INSTITUTO TECNOLÓGICO DE LA ENERGÍA

TEST REPORT

UNE 21186:2011//NF C17-102:2011

Lightning protection: Early streamer emission lightning conductor

TEST REPORT	**IE-ITE-130912-04/M4/EN**
Customer: Address:	Lightning Protection International Pty Ltd Patriarch drive, 49, Hungtingfield Tas, 7055, Australia
Test specification: Standard/s: Test procedure: Deviations: Non-standard test method:	 UNE 21186:2011// NF C17-102:2011 PE-ITE-21186 N/A N/A
Sample description: Date of receipt:	Stormaster 15 SS 2013-10-07
Period of tests:	2014-02-14 / 2014-03-07
Issued by: **INSTITUTO TECNOLÓGICO DE LA ENERGIA (ITE)**	**Testing location:** ☒ Edificio Institutos 8A, U.P.V. Camino de Vera, s/n 46022 Valencia (Spain) ☐ Parque Tecnológico de Valencia – Av. Juan de la Cierva, 24 – 46980 Paterna (Spain)
Performed by: Jorge Moreno	Job title: Lab Technician
Reviewed by: Anabel Soria	Job title: Lab Coordinator

The results contained in this report, in accordance with requested tests, refers exclusively to the objects under test identified therein. Tested in the manner and date indicated in this report.

This report cancels and replaces the test report IE-ITE-130912-04/M3/EN

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1 General Characteristics

1.1 Guarantees

The Instituto Tecnologico de la Energia (**ITE**) guarantees the accuracy of the data and results presented in this document obtained from the measurements of the equipment tested on the dates and under the conditions here established.

The **ITE** guarantees information confidentiality as regards test results. All data related to the tested item and testing procedure will be confidential.

1.2 Important observations

1. Reproduction of this report is only allowed whenever the result be the exact copy from the original and the procedure be fully developed.

2. This report cannot be modified or reproduced partially without the permission of **ITE**.

3. This test report is only concerned with the specific items under testing, whose code is indicated in this document.

4. This test report only refers to the requested tests that are reflected in this document.

5. This test report, by itself, does not constitute or imply in any way an approval of the product by the **ITE**, by a certification body or any other body.

6. This test report will not be used either fully or partially by the customer or by anybody authorized by the customer, for promotion or commercial purposes, whenever ITE considers it inappropriate.

7. The accuracy of the data which are referred to in this document as *data provided by customer* will be the customer´s own responsability.

8. The reliability of the Certificates and Specifications presented in this document as *offered by the customer* will be customer´s own responsibility.

9. **ITE** is not responsible for the accuracy of certificates and statements of compliance provided by the customer.

10. **Possible test verdict:**

Device under test meets the requirements: P (Pass)
Device under test doesn't meet the requirements: F (Fail)
The test doesn't apply to the device under test: N/A

2 Sample data

Early streamer supplied by the customer:

Sample ref.	Name, logo or manufacturer trademark	Product reference	Early streamer efficacy: Δt (in μs)	Serial number
ME-ITE-130912/04	LPI	Stormaster 15 SS	20,2	10336

3 Tests performed

The requested tests are operation assessment tests of an ESE lightning conductor.

Table 1 contains a summary of the tests results.

Annex A contains the results of performed tests and Annex B contains sample drawings.

SECTION OF STANDARD UNE 21186:2011 / NF C17-102 :2011 / NP 4426 :2013 (Annex C)	Test	Verdict	Not performed
C.3.1/-/-	**General Tests**		
C.3.1.1/-/-	Documentation, information and identification	P	
C.3.1.2/-/-	Marking	P	
C.3.2/-/-	**Mechanical tests**	P	
C.3.3/-/-	**Environmental testing**		
C.3.3.1/-/-	Salt mist test	P	
C.3.3.2/-/-	Humid sulphurus atmosphere test	P	
C.3.4/-/-	**Withstand current test**	P	
C.3.5/-/-	**Advance time test**		
C.3.5.3/C.3.5.2.4/ C.3.5.2.4	Determination of ESE advance time	P	

Table 1

4 Additional information

The expanded uncertainties associated with the results of the measures, are estimated a coverage factor k = 2, which means, for a confidence level of approximately 95%. They have been estimated from the contributions set in the corresponding test procedures identified.

