SHENZHEN GEMBIRD ELECTRONICS LTD

CE LVD REPORT

Prepared For:	SHENZHEN GEMBIRD ELECTRONICS LTD 2nd Floor, Building B, Shifeng Industry District, Huaning Lu, Dalang Street, Baoan, Shenzhen, China
Product Name:	SOCKET
Model :	SPG4-C-6, SPG4-C-5, SPG4-C-10, SPG4-C-15 , SPG5-C-5 SPG5-C-10, SPG5-C-15, SPG5-U-5, SPG5-CBG-5
Prepared By :	Shenzhen BST Technology Co., Ltd. 3F,Weames Technology Building,No. 10 Kefa Road, Science Park,Nanshan District,Shenzhen,Guangdong,China
Test Date:	Sep. 19, 2010 - Sep. 29, 2010
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Report No.:	BST10090999SR-2

TEST REPORT

EN 61643-11

Low-voltage SOCKETs

Part 11: SOCKETs connected to low-voltage power Systems-Requirements and test

Testing Laboratory Name .....:	Shenzhen BST Technology Co., Ltd.
Address .....:	3F,Weames Technology Building,No. 10 Kefa Road, Science Park, Nanshan District,Shenzhen, Guangdong, China
Testing location .....:	Shenzhen BST Technology Co., Ltd.
Applicant's Name .....:	SHENZHEN GEMBIRD ELECTRONICS LTD
Address .....:	2nd Floor, Building B, Shifeng Industry District, Huaning Lu, Dalang Street, Baoan, Shenzhen, China
Manufacturer …… ……:	SHENZHEN GEMBIRD ELECTRONICS LTD
Address …… …… :	2nd Floor, Building B, Shifeng Industry District, Huaning Lu, Dalang Street, Baoan, Shenzhen, China
Test specification	
Standard .....:	EN 61643-11:2002+A11:2007
Procedure deviation .....:	N/A
Non-standard test method .....:	N/A
Test item description .....:	SOCKET
Trademark .....:	Gembird
Model and/or type reference .....:	SPG4-C-6, SPG4-C-5, SPG4-C-10, SPG4-C-15
Rating(s) .....:	Uc: 250V, Imax: 13.5kA, Up≤4.5kV
Test case verdicts	
Test case does not apply to the test object ...:	N/A
Test item does meet the requirement .....:	P(ass)
Test item does not meet the requirement .....:	F(ail)

General remarks

This report shall not be reproduced except in full without the written approval of the testing laboratory.

The test results presented in this report relate only to the item(s) tested.

"(see remark #)" refers to a remark appended to the report.

"(see Annex #)" refers to an annex appended to the report.

Clause numbers between brackets refer to clauses in EN 61643-11:2002+A11:2007

Throughout this report a comma is used as the decimal separator.

Copy of marking plate:

SOCKET

Model : SPG4-C-6

Rated : Uc: 250V, Imax: 13.5kA, Up≤4.5kV; Type1

CE

SHENZHEN GEMBIRD ELECTRONICS LTD

Prepared by : Blair Wong
Engineer

Reviewer : Kent Chen
Supervisor

Approved & Authorized Signer : Christina
Christina / Manager

EN 61643-11			
Cl.	Requirement – Test	Result	Verdict
4	Classification		
	The manufacture shall classify the SPDs		
4.1	Number of ports	One	P
4.2	SPD design topology	Combination type	P
4.3	SPD types	Type1	P
4.4	Location	Indoor	P
4.5	Accessibility	Accessible	P
4.6	Mounting method	Fixed	P
4.7	SPD disconnector		
4.7.1	Location	Internal	P
4.7.2	Protection functions	Overcurrent	P
4.8	Overcurrent protection	Specified	P
4.9	Degree of protection provided by enclosures according to IP codes of IEC 60529	IP20	P
4.10	Temperature range	10℃- 40℃	P
4.11	Multipole SPD (if declared by manufacturer)		N

5	Preferred values		---
5.1	Preferred values of peak impulse current for class I tests *I*peak		N
5.2	Preferred values of nominal discharge current for class II tests *I*n	Imax: 13.5kA	P
5.3	Preferred values of open-circuit voltage for class III tests *U*oc		N
5.4	Preferred values of voltage protection level *U*p	≤4.5kV	P
5.5	Preferred values of r.m.s. or d.c. maximum continuous operating voltage *U*c	250V	P
5.6	Preferred values for *I*Total		N

6	Requirements		---
6.1.1	Identification		--
	The following minimum information provided by the manufacturer.		P
	a) Manufacturer's name or trade mark and model number		P
	b) Location category		P
	c) Number of ports		P

	d) Method of mounting		P
	e) Maximum continuous operating voltage *U*c (one value for each mode of protection except if all values are equal)		P
	f) SPD type and discharge parameters for each mode of protection declared by the manufacturer		P
	g) Nominal discharge current *I*n for Type 1 and Type 2 SPDs (one value for each mode of protection)		P
	h) Voltage protection level *U*p (one value for each mode of protection)		P
	i) Rated load current *I*L (if required)		P
	j) Degree of protection provided by the enclosure (IP code) (if IP > 20)		N
	k) Short-circuit withstand		P
	l)Maximum recommended ratings of overcurrent protection (if applicable)		P
	m) Indication of disconnector operation (if any)		P
	n) Position of normal use if significant		P
	o) Identification of terminals (if necessary)		P
	p)installation instructions (e.g. type of LV systems: TN, TT, IT etc , connections to LV systems rated system voltages for which the SPD is designed, mechanical dimensions, lead lengths, etc.)and		P
	q) Type of current: a.c. frequency or d.c., or both		P
	r) Specific energy W/R for Type 1 SPDs only (from 7.1.1)		N
	s) Temperature range		P
	t) Follow current interrupting rating (except in the case of voltage limiting SPDs)		N
	u) The external SPD disconnector requirements, if any, shall be defined by the manufacturer		P
	v) Residual current (optional)		N
	w) Temporary overvoltage characteristic		N
	Total discharge current *I*Total for multipole SPDs (if declared by the manufacturer)		P
6.1.2	Marking		P
	Markings a), e), f), g), h), j), l), o) and q) in 6.1.1 are mandatory on the body, or permanently attached to the body, of the SPD. For some designs of one port SPDs, there may not be a need to provide a rated load current.		P

