20 Heat resistance: 100°C, 1h Ball pressure test: 125°C, measured value: 0.98mm Fire resistance: 850°C for enclosure and internal insulation material, extinguish within 1.09s after the removal of the glow-wire. Tracking resistance: CTI 175	P
6.4.2	Life test under damp heat		P
	Compliance is tested in accordance with 7.6.1.		P
6.4.3	Electromagnetic compatibility		—
6.4.3.1	Electromagnetic immunity		N/A
	SPDs either incorporating no electronic circuits or incorporating electronic circuits in which all components are passive (for example diodes, resistors, capacitors, inductors, varistors and other surge protective components) are generally not sensitive to electromagnetic disturbances expected under normal service conditions and therefore no immunity tests are required.		N/A
6.4.3.2	Electromagnetic emission		N/A

	For SPDs not incorporating electronic circuits, or incorporating electronic circuits that do not generate fundamental frequencies greater than 9 kHz in normal operation, electromagnetic disturbances can only be generated during protective operations. The duration of these disturbances is in the order of microseconds to milliseconds.		N/A
	The frequency, level and the consequences of these emissions are considered as part of the normal electromagnetic environment of low-voltage installations. Therefore, the requirements for electromagnetic emissions are deemed to be satisfied and no verification is necessary.		N/A
	For SPDs containing electronic circuits that perform a switching function operating at a frequency of 9 kHz or greater, refer to IEC 61000-6-3.		N/A
6.5	Additional requirements for specific SPD designs		—
6.5.1	One-port SPDs with separate input/output terminals – Rated load current I_L		N/A
	The manufacturer declare the rated load current.		N/A
6.5.2	Environmental tests for outdoor SPDs		N/A
	Outdoor SPDs sufficiently resistant to UV radiation and corrosion.		N/A
6.5.3	SPDs with separate isolated circuits		P
	If an SPD includes a circuit that is electrically isolated from the main circuit, the manufacturer provide information about the isolation and dielectric withstand voltages between the circuits as well as the relevant standards that the manufacturer is claiming conformity with.		P
	If there are more than two circuits, declarations made with regard to each combination of circuits.		N/A
	The insulation resistance between the main circuits and separate isolated circuits tested in accordance with Subclause 8.3.6 of IEC 61643-11:2011.		P
	This test is not applicable to SPDs having a metallic enclosure connected to protective earth.		N/A
	a) between all interconnected live parts and the SPDs body accessible to accidental contact		P
	b) between the live parts of the SPD main circuit and live parts of separate isolated circuits if there are any		P
	Not lower 5 MΩ according to a)	R=7.28MΩ	P
	Not lower 2MΩ according to b)	R=5.72GΩ	P
6.6	Additional parameter if declared by the manufacturer – Maximum discharge current I_{max}		—

	If the manufacturer declares I_{max} , this value tested in accordance with Subclause 8.3.3.1 of IEC 61643-11:2011 using only one impulse of I_{max} which is applied at the polarity which resulted in the higher residual voltage value during the previous test.	-37.01kA / -4.45kV	P
	Residual voltage with 8/20 current impulses		P
	a) Class I		N/A
	Current impulses with a sequence of crest values of approximately 0,1; 0,2; 0,5; 1.0 times of the crest value applied (I_{imp})		N/A
	Class II		P
	Current impulses with a sequence of crest values of approximately 0,1; 0,2; 0,5; 1.0 times of the crest value applied (I_n)	20.20kA / 3.54kV -21.49kA / -3.78kV	P
	b) One sequence of positive polarity and one sequence of negative polarity		P
	c) Interval between individual impulses long enough for sample to cool down		P
	d) Current and voltage oscillogram recorded for each impulse	see Oscillogram Attachment	P
	e) The residual voltage used for determining the measured limiting voltage is the highest voltage value corresponding to the range of currents for:		P
	- class I: up to I_{imp}		N/A
	- class II: up to I_n	20kA / 3.54kV	P
	f) The value for determining U_{max} is the highest residual voltage measured at I_n , I_{max} or I_{imp} , as applicable depending on the SPD test class.	40kA / 4.45kV	P
7	TYPE TESTS		P
7.1	General		—
	Type tests are carried out on three samples per test sequence.	(see table 4)	P
	Within any test sequence, the tests carried out.	(see table 4)	P
	The order in which test sequences are carried out may be varied.		P
	Tests on terminals performed on three terminal samples for each construction/terminal type		P
	Common pass criteria for the type tests.	(see table 5)	P
	A sample has passed a test sequence if all the requirements of the relevant test clauses and the relevant pass criteria are fulfilled.	(see table 4)	P
	If all required samples pass a test sequence, the design of the SPD is acceptable for that test sequence. If two or more test samples fail a test sequence, the SPD does not comply with this standard.		P

	In the event that a single sample does not pass a test, this test, and those preceding in the same test sequence that may have influenced the result of this test, repeated with three new samples, but this time no failure of any sample is allowed.		N/A
	A set of three samples may be used for more than one test sequence, if agreed by the manufacturer.		P
	If the SPD is an integral part of a product covered by another standard, the requirements of the other standard apply to those parts of the product, which do not belong to the SPD section of the product.		N/A
	The SPD section comply with the general (6.1), the electrical (6.2), the environmental and material (6.4) requirements of this document.		N/A
7.2	Testing procedures		—
7.2.1	General		—
	If not otherwise specified, the reference standard for high-voltage test procedures is IEC 61180-1.		P
	The SPD mounted and electrically connected in accordance with the manufacturer's installation procedures. This setup then be kept throughout the entire type testing procedure except if otherwise specified. Neither external cooling nor heating employed.		P
	When not otherwise specified, the test performed in free air and the ambient temperature $(20 \pm 15) ^\circ\text{C}$.		P
	For all static DC current measurement such as I_{CPV} and, I_{PE} , the initial decrease after the application of voltage disregarded and readings not be taken earlier than 30 sec after the application of voltage.	I_{CPV} and I_{PE}	P
	Unless otherwise specified, where a power source is required for testing, all instantaneous values of the test voltage remain between U_{test} and $U_{\text{test}} - 5\%$ when a load current equal of 1 A is flowing.		P
	To ensure comparable test results, at least a 6-pulse rectifier bridge used to limit the maximum ripple under full-load conditions.		P
	When testing SPDs for which the manufacturer supplies integral cables, the full length of those cables form part of the SPD under test.		N/A
	Unless otherwise specified, during the test, no maintenance or dismantling of the SPD is allowed.		P
	External disconnectors selected according to the manufacturer's instructions and connected for testing if required according to Table 4.		N/A

	All tests performed on each mode of protection declared by the manufacturer, however, if some modes of protection have identical circuitry, one single test can be performed on the mode of protection which presents the most vulnerable configuration, using new samples each time.		P
	If the manufacturer provides information on the external SPD disconnecter necessary to achieve correct coordination with prospective short-circuit currents higher than the ISCPV (of the SPD alone); these tests repeated (for each sequence and combination) on the combination including this additional external disconnecter.		N/A
	If the use of tissue paper is required according to Table 4, it fixed at a distance of 100 mm $\pm$ 20 mm in all directions of the sample, except the mounting surface.		P
	Throughout the entire type testing procedure, the status shown by the indicator(s) give a clear sign of the status of the part to which it is linked. Where there is more than one method of status indication, for example local and additional features for remote indication, each type of indication checked and comply with the manufacturer's specification.		—
	It should be noted that good testing techniques are required for impulse testing and measurements. This is needed to ensure that correct test values are measured and recorded.		P
	SPDs not create any hazard when operated under the test conditions in accordance with this standard.		P
7.2.2	Test impulses		P
	For test impulse specifications refer to 8.1.1, 8.1.2, 8.1.3 and 8.1.4 of IEC 61643-11:2011.		P
7.2.3	Characteristics of power sources for testing		—
7.2.3.1	General source characteristics		P
	The test circuit have an inductance equal to or greater than 100 μ H.		P
	Two different types of power sources can be used for the operating duty and failure mode tests	DC Source	P
	The tolerance of the simulated PV-source is defined by the shaded area between the points P ₁ and P ₂ :		N/A
	• P ₁ : [U_{Test} , $1,05 \times I_{Test}$]		N/A
	• P ₂ : [$0,7 \times U_{Test}$, $0,7 \times I_{Test}$]		N/A
	• P ₃ : [$0,95 \times U_{Test}$]		N/A
	• P ₄ : [0 , $1,05 \times I_{Test}$]		N/A
	This area may be exceeded towards higher voltage and current values depending on the agreement between the test laboratory and the SPD manufacturer.		N/A

