




# Product Test Report

## RR1616 to IEC 62561-1: 2012

Report No. RR1616\_TR\_02\_0

## 1 Revision Record

Rev	Description	Prep.	Check'd	App'd	Date
0	Original issue.	A.P.M.	A.P.M.		30/07/2014

## 2 Introduction

This report details the testing of the Furse component RR1616; Regbar to rebar connecting clip in accordance with IEC 62561-1:2012 Lightning Protection System Components (LPSC) – Part 1: Requirements for connection components.

### 2.1 Declaration

The above product supplied by Furse has been successfully tested in accordance with IEC 62561-1:2012 Lightning Protection System Components (LPSC) – Part 1: Requirements for connection components.

Therefore this component is declared appropriate for use in a lightning protection system (LPS) in line with the scope below.

### 2.2 Scope of Conformity

For use in a lightning protection system (LPS) for the connection of rebar to rebar in accordance with Furse literature. In a parallel connection arrangement (B2). For an impulse current withstand capability of 100kA (class H).

## 3 Variant Part Numbers

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**RESEARCH CENTRE FOR TESTS AND DEVELOPMENT  
SURGE CURRENT  
AND HIGH VOLTAGE LABORATORY  
ELEMKO SA**

**TEST REPORT No. 31355**

OF REBAR TO REBAR CLAMP, PART NUMBER RR1616  
DESIGNED TO BE EXCLUSIVELY AND COMPLETELY EMBEDDED IN CONCRETE  
TESTED IN PARALLEL CONNECTION ARRANGEMENT (B2)

COMPANY :



APPLICABLE STANDARD:  
IEC/BS EN 62561-1:2012



<http://www.a2la.org/scopepdf/3051-01.pdf>

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## ABBREVIATIONS

IEC : International Electrotechnical Commission  
ISO : International Standardization Organization  
EN : European Norm  
A2LA : American Association for Laboratory Accreditation

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## **1. (8) STRUCTURE AND CONTENT OF THE TEST REPORT**

### **1.1 (8.1) General**

For the purpose of the easier assimilation of this report by the reader and for the better and the complete presentation of the test data, which is required by the standard IEC/BS EN 62561-1:2012, the format of the headings kept the same as it is mentioned in clause 8 of the above standard.

For the better comparison and completeness of this report with the standard's requirements, the corresponding numbering of the standard is also mentioned in each clause, in brackets.

## **2. (8.2) REPORT IDENTIFICATION**

### **2.1 (8.2.a.) Subject of the report**

Description and results presentation of laboratory type testing according to IEC/BS EN 62561-1:2012 on rebar to rebar clamp provided by FURSE (THOMAS & BETTS) with part number RR1616.

### **2.2 (8.2.b) Name, address and telephone number of the test laboratory**

Research Development and Testing Centre – High Voltage and High Current Testing laboratory  
ELEMKO SA

2<sup>nd</sup> km Thiva-Chalkida Old National Road, GR 32200, THIVA

Tel: (+30) 2262024523 - 2262024574,

Fax : (+30) 2262023571

e-mail: [elemko@elemko.gr](mailto:elemko@elemko.gr)

### **2.3 (8.2.c) Name, address and telephone number of the sub contracting test laboratory**

There were no tests subcontracted by other laboratory.

**2.4 (8.2.d) Number of test report :** 31355

### **2.5 (8.2.e) Applicant's name and address**

**Request number:** 174

**Name:** W. J. FURSE Ltd (THOMAS & BETTS)

**Address:** Wilford Road, Nottingham NG2 1EB,  
United Kingdom

**2.6 (8.2.f) Total number of pages:** 16

**2.7 (8.2.g) Date of issue of report:** 2014/05/30

### **2.8 (8.2.h) Dates of performance the tests**

**Initiation date:** 2014/04/10

**Closing date:** 2014/04/15

**2.9 (8.2.i) Authorized person to sign for the testing laboratory for the content of the report****Dr. N. KOKKINOS**

Electrical Engineer Beng, MSc, PhD

Laboratory Technical Manager

**2.10 (8.2.j) The tests were conducted by****L. KATSIKOGIANNIS**

Electrical Engineer

Test engineer

**S. MARKOU**

Laboratory Technician

**3. (8.3) SPECIMEN DESCRIPTION****3.1 (8.3.a) Sample description**

Rebar to rebar clamp of FURSE (THOMAS & BETTS) company, for connection of 16 mm diameter re-bars. For more details see drawing in clause 3.6.