	Marking shall be indelible and legible and shall not be placed on screws and removable washers. Compliance is in accordance with the test of 7.2.		P
6.2	Electrical requirements		---
6.2.1	Electrical connections		P
	Terminals shall be designed for the connection of cables having a minimum and a maximum cross-sectional area according to the manufacturer declaration.		P
	Each of the tests must be passed by using the most severe configuration (i.e. the maximum or minimum cross-sectional area depending on the test (see clause 7). The SPD shall be equipped with terminals where electrical connection is possible by means of screws, nuts, plugs, sockets or equal effective means. This is checked in 7.3.		P
6.2.2	Voltage protection level *U*p		P
	The measured limiting voltage of SPDs shall not exceed the voltage protection level that is specified by the manufacturer. Compliance is in accordance with the test of 7.5.		P
6.2.3	Class I impulse current test(s)		N
	An SPD shall be tested to class I test when the manufacturer declares that it meets those requirements. Compliance is in accordance with the test of 7.6.5.		N
6.2.4	Class II nominal discharge current test(s)		P
	An SPD shall be tested to class II test when the manufacturer declares that it meets those requirements. Compliance is in accordance with 7.6.5.		P
6.2.5	Class III combination wave test(s)		N
	An SPD shall be tested to class III test when the manufacturer declares that it meets those requirements. Compliance is in accordance with the test of 7.6.7.		N
6.2.6	Operating duty test		P
	The SPD shall be capable of withstanding specified discharge currents during application of the maximum continuous operating voltage *U*c without unacceptable changes in its characteristics.		P
6.2.7	SPD disconnector		P

	The SPD may have SPD disconnectors (which can be either internal, external or both). Their operation shall be indicated.		P
	SPD disconnectors shall be tested with the SPD during the sequence of type tests of 7.7 and 7.8.3, except for RCDs which are not tested during the operating duty test according to 7.7.1		P
6.2.8	Air clearances and creepage distances		P
	The SPD shall have sufficient air clearances and creepage distances. Testing is in accordance with 7.9.5.		P
6.2.9	Tracking resistance		P
	Insulating materials necessary to retain live parts in their position shall be composed of nontracking material, or they shall be sufficiently dimensioned. Testing in accordance with 7.9.6.		P
6.2.10	Dielectric withstand		P
	The dielectric withstand of the housing of the SPD shall be sufficient with respect to insulation breakdown and protection against direct contact. Testing in accordance with 7.9.8.		P
6.2.11	Short-circuit withstand capability		P
	An overstressed (short-circuited) SPD shall withstand the power short-circuit currents that may in service. Testing is in accordance with 7.7.3.		P
6.2.12	Status indicator operation		N
6.2.13	Isolation between separate circuits		P
	Where a SPD includes a circuit which is electrically isolated from the main circuit, the manufacturer shall provide information about the isolation and dielectric withstand voltages between the circuits as well as the relevant standards with which the manufacturer is claiming conformity.		P
	Where there are more than two circuits, declarations shall be made with regard to each combination of circuits.		N
	The isolation and dielectric withstand of the separate circuits shall be tested according to the manufacturer’s declaration.		P
6.3	Mechanical requirements		P
	SPDs shall be provided with appropriate means for mounting that will ensure mechanical stability. Testing in accordance with 7.9.2.		P
6.3.1	General		---

	The SPD shall be equipped with terminals where electrical connection is possible by means of:	terminal with screw	P
6.3.2	Mechanical connections		P
	Terminals shall be fastened to the SPD in such a way that they will not work loose if the clamping screws or the lock nuts are tightened or loosened.		P
	A tool shall be required to loosen the clamping screws or the lock nuts.		P
	Plugs and socket outlets shall correspond to the relevant national requirements, and those clauses of IEC 60884-1 that may apply.		N
	Screws, current-carrying parts and connections 1) Connections, whether electrical or mechanical, shall withstand the mechanical stresses occurring in normal use.		P
	Screws operated when mounting the SPD during installation shall not be of the threadcutting type. Compliance is checked by inspection and tested in accordance with 7.3.2.1.		P
	2) Electrical connections shall be so designed that contact pressure is not transmitted through insulating material other than ceramic, pure mica or other material with characteristics no less suitable, unless there is sufficient resilience in the metallic parts to compensate for any possible shrinkage or yielding of the insulating material. Compliance is checked by inspection.		P
	The suitability of the material is considered in respect of the stability of the dimensions.		P
	3) Current-carrying parts and connections including parts intended for protective conductors, if any, shall be of either – copper, or – an alloy containing at least 58 % copper for parts worked cold, or at least 50 % copper for other parts, or – other metal or suitably coated metal, no less resistant to corrosion than copper and having mechanical properties no less suitable.		P
	d) Terminals with screw for external conductors		P
	1) Terminals for external conductors shall be such that the conductors may be connected so as to ensure that the necessary contact pressure is maintained permanently.		P
	The terminals shall be readily accessible under the intended conditions of use. Compliance is checked by inspection and tested in accordance with 7.3.2.2.2.		P

	2) The means for clamping the conductors in the terminals shall not serve to fix any other component, although they may hold the terminals in place or prevent them from turning. Compliance is checked by inspection and tested in accordance with 7.3.2.2.2.		P
	3) Terminals shall have adequate mechanical strength. Screws and nuts for clamping the conductors shall have a metric ISO thread or a thread comparable in pitch and mechanical strength. Compliance is checked by inspection and tested in accordance with 7.3.2.1 and 7.3.2.2.		P
	Provisionally, SI, BA and UN threads may be used as they are virtually equivalent in pitch and mechanical strength to metric ISO threads.		N
	4) Terminals shall be so designed that they clamp the conductor without undue damage to the conductor. Compliance is checked by inspection and tested in accordance with 7.3.2.2.2.		P
	5) Terminals shall be so designed that they clamp the conductor reliably and between metal surfaces.		P
	6) Terminals shall be so designed or positioned that neither a rigid solid conductor nor a wire of a stranded conductor can slip out while the clamping screws or nuts are tightened.		N
	This requirement does not apply to lug terminals. Compliance is checked by inspection and tested in accordance with 7.3.2.2.3.		P
	7) Terminals shall be so fixed or located that, when the clamping screws or nuts are tightened or loosened, the terminals shall not work loose from their fixings to the SPDs.		P
	These requirements do not imply that the terminals shall be so designed that their rotation or displacement is prevented, but any movement shall be sufficiently limited so as to prevent non-compliance with the requirements of this standard.		P
	The use of sealing compound or resin is considered to be sufficient for preventing a terminal from working loose, provided that – the sealing compound or resin is not subject to stress during normal use, and		P

