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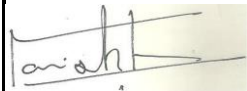
Number	Item	Description	Qty.	Unit	Unit Cost	Total Cost
					(in INR)	(in INR)
		Lightning Protection System				
1	Terrastreamer 20	ALLTEC USA Terrastreamer 20 Lightning Arrester with SS ADAPTOR	1	No	INR 78,900	INR 78,900
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3	Elevation Mast	Specially designed 3 mtrs GI mast Setting , and 1 mtr FRP insulation mast Specially designed As per ALLTEC USA Standards; Roof top/Tower side mounting arrangement & fixing accessories (anchoring rope & anchoring plate, Base -for roof top installation). The mast coated with paint for additional protection,Cable connector Adaptor	1	Set	INR 8,000	INR 8,000
4	Down Conductor	50 Sq MM V Guard HRFR Insulated Copper Cable with tester cables for ESE Lightnig Arrester tester	25	Mtrs	INR 700	INR 17,500
5	Surge protection device	LSG Protect BC100 Imported 3 Phase 1+2 Combicontrol 100KA AC Surge protection device	1	No	Complementary	Complementary
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7	Installation	Installation of ESE Lightning Protection System, tester system, SPDs with Down conductor routing from the LA terminal to the earth pit. Earth termination, fixing & Backfilling	1	Job	INR 7,500	INR 7,500
Quotation Valid For 20 days			GRAND TOTAL		INR	1,19,900.00

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The ESE Principle

The principle of operation for ESE terminals is to create an upward propagating streamer earlier than conventional air terminals or other objects on the earth. TerraStreamer® does this by collecting and storing ground charge during the initial phase of a thunderstorm development.

1. Thunderstorm begins creating downward step leaders
2. Ambient electric field intensity in the area of the ESE terminal increases
3. Terminal is triggered to release the stored ground charge
4. Upward streamer is formed microseconds earlier than other objects in the immediate area
5. The TerraStreamer® ESE terminal becomes the target of the developing lightning strike

The selection of the TerraStreamer® model, placement, and mounting height above the protected area all factor into formulas calculating the dimensions of the protection area.

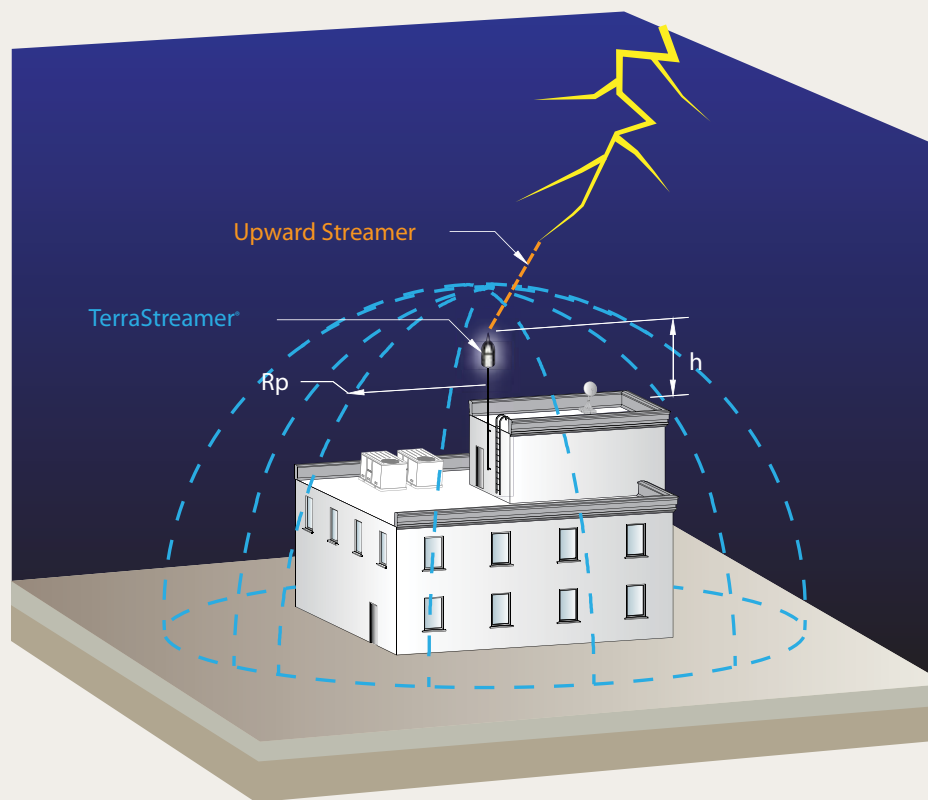
Advantages

The installation of a TerraStreamer® ESE Terminal combines the best advantages of two systems: the direct path to ground of a conventional lightning protection system, and state-of-the-art ESE technology employed in the TerraStreamer®'s patented design. TerraStreamer® terminals are:

- Externally mounted, proactive, structural lightning protection devices
- Designed to activate in the moments directly preceding an imminent, direct strike
- Tested to certify gain in triggering time (ΔT) as per NF C 17-102 and UNE 21 186
- Designed to ensure that the system provides a secure zone of protection

Protection Radius

The standard protection radius R_p of the TerraStreamer® is linked (according to NF C 17-102 standard) to T , to the protection levels I, II, III, or IV and to the height of the TerraStreamer® above the protected structure (h , defined by NF C 17-102 as a minimum of 2 m). The NF C 17-102 standard includes four levels of protection.



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CERTIFICATE

By Authority Of THE UNITED STATES OF AMERICA Legally Binding Document

By the Authority Vested By Part 5 of the United States Code § 552(a) and Part 1 of the Code of Regulations § 51 the attached document has been duly **INCORPORATED BY REFERENCE** and shall be considered legally binding upon all citizens and residents of the United States of America. ***HEED THIS NOTICE:*** Criminal penalties may apply for noncompliance.



Document Name: ASTM B117: Standard Practice for Operating Salt Spray (Fog) Apparatus

CFR Section(s): 49 CFR 571.209 S5.2(a)

Standards Body: American Society for Testing and Materials



Official Incorporator:

THE EXECUTIVE DIRECTOR
OFFICE OF THE FEDERAL REGISTER
WASHINGTON, D.C.



Standard Method of SALT SPRAY (FOG) TESTING¹

This Standard is issued under the fixed designation B 117; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval.

This method has been approved by the Department of Defense to replace method 811.1 of Federal Test Method Standard No. 151b and for listing in DoD Index of Specifications and Standards. Future proposed revisions should be coordinated with the Federal Government through the Army Materials and Mechanics Research Center, Watertown, Mass. 02172.

1. Scope

1.1 This method sets forth the conditions required in salt spray (fog) testing for specification purposes. Suitable apparatus which may be used to obtain these conditions is described in Appendix A1. The method does *not* prescribe the type of test specimen or exposure periods to be used for a specific product, nor the interpretation to be given to the results. Comments on the use of the test in research will be found in Appendix A2.

NOTE 1—This method is applicable to salt spray (fog) testing of ferrous and non-ferrous metals, and is also used to test inorganic and organic coatings, etc., especially where such tests are the basis for material or product specifications.

2. Apparatus

2.1 The apparatus required for salt spray (fog) testing consists of a fog chamber, a salt solution reservoir, a supply of suitably conditioned compressed air, one or more atomizing nozzles, specimen supports, provision for heating the chamber, and necessary means of control. The size and detailed construction of the apparatus are optional, provided the conditions obtained meet the requirements of this method.

2.2 Drops of solution which accumulate on the ceiling or cover of the chamber shall not be permitted to fall on the specimens being tested.

2.3 Drops of solution which fall from the specimens shall not be returned to the solution reservoir for respraying.

2.4 Material of construction shall be such that it will not affect the corrosiveness of the fog.

3. Test Specimens

3.1 The type and number of test specimens to be used, as well as the criteria for the evaluation of the test results, shall be defined in the specifications covering the material or product being tested or shall be mutually agreed upon by the purchaser and the seller.

4. Preparation of Test Specimens

4.1 Metallic and metallic-coated specimens shall be suitably cleaned. The cleaning method shall be optional depending on the nature of the surface and the contaminants, except that it shall not include the use of abrasives other than a paste of pure magnesium oxide nor of solvents which are corrosive or will deposit either corrosive or protective films. The use of a nitric acid solution for the chemical cleaning, or passivation, of stainless steel specimens is permissible when agreed upon by the purchaser and the seller. Care shall be taken that specimens are not recontaminated after cleaning by excessive or careless handling.

4.2 Specimens for evaluation of paints and other organic coatings shall be prepared in accordance with applicable specification(s) for the material(s) being tested, or as agreed upon by the purchaser and supplier. Otherwise, the test specimens shall consist of steel meeting the requirements of ASTM Methods D 609 for Preparation of Steel Panels for Testing

¹ This method is under the jurisdiction of ASTM Committee G-1 on Corrosion of Metals, and is the direct responsibility of Subcommittee G01.05 on Laboratory Corrosion Tests.

Current edition approved March 29, 1973. Published June 1973. Originally published as B 117 - 39 T. Last previous edition B 117 - 64.

Paint, Varnish, Lacquer, and Related Products,² and shall be cleaned and prepared for coating in accordance with applicable procedure of Method D 609.

4.3 Specimens coated with paints or nonmetallic coatings shall not be cleaned or handled excessively prior to test.

4.4 Whenever it is desired to determine the development of corrosion from an abraded area in the paint or organic coating, a scratch or scribed line shall be made through the coating with a sharp instrument so as to expose the underlying metal before testing. The conditions of making the scratch shall be as defined in ASTM Method D 1654, Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments,² unless otherwise agreed upon between the purchaser and seller.

4.5 Unless otherwise specified, the cut edges of plated, coated, or duplex materials and areas containing identification marks or in contact with the racks or supports shall be protected with a suitable coating stable under the conditions of the test, such as ceresin wax.

NOTE 2—Should it be desirable to cut test specimens from parts or from preplated, painted, or otherwise coated steel sheet, the cut edges shall be protected by coating them with paint, wax, tape, or other effective media so that the development of a galvanic effect between such edges and the adjacent plated or otherwise coated metal surfaces, is prevented.

5. Position of Specimens During Test

5.1 The position of the specimens in the salt spray chamber during the test shall be such that the following conditions are met:

5.1.1 Unless otherwise specified, the specimens shall be supported or suspended between 15 and 30 deg from the vertical and preferably parallel to the principal direction of horizontal flow of fog through the chamber, based upon the dominant surface being tested.

5.1.2 The specimens shall not contact each other or any metallic material or any material capable of acting as a wick.

5.1.3 Each specimen shall be so placed as to permit free settling of fog on all specimens.

5.1.4 Salt solution from one specimen shall not drip on any other specimen.

NOTE 3—Suitable materials for the construction or coating of racks and supports are glass, rubber, plastic, or suitably coated wood. Bare metal shall not be used. Specimens shall preferably be supported from the bottom or the side. Slotted wooden

strips are suitable for the support of flat panels. Suspension from glass hooks or waxed string may be used as long as the specified position of the specimens is obtained, if necessary by means of secondary support at the bottom of the specimens.

6. Salt Solution

6.1 The salt solution shall be prepared by dissolving 5 ± 1 parts by weight of sodium chloride in 95 parts of distilled water or water containing not more than 200 ppm of total solids. The salt used shall be sodium chloride substantially free of nickel and copper and containing on the dry basis not more than 0.1 percent of sodium iodide and not more than 0.3 percent of total impurities. Some salts contain additives that may act as corrosion inhibitors; careful attention should be given to the chemical content of the salt. By agreement between purchaser and seller, analysis may be required and limits established for elements or compounds not specified in the chemical composition given above.

6.2 The pH of the salt solution shall be such that when atomized at 35 C (95 F) the collected solution will be in the pH range of 6.5 to 7.2 (Note 4). Before the solution is atomized it shall be free of suspended solids (Note 5). The pH measurement shall be made electrometrically at 25 C (77 F) using a glass electrode with a saturated potassium chloride bridge in accordance with Method E 70, Test for pH of Aqueous Solutions with the Glass Electrode³; or colorimetrically using bromothymol blue as indicator, or short range pH paper which reads in 0.2 or 0.3 of a pH unit (Note 6).

NOTE 4—Temperature affects the pH of a salt solution prepared from water saturated with carbon dioxide at room temperature and pH adjustment may be made by the following three methods:

(1) When the pH of a salt solution is adjusted at room temperature, and atomized at 35 C (95 F), the pH of the collected solution will be higher than the original solution due to the loss of carbon dioxide at the higher temperature. When the pH of the salt solution is adjusted at room temperature, it is therefore necessary to adjust it below 6.5 so the collected solution after atomizing at 35 C (95 F) will meet the pH limits of 6.5 to 7.2. Take about a 50-ml sample of the salt solution as prepared at room temperature, boil gently for 30 s, cool, and determine the pH. When the pH of the salt solution is adjusted to 6.5 to 7.2 by this procedure, the pH of the atomized and collected solution at 35 C (95 F) will come within this range.

² 1974 Annual Book of ASTM Standards, Part 27.

³ 1973 Annual Book of ASTM Standards, Parts 16, 22, 30.

(2) Heating the salt solution to boiling and cooling to 95 F or maintaining it at 95 F for approximately 48 h before adjusting the pH produces a solution the pH of which does not materially change when atomized at 35 C (95 F).

(3) Heating the water from which the salt solution is prepared to 35 C (95 F) or above, to expel carbon dioxide, and adjusting the pH of the salt solution within the limits of 6.5 to 7.2 produces a solution the pH of which does not materially change when atomized at 35 C (95 F).

NOTE 5—The freshly prepared salt solution may be filtered or decanted before it is placed in the reservoir, or the end of the tube leading from the solution to the atomizer may be covered with a double layer of cheesecloth to prevent plugging of the nozzle.

NOTE 6—The pH can be adjusted by additions of dilute cp hydrochloric acid or cp sodium hydroxide solutions.