**3.2 (8.3.b) Description and identification of the test assembly**

Six rebar to rebar clamps, each connected with two steel rebars of 16 mm diameter in parallel connection arrangement (B2) as per Annex B of the standard. For traceability, the specimens were marked with the identification numbers 31355 A, 31355 B & 31355 C (specimens intended for the electrical test) and 31355 D, 31355 E & 31355 F (specimens intended for the static mechanical test).

Specimen configuration is illustrated in clause 3.6.

**3.3 (8.3.c) Characterization and condition of the test specimen and/or assembly**

The received specimens were new and in good condition.

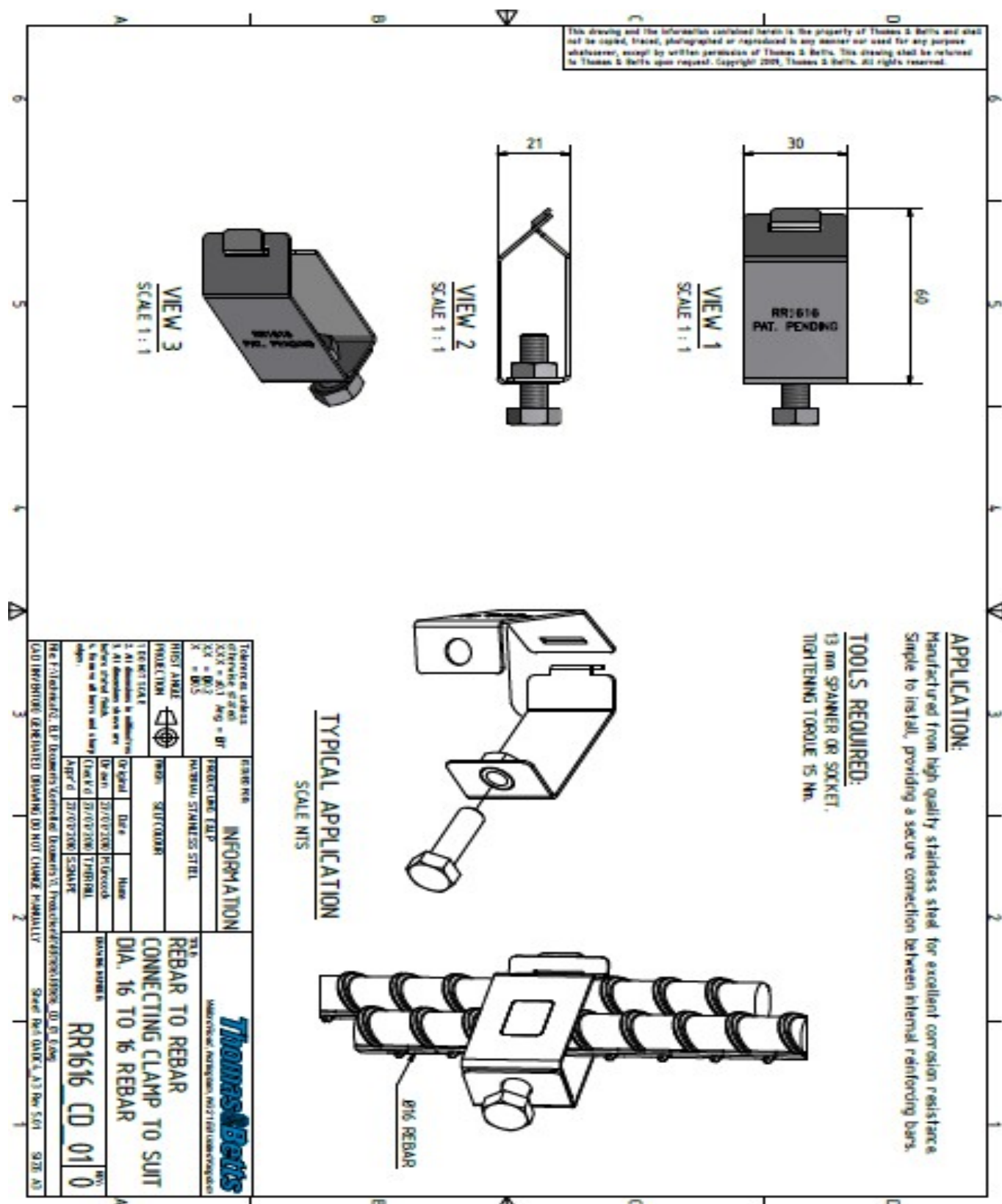
**3.4 (8.3.d) Sampling procedure**

Not relevant.