	– the effectiveness of the sealing compound or resin is not impaired by temperatures attained by the terminal under the most unfavorable conditions specified in this standard. Compliance is checked by inspection, by measurement and tested in accordance with 7.3.2.1.		P
	8) Clamping screws or nuts of terminals intended for the connection of protective conductors shall be adequately secured against accidental loosening. Compliance is checked by manual test.		P
	e) Screwless terminals for external conductors		N
	1) Terminals shall be so designed and constructed that		---
	– each conductor is clamped individually. During the connection or disconnection the conductors can be connected or disconnected either at the same time or separately;		N
	– it is possible to clamp securely any number of conductors up to the maximum provided. Compliance is checked by inspection and tested in accordance with 7.3.3.		P
	2) Terminals shall be so designed and constructed that they clamp the conductor without undue damage to the conductor Compliance is checked by inspection.		P
	f) Insulation pierced connections for external conductors		N
	1) The insulation pierced connections shall make a reliable mechanical connection.		P
	2) Screws for making contact-pressure shall not serve to fix any other component, although they may hold the SPD in place or prevent it from turning.		N
	3) Screws shall not be of metal which is soft or liable to creep.		N
6.3.3	Corrosive resistant metals		P
	Clamps, except clamping screws, lock nuts, binding clip thrust washers, wire, and similar, shall consist of corrosion resistant metal such as copper, brass, etc. (see IEC 60999).		P
6.4	Environmental requirements		---

	SPDs shall be designed in such a way that they operate satisfactorily under the environmental conditions given by the normal service conditions. Compliance is tested in accordance with 7.9.9. Outdoor SPDs shall be contained in a weather shield of glass, glazed ceramic or other acceptable material that is resistant to UV radiation, corrosion, erosion, and tracking.		N
	They shall have sufficient surface creepage distance between any two parts of different potential.		P
6.5	Safety requirements		P
	SPDs shall be safe when operated under normal service conditions in accordance with the recommendation.		P
6.5.1	Protection against direct contact		P
	These requirements are valid for accessible SPDs where the maximum continuous operating voltage *U*c is above 50 V r.m.s. a.c.		P
	For protection against direct contact (inaccessibility of live parts), SPDs shall be designed in such a way that live parts cannot be touched when the SPD is installed for the intended use. Compliance is verified by standardized test methods of IEC 60529 and to 7.4.		N
	SPDs, except SPDs classified as inaccessible, shall be 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. Compliance is checked by inspection and, if necessary, by the tests of 7.4.1.		N
	The connection between the earthing terminals and all accessible parts connected there to shall be of low resistance. Compliance is checked by the test according to 7.4.2.		P
6.5.1.1	Mechanical strength		P
	All parts of the SPD relating to the protection against direct contact shall have sufficient mechanical strength. Compliance is tested in accordance with 7.9.2.		P
6.5.1.2	Heat resistance		P
	All parts relating to the protection against direct contact shall be sufficiently heat resistant. Compliance is tested in accordance with 7.9.3.		P
6.5.1.3	Insulation resistance		P

	The insulation resistance of the SPD shall be sufficient. Compliance is tested in accordance with 7.9.7.		P
6.5.2	Fire resistance		P
	Insulating parts of the housing shall be either nonflammable or self-extinguishing. Compliance is tested in accordance with 7.9.4.		P
6.5.3	Standby power consumption P_C		P
	For all SPDs, the P_C shall be measured at the SPD's maximum continuous operating voltage (U_C) when connected according to the manufacturer's instructions without a load.		P
6.5.4	Residual current		N
	For all SPDs with a terminal for the protective conductor, the residual current shall be measured at the SPD's maximum continuous operating voltage (U_C) when connected according to the manufacturer's instructions, without a load.		N
6.5.5	Behaviour under temporary overvoltages		P
	An SPD shall either withstand a TOV without changes in functionality, or fail in a manner described in 7.7.4 and 7.7.6.		P
6.5.5.1	TOVs caused by faults in the high (medium) voltage system		P
	SPDs connected to PE and for use on power distribution systems shall be tested at *U*T in accordance with 7.7.4 and Table B.1.		P
6.5.5.2	TOVs caused by faults or disturbances in the low voltage system		P
	If *U*c is greater or equal to *U*T there is no need to perform this test.		N
	All other SPDs shall be tested using either the TOV voltages *U*T given in Table B.1 or the TOV voltages stated by the manufacturer according to 6.1.1 w), whichever values are higher. This test shall be performed in accordance with 7.7.6.		P
6.5.6	Total discharge current *I*Total		P
	This test is only conducted		P
6.6	Additional test requirements for two-port SPDs and one-port SPDs with separate input/output terminals		N
6.6.1	Percent of voltage regulation		N
6.6.2	Rated load current *I*L		N
6.6.3	Load-side surge withstand capability		N
6.6.4	Overload behaviour		N