	These checked under static and transient conditions within 100 μ s. Annex B provides appropriate test procedures to confirm compliance with this requirement.		N/A
7.2.3.2	Specific source characteristics for operating duty tests		—
	Depending on the SPDs follow current, the following power sources at U _{CPV} used for testing:		P
	Operating duty test according to 7.4.2.3 or 7.4.2.6 (Follow current according to Annex A)		P
	≤ 5 A (DC ₁ or PV ₁)		P
	> 5 A (PV ₂)		N/A
	Additional duty test for test class I according to 7.4.2.5 (Follow current according to Annex A)		N/A
	≤ 5 A (DC ₂ or PV ₃)		N/A
	> 5 A (DC ₂ or PV ₃)		N/A
	DC ₁ : Linear DC source with an impedance such that during the flow of follow current the voltage, measured at the SPD terminals, does not fall below U _{CPV} by more than 5 %.		—
	DC ₂ : Linear DC source with a prospective short-circuit current of 5 A (0 / +10 %), corresponding to I _{Test} .		—
	PV ₁ : Simulated PV-source with a prospective short-circuit current of at least 20 A (0 / +10 %), corresponding to I _{Test} .		—
	PV ₂ : Simulated PV-source with a prospective short-circuit current equal to I _{SCPV} (0 / +5 %), corresponding to I _{Test} .		—
	PV ₃ : Simulated PV-source with a prospective short-circuit current of 5 A (0 / +10 %), corresponding to I _{Test} .		—
7.2.3.3	Specific source characteristics for failure mode tests		P
	Depending on the SPD's failure mode, the following power sources at U _{CPV} / 1,2 used for testing:	U _{test} : 999V DC	P
	SPD failure mode test according to 7.4.4 (Expected failure mode according to 6.1.1 13)		P
	OCFM (DC ₃ ^a or PV ₄) ^a only upon agreement with the manufacturer		P
	DC ₃ : Linear DC source with a prospective short-circuit current according to 7.4.4, corresponding to I _{Test}		—
	PV ₄ : Simulated PV-source with a prospective short-circuit current according to 7.4.4, corresponding to I _{Test}		—
7.3	Indelibility of markings		—
	This test applied on markings of all types except those made by impressing, moulding and engraving.		P

	The test is made by rubbing the marking by hand for 15 s with a piece of cotton soaked with water and again for 15 s with a piece of cotton soaked with aliphatic solvent hexane with a content of aromatics of maximum 0,1 % volume, a kauributanol value of 29, initial boiling-point approximately 65 °C and specific gravity of 0,68 g/cm ³ .		P
	As an alternative, it is permitted to use a reagent grade hexane with a minimum of 85 % as n-hexane.		P
7.4	Electrical tests		—
7.4.1	Residual current I _{PE}		—
7.4.1.1	Test procedure		—
	Measurements taken by consecutively applying the following power sources between + to PE and – to PE:		P
	– a DC source at U _{CPV} ,	U _{CPV} =1200V DC	P
	– an AC source providing a sinusoidal voltage at 50 Hz or 60 Hz with a peak value corresponding to U _{CPV} .	U _{test} =848.7V AC	P
	The residual currents (AC and DC) flowing through the PE-terminal recorded	Measured value: DC: 0.007mA AC: 0.30mA	P
7.4.1.2	Pass criteria		P
	The highest measured residual current value not exceed the value declared by the manufacturer according to 6.1.1.3, 12).	Required value: DC :0.5mA AC :0.5mA	P
7.4.2	Operating duty test		—
7.4.2.1	General		—
	An overview is given in the flow chart for the operating duty test.		P
7.4.2.2	Test procedure		—
	This is a test in which service conditions are simulated by the application of a stipulated number of specified impulses to the SPD while it is energized at the maximum continuous operating voltage U _{CPV} using a source according to 7.2.3.	U _{CPV} =1200V DC	P
	The test setup comply with the circuit diagram.		P
	The measured limiting voltage checked and below or equal to U _P .	Required value: U _P : 4.5kV	P
	The measured limiting voltage determined using the tests described in Subclause 8.3.3 of IEC 61643-11:2011.	Measured limiting voltage: Class II: 3.64kV	P
	To avoid overstress of the samples, the measured limiting voltage test is performed:		P

	• in accordance with Subclause 8.3.3.1 of IEC 61643-11:2011 but only with an 8/20 impulse current at a crest value corresponding to I_{imp} for test class I		N/A
	• in accordance with Subclause 8.3.3.1 of IEC 61643-11:2011 but only at I_n for test class II	Measured limiting voltage: Class II: 3.64kV	P
	• in accordance with Subclause 8.3.3.3 of IEC 61643-11:2011 but only at U_{oc} for test class III		N/A
7.4.2.3	Power source characteristics for the operating duty test		P
	The test sample connected to a power source described in 7.2.3.2. as follows:		P
	• DC_1 or PV_1 if the SPDs has a follow current of 5 A or less.		P
	• PV_2 if the SPD has a follow current above 5 A.		N/A
7.4.2.4	Class I and II operating duty tests		P
	Three groups of five current impulses 8/20 applied with the same polarity as the power source. The test samples are connected to a power source according to 7.2.3. and 7.4.2.3.	Class II I_n : 20kA	P
	After the application of each group of impulses, and after the interruption of the last follow current (if any), the SPD remain energized without interruption for at least 1 min to check for re-ignition. After the last group of impulses and the 1 min period, the SPD either remains applied or is reapplied within less than 30 s to UCPV for another 15 min to check for stability. For that purpose, the short-circuit capability of the power source (at UCPV) may be reduced to 5 A.	$U_{CPV}=1200V$ DC	P
	When testing SPDs to class I, 8/20 current impulses with a crest corresponding to I_{imp} applied.		N/A
	When testing SPDs to class II, 8/20 current impulses with I_n applied.	I_n : 20kA	P
	If an SPD is classified for test class I and test class II this test may be performed only once, but with the most severe set of parameters of both test classes, subject to agreement by the manufacturer.		N/A
	The interval between the impulses is 50 s to 60 s, the interval between the groups is 30 min to 35 min. It is not required that the test sample is energized between the groups.		P
	All current impulses recorded and the current records show no sign of puncture or flashover of the samples.		P
7.4.2.5	Additional duty test for test class I		N/A
	This test is carried out with current impulses in steps up to I_{imp} passing through the SPD.		N/A

	The SPD connected to a power source in accordance with 7.2.3.2. After the application of each impulse, and after interruption of each follow current (if any), the SPD remain energized without interruption for at least 1 min to check for re-ignition. After that period, the SPD either remains applied or is reapplied within less than 30 s to UCPV for another 15 min to check for stability. For that purpose, the short-circuit capability of the power source may be reduced to 5A.		N/A
	Current impulses with the same polarity as the applied power source applied to the energized test sample as follows:		N/A
	a) one current impulse at $0,1 I_{imp}$; check thermal stability; cool down to ambient temperature;		N/A
	b) one current impulse at $0,25 I_{imp}$; check thermal stability; cool down to ambient temperature;		N/A
	c) one current impulse at $0,5 I_{imp}$; check thermal stability; cool down to ambient temperature;		N/A
	d) one current impulse at $0,75 I_{imp}$; check thermal stability; cool down to ambient temperature;		N/A
	e) one current impulse at $1,0 I_{imp}$; check thermal stability; cool down to ambient temperature.		N/A
7.4.2.6	Class III operating duty tests		N/A
	The SPD energized at U_{CPV} . The prospective short-circuit current of the power source comply with 7.2.3.1 and 7.4.2.3 during the application of groups of impulses. After the application of each group of impulses, and after the interruption of the last follow current (if any), the SPD remain energized without interruption for at least 1 min to check for re-ignition. After the last group of impulses and the 1 min period, the SPD either remains applied or is reapplied within less than 30 s to U_{CPV} for another 15 min to check for stability. For that purpose, the short-circuit capability of the power source (at U_{CPV}) may be reduced to 5A.		N/A
	The SPD is tested with three groups of five positive impulses corresponding to U_{OC} :		N/A
	The interval between the impulses is 50 s to 60 s, the interval between the groups is 30 min to 35 min.		N/A
	It is not required that the test sample is energized between the groups.		N/A
	All current impulses recorded and the current records show no sign of puncture or flashover of the samples.		N/A
7.4.2.7	Pass criteria for all operating duty tests and for the additional duty test for test class I		P