ANNEX A. TEST RESULTS

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A.1. General Tests (Par. C.3.1 UNE 21186:2011//NF C17-102:2011)

Test: **Documentation, information and identification (C.3.1.1)**
Test conducted by inspection, through the examination of the information identified in the product.

Acceptance criteria: *The early streamer has passed the test if the information identified in the product is correct.*

Testing date: 2016/06/28

Tested Sample	Test topics			RESULT
ME-ITE-130912/04	Name, logo or manufacturer trademark.	☒ YES	☐ NO	☒ Complies ☐ Non-complying
	Product reference	☒ YES	☐ NO	
	ESE lightning conductor efficacy: Δt (in Δs)	☒ YES	☐ NO	
	Serial number	☒ YES	☐ NO	

Test performed by: Jorge Moreno and Angel Medina
Job title: Lab Technicians

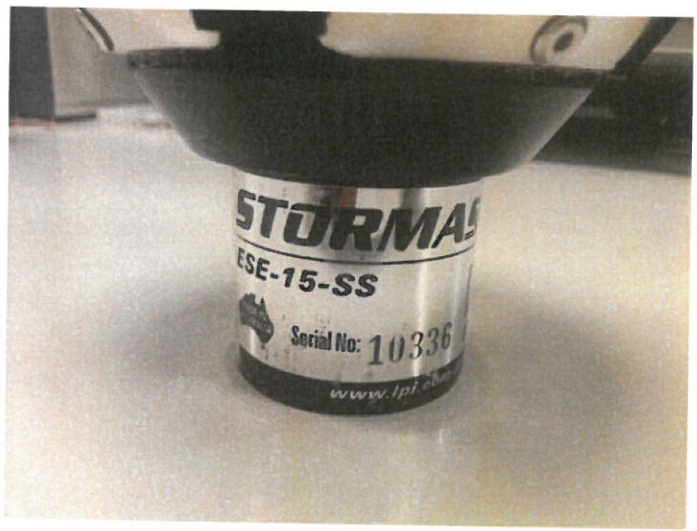

Figure 1. ESE's marking.

Test:

Marking (C.3.1.2)
Test carried out in, all types of marking except those made by etching or molding, rubbing manually the marks for 15 s with a cloth soaked in water and then for 15 s with a cloth soaked in solvent.

Acceptance criteria: *The early streamer has passed the test if the marking is legible.*

Testing date: 2016/06/28

Tested Sample	Test topics			RESULT
ME-ITE-130912/04	Marking type	Sticker		☒ Complies ☐ Non-complying
	Test performed	☒ YES	☐ NO	