7	Type tests		---
7.1.1	Class I impulse current test		N
7.1.2	Class I and class II nominal discharge current test		P
7.1.3	Class I and II voltage impulse test		N
7.1.4	Class III combination wave test		N
7.1.5	Testing of SPDs classified outdoor only and for mounting out of reach		N
7.2	Identification and marking		P
7.2.1	Verification of the identification and markings		P
7.2.2	Test of indelibility of markings	After this test, the marking shall be easily legible.	P
7.3	Terminals and connections		P
	Verification of the incorporated terminals and their conformity is met by the requirements of 7.3.1.		P
7.3.2	Terminals with screws		P
7.3.2.1	Test of reliability of screws, current-carrying parts and connections		P
	Compliance is checked by inspection and for screws which are operated when connecting up the SPD by the following test.		P
	The screws are tightened and loosened		P
	ten times for screws in engagement with a thread of insulating material,		P
	five times in all other cases.		P
	Screws or nuts in engagement with a thread of insulating material are completely removed and reinserted each time unless the construction of the screw prevents this.		P
	The test is made by means of a suitable test screwdriver or spanner applying a torque as shown in table 5.	$3.4mm^2$: 0.8Nm	P
	The screws shall not be tightened in jerks.		P
	The conductor is moved each time the screw is loosened.		P
7.3.2.2	Test of reliability of terminals for external conductors		P
7.3.2.2.1	The terminals are fitted with copper conductors of the smallest or largest crosssectional areas specified in 7.3.1, solid or stranded, whichever is most unfavourable.		P

7.3.2.2.2	The terminals are fitted with copper conductors of the smallest or largest crosssectional areas specified in 7.3.1 solid or stranded, whichever is the most unfavourable and the terminal screws are tightened with a torque equal to two-thirds of that shown in the appropriate column of table 5. The terminal screws are then loosened and the part of the conductor which may have been affected by the terminal is inspected.		P
7.3.2.2.3	The terminals are fitted with a rigid stranded copper conductor conforming to table 8.		P
7.3.3	Screwless terminals		N
	Pull out test		N
7.3.4	Insulation pierced connections		N
7.3.4.1	Pull out test on SPD terminals designed for single core conductors		N
7.3.4.2	Pull out test on SPD terminals designed for multi-core cables or cords		N
7.3.5	Nuts, plug, socket		P
7.4	Testing for protection against direct contact		P
7.4.1	Insulated parts		P
7.4.2	Metal parts		P
7.5	Determination of the measured limiting voltage		P
7.5.5	Alternate test to the combination wave test, without a decoupling network		P
7.6	Operating duty test		P
7.6.2	Preliminary test to determine the magnitude of the follow current		P
7.6.3	Power frequency source characteristics for preconditioning		P
7.6.3.1	SPDs with follow current below 500 A		N
7.6.3.2	SPDs with follow current above 500 A		P
7.6.4	Class I and II preconditioning tests		P
7.6.5	Class I and II operating duty test		P
7.6.6	The SPD has passed the test if thermal stability is achieved after each impulse of the preconditioning and operating duty cycle. Additionally, any follow current has to be selfextinguished.		P
	Both the voltage and current records and visual inspection shall show no indication of puncture or flashover of the samples. Mechanical damage shall not occur during these tests.		P

	One more impulse at *I*n or *U*OC shall be applied to the SPD whilst the SPD is energized at *U*c by means of a voltage source having a nominal current capability of at least 5 A. After this impulse, *U*C remains applied and thermal stability shall be achieved within 30 min.		P
	Once thermal stability is achieved, either: the current which flows through the test sample is measured. Its resistive component (measured at the crest of the sine wave) shall not exceed a value of 1 mA.		N
	or in case of this current exceeds 1 mA the stand-by power consumption shall not be greater than 20 % above the value measured in 7.7.5		P
7.6.7	Class III operating duty test		N
7.7	SPD disconnectors and safety performance of overstressed SPDs		P
7.7.1	Operating duty withstand test of SPD disconnectors		P
7.7.2	Test of thermal stability of SPDs		P
7.7.2.1	Temperature withstand test		P
7.7.2.2	Thermal stability test		P
	A disconnector operates, there shall be clear evidence of effective and permanent disconnection by the device. To check this, a power frequency voltage equal to *U*c 1) shall be applied for 1 min without current flow in excess of 0,5 mA r.m.s.		P
	Indoor SPDs: The surface temperature rise shall be less than 120 K during the test. The surface temperature shall not exceed 80 K above ambient temperature 5 min after the disconnector has operated.		P
	During the test there shall be no expulsion of solid material.		P
	Outdoor SPDs: There shall be no evidence of burning and there shall be no expulsion of solid material.		N
	Accessible SPDs: After the test, SPDs having an IP degree equal or greater than IP20 shall not have live parts accessible with the standardized test finger applied with a force of 5 N (see EN 60529), except the life parts which were already accessible before the test when the SPD is fitted as in normal use.		N
7.7.3	Short-circuit withstand capability		P

	This test is not applied to SPDs which are either – classified for outdoor use and mounted out of reach, or		N
	– for connection N-PE in TN- and/or TT-systems only.		P
	During the above two short-circuit tests, neither the muslin paper nor the cheese cloth shall catch fire.		N
	In addition, during the test for the short circuit withstand capability, the power short-circuit current shall be interrupted by one of the disconnectors (internal or external) required by the manufacturer.		P
	Internal and/or special disconnectors not covered by another IEC standard: If they operate there shall be clear evidence of effective and permanent disconnection. To check this, a power frequency voltage equal to *U*c shall be applied for 1 min to the disconnector(s) having operated. The current flow shall not exceed 0,5 mA r.m.s.		P
	Accessible SPDs: After the test, SPDs having an IP degree equal or greater than IP20 shall not have live parts accessible with the standardized test finger applied with a force of 5 N (see EN 60529), except for those live parts which were already accessible before the test when the SPD is fitted as in normal use.		N
7.7.3.1	Additional test for SPDs with *I*fi lower than the declared short-circuit withstand capability		N
	The tests according to 7.7.3 are repeated but without voltage switching components being shortcircuited.		N
	The short-circuit is initiated by triggering the SPD with a positive surge current (8/20 or other appropriate waveshape) at 30 to 40 electrical degrees after the zero crossing of the voltage on the positive half wave. The surge current shall be high enough to initiate a follow current but shall in no case exceed *I*n.		N
7.7.4	Test under TOVs caused by faults in the high (medium) voltage system		P
	New samples shall be used and fitted as in normal use, according to the manufacturer's instructions, and connected to a test circuit according to Figure 13 or equivalent.		P