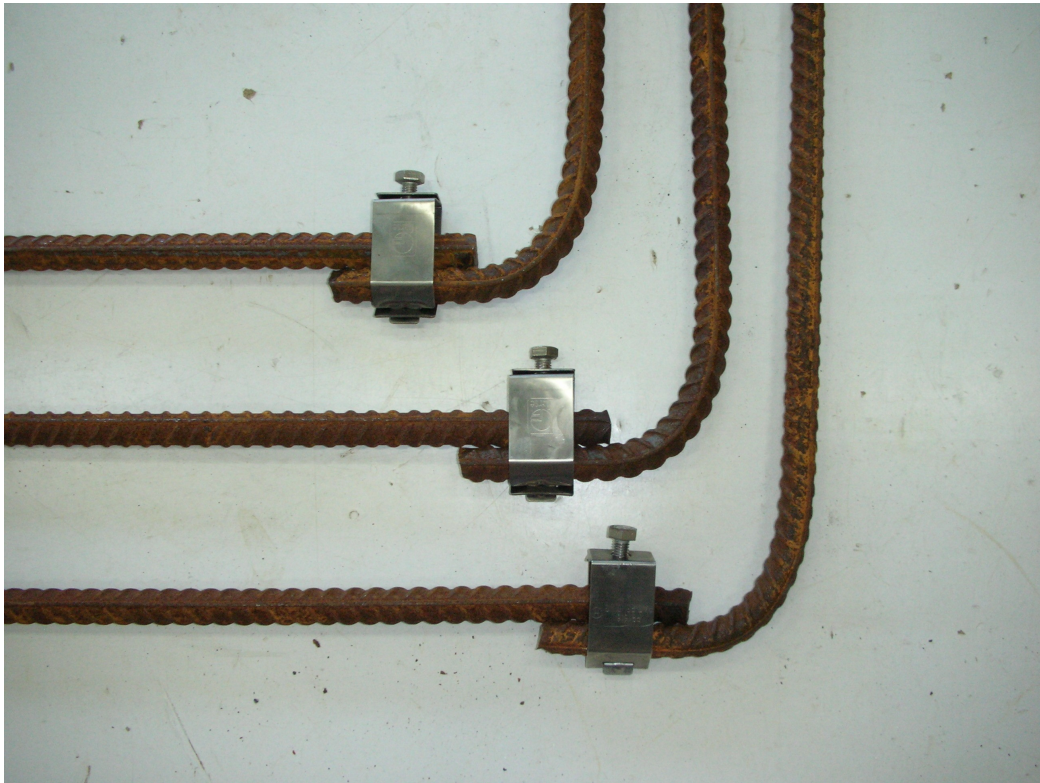
**3.5 (8.3.e) Date of receipt of test items : 2014/03/27**