7. Air Supply

7.1 The compressed air supply to the nozzle or nozzles for atomizing the salt solution shall be free of oil and dirt (Note 7) and maintained between 69 and 172 kN/m² (10 and 25 psi) (Note 8).

NOTE 7—The air supply may be freed from oil and dirt by passing it through a water scrubber or at least 610 mm (2 ft) of suitable cleaning material such as asbestos, sheep's wool, excelsior, slag wool, or activated⁴ alumina.

NOTE 8—Atomizing nozzles may have a "critical pressure" at which an abnormal increase in the corrosiveness of the salt fog occurs. If the "critical pressure" of a nozzle has not been established with certainty, control of fluctuation in the air pressure within plus or minus 0.7 kN/m² (0.1 psi), by installation of a suitable pressure regulator valve⁵ minimizes the possibility that the nozzle will be operated at its "critical pressure."⁶

8. Conditions in the Salt Spray Chamber

8.1 *Temperature*—The exposure zone of the salt spray chamber shall be maintained at 35 + 1.1 - 1.7 C (95 + 2 - 3 F). The temperature within the exposure zone of the closed cabinet shall be recorded at least twice a day at least 7 h apart (except on Saturdays, Sundays, and holidays when the salt spray test is not interrupted for exposing, rearranging, or removing test specimens or to check and replenish the solution in the reservoir).

NOTE 9—A suitable method to record the temperature is by a continuous recording device or by a thermometer which can be read from outside the closed cabinet. The recorded temperature must be obtained with the salt spray chamber closed to avoid a false low reading because of wet-bulb effect when the chamber is open.

8.2 *Atomization and Quantity of Fog*—At least two clean fog collectors shall be so

placed within the exposure zone that no drops of solution from the test specimens or any other source shall be collected. The collectors shall be placed in the proximity of the test specimens, one nearest to any nozzle and the other farthest from all nozzles. The fog shall be such that for each 80 cm² of horizontal collecting area there will be collected in each collector from 1.0 to 2.0 ml of solution per hour based on an average run of at least 16 h (Note 10). The sodium chloride concentration of the collected solution shall be 5 ± 1 weight percent (Note 11). The pH of the collected solution shall be 6.5 to 7.2. The pH measurement shall be made electrometrically or colorimetrically using bromothymol blue as the indicator.

NOTE 10—Suitable collecting devices are glass funnels with the stems inserted through stoppers into graduated cylinders, or crystallizing dishes. Funnels and dishes with a diameter of 10 cm have an area of about 80 cm².

NOTE 11—A solution having a specific gravity of 1.0255 to 1.0400 at 25 C (77 F) will meet the concentration requirement. The concentration may also be determined as follows: Dilute 5 ml of the collected solution to 100 ml with distilled water and mix thoroughly; pipet a 10-ml aliquot into an evaporating dish or casserole; add 40 ml of distilled water and 1 ml of 1 percent potassium chromate solution (chloride-free) and titrate with 0.1 N silver nitrate solution to the first appearance of a permanent red coloration. A solution that requires between 3.4 and 5.1 ml of 0.1 N silver nitrate solution will meet the concentration requirements.

8.3 The nozzle or nozzles shall be so directed or baffled that none of the spray can impinge directly on the test specimens.

9. Continuity of Test

9.1 Unless otherwise specified in the specifications covering the material or product being tested, the test shall be continuous for the duration of the entire test period. Continuous operation implies that the chamber be

⁴ Registered U. S. Patent Office.

⁵ The Nullmatic pressure regulator (or equivalent) manufactured by Moore Products Co., H and Lycoming Sts., Philadelphia, Pa. 19124, is suitable for this purpose.

⁶ It has been observed that periodic fluctuations in air pressure of ±3.4 kN/m² (0.5 psi) resulted in about a two-fold increase in the corrosivity of the fog from a nozzle which was being operated at an average pressure of 110 kN/m² (16 psi). Controlling the fluctuations within ±0.7 kN/m² (0.1 psi), however, avoided any increase in the corrosivity of the salt fog. See Darsey, V. M. and Cavanagh, W. R., "Apparatus and Factors in Salt Fog Testing," *Proceedings, ASTEA, Am. Soc. Testing Mats.*, Vol. 48, 1948, p. 153.



closed and the spray operating continuously except for the short daily interruptions necessary to inspect, rearrange, or remove test specimens; to check and replenish the solution in the reservoir, and to make necessary recordings as described in Section 8. Operations shall be so scheduled that these interruptions are held to a minimum.

10. Period of Test

10.1 The period of test shall be as designated by the specifications covering the material or product being tested or as mutually agreed upon by the purchaser and the seller.

NOTE 12—Recommended exposure periods are to be as agreed upon by the purchaser and seller, but exposure periods of multiples of 24 h are suggested.

11. Cleaning of Tested Specimens

11.1 Unless otherwise specified in the specifications covering the material or product being tested, specimens shall be treated as follows at the end of the test:

11.1.1 The specimens shall be carefully removed.

11.1.2 Specimens may be gently washed or dipped in clean running water not warmer than 38 C (100 F) to remove salt deposits from their surface, and then immediately dried. Drying shall be accomplished with a stream of clean, compressed air.

12. Evaluation of Results

12.1 A careful and immediate examination shall be made for the extent of corrosion of the dry test specimens or for other failure as required by the specifications covering the

material or product being tested or by agreement between the purchaser and the seller.

13. Records and Reports

13.1 The following information shall be recorded, unless otherwise prescribed in the specifications covering the material or product being tested:

13.1.1 Type of salt and water used in preparing the salt solution,

13.1.2 All readings of temperature within the exposure zone of the chamber,

13.1.3 Daily records of data obtained from each fog-collecting device including the following:

13.1.3.1 Volume of salt solution collected in milliliters per hour per 80 cm²,

13.1.3.2 Concentration or specific gravity at 35 C (95 F) of solution collected, and

13.1.3.3 pH of collected solution.

13.4 Type of specimen and its dimensions, or number or description of part,

13.5 Method of cleaning specimens before and after testing,

13.6 Method of supporting or suspending article in the salt spray chamber,

13.7 Description of protection used as required in 4.5,

13.8 Exposure period,

13.9 Interruptions in test, cause and length of time, and

13.10 Results of all inspections.

NOTE 13—If any of the atomized salt solution which has not contacted the test specimens is returned to the reservoir, it is advisable to record the concentration or specific gravity of this solution also.

APPENDICES

A1. CONSTRUCTION OF APPARATUS

A1.1 Cabinets

A1.1.1 Standard salt-spray cabinets are available from several suppliers, but certain pertinent accessories are required before they will function according to this method and provide consistent control for duplication of results.

A1.1.2 The salt spray cabinet consists of the basic chamber, an air-saturator tower, a salt solution reservoir, atomizing nozzles, specimen supports, provisions for heating the chamber, and suitable controls for maintaining the desired tempera-

ture.

A1.1.3 Accessories such as a suitable adjustable baffle or central fog tower, automatic level control for the salt reservoir, and automatic level control for the air-saturator tower are pertinent parts of the apparatus.

A1.1.4 The cabinet should be of sufficient size to test adequately the desired number of parts without overcrowding. Small cabinets have been found difficult to control and those of less than 0.43-m³ (15-ft³) capacity should be avoided.

A1.1.5 The chamber may be made of inert materials such as plastic, glass, or stone, but most preferably is constructed of metal and lined with impervious plastics, rubber, or epoxy-type materials or equivalent.

A1.2 Temperature Control

A1.2.1 The maintenance of temperature within the salt chamber can be accomplished by several methods. It is generally desirable to control the temperature of the surroundings of the salt spray chamber and to maintain it as stable as possible. This may be accomplished by placing the apparatus in a constant-temperature room, but may also be achieved by surrounding the basic chamber of a jacket containing water or air at a controlled temperature.

A1.2.2 The use of immersion heaters in an internal salt-solution reservoir or of heaters within the chamber is detrimental where heat losses are appreciable, because of solution evaporation and radiant heat on the specimens.

A1.2.3 All piping which contacts the salt solution or spray should be of inert materials such as plastic. Vent piping should be of sufficient size so that a minimum of back pressure exists and should be installed so that no solution is trapped. The exposed end of the vent pipe should be shielded from extreme air currents that may cause fluctuation of pressure or vacuum in the cabinet.

A1.3 Spray Nozzles

A1.3.1 Satisfactory nozzles may be made of hard rubber, plastic, or other inert materials. The most commonly used type is made of plastic. Nozzles calibrated for air consumption and solution atomized are available. The operating characteristics of a typical nozzle are given in Table A1.

A1.3.2 It can readily be seen that air consumption is relatively stable at the pressures normally used, but a marked reduction in solution sprayed occurs if the level of the solution is allowed to drop appreciably during the test. Thus, the level of the solution in the salt reservoir must be maintained automatically to ensure uniform fog delivery during the test.⁷

A1.3.3 If the nozzle selected does not atomize the salt solution into uniform droplets, it will be necessary to direct the spray at a baffle or wall to pick up the larger drops and prevent them from impinging on the test specimens. Pending a complete understanding of air-pressure effects, etc., it is important that the nozzle selected shall produce the desired condition when operated at the air pressure

selected. Nozzles are not necessarily located at one end, but may be placed in the center and can also be directed vertically up through a suitable tower.

A1.4 Air for Atomization

A1.4.1 The air used for atomization must be free of grease, oil, and dirt before use by passing through well-maintained filters. Room air may be compressed, heated, humidified, and washed in a water-sealed rotary pump, if the temperature of the water is suitably controlled. Otherwise cleaned air may be introduced into the bottom of a tower filled with water, through a porous stone or multiple nozzles. The level of the water must be maintained automatically to ensure adequate humidification. A chamber operated according to this method and Appendix will have a relative humidity between 95 and 98 percent. Since salt solutions from 2 to 6 percent will give the same results (though for uniformity the limits are set at 4 to 6 percent), it is preferable to saturate the air at temperatures well above the chamber temperature as insurance of a wet fog. Table A2 shows the temperatures, at different pressures, that are required to offset the cooling effect of expansion to atmospheric pressure.

A1.4.2 Experience has shown that most uniform spray chamber atmospheres are obtained by increasing the atomizing air temperature sufficiently to offset heat losses, except those that can be replaced otherwise at very low-temperature gradients.

A1.5 Types of Construction

A1.5.1 A modern laboratory cabinet is shown in Fig. A1. Walk-in chambers are not usually constructed with a sloping ceiling due to their size and location. Suitably located and directed spray nozzles avoid ceiling accumulation and drip. Nozzles may be located at the ceiling, or 0.91 m (3 ft) from the floor directed upward at 30 to 60 deg over a passageway. The number of nozzles depends on type and capacity and is related to the area of the test space. A 11 to 19-dm³ (3 to 5-gal) reservoir is required within the chamber, with the level controlled. The major features of a walk-in type cabinet, which differs significantly from the laboratory type, are illustrated in Fig. A2. Construction of a plastic nozzle, such as is furnished by several suppliers, is shown in Fig. A3.

⁷ A suitable device for maintaining the level of liquid in, either the saturator tower, or reservoir of test solution may be designed by a local engineering group, or may be purchased from manufacturers of test cabinets as an accessory.

A2. USE OF THE SALT SPRAY (FOG) TEST IN RESEARCH

A2.1 The detailed requirements of this method are primarily for quality acceptance and should not be construed as the optimum conditions for research studies. The test has been used to a considerable extent for the purpose of comparing different materials or finishes with an acceptable standard. The recent elimination of many cabinet variables and the improvement in controls have made the three

ASTM Salt Spray Tests: Method B 117, Method B 287, Acetic Acid-Salt Spray (Fog) Testing,^{2, 8} and Method B 368, for Copper-Accelerated Acetic Acid-Salt Spray (Fog) Testing (CASS),^{2, 8} into useful tools for many industrial and military production

⁸ 1973 Annual Book of ASTM Standards, Part 7.



and qualification programs.

A2.2 The test has been used to a considerable extent for the purpose of comparing different materials or finishes. It should be noted that there is seldom a direct relation between salt spray (fog) resistance and resistance to corrosion in other media, because the chemistry of the reactions, including the formation of films and their protective value, frequently varies greatly with the precise conditions encountered. Informed personnel are aware of the erratic composition of basic alloys, the possibility of wide variations in quality and thickness of plated items produced on the same racks at the same time, and the consequent need for a mathematical determination of the number of specimens required to constitute an adequate sample for test purposes. In this connection it is well to point out that Method B 117 is not applicable to the study or testing of decorative chromium plate (nickel-chromium or copper-nickel-chromium) on steel or on zinc-base die castings or of cadmium plate on steel. For this purpose Methods B 287 and B 368 are available, which are also considered by some to be superior for comparison of chemically-treated aluminum

(chromated, phosphated, or anodized), although final conclusions regarding the validity of test results related to service experience have not been reached. Method B 117 is considered to be most useful in estimating the relative behavior of closely related materials in marine atmospheres, since it simulates the basic conditions with some acceleration due to either wetness or temperature or both.

A2.3 When a test is used for research, it may prove advantageous to operate with a different solution composition or concentration or at a different temperature. In all cases, however, it is desirable to control the temperature and humidity in the manner specified, and to make certain that the composition of the settled fog and that of the solution in the reservoir are substantially the same. Where differences develop, it is necessary to control conditions so that the characteristics of the settled fog meet the specified requirements for the atmosphere.

A2.4 Material specifications should always be written in terms of the standard requirements of the appropriate salt-spray method, thereby making it possible to test a variety of materials from different sources in the same equipment.