	The SPD shall be mounted in a cube-shaped wooden box as described in 7.7.3. The internal surface of the box shall be covered with muslin paper or cheese cloth. One of the box sides (not the bottom) shall remain open in order that the supply cables can be connected according to the manufacturer's instructions.		P
7.7.4.2	The muslin paper or cheese cloth shall not catch fire during the test.		N
	SPDs having an IP degree equal or greater than IP20 shall not have live parts accessible with the standardized test finger applied with a force of 5 N, except for those live parts which were already accessible before the test when the SPD is fitted as in normal use.		N
	SPDs, for which the manufacturer declares in his installation instructions that they may be installed in TT systems between Neutral and PE upstream the main RCD, shall pass the TOV withstand mode criteria given below.		P
	a) TOV failure mode If the manufacturer claims a TOV failure mode, the following additional pass criteria shall be fulfilled:		P
	If a disconnector has operated, there shall be clear evidence of effective and permanent disconnection by the device. To check this, a power frequenc		P
	b) TOV withstand mode If the manufacturer claims a TOV withstand capability, the following additional pass criteria shall be fulfilled:		P
	The SPD shall maintain thermal stability during the application of *U*CS (following the application of *U*T). The SPD is considered to be thermally stable if the current flowing through it or its power dissipation do not continue to increase during the total time of application of *U*CS		P
	The test sample is then connected to *U*C. The test transformer shall have a short-circuit current capability of at least 200 mA.		P
	The current which flows through the test sample is measured. Its resistive component (measured at the crest of the sine wave) shall not exceed a value of 1 mA or		P
	the stand-by power consumption shall not increase by more than 20 % of the value measured in 7.7.5.		P

	After the test sample has cooled down to near ambient temperature, the measured limiting voltage shall be determined, using the tests described in 7.5, in order to check if the voltage protection level specified by the manufacturer has been maintained. However, the test of 7.5.2. is performed only at *I*n and the tests of 7.5.4 and 7.5.5 only at *U*oc. Auxiliary circuits, like status indicators, shall be in working order.		P
	For the purpose of this subclause, 'working order' means that there is no visible damage of the disconnector and that it is still operational. Operation can be checked either manually (where possible) or by a simple electrical test agreed between the manufacturer and the laboratory.		P
	Visual inspection of the test sample shall reveal no evidence of any damage.		P
7.7.5	Standby power consumption and residual current test		N
	The SPD is connected to a voltage source at its maximum continuous operating voltage (*U*C) in accordance with the manufacturer's instructions. The apparent power (Volt-Amperes) consumed by the SPD is measured. The current flowing through the PE terminal is called the residual current.		P
7.7.6	Test under TOVs caused by faults in the low voltage system		N
	The muslin paper or cheese cloth shall not catch fire during the test.		N
	SPDs having an IP degree equal or greater than IP20 shall not have live parts accessible with the standardized test finger applied with a force of 5 N, except for those live parts which were already accessible before the test when the SPD is fitted as in normal use.		N
	The SPD shall maintain thermal stability during the application of UCS (following the application of UT). The SPD is considered to be thermally stable if the current flowing through it or its power dissipation do not continue to increase during the total time of application of UCS.		N
	The test sample is then connected to *U*C. The test transformer shall have a short-circuit current capability of at least 200 mA.		N

	The current which flows through the test sample is measured. Its resistive component (measured at the crest of the sine wave) shall not exceed a value of 1 mA or the stand-by power consumption shall not increase by more than 20 % of the value measured in 7.7.5.		N
	After the test sample has cooled down to near ambient temperature, the measured limiting voltage shall be determined, using the tests described in 7.5, in order to check if the voltage protection level specified by the manufacturer has been maintained. However, the test of 7.5.2. is performed only at *I*n and the tests of 7.5.4 and 7.5.5 only at *U*oc. Auxiliary circuits, like status indicators, shall be in working order.		N
	For the purpose of this subclause, 'working order' means that there is no visible damage of the disconnector and that it is still operational. Operation can be checked either manually (where possible) or by a simple electrical test agreed between the manufacturer and the laboratory.		N
	Visual inspection of the test sample shall reveal no evidence of any damage.		N
7.8	Test for two-port SPDs and one-port SPDs with separate input/output terminals		P
7.8.2	Rated load current *I*L		P
7.8.3	Load-side short circuit withstand capability test (in conjunction with SPD disconnectors required by the manufacturer, if any).		N
	During the test the power short-circuit current shall be interrupted within 5 s. During the test the muslin paper, or cheesecloth, shall not catch fire. In addition, there shall be no explosion or hazard for either personnel or facility.		N
	Accessible SPDs After the test, SPDs having an IP degree equal or greater than IP 2X shall not have live parts accessible with the standardized test finger applied with a force of 5 N (see IEC 60529). If no internal disconnector has operated, the SPD shall fulfil the requirements according to 7.4.1 and 7.5. If an SPD internal disconnector has operated, there shall be clear evidence of effective and permanent disconnection.		N
	In checking for disconnection: a) confirm that there is no voltage on the output terminals		N

	b) apply a power frequency voltage equal to two times *U*C, between the corresponding input and output terminals for 1 minute without current flow in excess of 0,5 mA r.m.s. The test shall include all the auxiliary parts in series with the SPD as declared by the manufacturer.		N
7.8.4	Load-side surge withstand capability		P
	The test sample shall be energized during the whole test sequence. The voltage on the output terminals shall be recorded.		P
	The SPD has passed the test if the criteria according to 7.6.6 are fulfilled.		P
	Overload behaviour		P
	For touchable surfaces, the temperature rise shall always be less than 60 K during the test.	45.1 K	P
	a) No internal disconnector has operated:		P
	Visual inspection of the test sample shall reveal no evidence of any damage.		P
	SPDs having an IP degree equal or greater than IP20 shall not have live parts accessible with the standardized test finger applied with a force of 5 N, except for those live parts which were already accessible before the test when the SPD is fitted as in normal use.		N
	The current which flows through the test sample is measured. Its resistive component (measured at the crest of the sine wave) shall not exceed a value of 1 mA. or		P
	the stand-by power consumption shall not increase by more than 20 % of the value measured in 7.7.5.		P
	After the test sample has cooled down to ambient temperature, the measured limiting voltage shall be determined, using the tests described in 7.5, to check, if the voltage protection level specified by the manufacturer has been maintained. The test of 7.5.2. is performed only at *I*n and the tests of 7.5.4 and 7.5.5 only at *U*oc.		P
	Auxiliary circuits, such as status indicators, shall be in working order.		N
	SPDs having an IP degree equal or greater than IP20 shall not have live parts accessible with the standardized test finger applied with a force of 5 N, except for those live parts which were already accessible before the test when the SPD is fitted as in normal use.		N