	Three groups of five impulses of 8/20 current impulses with positive polarity shall be applied. The test samples are connected to a power source according to 8.3.4.2. Each impulse shall be increased in steps of 30° with a tolerance of $\pm 5^\circ$ for each synchronisation angle. time interval between the impulses 50s – 60s time interval between the groups 30 min – 35 min	Class II: <u>20kA</u>	P
	The SPD shall be energized at U_{CPV}. The prospective short-circuit current of the power source shall comply with 8.3.4.2 during the application of groups of impulses. After the application of each group of impulses and after the interruption of the last follow current (if any) the SPD shall remain energized without interruption for at least 1 min to check for reignition. After the last group of impulses and the 1 min period the SPD either remains applied or is reapplied within less than 30s to U_C for another 15 min to check for stability. For that purpose, the short-circuit capability of the power source (at U_C) may be reduced to 5A.	$U_{CPV}=1200V$ DC	P
	When testing SPDs to class I, 8/20 current impulses with a crest corresponding to I_{imp} shall be applied.		N/A
	When testing SPDs to class II, 8/20 current impulses with I_n shall be applied.	I_n : 20kA	P
	Current records show no sign of puncture or flashover of the sample		P
	This test is carried out with current impulses in steps up to I_{imp} passing through the SPD. SPD energized at U_{CPV} by a voltage source having a nominal current capability of 5A during the application of impulses.	$U_{CPV} = \underline{\hspace{2cm}}$ VDC	N/A
	Current impulses of positive polarity shall be initiated in the corresponding positive crest value of the power frequency voltage source to the energized test sample as follows: a) One current impulse at 0,1 I_{imp} b) One current impulse at 0,25 I_{imp} c) One current impulse at 0,5 I_{imp} d) One current impulse at 0,75 I_{imp} e) One current impulse at 1,0 I_{imp}	$\underline{\hspace{2cm}}$ kA $\underline{\hspace{2cm}}$ kA $\underline{\hspace{2cm}}$ kA $\underline{\hspace{2cm}}$ kA $\underline{\hspace{2cm}}$ kA	N/A
	After each impulse cool down to ambient temperature		P
7.4.3	Disconnectors and safety performance of overstressed SPDs		P

7.4.3.1	Temperature withstand test		P
	The SPD is kept in a heated cabinet at an ambient temperature of $80\text{ }^{\circ}\text{C} \pm 5\text{ K}$ for 24 h.	80.4°C, for 24 h	P
C	No mechanical damage		P
G	Internal disconnectors shall not operate during the test and shall be in working order after the test.		P
7.4.3.2	Thermal stability		—
7.4.3.2.1	Test settings		—
	This test procedure addresses two different designs:		P
	• SPDs containing only voltage-limiting components, procedure a) applies.		P
	• SPDs containing both voltage-limiting and voltage-switching components in series, procedure b) applies.		N/A
7.4.3.2.2	Sample preparation		—
	For SPDs with non-linear protective components connected in parallel, this test performed on every single current path of the SPD having a separate and independent acting disconnector section, by disconnecting/interrupting all the remaining current paths. If components of the same type and parameters are connected in parallel, and identical parts and construction are used for every single disconnector section belonging to each of these components, testing of any three of these identical current paths may fulfil the 3 sample requirement.		—
	Any voltage-switching component within the current path under test, which is connected in series with a voltage-limiting component, short-circuited by a copper wire or dummy with a diameter such that it does not melt during the test.		N/A
	The manufacturer provide samples prepared according to the above requirements.		P
	a) Test procedure for SPDs having only voltage-limiting components		—
	The test samples connected to a conditioning linear DC power source.		P
	The voltage high enough to allow a current to flow through the SPD. For this test, the current is set to a constant value. The tolerance for the test current is $\pm 10\%$. The test is started at a value of 2 mA DC for the first sample, or at U_{CPV} , if the leakage current at U_{CPV} does already exceed 2 mA DC Sample 1: 2mA 4mA 6mA	Duration 39.22min 14.15min 13.62min	P
	This value of current is then increased in steps of either 2 mA or 5 % of the previously adjusted test current, whichever is greater.		P

	For the other two samples. the starting point changed from 2 mA to a current corresponding to 5 steps below the current value at which the first sample disconnected. Sample 2: 2mA 4mA 6mA Sample 3: 2mA 4mA 6mA	Duration 23.87min 42.05min 8.17min 47.27min 17.58min 10.93min	P
	Each step is maintained until thermal equilibrium is reached (i.e. variation of temperature at the hottest spot less than 2 K within 10 min).		P
	The outer surface temperature on the hottest spot of the housing of the SPD (for accessible SPDs only) and the current through the SPD are monitored continuously.		P
	The hottest spot of the SPD may be determined by an initial test or alternatively many points may be monitored in order to determine the hottest spot.		P
	This test is terminated when all non-linear components under test are disconnected. The voltage not be increased further in order to avoid any malfunction of disconnectors.		P
	In case of doubt that all non-linear components are disconnected a visual inspection performed.		N/A
	If the voltage across the SPD falls 10 % below U_{CPV} during the test, the test sample is disconnected from the conditioning supply and connected to a high current DC power supply at U_{CPV} having a short-circuit current rating as declared by the manufacturer up to a maximum of 5 kA. The transition from the sensing of the voltage decrease to the connection of the test sample to the high current DC power source not exceed 100 ms. The sample remain connected to the high current DC supply for a duration of 15 min.		—
	b) Test procedure for SPDs having a voltage-switching component in series with other components		—
	The SPD is energized with a high current linear DC power source at U_{CPV} having a short-circuit current capability which will not limit the current before any disconnector operates. The maximum available current value not exceed the short-circuit current rating declared by the manufacturer.		N/A
	If no significant current flows, test procedure a) followed.		N/A
7.4.3.2.3	Pass criteria		—
	No mechanical damage		P
	SPDs having an IP degree $\geq$ IP 2X – no live parts accessible with standardised test finger applied with a force of 5N, except the ones which are accessible when the SPD is fitted as in normal use.		P

	There shall be no explosion or other hazard to either personnel or the facility		P
	In addition, for indoor SPDs, the surface temperature rise not exceed 120 K during and after the test. Five min after disconnection of all non-linear components under test, the surface temperature rise not exceed 80 K.	During and after the test: 78.6K<120K Five min after disconnection: 55.7K<80K	P
7.4.4	SPD failure mode behaviour test		—
7.4.4.1	Sample preparation		—
7.4.4.1.1	General		—
	The manufacturer provide samples prepared in the following manner for those components connected between any of the modes of protection: + to –, – to PE, or + to PE.	+ to PE	P
7.4.4.1.2	General:		N/A
	When the SPD has only one voltage-limiting component, or more than one connected in series, all of these replaced with components of the same type but with the value U_{1mA} equal to 50 % – 60 % of the original. All other characteristics of the replacement components, e.g. surge ratings, dimensions, the same except those related to the choice of the U_{1mA} voltage. Other parts of the SPD, e.g. disconnectors, terminals, interconnections etc. remain unchanged.		N/A
7.4.4.1.3	Alternative 1:		P
	When the SPD has 2 identical voltage-limiting components in series, one of these replaced by an appropriate copper block		P
	A separate batch of three samples is required for each prospective current setup. If the voltage-limiting components within the mode of protection under test including their internal connections and their cross-section area and surrounding material (e.g. resins) and packaging are not identical, the test repeated by short-circuiting one of the other voltage-limiting components.		P
7.4.4.1.4	Alternative 2:		N/A
	Use an unmodified sample but energized with a test voltage as specified in 7.4.4.2.1 or 7.4.4.3.1 equal to 2 times $U_{CPV/1,2}$ or even higher if agreed by the manufacturer.		N/A
7.4.4.2	Test for SPDs with a declared OCFM		—
7.4.4.2.1	Test setup and test procedure		P
	The SPD itself and its disconnectors, if specified by the manufacturer, mounted according to manufacturer's instructions and be connected with conductors of the highest cross-sectional area according to the manufacturer's instructions.		P