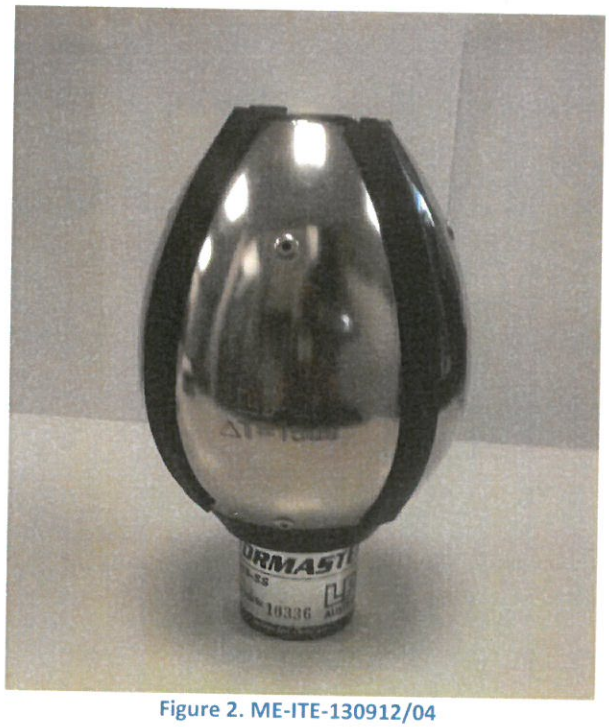

Figure 2. ME-ITE-130912/04

The ESE's marking is engraved on its body (LPI and Δt) and also printed on a sticker in the lower part.

Test performed by: Jorge Moreno and Angel Medina
Job title: Lab Technicians

A.2. Mechanical tests (Par. C.3.2 UNE 21186:2011//NF C17-102:2011)

Test: **Mechanical tests (C.3.2)**
Checking the dimensional tolerances according to the manufacturer's data and drawings.

Acceptance criteria: *The early streamer has passed the test if the measured dimensions are within the range of the dimensions and its tolerances according manufacturer drawings.*

Testing date: 2016/06/28

Tested sample: ME-ITE-130912/04

Dimensional features of parts of the ESE capturing lightning

Material	Solid	A (mm^2)	$A_{min.}$ (mm^2)	Ø (mm)	$Ø_{min}$ (mm)
Stainless Steel	☒ YES ☐ NO	452	200	24	16

Checking of the dimensional characteristics

Dimension to verify	Draw measurement	Units	Measured result	Dimension ± Tolerance ac./draw
Tip	85	mm	85	S/T
ESE body's height	147	mm	147	S/T
ESE body's maximum width	105	mm	105	S/T
ESE base's height	-	mm	35	S/T

Result of test:
☒ Complies
☐ Non-complying

S/T: Tolerance not specified

S = π * rpc2 = π * (24/2)2 = 452,4 mm2

S = π * (Ae2 - Ai2) = π * ((25/2)2 – (23/2)2) = 75,39 mm2

Test performed by: Jorge Moreno and Angel Medina
Job title: Lab Technicians

A.3. Environmental testing (Par. C.3.3 UNE 21186:2011//NF C17-102:2011)

Test: **Salt mist test (C.3.3.1)**

Test conducted according to the UNE-EN 60068-2-52; except sections 7, 10 and 11 which are not applicable, with a severity degree two (three periods of salt spray of 2 hours each, followed by a storage under humidity conditions of 20 to 22 hours after each of them).

Acceptance criteria: -

Testing date: 2014-02-12 / 2014-02-15

Tested sample	Remarks
ME-ITE-130912/04	☐ The sample shows signs of corrosion ☒ The sample doesn´t show signs of corrosion

Test performed by: Jose Luis Martinez
Job title: Lab Technician

Test: **Humid sulphurus atmosphere test (C.3.3.2)**
Test conducted according to UNE-EN ISO 6988 with 7 cycles and SO2 concentration of 667 ppm (by volume).

Acceptance criteria: -

Testing date: 2014-02-17 / 2014-02-26

Tested sample	Remarks
ME-ITE-130912/04	☐ The sample shows signs of corrosion ☒ The sample doesn´t show signs of corrosion

Test performed by: Jose Luis Martinez
Job title: Lab Technician

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A.4. Withstand current test (Par. C.3.4 UNE 21186:2011//NF C17-102:2011)

Test:

Withstand current test (C.3.4)
Test conducted after environmental preconditioning and without cleaning the sample. Then sample is subjected to the current surge test (I_{imp}).

Acceptance criteria:

The early streamer has passed the test if the registration of the voltage / current and visual inspection does not reveal any indication of damage or perforation of the sample, except for the parts that lead the lightning current where emission lines and surface melting can occur.