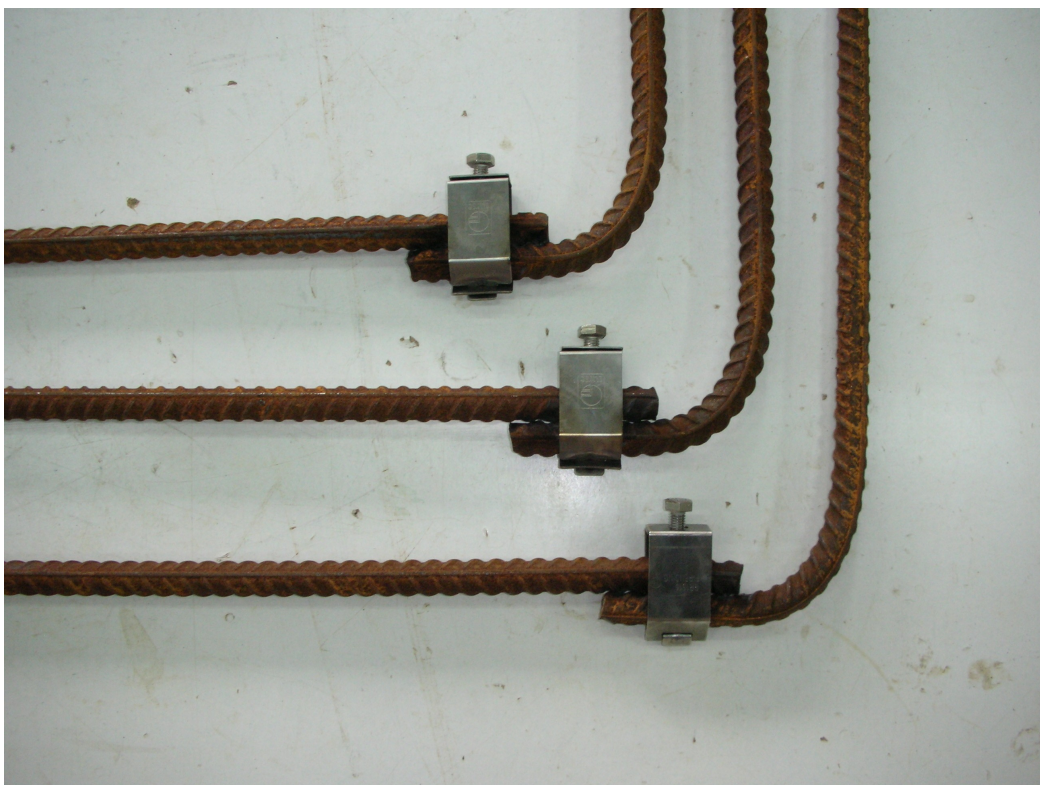
## 3.6 (8.3.f) Photographs and drawings



Specimen's drawing

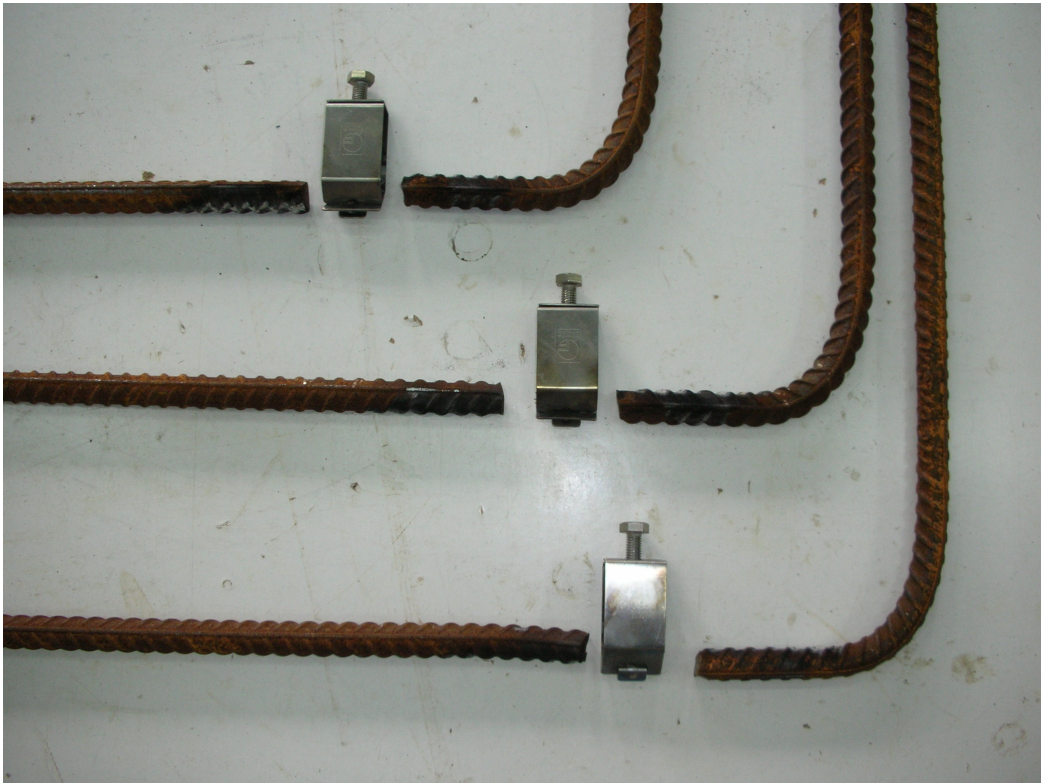


1. The assembled specimens before the initiation of the test sequence



2. The specimens following the termination of the electrical tests.





3. The specimens fully disassembled following the termination of the tests.

#### **4. (8.4) CONDUCTORS**

##### **4.1 (8.4.a) Conductors' material**

Conductor "a": Steel.