	The SPD connected to a power source in accordance with 7.2.3. The test performed for each of the following prospective short-circuit currents.		P
	If test source PV ₄ is used:		N/A
	• I _{SCPv} (0/+5 %);		N/A
	• 10 A (0/+5 %), but only if I _{SCPv} is higher than 10 A.		N/A
	If test source DC ₃ is used:		P
	• 2,7 times I _{SCPv} (0/+5 %);	Required value: 54A Measured value: 54.3A	P
	• I _{SCPv} (0/+5 %);	Required value: 20A Measured value: 20.5A	P
	• 10 A (0/+5 %), but only if I _{SCPv} is higher than 10 A.	Required value: 10A Measured value: 10.2A	P
	When using power source DC ₃ for the test with a prospective short-circuit current equal to 2,7 times I _{SCPv} , a fuse connected in series with the sample under test for detection purposes. This fuse have an I ² t melting integral value not higher than a fuse with gPV characteristic and rated current equal to I _{SCPv} . The SPD manufacturer may provide information on the lower value of the fuse.		—
	For SPDs not satisfying the time criteria of acceptance the test may be repeated with an increased test voltage. If the time criteria of acceptance are again not satisfied this procedure may be repeated.		N/A
	In addition, a trigger voltage generated by an impulse voltage generator described in 8.1.3 of IEC 61643-11:2011 and high enough to put any series connected switching component into a conductive state is applied to the actual mode of protection under test.		N/A
	If the switching component does not maintain a conductive state, the test may be repeated with one of the following options:		N/A
	• short-circuit the switching component, or		N/A
	• use a voltage-limiting component with lower U _{1mA} , or		N/A
	• increase the test voltage.		N/A
7.4.4.2.2	Pass criteria		P
	The current of the source interrupted by an internal or external SPD disconnecter:	Internal disconnecter operated	P
	• in less than 60 s when PV ₄ with I _{SCPv} or DC ₃ with 2,7 times I _{SCPv} is applied. During the tests when DC ₃ with 2,7 times I _{SCPv} is applied, the fuse for detection not operate;	Measured value: 7.6s	P
	• in less than 5 min when DC ₃ with a prospective short-circuit current of equal to I _{SCPv} is applied;	Measured value: 8.8s	P
	• in less than 20 min when PV ₄ or DC ₃ with a prospective short-circuit current of 10 A is applied.	Measured value: 9.8s	P

	No mechanical damage		P
	Disconnection shall be provided by one or more internal or external disconnector(s). Their correct indication shall be checked.	Internal disconnector	P
	SPDs having an IP degree $\geq$ IP 2X – no live parts accessible with standardised test finger applied with a force of 5N, except the ones which are accessible when the SPD is fitted as in normal use.		P
	If disconnection occurs during the test, there shall be clear evidence of effective disconnection of the corresponding protective component(s). If internal disconnection occurs, the test sample is connected at U_{CPV} and rated frequency for 1 min. The current flow shall not exceed a value of 1 mA.	Internal disconnector operated $U_{CPV}=1200V$ DC 0mA	P P
	Currents through components connected in parallel to the relevant protective component(s), are disregarded for this measurement.		N/A
	Current through the PE-terminal shall not exceed 1mA If there is more than one possible connection arrangement for normal use, this check shall be performed for all arrangements.	I_{PE} : 0mA	P N/A
	There shall be no explosion or other hazard to either personnel or the facility		P
7.4.4.3	Test for SPDs with a declared SCFM		—
7.4.4.3.1	Test setup and test procedure		N/A
	The SPD mounted according to manufacturer's instructions and be connected with conductors of the highest cross-sectional area according to the manufacturer's instructions.		N/A
	The SPD connected to a power source in accordance with 7.2.3. The test performed for each of the following prospective short-circuit currents.		N/A
	Test source PV_4 used:		N/A
	• I_{SCPv} (0/+5 %);		N/A
	• 10 A (0/+5 %), but only if I_{SCPv} is higher than 10 A.		N/A
	For SPDs not satisfying the time criteria of acceptance the test may be repeated with an increased test voltage. If the time criteria of acceptance are again not satisfied this procedure may be repeated.		N/A
	In addition, a trigger voltage generated by an impulse voltage generator described in 8.1.3 of IEC 61643-11:2011 and high enough to put any series connected switching component into a conductive state is applied to the actual mode of protection under test.		N/A

	If the switching component does not maintain a conductive state, the test may be repeated with one of the following options:		N/A
	• use a voltage limiting component with lower U_{1mA} , or		N/A
	• increase the test voltage.		N/A
7.4.4.3.2	Pass criteria		N/A
	For SPDs for which the manufacturer declares short-circuit mode as SPD failure mode status this mode reached:		N/A
	In less than 60 s during the test when PV_4 with a prospective short-circuit current of I_{SCPV} is applied;		N/A
	in less than 20 min when PV_4 with a prospective short-circuit current of 10 A is applied.		N/A
	The pass criteria C, I, M, L, P and Q according to Table 5 apply.		N/A
	- No visible damage during the test		N/A
	- No accessible live parts		N/A
	- No explosion or other hazard		N/A
	- Tissue paper not catch fire		N/A
	- Correct indication checked		N/A
	- Temperature rise at the hottest point not exceed 80 K		N/A
7.4.5	Dielectric withstand		—
7.4.5.1	General		P
	SPDs classified for outdoor use are tested between the terminals with the internal parts removed. During this test the SPD is subjected to sprinkling according to 9.1 of IEC 60060-1:2010.		N/A
	SPDs category indoor are tested as indicated in a) and b) in 8.3.6 of IEC 61643-11:2011.		P
	SPDs are tested with a DC voltage according to Table 8. Starting with not more than half the required DC voltage, this voltage is increased to the full value within 30 s which is maintained for 1 min.	U_{test} : 5.8kV DC for 1min	P
7.4.5.2	Pass criteria		P
	Arcing or puncturing not occur, however, partial discharges are accepted if the voltage change during the discharge is less than 5 %.	No arcing or puncturing	P
	The power source used for testing designed in such a way that, after having been adjusted to the test voltage at its open terminals. it will generate a short-circuit current of at least 200 mA after short-circuiting the terminals. An overcurrent relay, if any, only react if the test circuit current exceeds 100 mA. The device for measuring the test voltage have a precision of ± 3 %.		—
7.4.6	Continuous current I_{CPV}		—
7.4.6.1	General		P

	Measurements taken by applying a DC power source at UCPV between + and – terminals of the SPD.	$U_{CPV}=1200V$ DC	P
	The DC currents flowing (excluding ripple current) through the + and – terminals recorded.	Measured value: 0.001mA	P
7.4.6.2	Pass criteria		P
	The measured continuous current consumption values not exceed the values declared by the manufacturer according to 6.1.1.	Required value:0.5mA	P
7.5	Mechanical tests		—
7.5.1	Verification of air clearances and creepage distances		P
	SPDs for domestic and similar applications designed for pollution degree 2.		P
	SPDs for more stringent environmental applications may require special precautions, e.g. an appropriate SPD housing or an additional enclosure, which will ensure pollution degree 2 for the SPDs.		N/A
	For SPDs for outdoor, and out of reach applications, pollution degree 4 applies. This may be reduced to pollution degree 3 for internal distances, if they are covered by an adequate housing ensuring pollution degree 3 conditions.		N/A
	The electrode spacing of spark gaps not be considered for the determination of air clearances and creepage distances.		N/A
7.5.2	Pass criteria		P
	The air clearances and creepage distances not be smaller than the values indicated in Table 9 and Table 10 and applied to items 1), 2) and 3) according to Table 9, the material classification of Table 11 being previously applied to the relevant parts of the SPD as an input parameter for Table 10.		—
	The measurements are carried out without conductors as well as with conductors of the greatest cross-sectional area indicated by the manufacturer. Nuts and screws with out-of-round heads are assumed to be in the least favourable tightening position.		—
	In the case that there is a cavity in the course of the creepage distance, its profile is only considered if it is at least 1 mm wide; cavities smaller than 1 mm are only considered in their width.		—
	In the case that there is a partition made out of two parts which are not glued together, the creepage distance is measured through the separating gap. If the air gap between a live part and a partition with fitting surfaces is smaller than 1 mm, only the distance through the separating surface is considered, which is then looked upon as creepage distance. If not, the whole distance, namely the sum out of air gap and the distance through the separating surface, is taken as air clearance. If metal parts are covered with self-hardening resin of a least 2 mm thickness, or if they are covered with an insulation, withstanding a test voltage according to 7.4.5, creepage distances and air clearances are not necessary.		—
	Casting material or resin not come over the rim of the cavity, it adhere to the walls of the cavity and the metal parts in it.		—
	This is tested by examination and attempting to detach the casting material or resin without use of a tool.		—