Testing date 2014/03/05	Temperature(ºC)	Relative Humidity (%)	Barometric pressure (mbar)
Start	20,37	54,2	1014,3
End	20,96	50,8	1014,8

Tested sample	Impulse No.	I_{peak} (kA) [100 kA ± 10%]	Q (A .s) [50 A·s ± 20%]	W/R (kJ/Ω) [2500 kJ/Ω± 35%]
ME-ITE-130912/04	1	94,719	46,6	2116
	2	95,063	43,7	2031
	3	95,281	45,8	2118
Visual Inspection	☒ It reveals no indication of damage or perforation of the sample ☐ In the parts that lead the lightning, current emission lines and surface melting appears ☐ Reveals damage or perforation of the sample			
Result	☒ Complies ☐ Non-complying			

Test performed by: Manuel Martinez and Angel Medina
Job title: Lab Technicians

Figure 3. Electric Test.

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A.5. Advance time test (Par. C.3.5 UNE 21186:2011//NF C17-102:2011)

Test:

Determination of ESE advance time (C.3.5.3 UNE 21186 :2011 / C.3.5.2.4 NF C17-102 :2011)

The advance time is determined relative to a reference wave defined by a rise time Ts = 650 ms and as defined in the standard.

Acceptance criteria:

The tested sample is an early streamer emission lightning rod if:

- $T_{PDC} < T_{PR}$
- $\sigma_{PDC} < 0{,}8\ \sigma_{PR}$
- $T_{PR} - T_{PDC} \geq 10\ \mu s$

Testing date 2014/03/06	Temperature (ºC)	Relative Humidity (%)	Barometric pressure (mbar)
Start	21,2	42,8	1024,1
End	18,21	50,2	1024,3

Test voltage to be applied U_{100} (kV) = 494,6
Continuous polarization voltage (kV) = 45,2

ME-ITE-130912/04				Reference rod (PR)			
Shoot no.	**T_{ESE} (µs)**	**Shoot no.**	**T_{ESE} (µs)**	**Shoot no.**	**T_{PR} (µS)**	**Shoot no.**	**T_{PR} (µS)**
1	120,018	26	126,751	1	152,244	26	113,818
2	105,351	27	134,735	2	139,334	27	118,901
3	123,936	28	136,968	3	139,551	28	123,168
4	126,234	29	128,651	4	125,985	29	144,785
5	114,867	30	131,918	5	123,084	30	129,551
6	142,602	31	109,684	6	170,351	31	130,734
7	151,101	32	125,552	7	121,901	32	146,734
8	114,769	33	127,334	8	127,201	33	160,584
9	149,718	34	122,818	9	172,934	34	155,736
10	133,784	35	118,418	10	118,868	35	129,067
11	117,485	36	124,019	11	148,101	36	122,884
12	140,017	37	137,435	12	122,869	37	165,267
13	129,402	38	122,484	13	120,918	38	146,917
14	116,284	39	133,051	14	117,817	39	176,135
15	117,134	40	129,018	15	137,067	40	113,136
16	113,434	41	110,085	16	129,217	41	129,135
17	130,969	42	124,151	17	135,668	42	113,335
18	124,1	43	115,734	18	125,536	43	146,267
19	132,818	44	121,034	19	135,967	44	127,301
20	138,434	45	136,884	20	172,917	45	128,884
21	150,434	46	118,152	21	124,834	46	115,518
22	120,853	47	107,084	22	128,434	47	120,601
23	155,118	48	134,284	23	117,687	48	128,101
24	122,935	49	125,151	24	145,285	49	183,651
25	121,819	50	130,169	25	120,868	50	120,068
Average instant of initiation time (T'_{ESE}) µs			126,9	Average instant of initiation time (T'_{PR}) µs			135,3
Deviation (σ_{PDC})			11,37	Deviation (σ_{PR})			18,32
Initiation time (T_{PDC}) µs			348,5	Initiation time (T_{PR}) µs			368,7
Advance time ΔT (µs):			**20,2**	**Measurement uncertainty (µs):**			**29**
Specified limits:	• $T_{PDC} < T_{PR}$ • $\sigma_{PDC} < 0{,}8\ \sigma_{PR}$ • $T_{PR} - T_{PDC} \geq 10\ \mu s$						
Test result:	☒ Complies ☐ Non-complying						