Conductor "b": Steel.

##### **4.2 (8.4.b) Nominal cross-section area, dimensions and shape**

Conductor "a": 200 mm<sup>2</sup>, 16 mm diameter rebar.

Conductor "b": 200 mm<sup>2</sup>, 16 mm diameter rebar.

#### **5. (8.5) STANDARDS AND REFERENCES**

##### **5.1 (8.5.a) Test standard used**

IEC/BS EN 62561-1:2012 "Lightning protection system components (LPSC) – Part 1: Requirements for connection components".

## **5.2 (8.5.b) Other relevant documentation**

- IEC EN 62305-1:2012 "Protection against lightning – Part 1: General principles".
- IEC EN 62305-3:2012 "Protection against lightning – Part 3: Physical damage to structures and life hazards".
- IEC EN 62305-4:2012 "Protection against lightning – Part 4: Electrical and electronic systems within structures".
- Furse, Thomas & Betts, Total Sollution Product Catalogue, as downloaded from the website of Thomas & Betts, [www.tnb.com](http://www.tnb.com) in March 2014.

## **6. (8.6) TEST PROCEDURE**

### **6.1 (8.6.a) Description of the test procedure**

According to IEC/BS EN 62561-1:2012 the following tests has to be performed:

- Inspection on installation instructions literature provided by applicant as per clause 5.2 of the standard.
- Lightning current carrying capability as per clause 6.3 of the standard.
- Contact resistance measurement test as per clause 6.3.a of the standard.
- Visual inspection of the specimens after the completion of the tests as per clause 6.3.b of the standard.
- Screw clamping loosening torque as per clause 6.3.c of the standard.
- Measurement of the displacement of the component's conductors as per clause 6.3.d of the standard.
- Static mechanical test to a second set of three new specimens as per clause 6.4 of the standard.
- Marking test as per clause 6.5 of the standard.

Note: Conditioning / ageing test as per clause 6.2.2 of the standard is not applicable, as the connection component under test is designed to be embedded exclusively in concrete (clause 6.2.2, third paragraph)

For each test 3 specimens were used. The specimens were assembled in a typical arrangement as per Annex B of the standard, according to the applicant's instructions.

Before beginning of tests all specimens were cleaned by using a suitable degreasing agent and each one was marked for identification.

The tests were performed according the standard IEC/BS EN 62561-1:2012. Requirements and results are illustrated in detail in clause 9 "Results and parameters recorded" of the present report.

Initially it was checked that the installation instructions were adequate so as the selection of the tested connection components and its installation could be performed in a suitable and safe manner.

Marking on the specimens was made by engraving and it was visually inspected.

The assembly was made in parallel connection (B2) arrangement, according to IEC/BS EN 62561-1:2012 (see 6.4 "configuration of testing assembly"), using two 16 mm diameter steel rebars.

The screws of the specimens were tightened with a torque wrench. The tightening torque given by the applicant was 15 Nm.

Each specimen A, B & C was stressed three (3) times by an impulse current with a negative polarity. In order to test them for class H lightning current withstand capability, the applied impulse test currents had a peak magnitude (Iimp) of 100 kA  $\pm 10\%$ , and a specific energy (W/R) of 2,50 MJ/ $\Omega$   $\pm 35\%$  measured up

to a waveform duration of 5 ms and a front duration equal or less than 50  $\mu$ s, as per table 1 of IEC/BS EN 62561-1:2012.

Upon completion of the tests the following measurements and inspections were performed on each test assembly:

- The contact resistance measurement by means of a digital micro-ohmmeter.
- The measurement of the displacement of the component's conductors by means of a sliding calipers.
- The measurement of the loosening torque by means of a torque meter.
- The visual inspection in order to ensure that each test specimen:
  - did not exhibit any crack, nor any loose parts or deformation impairing its normal use;
  - did not damage the conductors and / or the metal installations.

The specimens identified as D, E and F were subjected to a mechanical tensile force of 900N  $\pm$  20N for 1 min (static mechanical test). Each conductor of the specimen assemblies were subjected independently to the mechanical tensile force.