7.6	Environmental and material tests		—
7.6.1	Life test under damp heat		P
	The test is carried out according to IEC 60068-2-78 and is applied to each mode of protection of the sample.		P
	The samples are then placed in a climatic chamber for 500 h (± 1 h), adjusted to a temperature of $40\text{ }^{\circ}\text{C} \pm 2\text{ K}$, and with a relative humidity of $93\% (\pm 3\%)$. Each mode of protection is connected to a test source having a prospective short-circuit current of at least 100 mA and adjusted to a DC voltage of U_{CPV} during the complete test.	40 °C, 94 % for 500 h $U_{CPV}=1200\text{V DC}$	P
7.6.2	Pass criteria		P
	One hour ± 10 min after removal of the samples from the climatic chamber, the pass criteria C, E and G according to Table 5 apply.	Meet the requirements of C, E, G.	P
7.7	Additional tests for specific SPD designs		N/A
7.7.1	Test for one-port SPDs with separate input/output terminals		N/A
7.7.1.1	Rated load current (I_L)		N/A
	The SPD energized at a voltage $U_{CPV} +0/-5\%$ at ambient temperature, using a cable with a nominal cross-section as specified in Table 12. The test conducted with rated load current into a resistive load until thermal stability is reached. Additional cooling of the SPD is not permitted.		N/A
7.7.1.2	Pass criteria		N/A
	The pass criteria C, F and G according to Table 5 and the following additional pass criteria apply.		N/A
	During the test, the temperature rise of surfaces, which are accessible in normal use, not exceed the values given in Annex G of IEC 61643-11:2011.		N/A
7.7.2	Environmental tests for outdoor SPDs		N/A
	See Annex F of IEC 61643-11:2011. Application of these tests or other appropriate test procedures is subject to an agreement between the manufacturer and the user.		N/A
	After Temperature cycle test:		N/A
	- No cracks, tracking and surface erosion		N/A
	- Residual currents not increase $> 10\%$		N/A
	- Verification of resistance to corrosion:		N/A
	Visual inspection to ensure that:		N/A
	- No evidence of rust, cracking or other deterioration		N/A
	- seals not damaged		N/A
	- moving parts working		N/A
7.7.3	SPDs with separate isolated circuits		P

	The insulation resistance between the main circuits and separate isolated circuits tested in accordance with Subclause 8.3.6 of IEC 61643-11:2011.		P
	The dielectric withstand between the main circuits and separate isolated circuits tested in accordance with:		P
	• 7.4.5 if the separate circuits are rated for DC and / or		P
	• Subclause 8.3.7 of IEC 61643-11:2011 if the separate circuits are rated for AC.		N/A
8	ROUTINE AND ACCEPTANCE TESTS		N/A
8.1	Routine tests		N/A
	Appropriate test(s) are performed during manufacturing production to verify that the SPD is capable of meeting its performance. The manufacturer declare the test method(s).		N/A
8.2	Acceptance tests		N/A
	Acceptance tests are made on agreement between manufacturer and purchaser. When the purchaser specifies acceptance tests in the purchase agreement, the following tests made on the nearest lower whole number to the cube root of the number of SPDs to be supplied. Any alteration in the number of test samples or type of test negotiated between the manufacturer and purchaser.		—
	Unless otherwise specified, the following acceptance tests performed:		N/A
	– verification of identification in accordance with 6.1.1;		N/A
	– verification of markings by inspection in accordance with 6.1.2.		N/A
	– verification of electrical parameters by relevant clause (e.g. measured limiting voltage, in accordance with Subclause 8.3.3 of IEC 61643-11:2011).		N/A
A	ANNEX A – TESTS TO DETERMINE THE PRESENCE OF A VOLTAGE-SWITCHING COMPONENT AND THE MAGNITUDE OF THE FOLLOW CURRENT OF AN SPD		N/A
A.1	General		N/A
	These tests are performed by the manufacturer to provide the information required in accordance with 6.1.1 1) and / or 6.1.1 2) and 7.2.3.2.		N/A
A.2	Test to determine the presence of a voltage-switching component		N/A
	This test has to be performed only if the internal design of the SPD is not known. A new sample used for this test.		N/A

	The standard 8/20 current impulse is used for class I and class II tests of SPDs with a crest value according to I_n or I_{imp} as declared by the manufacturer. For class III test of an SPD, a combination wave generator used with an open-circuit voltage equal to the U_{oc} declared by the manufacturer.		N/A
	One impulse applied to the SPD. Oscillographic record of the voltage across the SPD taken.		N/A
	If the waveshape of the recorded voltage shows a sudden collapse, the SPD is considered as containing a switching (crowbar) component.		N/A
A.3	Test to determine the magnitude of the follow current		N/A
	This test is intended to determine if the crest value of the follow current is above or below 5A.		N/A
	If the internal design and the crest value of the follow current of the SPD are known, this preliminary test is not required.		N/A
	a) The test performed on a separate test sample.		N/A
	b) The type of the power source is a linear DC source.		N/A
	c) The prospective short-circuit current 100 A (0/+5%). The test circuit have an inductance equal or greater than 100 μ H.		N/A
	d) The voltage measured at the SPD terminals, equal to U_{CPV} 0/-5%		N/A
	e) The follow current initiated with an impulse current 8/20 or a combination wave.		N/A
	f) The crest value of the test impulse correspond to I_n or I_{imp} or U_{oc} .		N/A
	g) The polarity of the impulse coincide with the voltage polarity of the power supply.		N/A
	h) Measure and record the peak value of the follow current.		N/A

Table 4 – Type test requirements for SPDs							
Test sequence	Test description	Subclause requirement/ test	External disconnectors connected a	Tissue paper used	Test class I	Test class II	Test class III
1	Identification and marking	6.1.1 / 6.1.2 / 7.3	N/A	N/A	A	A	A
	Mounting	6.3.1	N/A	N/A	A	A	A
	Terminals and connections	6.3.2 / 6.3.3	N/A	N/A	A	A	A
	Testing for protection against direct contact	6.2.1	N/A	N/A	A	A	A
	Environment IP-code	6.4	N/A	N/A	A	A	A
	Residual current	6.2.2 / 7.4.1 / 7.4.1.2	N/A	N/A	A	A	A
	Operating duty test ^d	6.2.4 / 7.4.2 ^b					
	Operating duty test for test classes I, II or III	7.2.3.2 / 7.4.2.3 / 7.4.2.6	A	N/A	A	A	A
	Additional duty test for test class I	7.4.2.5	A	N/A	A	N/A	N/A
	Thermal stability ^c	6.2.5.3/ 7.4.3.2	A	N/A	A	A	A
	Air clearances and creepage distances	7.5.1	N/A	N/A	A	A	A
	Ball pressure test	6.4	N/A	N/A	A	A	A
	Resistance to abnormal heat and fire	6.4	N/A	N/A	A	A	A
	Tracking resistance	6.4	N/A	N/A	A	A	A
2	Voltage protection level ^e	6.2.3					
3	Insulation resistance	6.2.6	N/A	N/A	A	A	A
	Dielectric withstand	6.2.7 / 7.4.5	N/A	N/A	A	A	A
3a	See below – only if applicable		N/A	N/A	N/A	N/A	N/A
	Mechanical strength	6.3.5	N/A	N/A	A	A	A
	Temperature withstand	6.2.5 / 7.4.3.1 ^b	N/A	N/A	A	A	A
3b	See below – only if applicable		N/A	N/A	N/A	N/A	N/A
4	Heat resistance	6.4	N/A	N/A	A	A	A

Table 4 – Type test requirements for SPDs							
Test sequence	Test description	Subclause requirement/ test	External disconnectors connected a	Tissue paper used	Test class I	Test class II	Test class III
5	SPD failure mode test	6.2.5.4 / 7.4.4	A	A	A	A	A
6	Live test under damp heat	7.6.1 ^b	N/A	N/A	A	A	A
7	Total discharge current test for multipole SPDs	6.2.9 ^b	N/A	N/A	A	A	A
Additional tests for one-port-SPDs with separate input / output terminals							
3b ^c	Rated load current	6.5.1/ 7.7.1.1	A	N/A	A	A	A
Additional tests for Outdoor use SPDs							
8	Environmental tests for outdoor SPDs	6.5.2 / 7.7.2	N/A	N/A	A	A	A
Additional tests for SPDs with separate isolated circuits							
3	Isolation between separate circuits	6.5.3 / 7.4.5	N/A	N/A	A	A	A
A applicable if declared N/A not applicable							
^a external disconnectors connected means that all disconnectors as specified by the manufacturer tested with the SPD during the type tests. ^b For these tests, initial measurements of continuous current and residual current according to Table 6, pass criterion E may be necessary. ^c For this test sequence more than one set of samples may be needed. ^d For the whole operating duty test (including the additional duty test, if applicable) one separate set of samples may be used. ^e See relevant clause and Table 3 of IEC 61643-11:2011.							