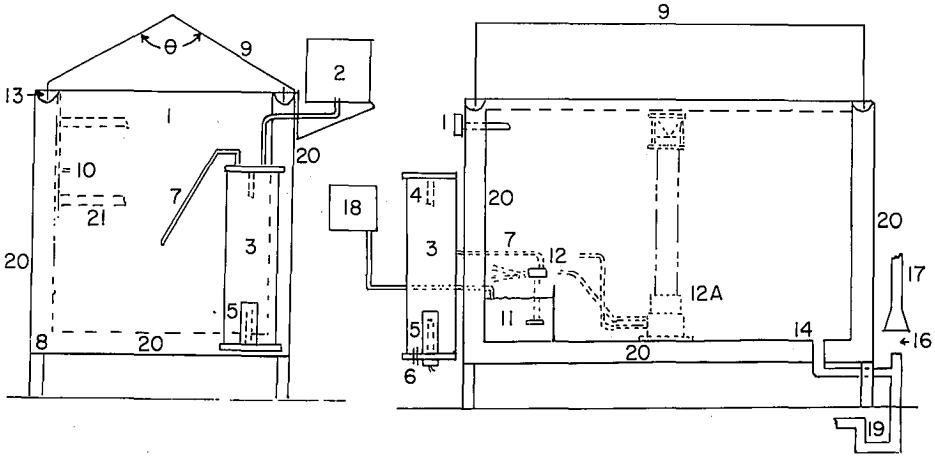
TABLE A1 Operating Characteristics of Typical Spray Nozzle

Siphon Height, in.	Air Flow, liters/min				Solution Consumption, ml/h			
	Air Pressure, psi				Air Pressure, psi			
	5	10	15	20	5	10	15	20
4	19	26.5	31.5	36	2100	3840	4584	5256
8	19	26.5	31.5	36	636	2760	3720	4320
12	19	26.5	31.5	36	0	1380	3000	3710
16	19	26.6	31.5	36	0	780	2124	2904

TABLE A2 Temperature and Pressure Requirements for Operation of Test at 95 F

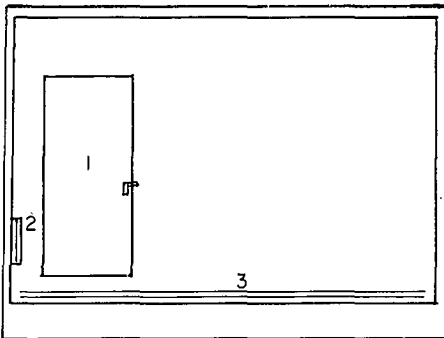
	Air Pressure, psi			
	12	14	16	18
Temperature, deg F	114	117	119	121
	Air Pressure, kN/m ²			
	83	96	110	124
Temperature, deg C	46	47	48	49

Siphon Height cm	Air Flow, dm ³ /min				Solution Consumption, cm ³ /h			
	Air Pressure, kN/m ²				Air Pressure, kN/m ²			
	34	69	103	138	34	69	103	138
10	19	26.5	31.5	36	2100	3840	4584	5256
20	19	26.5	31.5	36	636	2760	3720	4320
30	19	26.5	31.5	36	0	1380	3000	3710
40	19	26.6	31.5	36	0	780	2124	2904



- θ — Angle of lid, 90 to 125 deg
- 1 — Thermometer and thermostat for controlling heater (Item No. 8) in base
- 2 — Automatic water levelling device
- 3 — Humidifying tower
- 4 — Automatic temperature regulator for controlling heater (Item No. 5)
- 5 — Immersion heater, non-rusting
- 6 — Air inlet, multiple openings
- 7 — Air tube to spray nozzle
- 8 — Strip heater in base
- 9 — Hinged top, hydraulically operated, or counterbalanced
- 10 — Brackets for rods supporting specimens, or test table
- 11 — Internal reservoir
- 12 — Spray nozzle above reservoir, suitably designed, located, and baffled
- 12A — Spray nozzle housed in dispersion tower located preferably in center of cabinet
- 13 — Water Seal
- 14 — Combination drain and exhaust. Exhaust at opposite side of test space from spray nozzle (Item 12), but preferably in combination with drain, waste trap, and forced draft waste pipe (Items 16, 17, and 19).
- 16 — Complete separation between forced draft waste pipe (Item 17) and combination drain and exhaust (Items 14 and 19) to avoid undesirable suction or back pressure.
- 17 — Forced draft waste pipe.
- 18 — Automatic levelling device for reservoir
- 19 — Waste trap
- 20 — Air space or water jacket
- 21 — Test table or rack, well below roof area

FIG. A1 Typical Salt Spray Cabinet.



NOTE—The controls are the same, in general as for the laboratory cabinet (Fig. A1), but are sized to care for the larger cube. The chamber has the following features:

- (1) Heavy insulation,
- (2) Refrigeration door with drip rail, or pressure door with drip rail, inward-sloping sill,
- (3) Low-temperature auxiliary heater, and
- (4) Duck boards on floor, with floor sloped to combination drain and air exhaust.

FIG. A2 Walk-in Chamber, 1.5 by 2.4 m (5 by 8 ft) and Upward in Over-all Size.

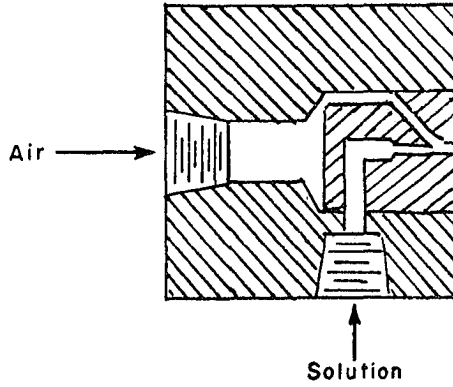


FIG. A3 Typical Spray Nozzle.

By publication of this standard no position is taken with respect to the validity of any patent rights in connection therewith, and the American Society for Testing and Materials does not undertake to insure anyone utilizing the standard against liability for infringement of any Letters Patent nor assume any such liability.



केन्द्रीय विद्युत अनुसंधान संस्थान

(भारत सरकार, विद्युत मंत्रालय)

प्रो.सर.सी.वी.रामन रोड, सदाशिवनगर डाक घर, पो.बा.सं.8066,
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CENTRAL POWER RESEARCH INSTITUTE

(Govt. of India, Ministry of Power)

Prof. Sir C.V. Raman Road, Sadashivanagar Post Office, P.B.No. 8066,

Bengaluru - 560 080, Karnataka, India

वेबसाइट website : www.cpri.res.in

सं./No. CPRIBLRHVDMISC24T0540

दिनांक / Date: 29 July 2024

सेवा में / To.

M/s. Genius Protection System Pvt Ltd.,
DCT- 601, DLF City Tower, Sikanderpur, Sec 25A,
Gurgaon. Haryana-122002.

विषय / Sub:- परीक्षण रिपोर्ट / Test Report

महोदय / Dear Sir(s).

आपके दिनांक 25 June 2024 के अनुरोध पर रिपोर्ट सं. CPRIBLRHVDMISC24T0540 दिनांक 29 July 2024 इसके साथ सलग्न है।

With Reference to your request dated 25 June 2024 we are enclosing herewith report No./S CPRIBLRHVDMISC24T0540 dated 29 July 2024.

कृपया प्रावती भेजें / Kindly acknowledge the receipt of the same

कृपया ध्यान दें कि संलग्न परीक्षण रिपोर्ट में विषमताएँ / विसंगतियाँ, यदि कोई पाई गई तो इस पत्र की प्राप्ति के 45 दिनों के अंदर सीपीआरआई के ध्यान में लाएँ।

Please note that anomalies/discrepancies in the test report enclosed, if any, shall be brought to the notice of CPRI within 45 days of receipt of this letter.

साथ ही कृपया ध्यान दें कि इस पत्र के जारी दिनांक से 15 दिनों के भीतर परीक्षण के लिए लाए गए नमूने तथा उनके साथ लाई गई अतिरिक्त सामग्री उच्च वोल्टता प्रयोगशाला के परिसर से हटा दी जाएगी। उपरोक्त अवधि के बाद किसी भी दावे पर विचार नहीं किया जाएगा तथा कुछ और दिनों के लिए नमूनों को रखने के लिए इस अवधि के अंदर कोई लिखित अनुरोध की अनुपलब्धि पर सीपीआरआई के मानकों के अनुसार नमूनों का निपटारा किया जाएगा।

Also, please note that the samples and any additional material brought along with them for the testing shall be removed from the High Voltage Laboratory premises within 15 days from the date of issue of this letter. No claims will be entertained after the above period and samples will be disposed off as per CPRI norms, unless written request is received within this period for retaining the samples for a few more days.

भविष्य में भी हमारी सर्वोत्तम सेवाओं के आश्वासन तथा धन्यवाद के साथ।

Thanking you and assuring you of the best of our services in the future also.

भवदीय / Yours faithfully,

(जी. पांडियन)

(G PANDIAN)

संयुक्त निदेशक एवं प्रभागीय प्रधान / JOINT DIRECTOR & HOD

उच्च वोल्टता प्रभाग / HIGH VOLTAGE DIVISION

CPRI

TEST REPORT



Central Power Research Institute

(A Govt. of India Society)
P.B. No. 8066, Sadashivanagar P.O.,
Prof. Sir. C.V. Raman Road,
Bangalore - 560 080

CENTRAL POWER RESEARCH INSTITUTE
(Member of STL)
TEST REPORT



CPRI

Test Report Number : CPRI BLRHVDMISC24T0540 **Date:** 29 July 2024

Name and Address of the Customer : M/s. Genius Protection System Pvt Ltd.,
DCT- 601, DLF City Tower, Sikanderpur, Sec 25A,
Gurugram, Haryana-122002.
Ref. No.: Customer Request Form Dated: 25 June 2024.

Name and Address of the Manufacturer : M/s. ALLTEC GLOBAL.,
10420, Harris Oaks Blvd, Suite F, Charlotte,
NC 28269, USA.

Particulars of sample tested
Type : Nil.
Description of test sample : ALLTEC MAKE
MODEL TSP-60


Serial Number : Nil.
Number of samples tested : One.
Date(s) of Test(s) : 25 June 2024.
CPRI Sample code Number(s). : HVD24S0479.
Particulars of tests conducted : Lightning impulse current withstand test at 70kA (8/20 μ s).

Test in accordance with Standard/Specification : As per customer's request.
Sampling Plan : Not applicable.
Customer's Requirement : Refer sheet 3 of 4.
Deviations if any : Nil.


Name of the witnessing persons
Customers representative : Mr. Manish J, (Sales Manager),
Mr. Sreenath S, (BD Supervisor).

Other than customer's representatives : None.
Test subcontracted with address of the laboratory : None.

Documents constituting this report (in words)
Number of Sheets : Four.
Number of Oscillogram(s) : Ten.
Number of Graph(s) : Nil.
Number of Photograph(s) : Four.
Number of Test Circuit Diagram(s) : One.
Number of Drawing(s) : One.


(B. V. Nagachandra)
Test Engineer




(G. Pandian)
Head of Division
Reviewed and Authorized by

CENTRAL POWER RESEARCH INSTITUTE
(Member of STL)
TEST REPORT



Test Report Number: CPRIBLRHVDMISC24T0540

Date: 29 July 2024

SUMMARY OF TESTS CONDUCTED

1. Tests conducted : As per customer's request.
2. Rating for which tested : Lightning impulse currents (8/20 μ s)
Five '+ve impulses and Five '-ve impulses of 70kA.
3. Schedule of tests

Tests Conducted	Clause Numbers	Sheet
Lightning impulse current withstand test (8/20 μ s).	As per customer's request.	3 of 4

4. Oscillogram Numbers : As per Table 1 (Sheet 3 of 4).
5. Graph Numbers : Nil.
6. Photograph Numbers : P01, P02, P03 & P04.
7. Test Circuit Diagram Numbers. : TCD01.

Drawing Numbers

The manufacturer has guaranteed that the sample(s) submitted for the test(s) has been manufactured in accordance with the following drawings

Sl. No.	Drawing Number	Sheet Number	Revision Number
1	GPS/TSP/001	-	-

It is verified that this drawing(s) adequately represent the sample(s) tested. Verification of this drawing(s) by CPRI is limited to dimensional check only wherever possible.

(B. V. Nagachandra)
Test Engineer

CENTRAL POWER RESEARCH INSTITUTE
(Member of STL)
TEST REPORT



Test Report Number: CPRIBLRHVDMISC24T0540

Date: 29 July 2024

TEST RESULTS

TEST PROCEDURE

Five positive and Five negative lightning impulse current shots of 8/20 μ s ($T_1 = 7-9\mu$ s & $T_2 = 18-22\mu$ s) wave shape with a magnitude of 70kA ($\pm 10\%$ tolerance) respectively. The current is injected through the tip of the sample by maintaining a small air gap between tip of the sample & the current input terminal and the bottom of the sample should be grounded. The sample should be checked for any external physical deformation after the test. The test was conducted as per the above procedure and the results are tabulated below.

Table 1: Lightning Impulse Current Withstand Test (8/20 μ s).


Shot No.	Polarity	Current Applied (kA)	Osc. No
1	+Ve	69.2	26038
2		70.0	26039
3		70.0	26040
4		70.0	26041
5		70.0	26042
6	-Ve	69.2	26043
7		69.1	26044
8		69.4	26045
9		69.8	26046
10		69.9	26047

OBSERVATIONS: The sample is subjected to ten lightning impulses at 70kA as per customer request. The sample has **WITHSTOOD** the test as per customer's requirement, since there is no external physical deformation observed on the sample after the test.

Ambient conditions during the above tests.

Temperature in Degree Celsius			Atmospheric Pressure
Date	Dry Bulb	Wet Bulb	in mm of Hg.
25-06-2024	28.0	25.0	681.0

CONCLUSION: The sample tested complies with the requirement of customer for the test conducted.