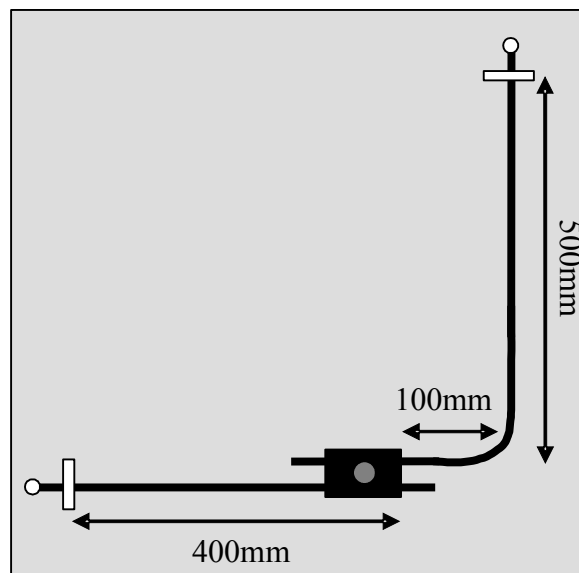
## 6.2 (8.6.b) Justification for any deviations from, additions to or exclusions from the referenced standard

There are no deviations from, additions to or exclusions from the referenced standard.

## 6.3 (8.6.c) Other information relevant to the tests

All information is tabled in clause 9 of this report.

## 6.4 (8.6.d) Configuration of the testing assembly



*B2: Parallel connector – Test Arrangement*

## 6.5 (8.6.e) Location of the arrangement in the testing area

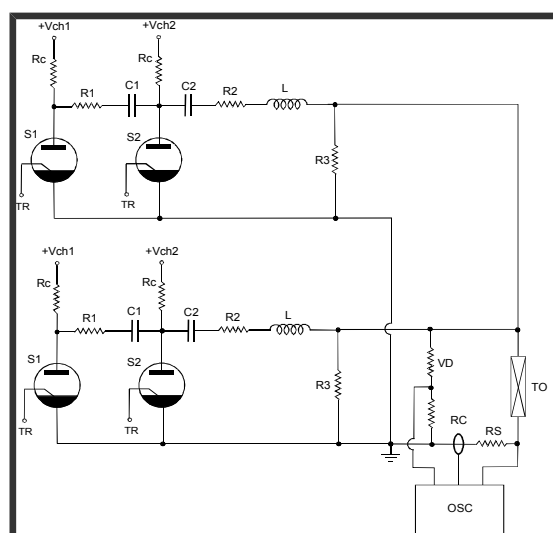
The electrical tests were performed in our laboratory's "high voltage area". Mechanical tests were performed in our laboratory's "Mechanical tests room".

## 7. (8.7) TESTING EQUIPMENT DESCRIPTION

1. Impulse current generator 0-100kA, 0-65C, 0-187kJ.
2. 4-channel trigger / delay pulse generator serial nr. 09720.
3. Shunt 1 mΩ.
4. 20kg weights.



Photograph of the 100kA, 10/350μs impulse current generator.



- |                                      |                        |
|--------------------------------------|------------------------|
| Vch1 : Start bank charging voltage   | S1 : Start switches    |
| Vch2 : Sustain bank charging voltage | S2 : Sustain switches  |
| Rc : Charging Resistors              | TR : Triggering module |
| R1 : Start Resistor                  | VD : Voltage Divider   |
| R2 : Sustain resistor                | RC : Rogowski coil     |
| R3 : Bleeding resistor               | RS : Resistive shunt   |
| L : Stray inductance                 | TO : Test object       |
| C1 : Start Capacitor                 | OSC: Oscilloscope      |
| C2 : Sustain Capacitor               |                        |

Figure a : A schematic diagram of the 100kA, 10/350μs impulse current generator.

## 8. (8.8) MEASURING INSTRUMENTS DESCRIPTION

Instrument	Calibration date	Calibration interval
1. Torque meter, 0-30Nm, serial nr. 0901610877	2013/08/19	1 year
2. Digital micro-ohmmeter, 5μΩ-400Ω, serial nr. 166423.	2013/05/30	1 year
3. 4-channel, digital oscilloscope, serial nr. LCRY3203N57222.	2013/09/10	1 year
4. Temperature, barometric pressure and humidity meter.	2013/07/24 (internal)	1 year
5. Digital sliding callipers (thickness gauge), 0-150±0.01mm serial nr. 1U206306.	2013/08/19	1 year
6. Balance, serial number 83017901.	2011/11/21	3 years