Table 8 – Dielectric withstand	
SPD continuous operating voltage V	DC test voltage kV
$U_{CPV} < 100$	1,1
$100 \leq U_{CPV} < 200$	1,7
$200 \leq U_{CPV} < 450$	2,2
$450 \leq U_{CPV} < 600$	3,3
$600 \leq U_{CPV} < 1200$	4,2
$1200 \leq U_{CPV} < 1500$	5,8

Table 9 – Air clearances for SPDs				
U_{max}	≤ 2 000 V^a	≤ 4 000 V	> 4 000 V up to 6 000 V	> 6 000 V up to 8 000 V
	Air clearances in millimetres			
1) Between live parts of different polarity	1,5	3	5,5	8
2) Between live parts and				
– Screws and other means to fasten a covering, having to be detached for mounting the SPD,	1,5	3	5,5	8
– Fastening surfaces (NOTE 2)	3	6	11	16
– Screws or other means for fastening the SPD (NOTE 2),	3	6	11	16
– Bodies (NOTES 1 and 2).	1,5	3	5,5	8
3) Between the metal parts of the disconnector mechanism and				
– Bodies (NOTE 1),	1,5	3	5,5	8
– Screws or other means for fastening the SPD.	1,5	3	5,5	8
NOTE 1 For definition of body, see Subclause 8.3.6 a) of IEC 61643-11:2011.				
NOTE 2 If clearances between live parts of the device and the metallic screen or the surface on which the SPD is mounted are dependent on the design of the SPD only and cannot be reduced when the SPD is mounted in the least favourable position (even in a metallic enclosure), the values of line 1) are sufficient.				
^a This column is only applicable for SPDs having a UCPV lower than or equal to 180 V.				

Table 10 – Creepage distances for SPDs

DC voltage V	Minimum creepage distances in millimetres								
	Printed wiring material		Pollution degree						
	Pollution degree								
	1	2	1	2			3		
	All material groups	All material groups, except IIIb	All material groups	Material group ^a			Material group ^a		
I				II	III	I	II	III	
10	0,025	0,04	0,08	0,4	0,4	0,4	1	1	1
12,5	0,025	0,04	0.09	0,42	4,42	4,42	1,0	1,05	1,05
16	0,025	0,04	0,1	0,45	0,45	0,45	1,1	1,1	1,1
20	0,025	0,04	0,11	0,48	0,48	0,48	1,2	1,2	1,2
25	0,025	0,04	0,125	0,5	0,5	0,5	1,2	1,25	1,25
32	0,025	0,04	0,14	0,53	0,53	0,53	1,3	1,3	1,3
40	0,025	0,04	0,16	0,56	0,8	1,1	1,4	1,6	1,8
50	0,025	0,04	0,18	0,6	0,85	1,2	1,5	1,7	1,9
63	0,04	0,063	0,2	0,63	0,9	1,25	1,6	1,8	2
80	0,063	0,1	0,22	0,67	0,95	1,3	1,7	1,9	2,1
100	0,1	0,16	0,25	0,71	1	1,4	1,8	2	2,2
125	0,16	0,25	0,28	0,75	1,05	1,5	1,9	2,1	2,4
160	0,25	0,4	0,32	0,8	1,1	1,6	2	2,2	2,5
200	0,4	0,63	0,42	1	1,4	2	2,5	2,8	3,2
250	0,56	1	0,56	1,25	1,8	2,5	3,2	3,6	4
320	0,75	1,6	0,75	1,6	2,2	3,2	4	4,5	5
400	1	2	1	2	2,8	4	5	5,6	6,3
500	1,3	2,5	1,3	2,5	3,6	5	6,3	7,1	8
630	1,8	3,2	1,8	3,2	4,5	6,3	8	9	10
800	2,4	4	2,4	4	5,6	8	10	11	12,5
1000	3,2	5	3,2	5	7,1	10	12,5	14	16
1250	-	-	4,2	6,3	9,0	12,5	16,0	18	20,0
1600	-	-	5,6	8,0	11,0	16,0	20,0	22,0	25,0
If the actual voltage differs from the values given in the table, it is allowed to interpolate values for intermediate voltages. When interpolating, linear interpolation should be used and values rounded to									

Table 10 – Creepage distances for SPDs

DC voltage V	Minimum creepage distances in millimetres								
	Printed wiring material		Pollution degree						
	Pollution degree								
	1	2	1	2			3		
	All material groups	All material groups, except IIIb	All material groups	Material group ^a			Material group ^a		
				I	II	III	I	II	III

the same number of digits than the values picked from the table.

^a For further information on material groups refer to Table 11.

^b This voltage is:

- for functional insulation, the working voltage,
- for basic and supplementary insulation of the circuit energized directly from the supply mains, the voltage rationalized through Table F.3a of IEC 60664-1:2011, based on the rated voltage of the equipment, or the rated insulation voltage,
- for basic and supplementary insulation of systems, equipment and internal circuits not energized directly from the mains, the highest voltage which can occur in the system, equipment or internal circuit when supplied at rated voltage and under the most onerous combination of conditions of operation within equipment rating.

^c For the main protection circuit, this column refers to U_{CPV} .

^d Material IIIb not be used for application in pollution degree 3 above 630 V.

Table 11 – Relationship between material groups and classifications

Material group I	$600 \leq CTI$
Material group II	$400 \leq CTI < 600$
Material group IIIa	$175 \leq CTI < 400$
Material group IIIb	$100 \leq CTI < 175$

NOTE Relationship between material groups and classifications is according to IEC 60112 (CTI values, using solution A).

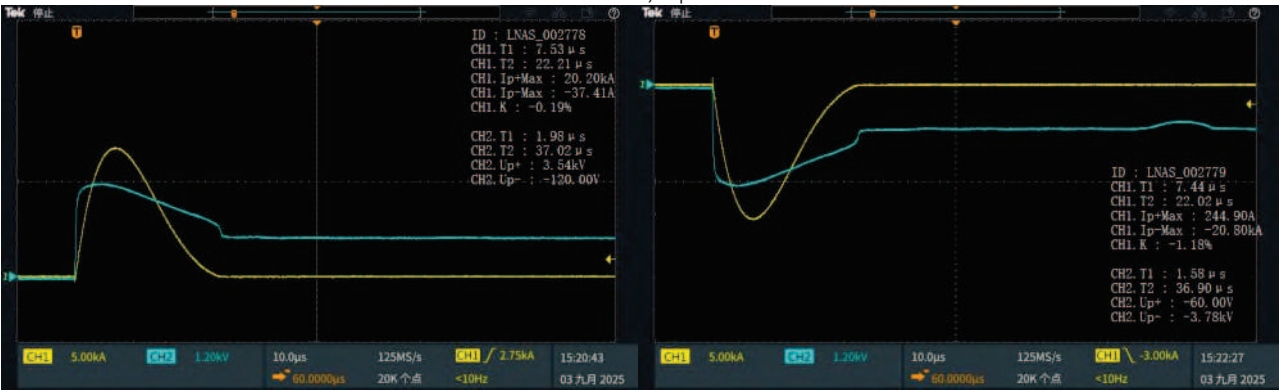
Table 12 – Test conductors for rated load current test

Greater than	Less or equal than	Cross section [mm ²]	Cross Section AWG
0	8	1,0	17
8	12	1,5	16
12	15	2,5	16
15	20	2,5	14
20	25	4,0	12
25	32	6,0	10
32	50	10	8
50	65	16	6
65	85	25	4
85	100	35	2
100	115	35	2
115	130	50	1/0
130	150	50	1/0
150	175	70	2/0
175	200	95	3/0
200	225	95	3/0
225	250	120	4/0
250	275	150	300MCM
275	300	185	350MCM
300	350	185	350MCM
350	400	240	500MCM
If other standardized cross-sections are used in specific countries, the next closest cross-section should be used for testing.			