(B. V. Nagachandra)
Test Engineer

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TEST REPORT

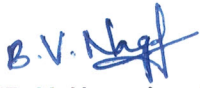


Test Report Number: CPRI BLRHVDMISC24T0540

Date: 29 July 2024

NOTE

- The Test results relate only to the sample(s) tested.
- Publication or reproduction of this Test Report /Test Certificate in any form other than by complete set of the whole Test Report /Test Certificate and in the language written is not permitted without the written consent of CPRI.
- Any Corrections/erasure invalidates the Test Report/Test Certificate
- Any anomaly/discrepancy in the Test Report / Test Certificate should be brought to the notice of CPRI within 45 days from the date of issue.
- All documents constituting the Test Report/Test Certificate are stitched together with a continuous silk thread/silk ribbon, the two ends of which have been brought over the front sheet of the Test Report/Test Certificate and sealed with a CPRI logo printer paper sticker/embossed.


(B. V. Nagachandra)
Test Engineer

-----End of Test Report-----

CENTRAL POWER RESEARCH INSTITUTE
(Member of STL)
TEST REPORT



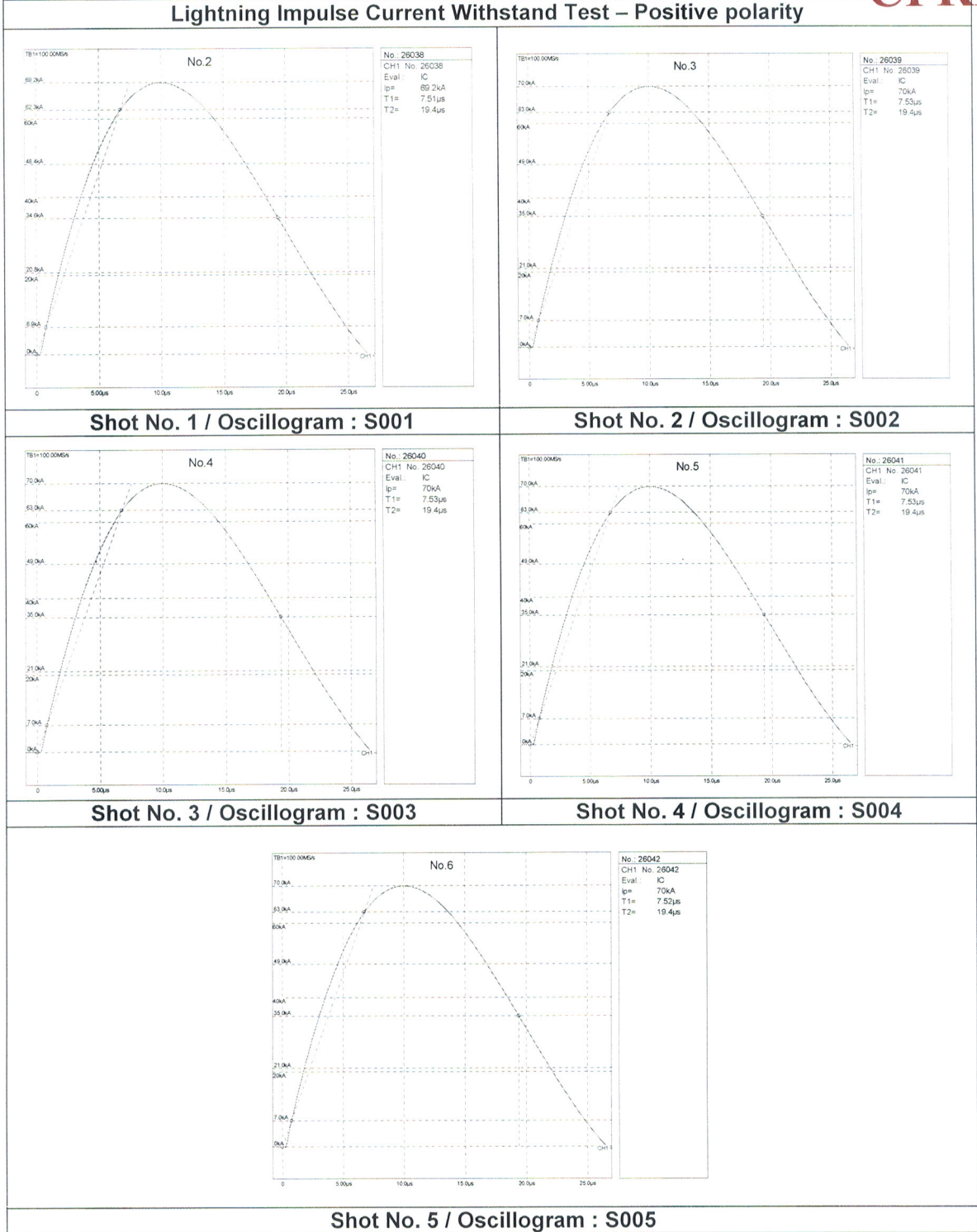
Test Report Number: CPRIBLRHVDMISC24T0540

Date: 29 July 2024

TEST RESULTS

CPRI

Lightning Impulse Current Withstand Test – Positive polarity



B.V. Nagf
(B. V. Nagachandra)
Test Engineer

CENTRAL POWER RESEARCH INSTITUTE
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TEST REPORT



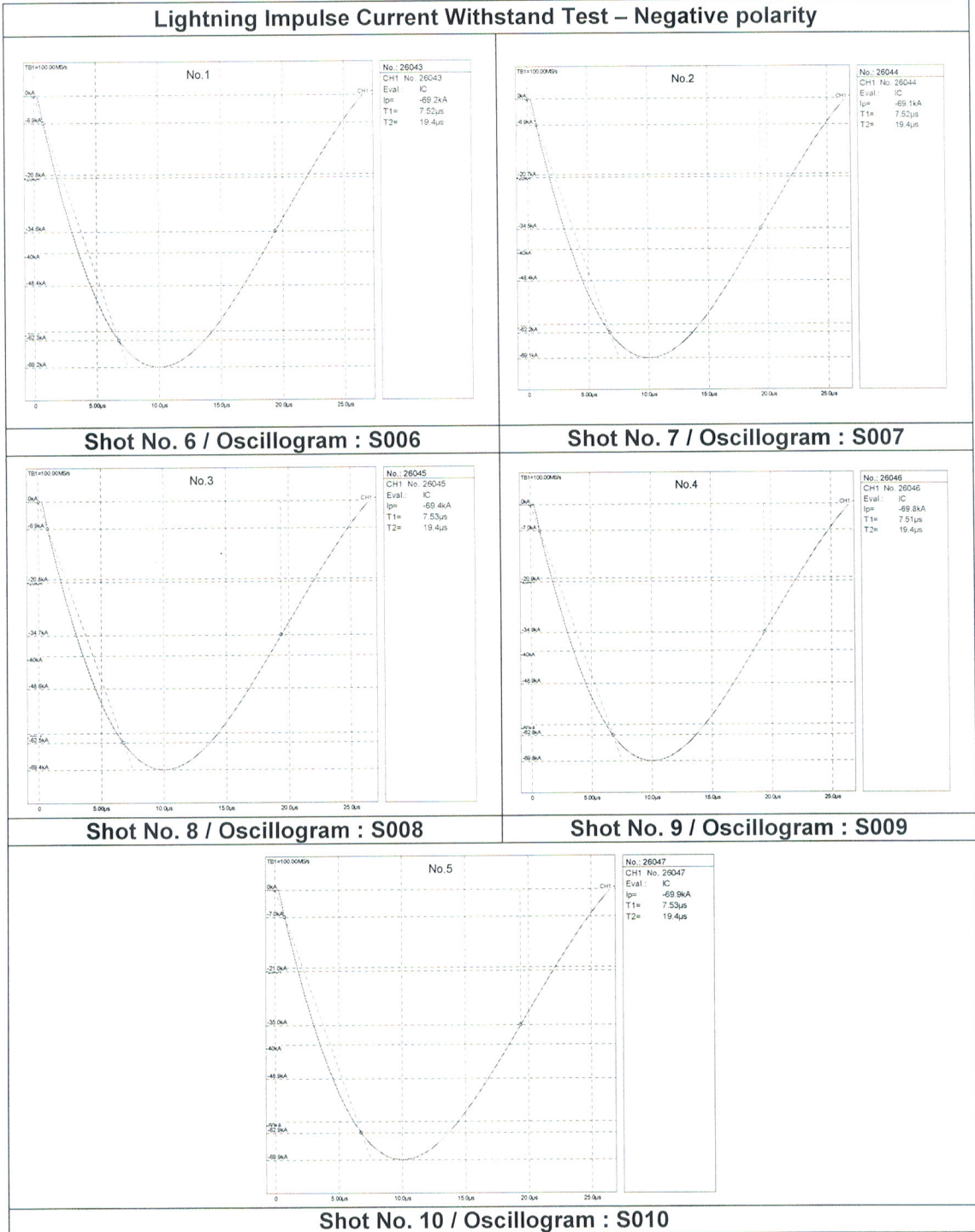
Test Report Number: CPRI BLRHVDMISC24T0540

Date: 29 July 2024

CPRI

TEST RESULTS

Lightning Impulse Current Withstand Test – Negative polarity



B.V. Nag
(B. V. Nagachandra)
Test Engineer

CENTRAL POWER RESEARCH INSTITUTE
(Member of STL)
TEST REPORT



CPRI

Test Report Number: CPRI BLRHVDMISC24T0540

Date: 29 July 2024

TEST RESULTS

 <p>25 Jun 2024 5:18:11 pm</p>	 <p>25 Jun 2024 4:29:53 pm</p>	
	Photograph Number: P02	
 <p>25 Jun 2024 4:28:24 pm</p>	 <p>25 Jun 2024 5:18:33 pm</p>	Tip before the test
		Tip after the test
Photograph Number: P01 (After the test)	Photograph Number: P03	Photograph Number: P04

B.V. Nagf
(B. V. Nagachandra)
Test Engineer

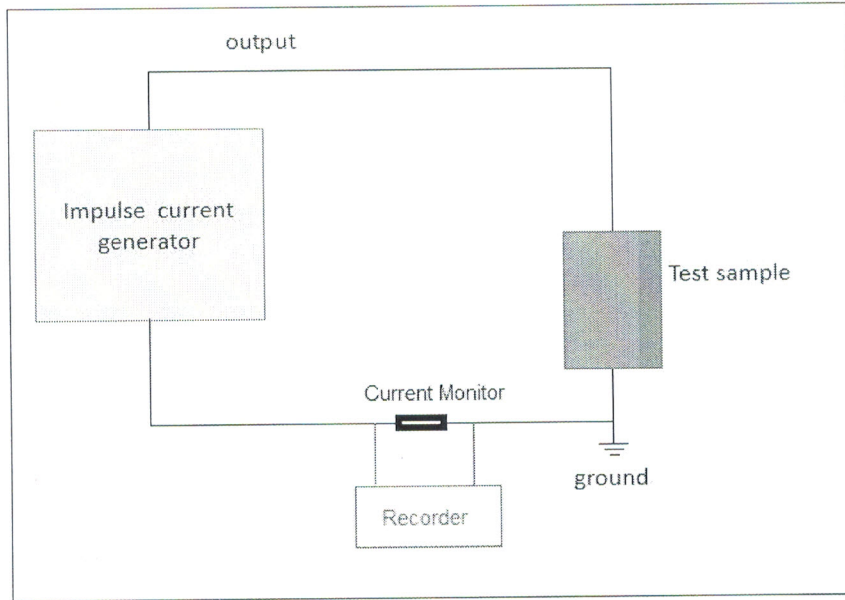
CENTRAL POWER RESEARCH INSTITUTE
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TEST REPORT



CPRI

Test Report Number: CPRI BLRHVDMISC24T0540

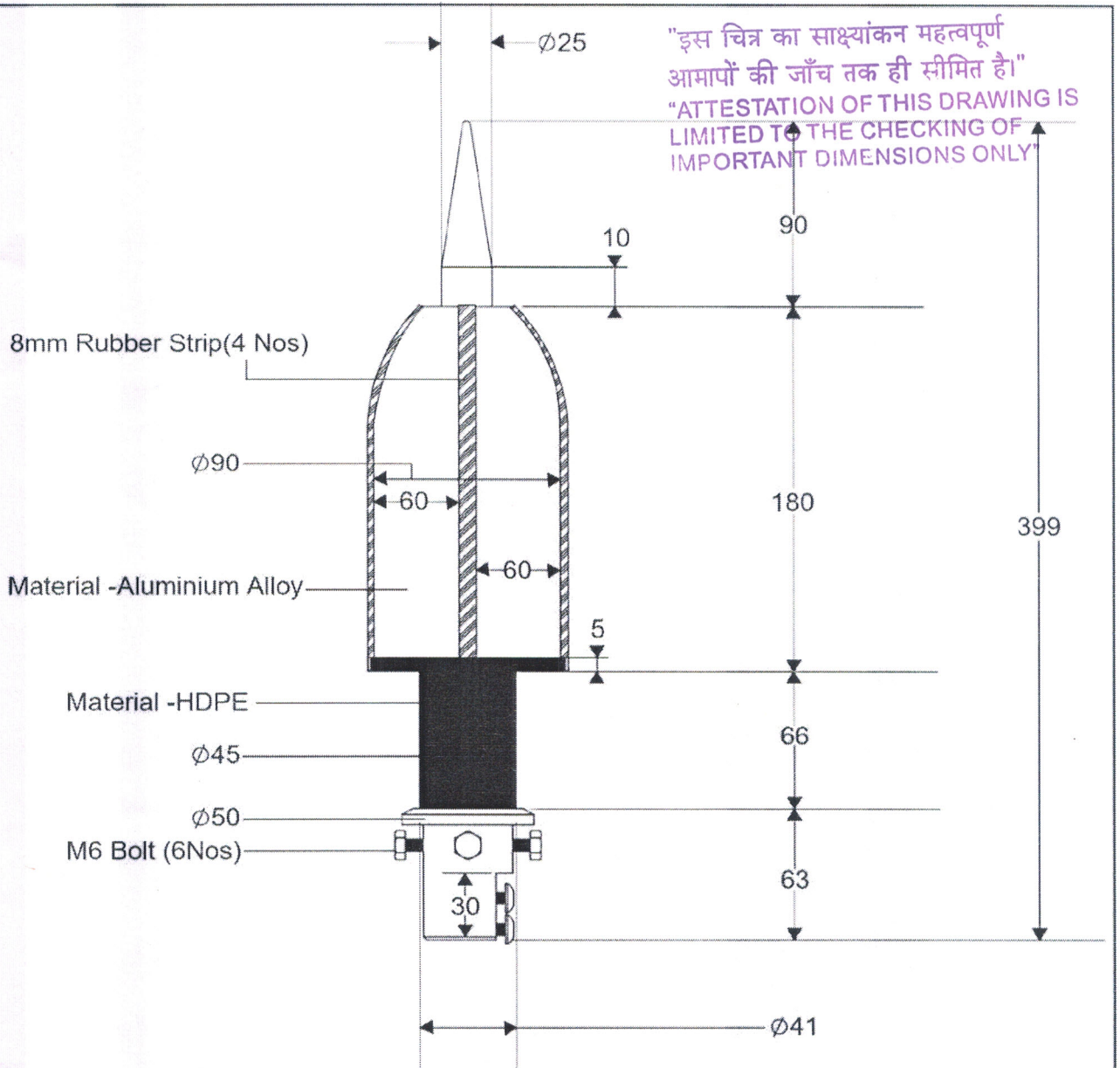
Date: 29 July 2024



Test Circuit Diagram Number: TCD01.