Test performed by: Manuel Martinez and Angel Medina
Job title: Lab Technicians

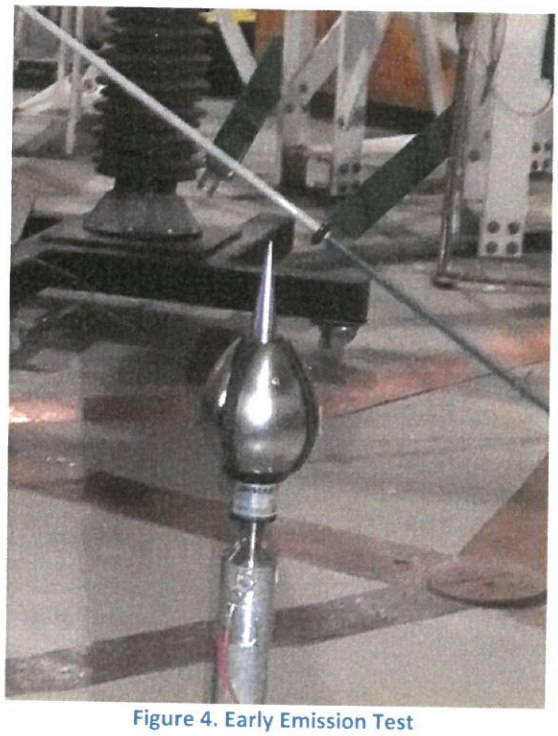

Figure 4. Early Emission Test

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ANNEX B. DRAWINGS

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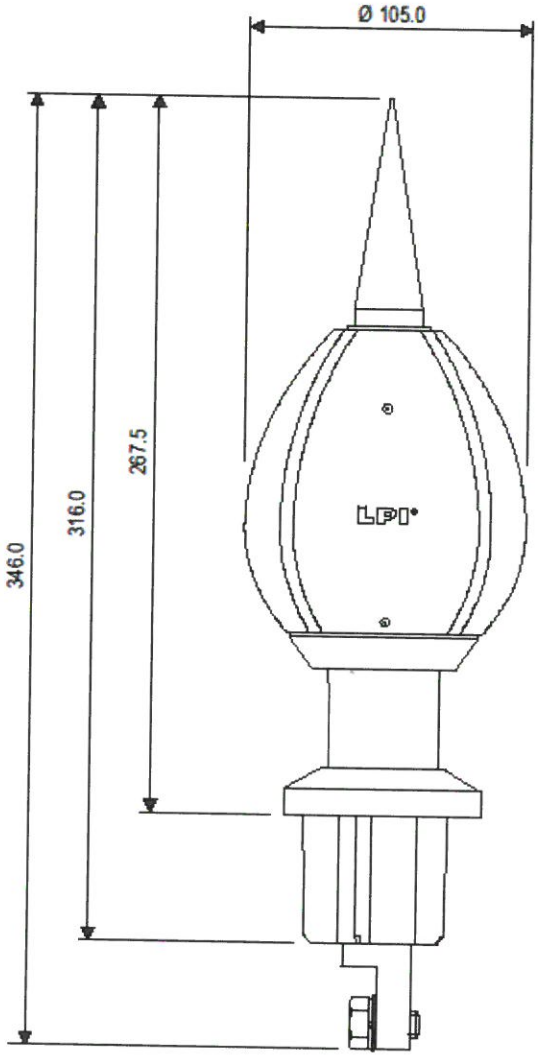

Figure 5. ESE's descriptive drawing.