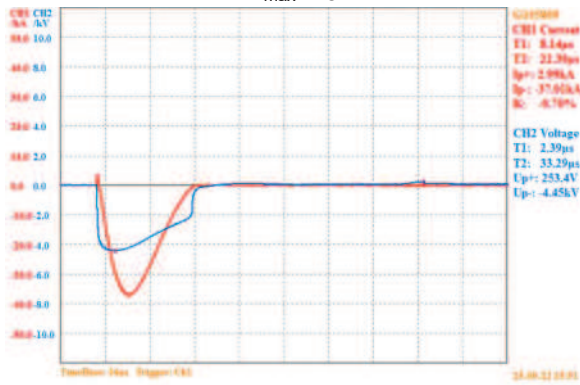
Clause 6.6 Oscillogram Attachment

Voltage protection level

I_n : 20kA, U_p : 4.5kV

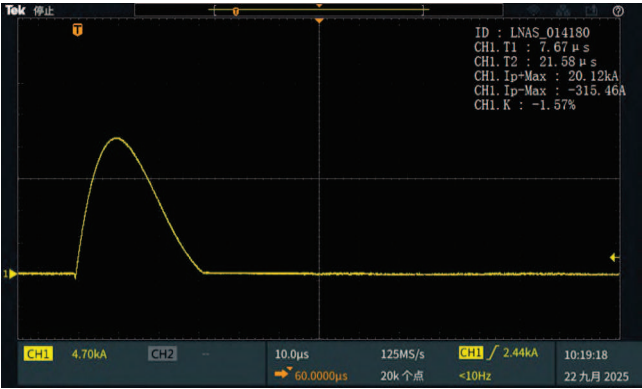


I_{max} : 40kA



Class II operating duty tests

I_n : 20kA



-End of the report-

ATTACHMENT 1**Equipment List**

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Report No.: CN252X5Z 001

Product: Surge Protective Device**Type Designation: YDF40-1200YPV FM**

Test Equipment List					
Instrument Number	Instrument Name	Technical Parameters	Model Type	Last Cal. Date	Next Cal. Date
LNP-SB-001	Impulse current generator	8/20us: 5kA~250kA	GIC200D100C	2025/5/6	2026/5/5
LNP-SB-005	AC/DC thermal stability tester	4000VDC; 2mA~1A; 200° C	TTS2/2000	2025/4/22	2026/4/21
LNP-SB-007	DC power supply	2000V; 5A~100A	GPAC100/1500	2025/4/22	2026/4/21
LNP-SB-011	Temp. & Hum. chamber	-40°C~150°C 30%~98% RH	TH8046-408	2024/11/22	2025/11/21
LNP-SB-012	Oven	40°C~300°C	TH8011A	2024/11/8	2025/11/7
LNP-SB-013	Glow-wire tester	500°C~1000°C	TH8055	2024/11/22	2025/11/21
LNP-SB-014	Tracking Test Apparatus	100~600V, 0.5A, 1.0A	TH8058	2024/11/22	2025/11/21
LNP-SB-015	Ball press tester	R: 2.5mm, 20N	TH8088	2024/11/22	2025/11/21
LNP-SB-016	Probe A	Probe A of IEC 61032	Probe A	2024/11/22	2025/11/21
LNP-SB-017	Probe B	Probe B of IEC 61032	Probe B	2024/11/22	2025/11/21
LNP-SB-021	Torque screwdriver	1Nm~9 Nm	EXPLOIT	2024/11/22	2025/11/21
LNP-SB-025	Digital Caliper	150mm	/	2024/11/22	2025/11/21
LNP-SB-026	Push-pull gauge	0-500N	NK-500	2024/11/22	2025/11/21
LNP-SB-027	Stop Watch	2000s	PC396	2024/11/22	2025/11/21
LNP-SB-028	Clock	12h	A2789	2024/11/22	2025/11/21
LNP-SB-034	Pendulum impact-tester	1000mm, 150g, 200g	BC-1	2025/4/24	2026/4/23
LNP-SB-045	Oscilloscope	100MHz, 2GS/s	TDS2014C	2024/11/11	2025/11/10
LNP-SB-048	N-hexane	99.2%	/	/	/

ATTACHMENT 1**Equipment List**

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Report No.: CN252X5Z 001

Product: Surge Protective Device**Type Designation: YDF40-1200YPV FM**

LNP-SB-054	Barometer	800-1060hPa	DYM3	2025/2/28	2026/2/27
LNP-SB-057	Oscilloscope	350MHz, 2.5GS/s	MDO3034	2025/2/17	2026/2/16
LNP-SB-065	Withstand Voltage/Insulation Tester	6kV, 25mA 0.1MΩ-50GΩ	TH9110A	2025/2/21	2026/2/20
LNP-SB-071	8/20 μs Impulse current generator	8/20us: 1kA~60kA	GIC60kA	2024/11/11	2025/11/10
LNP-SB-077	Differential Probe	70MHz, 7kV	SI-9010	2024/12/5	2025/12/4
LNP-SB-081	Oscilloscope	100MHz, 1GS/s	TBS 2102	2025/2/17	2026/2/16
LNP-SB-111	Hygrothermograph	-20° C~60° C; 0%~ 95%RH	Cos-03	2025/6/17	2026/6/16
LNP-SB-112	Hygrothermograph	-20°C~60°C 0%~95%RH	Cos-03	2025/6/17	2026/6/16
LNP-SB-113	DC Power Supply	2000VDC, 2A	ANS20002D	2025/6/17	2026/6/16
LNP-SB-122	IP2X	IP2X, φ12.5mm	IP2X	2025/4/22	2026/4/21
LNP-SB-125	DC/AC CLAMP LEAKAGE SENSOR	AC/DC 0mA~50A	007AD	2025/4/22	2026/4/21
LNP-SB-129	GIC40KA Impulse Current Generator	8/20μs: 1~40kA	GIC40kA	2025/9/9	2026/9/8
LNP-SB-130	Oscilloscope	100MHz, 1GS/s	TBS 2102	2025/9/9	2026/9/8
LNP-SB-131	Differential Probe	70MHz, 7kV	SI-9010	2025/9/10	2026/9/9
LNP-SB-133	028N Digital Caliper	150mm	034661	2024/11/22	2025/11/21
LNP-SB-135	Differential Probe	70MHz, 7kV	SI-9010	2024/11/13	2025/11/12
LNP-SB-136	Differential Probe	70MHz, 7kV	SI-9010	2024/11/13	2025/11/12
LNP-SB-139	Hygrothermograph	-5°C~40°C; 0%~100%RH	COS-03	2025/2/21	2026/2/20

ATTACHMENT 2

Photo Documentation

Product: Surge Protective Device
Type Designation: YDF40-1200YPV FM



Figure 1

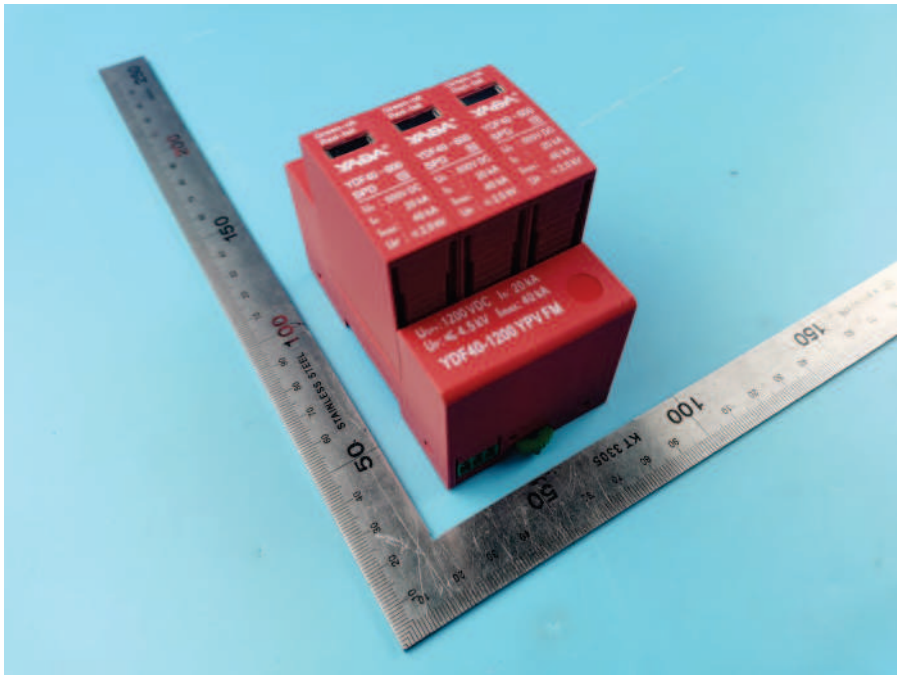


Figure 2

ATTACHMENT 2

Photo Documentation

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Product: Surge Protective Device
Type Designation: YDF40-1200YPV FM