B.V. Nagf
(B. V. Nagachandra)
Test Engineer

"इस चित्र का साक्ष्यांकन महत्वपूर्ण
आमापों की जाँच तक ही सीमित है।"
"ATTESTATION OF THIS DRAWING IS
LIMITED TO THE CHECKING OF
IMPORTANT DIMENSIONS ONLY"



इस रेखाचित्र परीक्षण दस्तावेज

सं. सीपीआरआईवीएलआरएचवीडीएमआईएससी24टी.....से संबंधित है।

THIS DRAWING PERTAINS TO TEST REPORT

No. CPRIBLRHVDMISC24T.0540.

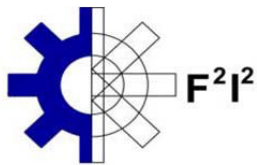
Date 29 July 2024.

B.V. Nagl

परीक्षण अभियंता / TEST ENGINEER
उच्च वोल्टता प्रभाग / HIGH VOLTAGE DIVISION
सी पी आर आई / CPRI
बेंगलूर / BANGALORE - 560 080

Note: All Dimensions are in MM
Dimension Tolerance :+/- 5%

Drawn By: Sandeep Date: 28.06.24	Title: ALLTEC MAKE Model - TSP- 60
Checked By: Mr. Manish Singh Date: 28.06.2024	Manufactured By: ALLTEC GLOBAL 10420 Harris Oaks Blvd, Suite F Charlotte NC28269, USA
Approved By: Mr. Manish Singh Date: 28.06.2024	
Drawing No : GPS/TSP/001 Submitted by: Genius Protection System P Ltd DCT-601, DLF City Tower Sikanderpur, Sector 25-A, GURUGRAM, HR - 122002	



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UPM Technological Center – Tecnogetafe
C/ Eric Kandel, 1 – 28906 Getafe (Madrid)
Telephone: +34 91 491 81 68
www.f2i2.net

TEST REPORT

2019 10 3F 0499-M

TESTED DEVICE	TerraStreamer (TSP) Lightning E.S.E. (Early Streamer Emission Lightning Conductor)
REQUESTED BY	ALLTEC. 64 Catalyst Drive, Canton, North Carolina, 28716, USA.
APPLIED STANDARDS	NFC 17-102 September 2011 Standard UNE 21186:2011, Article C.3.4 150 kA 10/350 μ s.
Beginning of tests date	28/10/2019
End of tests date	28/10/2019

This test report consists of pages 7 and 2 appendixes

Authorized signatory

Date of issue: 12th November, 2019

2019.11.1
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Mr. Abderrahim Khamlichi
Technical Responsible of HV Testing

Tested by: Mr. Juan Pablo Vega
HV Test Technician

CONDITIONS OF VALIDITY FOR THIS DOCUMENT:

The results of the tests refer exclusively to the sample which was tested.

The above mentioned sample is described in this report. If any modification of the sample has been made after it has been received, the details will also be given in the report and further documented in LCOE files.

Partial reproduction of this document is prohibited

This report will be considered void if it is altered in any way without prior authorization.

A. GENERAL DESCRIPTION

1. TESTED MATERIAL
 - 1.1. Marking
 - 1.2. Specimen description
2. TYPE OF TESTS
 - 2.1 Lightning impulse current withstand test:
150 kA of 10/350 μ s waveform
3. APPLIED STANDARDS
4. GENERAL DETAILS
 - 4.1 Ambient conditions.
5. MEASUREMENT UNCERTAINTY

1. TESTED MATERIAL

One (1) TerraStreamer (TSP) E.S.E. (Early Streamer Emission Lightning Conductor) was supplied to LCOE by ALLTEC.

Test date: October 28th, 2019

1.1. Marking

Manufacturer: ALLTEC

Serial Numbers: s/n

1.2. Specimen description

The specimen, according to the customer, consists of one Early Streamer Emission Lightning Conductor.

2. TYPE OF TESTS

- 2.1 Lightning impulse current withstand test:
150 kA of 10/350 μ s waveform

$I_{peak} = 150 \text{ kA} \pm 10 \%$
 $W/R = 5625 \cdot \text{kJ}/\Omega \pm 35\%$
 $Q = 75 \text{ C} \pm 20 \%$
Duration < 10 ms.

3. APPLIED STANDARDS.

The test referred in section 2 has been made with applied current impulses waveforms, 150 kA of 10/350 μ s, according to NFC 17-102 September 2011 Standard and UNE 21186:2011, Article C.3.4.

4. GENERAL DETAILS

Tests were carried out at the L.C.O.E. facilities in Getafe, located in Diesel Street No 13, Industrial park El Lomo, 28906 Getafe, Madrid on October 28th, 2019.

Tests were performed by:

Juan Pablo VEGA
Ángel Ramírez

FFII –LCOE
FFII –LCOE

4.1 Ambient Conditions

Ambient conditions during the tests were:

Temperature: 25°C ±3°C
Humidity: 40% ±20%.

5. GENERAL DETAILS

The uncertainty of the test is calculated and at the disposal of the applicant.

B. TESTS

- I. TEST PROCEDURE
- II. TEST RESULTS

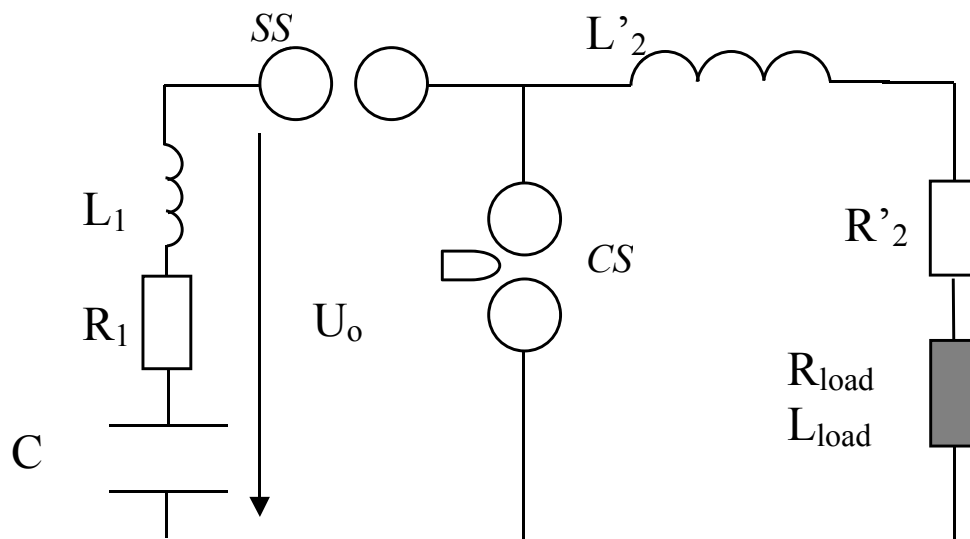
I. TEST PROCEDURE

I.1 INTRODUCTION

The purpose of the tests described in this report has been to test whether the tested sample has the ability to drain discharges of high current amplitude and high specific energy.

I.2 LIGHTNING TEST CURRENT GENERATION

It can be seen in figure 1 a schematic of the circuit generation for current impulses.



I.3 TEST PROCEDURE

The tested sample was subjected three times to a lightning impulse current of 150 kA of peak and 5625 kJ/ Ω of specific energy. Sufficient time was allowed between each applied impulse in order to enable the sample to cool down to ambient temperature.

II. TEST RESULTS

II.1. Tabulated results

Table 1. Tabulated results for the tests

Test	I_{peak} (kA)	W/R (kJ/Ω)	Q (C)	T₁ (μs)	Visual inspection
RJ28-02	147.3	5714	73.4	22.2	OK
RJ28-03	148.9	5921	76.0	22.2	OK
RJ28-04	148.4	5904	75.6	22.2	OK

II.2. Conclusions

The tested sample has successfully passed the test.

This test report was requested by Alltec and was issued in Madrid on 7th November, 2019.

Appendix I

To Test Report nº 2019 10 3F 0499

Photographs and current impulses waveforms

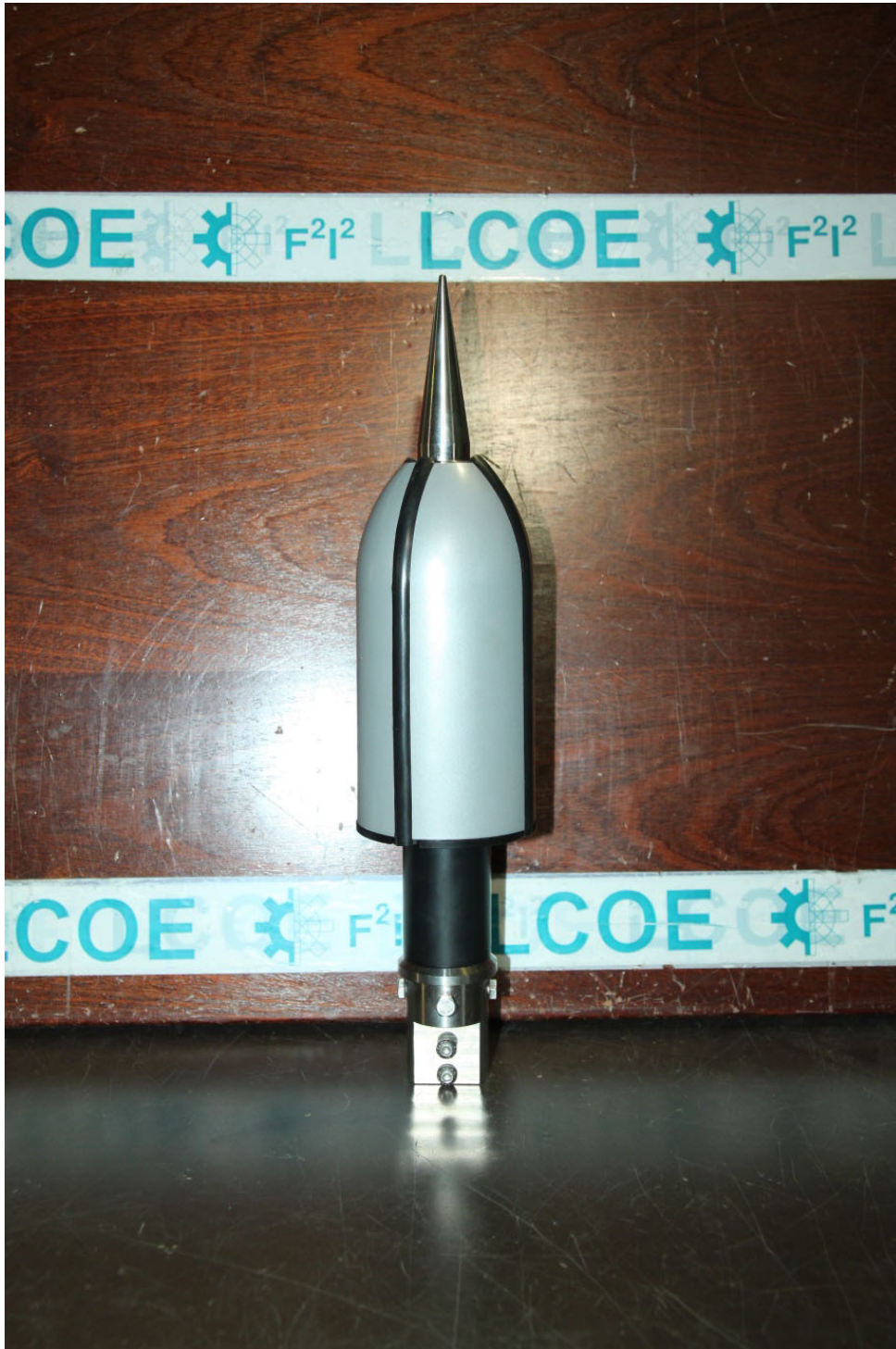


Figure 1. View of the specimen before the test.



Figure 2. Test rig.