	There shall be clear evidence of effective and permanent disconnection by the device. To check this, a power frequency voltage equal to *U*C shall be applied for 1 min without current flow in excess of 0,5 mA r.m.s.		P
	There shall be no evidence of burning and there shall be no expulsion of solid material during and after the test.,		P
7.9	Additional tests		---
	The entire subclause 7.9 is a safety issue. In some countries other national regulations may apply.		P
7.9.1	Portable SPDs with flexible cables and cords and their connection		N
7.9.1.1	Portable SPDs shall be provided with a cord anchorage such that the conductors are relieved from strain, including twisting, where they are connected to the terminals or terminations, and that their covering is protected from abrasion.		N
	The sheath, if any, of the cord shall be clamped within the cord anchorage.		N
	After reassembly of the sample, the component parts shall fit snugly and it shall not be possible to push the cable or cord into the sample to any appreciable extent.		N
	The cable or cord is then subjected 100 times to a pull of – 60 N if the rated current is not more than 16 A and the rated voltage is up to and including 250 V; – 80 N if the rated current is not more than 16 A and the rated voltage is above 250 V; – 100 N if the rated current is more than 16 A.		N
	After the tests, the cable or cord shall not have been displaced by more than 2 mm. For rewireable accessories, the end of the conductors shall not have moved noticeably in the terminals; for non-rewireable accessories, there shall be no break in the electrical connections.		N
	After these tests, the displacement of the mark on the cable or cord in relation to the sample or the cord guard is measured while the cable or cord is subjected to the pull.		N
7.9.1.3	Non-rewireable SPDs shall be provided with a flexible cable or cord complying with IEC 60227 and IEC 60245 with a cross-sectional area of the conductors suitable for the maximum rating of the SPD and associated equipment.		N

7.9.1.4	Non-rewireable SPDs shall be so designed that the flexible cable or cord is protected against excessive bending where it enters the accessory.		N
	Guards provided for this purpose shall be of insulating material and shall be fixed in a reliable manner.		N
	Helical metal springs, whether bare or covered with insulating material, shall not be used as core guards.		N
	The sample is fixed to the oscillating mechanism of the apparatus. Therefore when it is in midposition, the axis of the flexible cable or cord where it enters the sample is vertical; thus passing through the axis of oscillation.		N
	The accessory is, by variation of the distance between the fixed part of the oscillating mechanism and the axis of oscillation, so positioned that the cord makes the minimum lateral movement when the oscillating mechanism of the test apparatus is moved over its full length of travel.		N
	In order to have the possibility of finding easily by experiment the mounting position with the minimum lateral movement of the cord during the test, the flexing apparatus should be built in such a way that the different supports for the accessories mounted on the oscillating mechanism can be readily adjusted.		N
	The cable or cord is loaded with a mass such that the force applied is – 20 N for accessories with cables or cords having a nominal cross-sectional area exceeding 0,75 mm2; – 10 N for other accessories.		N
	A current equal to the rated current for the accessory or the following current, whichever is the lower, is passed through the conductors: – 16 A for accessories with cables or cords having a nominal cross-sectional area exceeding 0,75 mm2; – 10 A for accessories with cords having a nominal cross-sectional area of 0,75 mm2; – 2,5 A for accessories with cords having a nominal cross-sectional area less the 0,75 mm2.		N
	The voltage between the conductors is equal to the rated voltage of the sample.		N
	The oscillating mechanism is moved through an angle of 90° (45° on either side of the vertical), the number of flexings being 10 000 and the rate of flexing 60 per minute.		N

	A flexing is one movement, either backwards or forwards.		N
	Samples with circular section cables or cords are turned through 90° in the oscillating mechanism after 5 000 flexings, samples with flat cords are only bent in a direction perpendicular to the plane containing the axes of the conductors.		N
	During the flexing test, there shall be – no interruption of the current, – no short-circuit between conductors.		N
	A short-circuit between the conductors of the flexible cable or cord is considered to occur if the current attains a value equal to twice the test current of the accessory.		N
	The voltage drop between each contact and the corresponding conductor, with a test current flowing having a value of the rated current, shall not exceed 10 mV.		N
	After the test the guard, if any, shall not have separated from the body and the insulation of the flexible cable or cord shall show no sign of abrasion or wear; broken strands of the conductor shall not have pierced the insulation so as to become accessible.		N
7.9.2	Mechanical strength		P
7.9.2.1	SPDs shall have adequate mechanical strength so as to withstand the stresses imposed during installation and use.		P
	The samples are subjected to strikes by means of an impact-test apparatus		P
	After the test, the sample shall show no damage within the meaning of the standard. In particular, live parts shall not become accessible with the standard test finger.		P
	Damage to the finish, small dents which do not reduce creepage distances or clearances and small chips which do not adversely affect the protection against electric shock or harmful ingress of water are neglected.		P
	Cracks, not visible with the normal or corrected vision, without additional magnification, and surface cracks in fibre reinforced mouldings and the like, are ignored.		P
7.9.2.2	Portable SPDs are tested in a tumbling barrel		N
	After the test, the samples shall show no damage. In particular		N