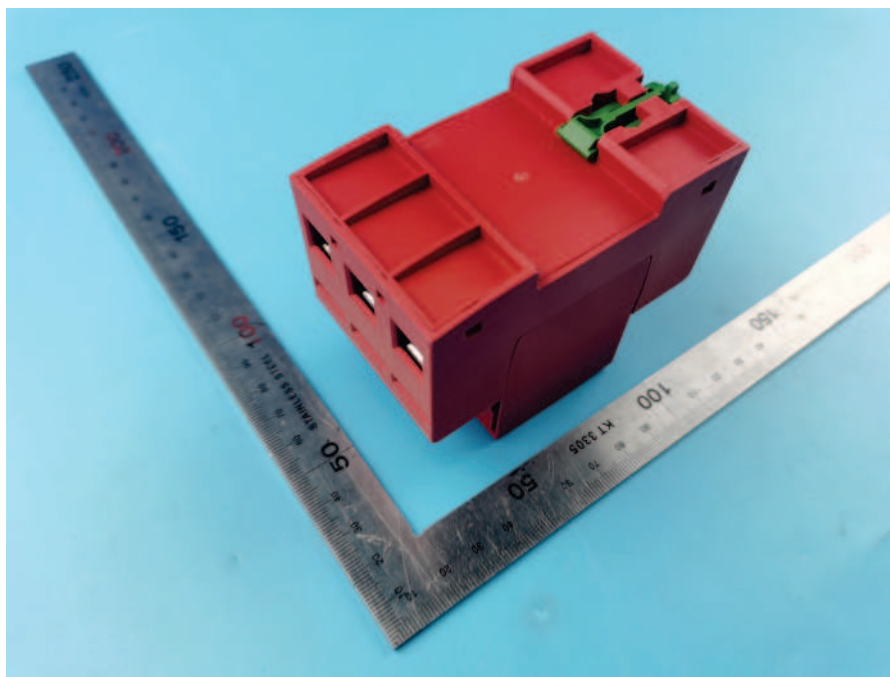


Figure 3

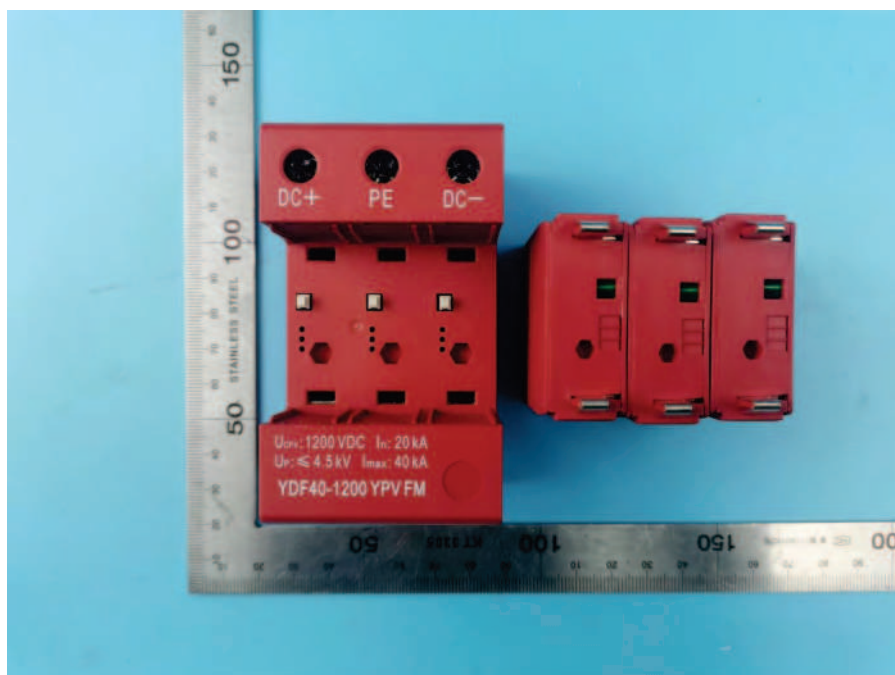


Figure 4

ATTACHMENT 2

Photo Documentation

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Report No.: CN252X5Z 001

Product: Surge Protective Device

Type Designation: YDF40-1200YPV FM

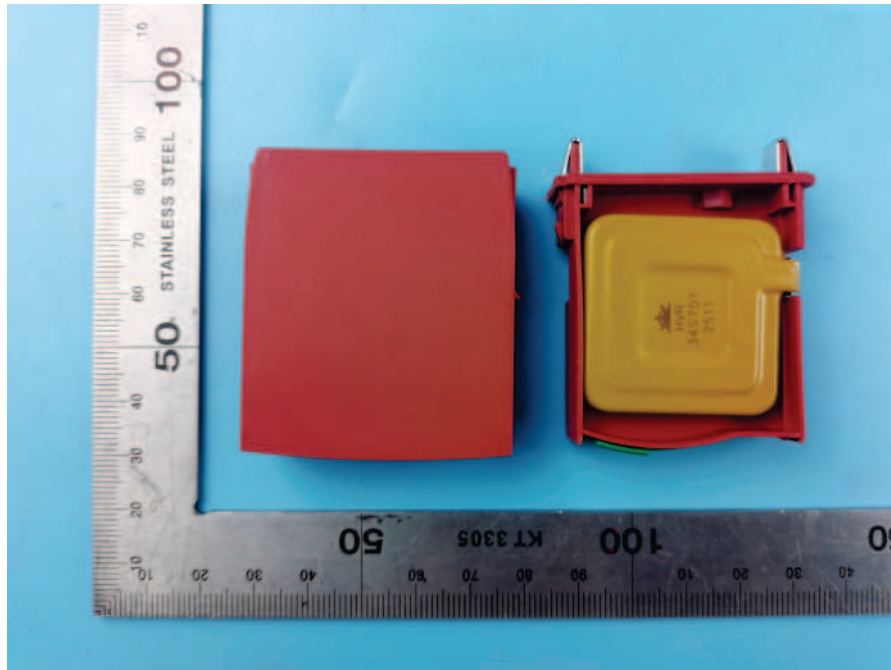


Figure 5



Figure 6

ATTACHMENT 2

Photo Documentation

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Report No.: CN252X5Z 001

Product: Surge Protective Device
Type Designation: YDF40-1200YPV FM

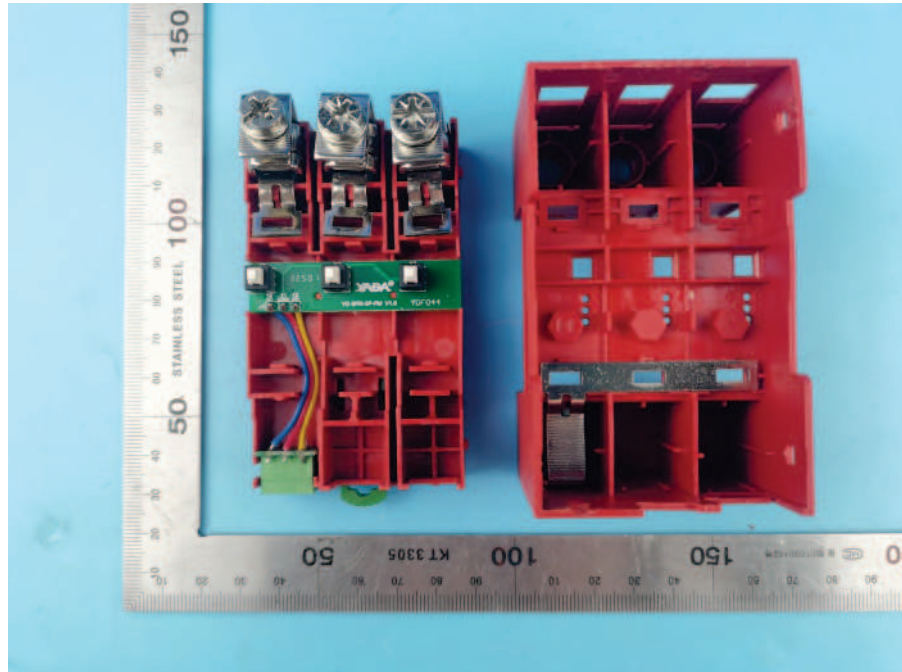


Figure 7

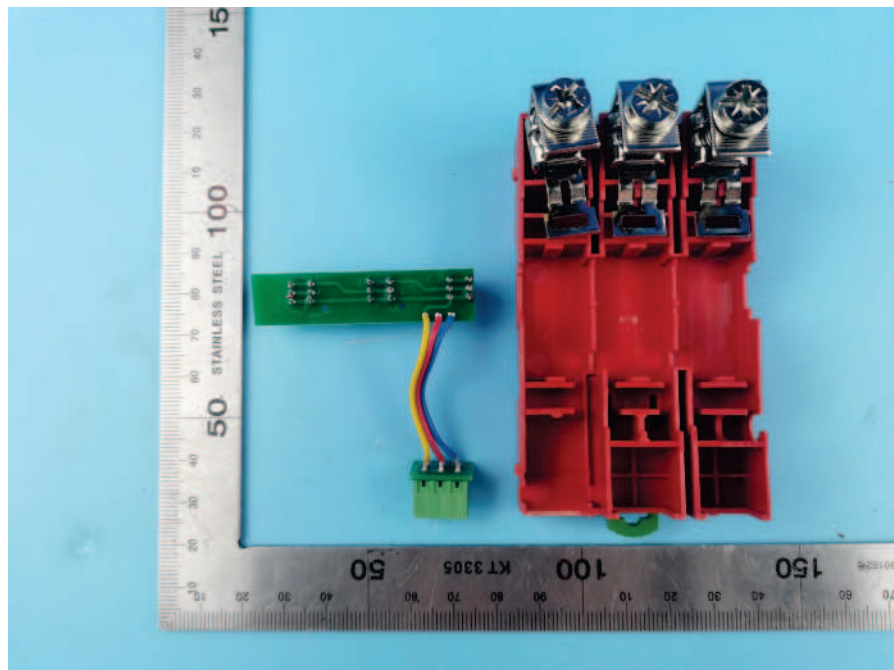


Figure 8