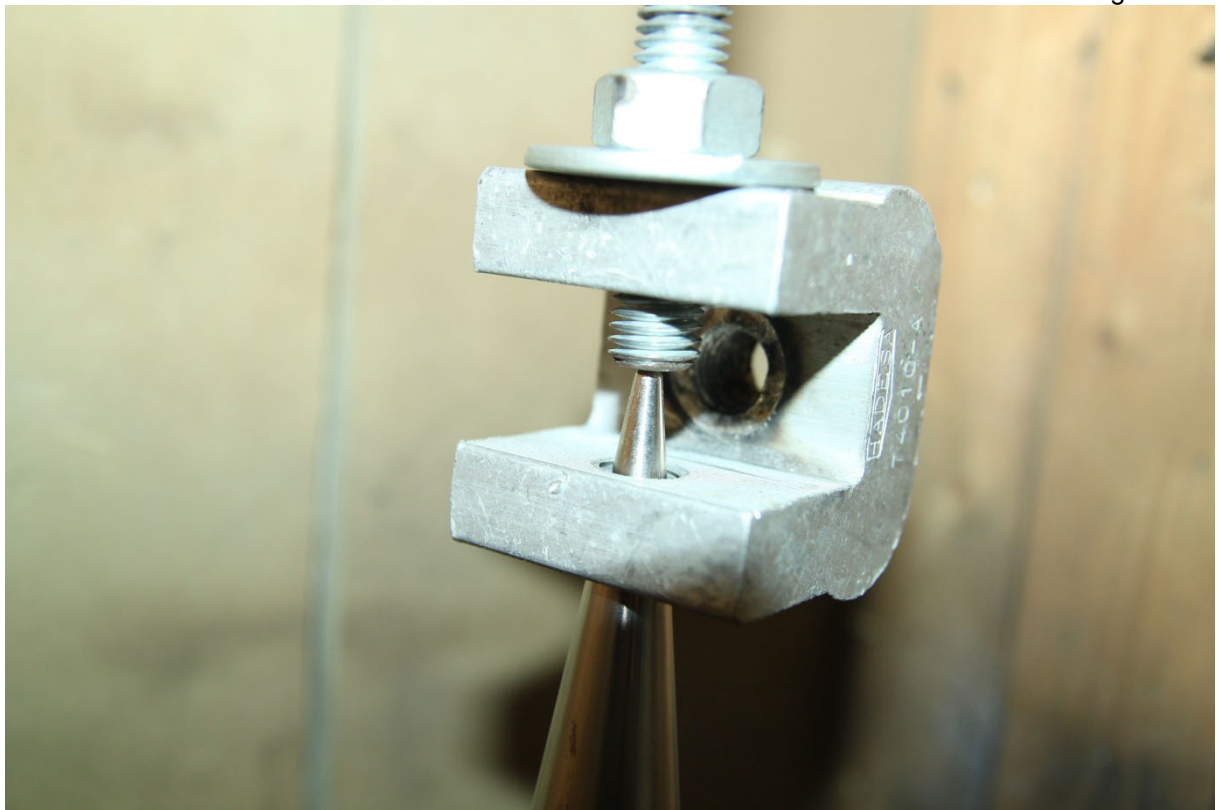


Figure 3. Detailed view of the test rig.



Figure 4. View of the specimen after the test.

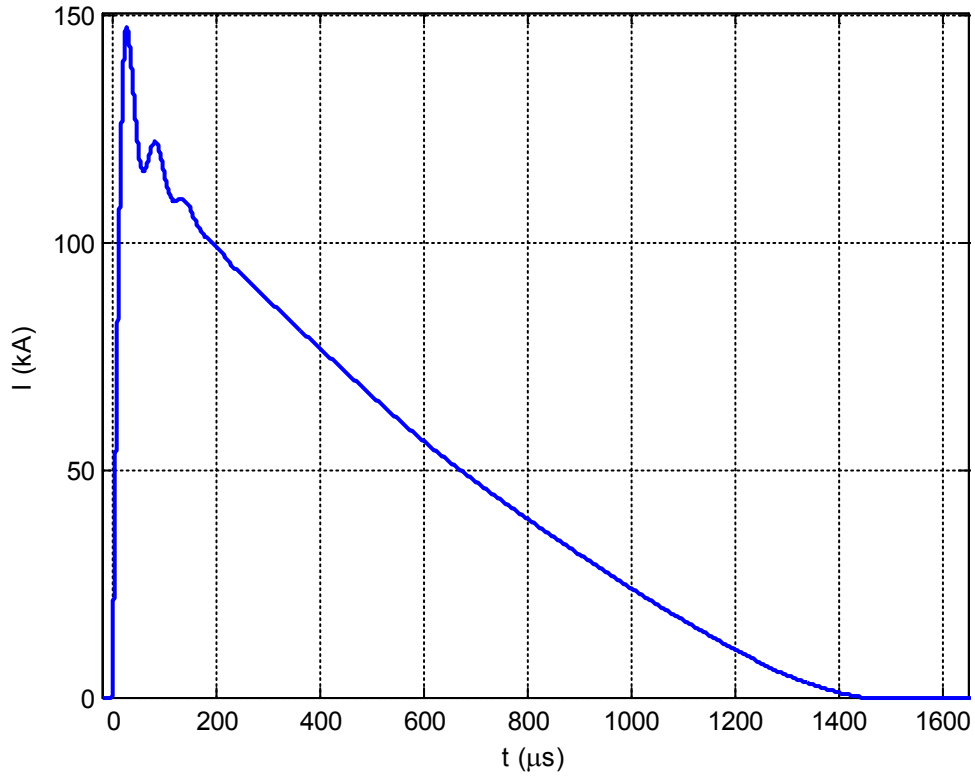


Figure 5. RJ28-02. Total Current Injected.

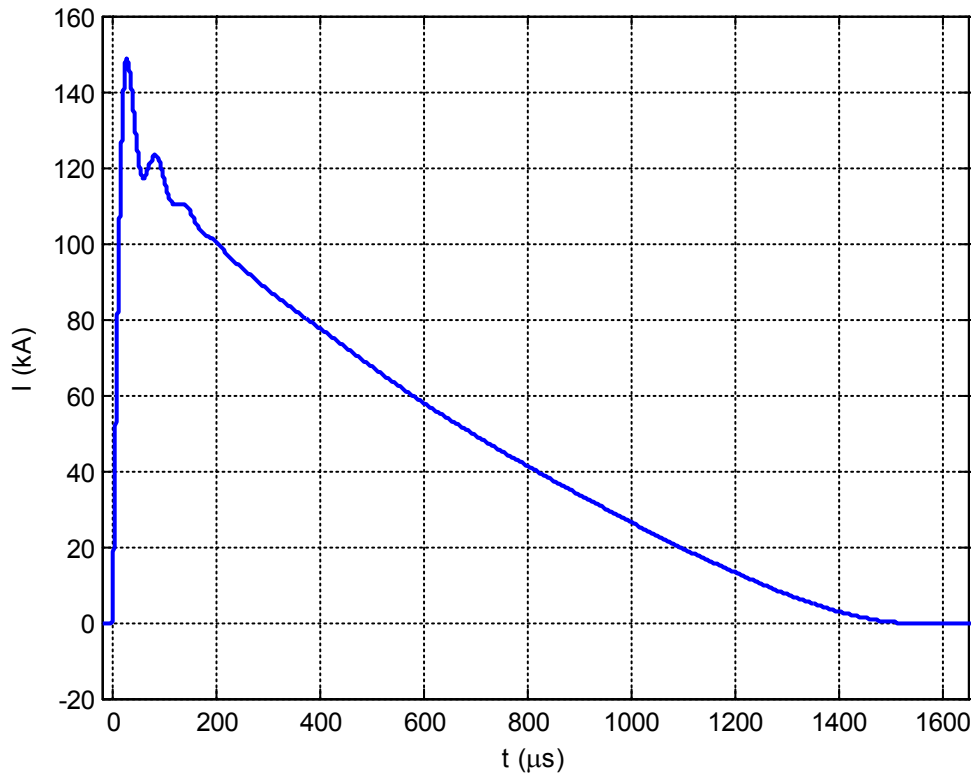


Figure 6. RJ28-03. Total Current Injected.

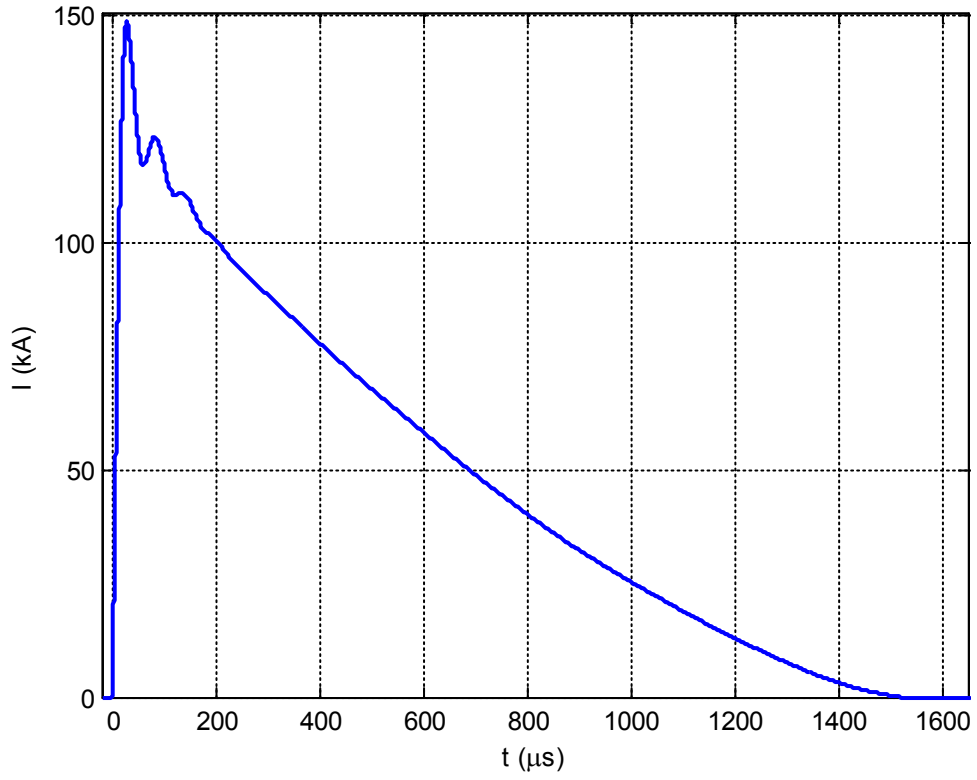


Figure 7. RJ28-04. Total Current Injected.

1. Test Facility

The component A and D waveforms were generated using a 52 μF capacitor bank charged up to 75 kV and a crowbar device. The output current waveform can be modified by varying the inductance and resistance in the generator and load circuit.

2. Measurement Systems and Calibration

Current Measuring System

Reference Number: III-4-IC-04

Acquisition:

Digital Storage Oscilloscope
Manufacturer: Yokogawa
Model: DL-750
Serial Number: 701210-F-J1-HE/C8
Reference number: III-1-OS-006

Measurement Software:

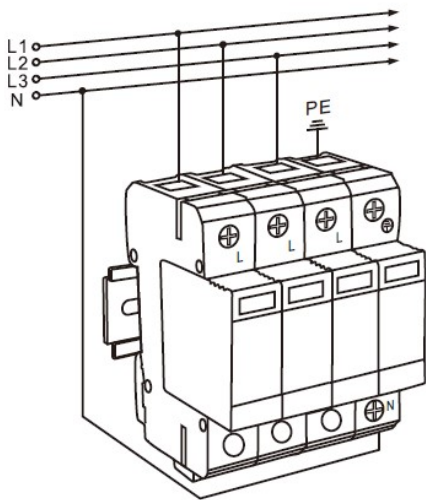
Reference number: III-1-SOFT-016
Ver. 1.0.3.

Last Calibration Date:

September 2019



AC SPD MODULE MODEL: **LSGBC50(2022)**



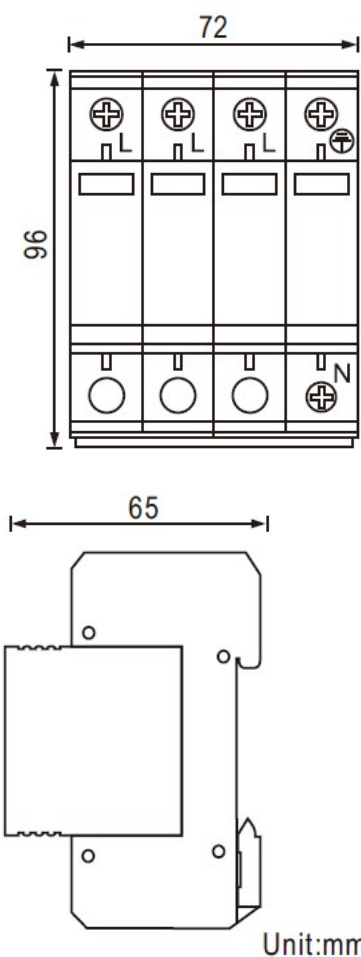
APPLICATIONS

- B+C class Surge Protective Device for AC Power System.
- Sensitive electronic equipment
- Telecom centers
- Automatic control centers
- Intelligent buildings
- Industrial enterprises
- Medical institutes

FEATURES:

- DIN rail mounting for easy installation
- Plug connectors for quick and easy connection or rewiring
- 50kA lightning impulse current Iimp
- Thermal disconnect device
- Status indicators visually verify protection level

TECHNICAL PARAMETER:



Model	LSGBC50-2022
Electrical Parameter	
Nominal working voltage Un	50/60Hz 220/380V,
Max. continuous operating voltage Uc	385V
Nominal discharge current (8/20μs) In	50kA
Lightning impulse current(10/350μs) Iimp	25kA
Protection level @20kA , 8/20μs Up	1500V
Response time tA	<25ns
Protection model	L1/L2/L3-N,N-PE
Mechanical characteristics	
Dimension	65 (H)×72 (W)×96(L)mm
Weight per unit	0.47KG
Mounting	35mm DIN rail
Connecting diameter	≥10mm ²
IP code	IP20
Working conditions	Temperature: -50 to 80°C , Relative humidity: ≤95%
Approval	FCC, CE, ROHS

LSGBCN100 Power Surge Protective Device

Product Manual

Introduction

1. Standard : IEC 61643-11:2011 Low Voltage Surge Protective Devices (SPD) Part 11: Performance requirements and test methods for surge protective devices for low-voltage power supply systems.
2. Features : surge protective device has over-voltage protection, over-current protection, over-heat protection, fault indication, and remote signal alarm function. The product has good sealing, dust-proof, flame-retardant functions, and can work stably for a long time in harsh environments .
3. Application Scope: AC power line protection for low-voltage power supply systems and lightning surge protection for power equipment.
4. Working Environment: Installed indoors; the temperature is $-5^{\circ}\text{C} \sim +40^{\circ}\text{C}$, the humidity is $5\% \sim 95\%$; the air pressure is between $80 \text{ kPa} \sim 106 \text{ kPa}$, the corresponding altitude is $+2000\text{m} \sim -500\text{m}$.