	no part shall have become detached or loosened, – it should not be possible to touch any live parts, even if the standard test finger is applied with a force not exceeding 10 N.		N
	During the examination after the test, special attention is paid to the connection of the flexible cable or cord. Small pieces may be broken off without rejection, provided that the protection against electric shock is not affected.		N
	Damage to the finish and small dents which do not reduce the creepage distances or clearances are neglected.		N
7.9.3	Heat resistance		P
7.9.3.1	For 1 h the SPD is kept in a heating cabinet at a temperature of 100 °C ± 2 K. Any sealing compound used in the internal assembly shall not flow out to any significant extent.		P
	After cooling, it should not be possible to touch any live parts when the test sample is mounted as for normal use even if the standard test finger is applied with a force not exceeding 5 N.		P
	The SPD is deemed to have passed the test even if the SPD disconnector is open.		P
	The sample to be tested is fastened accordingly, its surface being positioned horizontally; a steel ball having a diameter of 5 mm is pressed against the surface with a force of 20 N.		P
	After 1 h, the steel ball is taken away from the sample; by dipping it into cold water, the temperature of the sample is reduced to ambient temperature within 10 s.		P
	The diameter of the ball indentation is measured and shall not exceed 2 mm.		P
7.9.4	Resistance to abnormal heat and fire		P
	The glow wire test is performed in accordance with clauses 4 to 10 of IEC 60695-2-1/1 under the following conditions:		P
	for external parts of SPDs made of insulating material necessary to retain in position current-carrying parts and parts of the protective circuit, by the test made at a temperature of 850 °C ± 15 K;	Enclosure and Internal spring fixing pleastic element	P
	for all other external parts made of insulating material, by the test made at a temperature of 650 °C ± 10 K.		N
7.9.5	Verification of air clearances and creepage distances		P

	The electrode spacing of spark gaps shall not be considered for the determination of air clearances and creepage distances.		P
7.9.5.1	SPDs category outdoor		N
	Between live parts and earth,		N
7.9.5.2	SPDs category indoor		P
	Between live parts and earth,	cl./cr.:1.2/1.8	P
7.9.5.2.2	The casting shall not come over the rim of the deepening, it shall stick strongly to the walls of the cavity and the metal parts in it.		N
7.9.6	Tracking resistance		P
7.9.7	Insulation resistance		P
7.9.7.1	Requirement of the EUT and the reference test condition		---
	Additional entry holes for cables		P
	The moisture treatment is carried out in a humidity cabinet	93 % 25 °C	P
	Time for humidity Test	48h	P
7.9.7.2	After a delay period of between 30 min and 60 min following the humidity treatment, the insulation resistance is measured 60 s after having applied a d.c. voltage of 500 V.		P
	The insulation resistance shall not be lower than 5 ms for the measurements according to a), 2 ms for the measurements according to b).		P
7.9.8	Dielectric withstand		P
	SPDs classified for outdoor use are tested between the terminals with the internal parts removed.		P
	During this test, the SPD is subjected to sprinkling according to 9.1 of IEC 60060-1.		P
	Auxiliary circuits are tested according to IEC 60947-5-1.		N
7.9.9	Resistance to ingress of solid objects and to harmful ingress of water		N
	Testing shall be carried out in accordance with IEC 60529 to check the IP code.		N
7.9.10	Total discharge current test for multipole SPDs		P
	Each mode of the test sample is then connected to *U*C. The test transformer shall have a shortcircuit current capability of at least 200 mA.		P

	The current which flows through the test sample is measured. Its resistive component (measured at the crest of the sine wave) shall not exceed a value of 1 mA or the stand-by power consumption shall not increase by more than 20 % of the value measured in 7.7.5.		P
	After the test sample has cooled down to near ambient temperature, the measured limiting voltage shall be determined using the tests described in 7.5 to check if the voltage protection level specified by the manufacturer has been maintained. The test of 7.5.2. is performed only at *I*n.		P
	Auxiliary circuits, like status indicators, shall be in working order.		N
	Visual inspection of the test sample shall reveal no evidence of any damage.		P
7.10	Electromagnetic compatibility		N
7.10.1	Electromagnetic immunity		N
	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 not sensitive to normal electromagnetic disturbances and therefore no immunity tests are required.		N
	The requirements for SPDs containing electronic circuits are under consideration		N
7.10.2	Electromagnetic emission		N
8	Routine and acceptance tests		P
	Appropriate test(s) shall be conducted to verify that the SPD is capable of meeting its performance. The manufacturer shall declare the test method(s).		N
	Check that *I*c is below a specified value determined by the manufacturer at a specified *U*c.		P
Annex A	Considerations for SPDs when class I tests are to be applied		N
Annex B	TOV values	362.5V	P

ANNEX A:

Photo-documentation

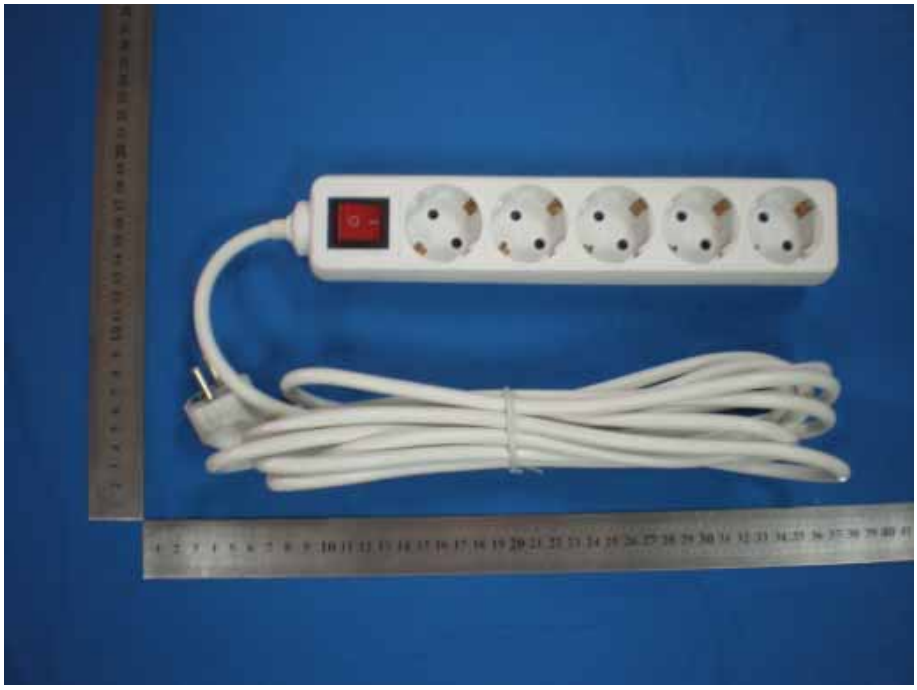

Photo 1 Overview

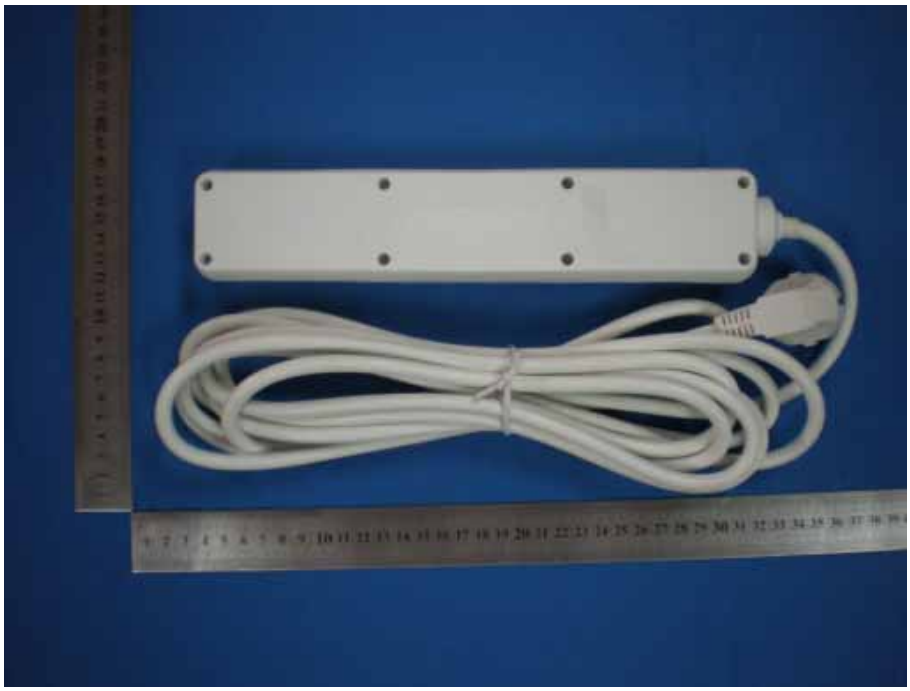

Photo 2 Overview

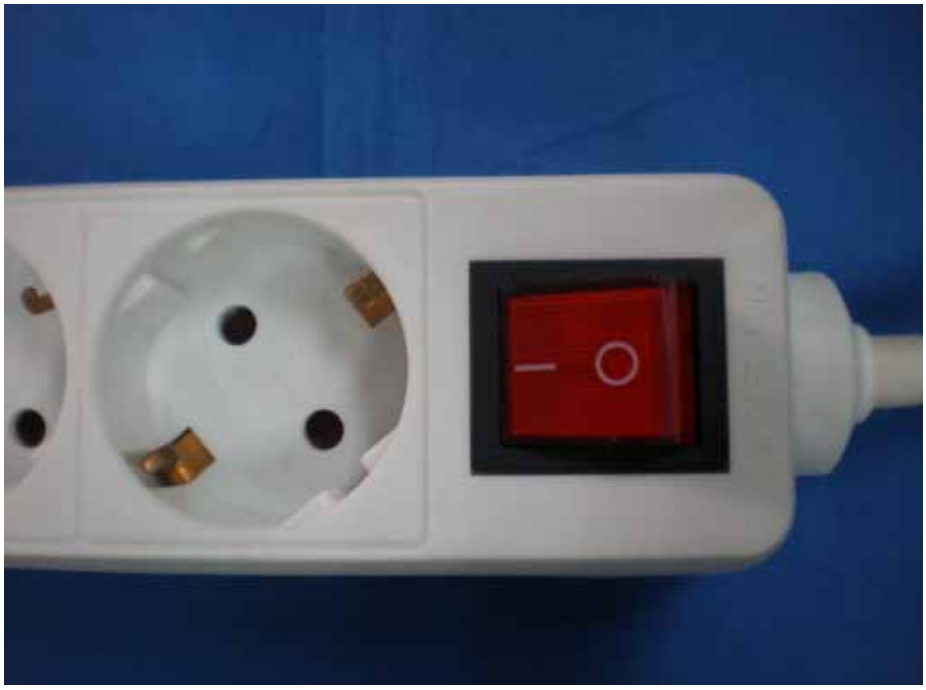

Photo 3 Part View

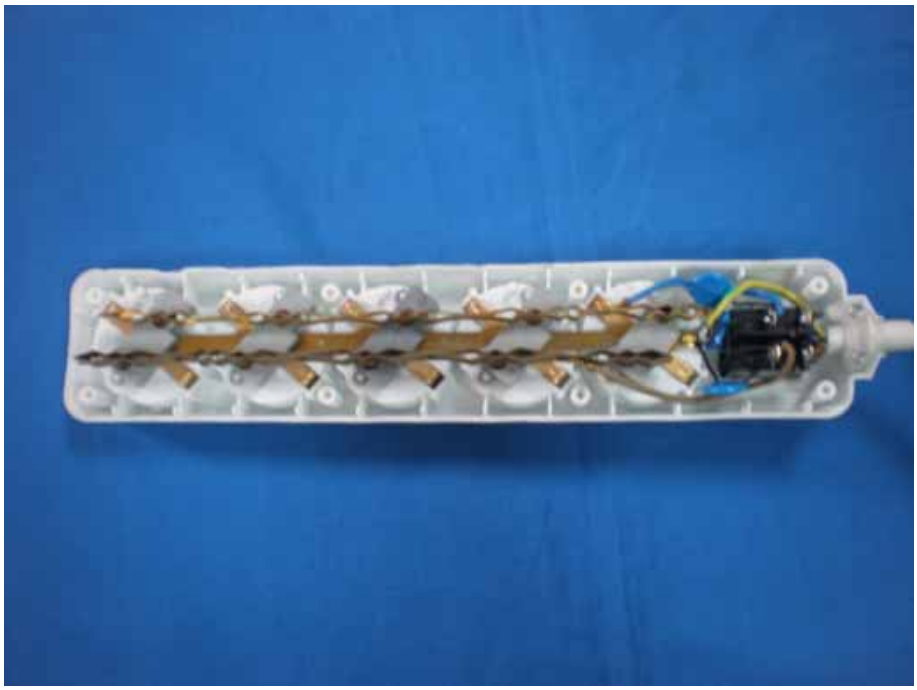

Photo 4 Internal View of The EUT