Technical Parameters

Table 1: Specification Parameter Table of Power Surge Protective Device

parameter Model	Maximum Continuous Operating Voltage U_c	Nominal Discharge Current I_n (kA)	Maximum Discharge Current I_{max} (kA)	Voltage Protection Level U_p (kV)	Protection Mode	L1×W×H (mm) 1P
LSGBCN100	275V AC	60	100	2.5	1. L-PE N-PE 2. L-N-PE	91*27*66

Mark: 1P means 1 module, when the protection mode is 1, the product has a combination of 1P, 2P, 3P, 4P, when the protection mode is 2, the product is a 3+1 combination; when the nP module is combined, the width is 1P width×n, length And the height does not change.

Installation Parameters

1. All levels of surge protective device for power lines should be installed at the entrance of the line into the building, the interface of the lightning protection zone and near the protected equipment.
2. The phase wire of the surge protective device should be connected by copper wire with a cross-sectional area $\geq 6\text{mm}^2$, and the grounding wire should be connected by a copper wire with a cross-sectional area $\geq 10\text{mm}^2$. The connecting wire should be as short, straight and neat as possible, and its length should not exceed 0.5m, and the grounding resistance should be less than 10Ω .
3. The bend angle of the grounding wire and the surge protective device connection wire should be greater than 90 degrees when turning, and the bend radius should be greater than 10 times the diameter of the wire. It is forbidden to make a loop when the connection wire is installed.
4. The wiring method for protection mode L-PE, N-PE (take 4P as an example) is shown in Figure 1, and the wiring method for protection mode LN-PE (take 3+1 as an example) is shown in Figure 2; the product has a remote monitoring and alarm function , the wiring method is shown in Figure 3 , and the product appearance size diagram is shown in Figure 4; the appearance of all products involved in the diagrams shall prevail in kind!

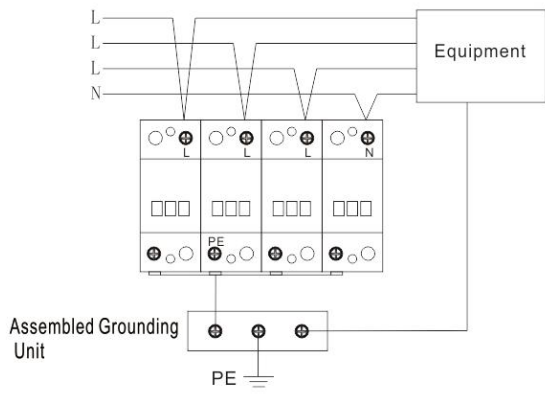


Figure 1: L-PE N-PE protection mode (4P) wiring diagram

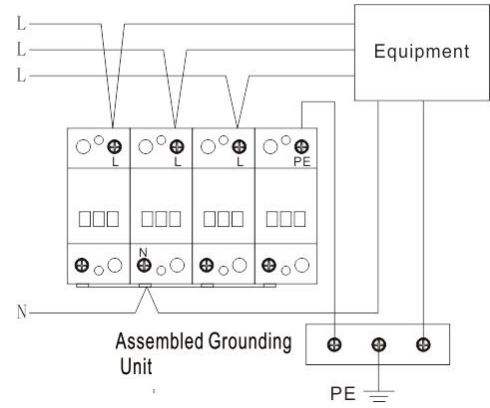
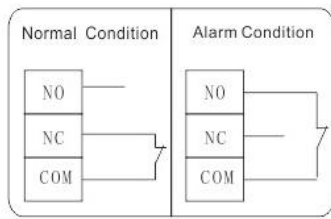
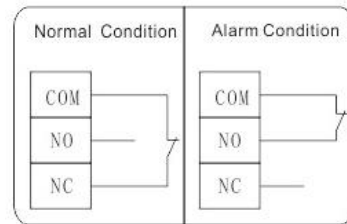


Figure 2: L-N-PE protection mode (3+1) wiring diagram



Mode 1



Mode 2

Figure 3: Schematic diagram of remote alarm status as mode 1, where DK-50G is as mode 2.

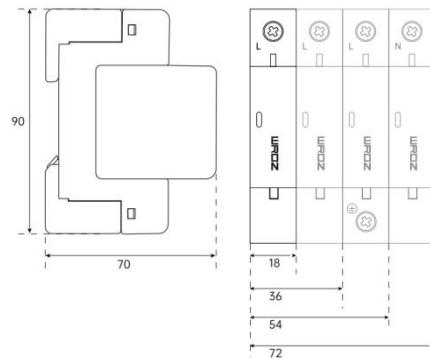


Figure 4: Schematic diagram of product size

Maintenance

For modules with an indicator window, when the module is damaged, the indicator window turns red. For modules without an indicator window, determine whether the module is damaged according to the status indication of the remote alarm terminal. See Figure 3 for details. If the module is damaged, remove the damaged module and replace it with a new one.

Lightning Strike Counter User Manual

I .Introduction

Lightning strike counter is a universal counter. When the lightning protection circuit system is normal, no current flows on the discharge line, and the lightning strike counter does not count; when lightning current discharge occurs in the line, the lightning protection circuit discharges lightning current to the ground, and there is current on the discharge line. When it flows through, the counter is coupled to the induced voltage, causing the counter to count.

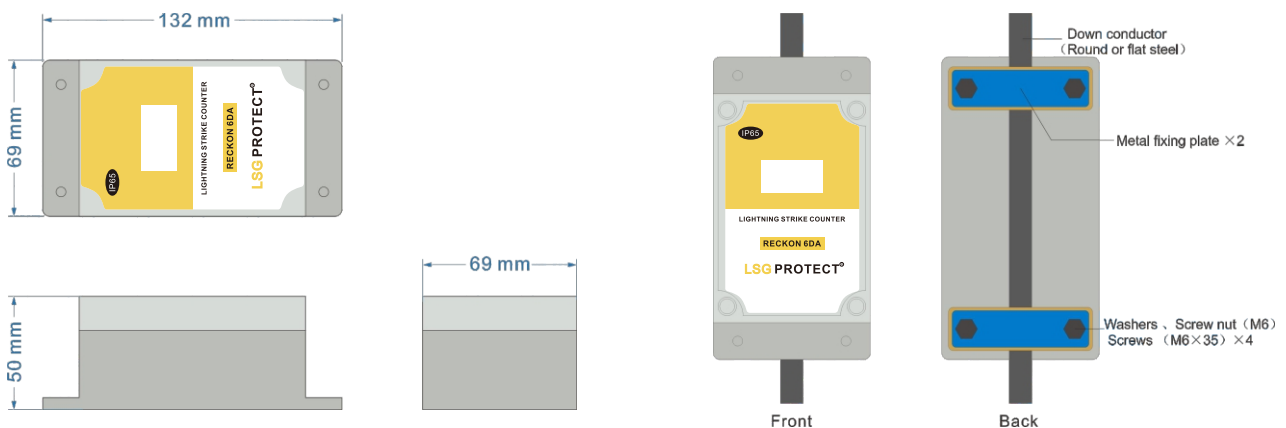
Lightning strike counter is suitable for all SPDs, lightning rods, etc. It can sense and discharge lightning current, and the cumulative number of lightning strikes is displayed on the counter. The product counts accurately and does not malfunction; it works without power supply, the counting value will not be lost for a long time, and cannot be reset to zero; it has dust-proof, waterproof and other functions.

II .Technical Parameters

1. Nominal Discharge Current I_n (8/20 μ s): 4kA ~ 150kA;
2. Impulse Discharge Current I_{imp} (10/350 μ s): 4kA ~ 50kA;
3. Maximum Diameter of Down Conductor $D \leq 20$ mm, Maximum Width of Flat Steel < 35mm, Thickness < 12mm;
4. Counting Number: 0-999999;
5. Protection Level: IP65;
6. L×W×H (mm) : 132×69×50, as below,
7. Working Temperature: -40°C ~ +85°C.

III. Installation

1. This product can be installed on the power SPD ground wire or lightning rod down wire using the matching screw and fixed metal sheet.
2. The power supply SPD ground wire or lightning rod down wire should be close to the plastic shell to avoid affecting the accuracy of counting.
3. After a thunderstorm, pay attention to check the counter value.



Product Installation Diagram

IV. Maintenance

This product works without power supply, requires no special maintenance, and is durable for a long time.

MODEL: EQB50
Equipotential connector manual

1) summarize

In order to prevent the difference in electric potential between various ground device, it is easy to strike back during lightning strikes, and equal potential connectors should be used.

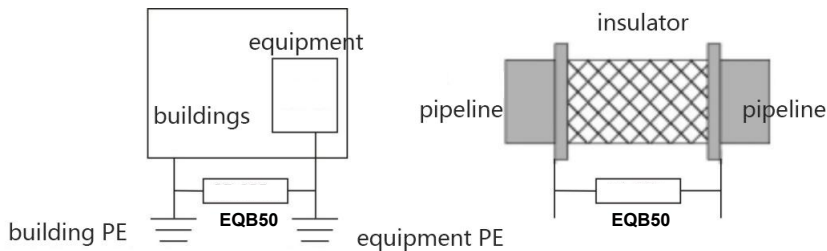
Equipotential connectors provide equipotential connections for non-charged metal part haven't connected to earth poles. The product can be used for equipotential protection between two close independent earth poles, insulation protection of insulation flanges, and metal devices that may exceed the voltage of 1kV or more in the ground network to prevent the risk of air discharge when lightning strikes. It can also be used for the oil (gas) pipelines which with cathodic corrosion protection function, which can prevent the danger of air discharge between metal pipelines and the earth pole. The interior of the equipotential connector is composed of two electrodes with a certain distance, and if a lightning strike occurs, gas discharge will occur in the insulated cavity due to the action of over voltage, so that the original isolation between the two electrodes will be transformed into a temporary electrical connection state, thereby eliminating the potential difference.

2) technical parameter

type	EQB50	EQB100
Lightning pulse current	50ka	100ka
Lightning pulse protection voltage	1.5kv	
Response time	100ns	
size	Φ 36*90	
Connector	10mm Stainless steel screw	
Protection class	IP66	

3) installation instructions

Equipotential connectors are installed between two different ground bodies and are secured by nuts and copper connectors. Cables should be connected using multi-strand copper conductors with a cross-sectional area of $\geq 25\text{mm}^2$. The cables should be short, straight, and neat. Wiring diagram as P1 P2.

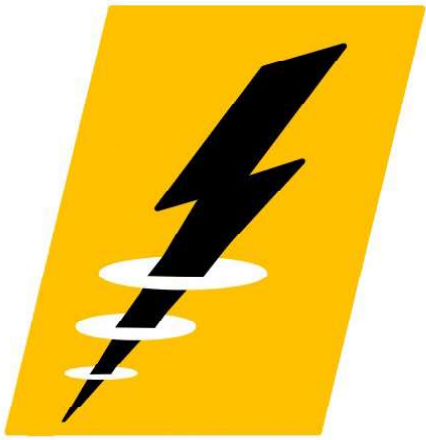


P1 Industrial/civil buildings and electrical equipment Installation wiring diagrams

P2 Oil and natural gas pipeline installation wiring diagram

4) maintenance

The equipotential connector need tested at least once a year, or at any time as needed.



LSG PROTECT[®]

KNIT WELD

EXOTHERMIC WELDING

APPROVED BY

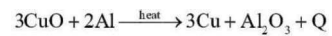


KNITWELD EXOTHERMIC WELD

Product Introduction:

LSG PROTECT Weld Exothermic Welding is a simple, efficient, high quality metal connection method Exothermic welding by aluminothermic reaction generated by high temperature to make metal molten completely, to achieve high quality welding effect. This reaction is conducted in the graphite mold of high temperature resistance, normally a graphite could be used for more than 70 points. Exothermic reaction process takes few seconds only.

Reaction Formula:



LSG PROTECT exothermic welding product was certified by U L, RoHS, C E and compliance with IEEE Std.80, UL467 and IEEE537. It has the national invention patent ZL200410021807X.



LSG PROTECT Weld has stable ignition point, good conductivity and corrosion protection and excellent tensile strength. After improved process, the connector is more bright and clean.

Product Features:

1. Safe and easy to operate.
2. No external power or heat source required, convenient to carry.
3. High purity copper connector, corrosion protected.
4. Connected in metallic bond style, fasten and tough.
5. The current-carrying ability of the connector is better than the conductor.
6. Widely application between copper and copper, copper and steel and cast or plated steel tape.
7. Non-degenerated suffering from several surge strike.

Product Application:

1. Horizontal connection of the grounding grid
2. The connection between cathode protection cable and oil or gas pipeline.
3. Connection between grounding cable and steel rail.
4. Cables and bars's
5. Leading wires and copper lugs
6. Other electrical connections.

Grid Connection



KNITWELD WELDING PROCEDURE: - EXOTHERMIC WELD



Note:

1. Before welding, check the mold clamp and adjust properly to make sure it close tightly.
2. Don't observe the welding process, it will hurt your eyes.
3. Don't touch the conductor and the joint after welding to avoid empyrosis.
4. Keep the weld metal in a dry place, don't operate when blowing



Step1:
Before the first welding, heat the mould for 3-5 minutes to make sure it is dry and clean



Step 2:
Heating the conductor to make sure it is dry and



Site 3:
Clean the conductor by steel brush.



Step 4:
Place and fix the conductors into the reaction cavity, put the starting powder on the top of welding powder while some on the lip of the mould.



Step 5:
Place the steel plate at the bottom of



Step 6:
Pour the welding powder into the reaction cavity. Put the starting powder in the top of welding powder while some on the lip of the mould.



Step 7:
Close the lid and ignite the starting powder with lighting gun



Step 8:
After the reaction, wait for 2-3 minutes, Open the mould and clean the welding residue.



The E-Plus exothermic welding electrical connections product is the third generation of **KNITWELD** weld product series, compared with the traditional electronic ignition exothermic welding products, E-Plus type exothermic welding focus on permanent bond with convenient and safer operation.

IV

Features:

I Technical Standards

Conform to IEEE 80, IEEE 837, UL467;

II Product Safety

- (A) Completes welds at distances, avoid burns during the exothermic reaction.
- (B) No external power or heat source required, easy to handle, store and transport by air, land or sea in short period.

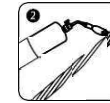
III Comfort Operation

- (A) Shorten the operating time. Operate in three steps- put the welding cup into the mold, connect the electrical quick connector and then start the switch button.
- (B) Environmental friendly, the metal cup melted into the welded joints after exothermic welding reaction.
- (C) E-Plus ensure easy ignition and high ignition rate.
- (D) Electronic Starter. Electronic Starter design by our company, handheld device matching the cup body starting device. Exothermic welding Electronic Starter initiates the reaction in 3 seconds;



Step 1:

Before making your first connection, be sure to dry the mold by heating it with a torch. Make sure that both the crucible, tap and wire cavities are also dried.



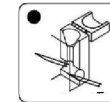
Step 2:

Dry the conductors to be welded with a torch.



Step 3:

Clean the dried conductor ends with a wire brush to remove any dirt and oxides. When welding to a steel surface, use a rasp or grinding wheel to remove any rustproofing, paint, or oxidation from the area to be welded. Steel surface must be cleaned to bright shiny metal.



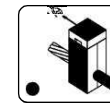
Step 4:

Position the mold over the conductors with the conductor ends under the center of the tap hole. Lock mold handles.



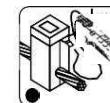
Step 5:

Insert the E-Plus Cup into the mold.



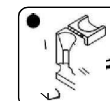
Step 6:

Connect the quick connector between the Electronic Starter and the cup.



Step 7:

Press and hold Electronic Starter switch and wait for the ignition.



Step 8:

Wait approximately 10-15 seconds. Open the mold and remove the finished connection. Remove any remaining slag with a mold cleaning tool. Brush off remaining residue with a natural bristle brush. DO NOT use a wire brush, doing so will damage the mold.

Selection Graphic



Weld metal size

Each joint requires one shot of weld metal



Mold number

Each mold can weld more than 70 connections on average



Handle clamp

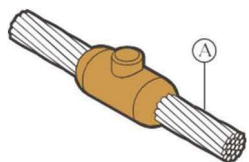
Determined according to construction volume and mold size



Sleeves used in construction

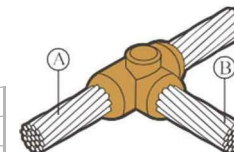
Conductor less than 16mm² must use sleeves

Cable To Cable CC1



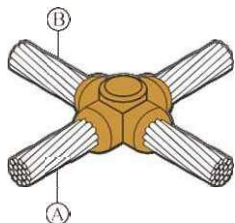
(A)				
16	#32	CC1-16	HK	
25	#32	CC1-25	HK	
35	#32	CC1-35	HK	
50	#45	CC1-50	HK	
70	#65	CC1-70	HK	
95	#90	CC1-95	HK	
120	#115	CC1-120	HK	
150	#115	CC1-150	HK	
185	#150	CC1-185	HK	
240	#200	CC1-240	HK	
300	#250	CC1-300	HK	
400	2x#150	CC1-400	HK5	

Cable To Cable CC2



16	16	#45	CC2-1616	HK	3xS103
25	25	#45	CC2-2525	HK	
35	35	#45	CC2-3535	HK	
35	25	#45	CC2-3525	HK	
50	50	#90	CC2-5050	HK	
50	35	#65	CC2-5035	HK	
50	25	#65	CC2-5025	HK	
70	70	#90	CC2-7070	HK	
70	50	#90	CC2-7050	HK	
70	35	#65	CC2-7035	HK	
70	25	#65	CC2-7025	HK	
95	95	#115	CC2-9595	HK	
95	70	#90	CC2-9570	HK	
95	50	#90	CC2-9550	HK	
95	35	#90	CC2-9535	HK	
120	120	#150	CC2-120120	HK	
120	95	#150	CC2-12095	HK	
120	70	#90	CC2-12070	HK	
120	50	#90	CC2-12050	HK	
150	150	#200	CC2-150150	HK	
150	120	#150	CC2-150120	HK	
150	95	#150	CC2-15095	HK	
150	70	#90	CC2-15070	HK	
185	185	#200	CC2-185185	HK	
185	150	#200	CC2-185150	HK	
185	120	#200	CC2-185120	HK	
185	95	#150	CC2-18595	HK	
240	240	2x#150	CC2-240240	HK5	
240	185	#200	CC2-240185	HK	
240	150	#200	CC2-240150	HK	
240	120	#200	CC2-240120	HK	
300	300	2x#200	CC2-300300	HK5	
300	240	2x#200	CC2-300240	HK5	
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300	150	#200	CC2-300150	HK	

Cable To Cable CC4

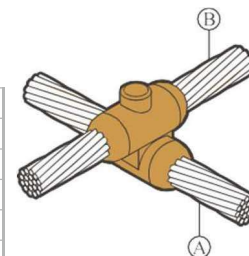


16	16	#65	CC4-1616	HK	4×S103
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50	50	#90	CC4-5050	HK	
50	35	#90	CC4-5035	HK	
50	25	#90	CC4-5025	HK	
70	70	#115	CC4-7070	HK	
70	50	#115	CC4-7050	HK	
70	35	#115	CC4-7035	HK	
70	25	#115	CC4-7025	HK	
95	95	#150	CC4-9595	HK	
95	70	#150	CC4-9570	HK	
95	50	#115	CC4-9550	HK	
95	35	#115	CC4-9535	HK	
120	120	#200	CC4-120120	HK	
120	95	#200	CC4-12095	HK	
120	70	#150	CC4-12070	HK	
120	50	#150	CC4-12050	HK	
150	150	#250	CC4-150150	HK	
150	120	#250	CC4-150120	HK	
150	95	#200	CC4-15095	HK	
150	70	#150	CC4-15070	HK	
185	185	2x#150	CC4-185185	HK5	
185	150	#250	CC4-185150	HK	
185	120	#250	CC4-185120	HK	
185	95	#200	CC4-18595	HK	
185	70	#200	CC4-18570	HK	
240	240	2x#250	CC4-240240	HK7	
240	185	2x#200	CC4-240185	HK5	
240	150	2x#200	CC4-240150	HK5	
240	120	2x#150	CC4-240120	HK5	

Cable To Cable CC11

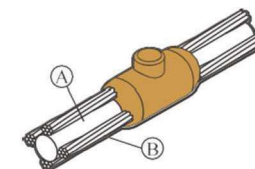


50	50	#150	CC11-5050	HK	
70	70	#200	CC11-7070	HK	
95	95	#250	CC11-9595	HK	
120	120	2x#150	CC11-120120	HK5	
150	150	2x#150	CC11-150150	HK5	
185	185	2x#250	CC11-185185	HK7	
240	240	3×#250	CC11-240240	HK7	
300	120	3×#250	CC11-300120	HK7	
300	300	3×#250	CC11-300300	HK7	



Cable to Rod CC1

(A) mm	(B) mm				
240	10×8	2x#150	CC1-24010×8S	HK5	8×S102
300	10×8	2x#150	CC1-30010×8S	HK5	8×S102
500	10×8	2x#200	CC1-50010×8S	HK5	8×S102





भारत सरकार Government of India
राष्ट्रीय परीक्षण शाला (द.क्षे.)
NATIONAL TEST HOUSE (SR)

तरमणी, चेन्नई - 600 113. Taramani, Chennai - 600 113.
Phone : 22432374, 22431157 Fax : 22433158 email : nthsr@tn.nic.in

परीक्षण प्रमाण पत्र

347218

TEST CERTIFICATE

INTERIM/FINAL REPORT

परीक्षण प्रमाण पत्र नं Test Certificate No NTH(SR)/EL(C)/2014/00176A	जारी होने की तिथि Date of Issue 23/04/2014	कोड नं Code No 1396938243840	पृष्ठ Page 1	पृष्ठों की संख्या No of Pages 2
जिसे जारी करना है Issued To	TEKSAI POWER SECURE SOLUTION PVT.LTD.			
पता Address	3/860, BLUE STAR INDUSTRIES COMPOUND, PUDUSSERY, KANJIKODE, PALLAKKAD, KERALA-678623			
ग्राहक का सन्दर्भ सं एवं दिनांक Customer's Ref. No.	TPSS/2014	Date: 25/01/2014		
पंजिका सं एवं दिनांक Register No & Date	00176/NTH(SR)/EL(C)/08/04/2014			
परीक्षण सामग्री का विवरण Description of Test Item	Earthing material			
परीक्षण सामग्री का पहचान Identification of Test Item	Printing marking on the bag:"Teksai-Ultra"			
नमूना का विशिष्टि (यदि हों) Product Specification (if any)	Electrical Resistivity test as per customer's specification			
नमूना प्राप्ति की तिथि Date of Receipt of the Test Item	08/04/2014			
कार्य सम्पादन की तिथि Date(s) of Performance of Tests	From: 08/04/2014	To: 23/04/2014		
ब्यावहृत प्रणाली का पहचान Method(s) used for Test	Electrical Resistivity test as per customer's specification			
नमूना प्रक्रिया जहाँ प्रासंगिक हों Sampling Procedure where relevant	NA			

Tested By

N. Joseph Kalai Selvan
Natarajan Joseph kalaiselvan

SO Electrical

Checked By

K. Jeyaraj

SO Electrical

Approved By

S.B. Nanda Kumar

Scientist-SC(Electrical)

**ARBRO™**PHARMACEUTICALS LIMITED
(ANALYTICAL DIVISION)ISO 9001 : 2008 Certified
Govt. Approved Test House

4/9, Kirti Nagar Industrial Area, New Delhi-110 015

Tele : 011-45754575 Fax : 011-45754545

e-mail : arbrolab@arbropharma.com, Website : www.arbropharmaindia.com

CERTIFICATE OF ANALYSIS

P



Sample : **EARTHING BACKFILL COMPOUND** Report No. : NR-11060906
 Supplied By : N.S. Received On : 09/06/2011
 Submitted By : GENIUS PROTECTION SYSTEM. (P) LTD. Mfg.Lic.No. : N.S.
 Address : 248A, RATI COMPLEX, RAMA MKT., MUNIRKA, N DELHI. Ref. No. : N.S.
 Batch No. Mfg. Date Expiry Date Batch Size Sample Qty
 N.S. N.S. N.S. N.S. 100GM.

RESULTS OF ANALYSIS

Date of start of analysis 10-06-11 Date of Completion of analysis 13-06-11.

Description :- Black powder.


<Sl.No.>	<Parameters>	<Results>	<Limit (MAX)>
B - TOXIC METALS		:	
1.	Mercury(as Hg)	:- 0.251ppm	1000.0ppm
2.	Lead(as Pb)	:- 8.225ppm	1000.0ppm
3.	Cadmium(as Cd)	:- 0.128ppm	100.0ppm
4.	Hexa-Chromium(as Cr)	:- Less than 1.0ppm	1000.0ppm

Remark :- Observed value for Pb,Cd,Hg & Cr+6 are very low from the max limit, Hence sample complies the ROHS.

REMARKS : PARTY ASKED FOR THE ABOVE TESTS ONLY

Page 1 of 1

Date : Monday, June 13, 2011


 Person In Charge



CENTRAL POWER RESEARCH INSTITUTE
(Member of STL)

Sheet 1 of 4

CPRI

TEST REPORT

Test Report Number	SC11376A	Dated: 29 th August, 2011
Name & Address of the Customer	M/s. Teksai Power Secure Solution Pvt. Ltd., 3/860, Blue Star Industrial Compound, Pudussery, Kanjikodu, Palaghat, Kerala - 678 029.	
Name & Address of the Manufacturer	M/s. Teksai Power Secure Solution Pvt. Ltd., 3/860, Blue Star Industrial Compound, Pudussery, Kanjikodu, Palaghat, Kerala - 678 029.	
Particulars of sample tested	GI Earthing Electrode	
Condition of the sample on Receipt	New	
Type	---	
Designation	Teksai	
Serial Number(s)	---	
Number of samples tested	One	
Date (s) of test (s)	10 th August, 2011	
CPRI sample code no(s)	SC11S1323	
Particulars of tests conducted	Short-Time current	
Test in accordance with	Customer's instruction	
Standard / specification	Not applicable	
Sampling plan	20 kA rms for 1.0 s	
Customer's requirement	---	
Deviations if any	---	
Name of the witnessing persons		
Customer's representative	Mr. Praveen.P.V	
Other than customer's representative	Mr. Jacob George	
Test subcontracted with address of the laboratory	None	
Documents constituting this report (In words)		
Number of sheets	Four	
Number of oscillograms	One	
Number of graphs	Nil	
Number of photos	Two	
Number of test circuit diagrams	One	
Number of drawings	One	


(N. Maheswara Rao)
Test Engineer




(Swaraj Kumar Das)
Joint Director

AUTHORISED SIGNATORIES