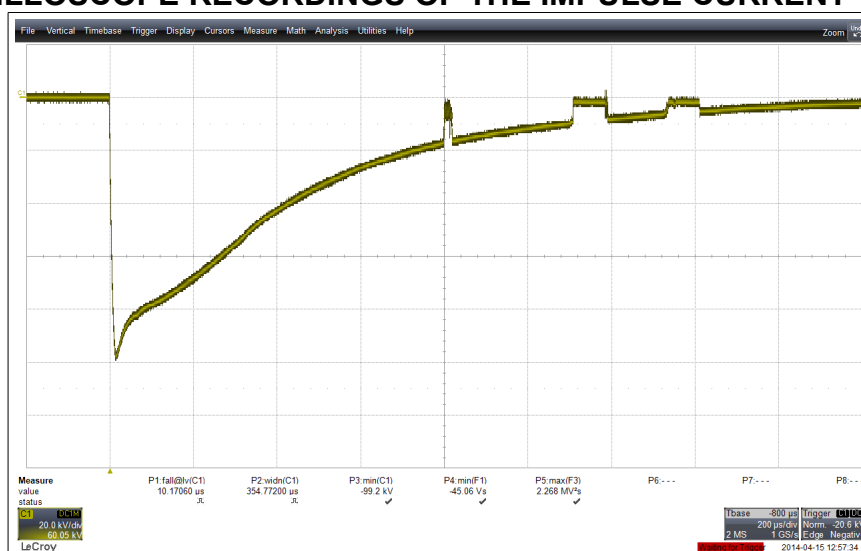
## 9. (8.9) RESULTS AND PARAMETERS RECORDED

REQUIREMENTS			RESULTS									PASS/ FAIL
CLAUSE	TEST - INSPECTION	IDENTIFICATION OF SPECIMEN										
		31355A			31355B			31355C				
5.2	<u>Installation instructions shall contain:</u> <ul style="list-style-type: none"><li>classification of the component</li><li>recommended tightening torque</li><li>range of conductors - materials</li><li>connection configuration</li></ul>		Inspection's results: <ul style="list-style-type: none"><li>provided</li><li>provided</li><li>provided</li><li>provided</li></ul>									PASS
6.2.2; Annex C1	Conditioning/ageing Salt mist treatment (IEC 60068-2-52)		Start : -- End : --									N/A
6.2.2; Annex C2	Conditioning/ageing Humid sulphurous atm. treatment (ISO 6988)		Start : -- End : --									N/A
6.2.2; Annex C3	Conditioning/ageing Ammonia atmosphere treatment (ISO 6957)		Start : -- End : --									N/A
6.3	<u>Electrical test</u> (Impulse current of 100 kA peak ± 10% and specific energy W/R 2,5 MJ/Ω ± 35%)	Test current:	A1	A2	A3	B1	B2	B3	C1	C2	C3	
		Peak (kA):	99,2	99,9	98,6	99,3	99,2	99,2	99,2	99,2	99,2	
		W/R (MJ/Ω):	2,268	2,276	2,266	2,265	2,282	2,270	2,265	2,259	2,264	
		shot nr:	8432	8433	8434	8435	8436	8437	8438	8439	8440	
		Environmental conditions: Humidity – Temper. - Atm. pres.	66% - 19° C – 998 mbar									
6.3.a	Contact resistance Rc (μΩ) (requirement Rc ≤ 2500 μΩ)		RcAfter: 173			RcAfter: 54			RcAfter: 817			PASS
6.3.d	Length of the conductor from connector (mm) (requirement: not less than 3 mm)		"a": 20,0 "b": 20,0			"a": 20,0 "b": 20,0			"a": 20,0 "b": 20,0			PASS
6.3.c	Loosening torque TL (Nm) (requirement 0,25TT ≤ TL ≤ 1,5TT) (TT :tightening torque)		TT: 15,0 TL: 4,0			TT: 15,0 TL: 10,5			TT: 15,0 TL: 4,5			PASS
6.3.b	Visual inspection (requirement: no cracks or loose parts or deformation impairing its normal use, no damage to the conductors and/or metal installations)		Y			Y			Y			PASS
6.3.g*	Tensile force 900N±20N for 1 min (applicable to screw-less components. Requirement: conductor's movement < 1mm, no damage to conductor or component)		-			-			-			N/A
6.4*	<u>Static mechanical test</u> 900N±20N for 1 min (On a 2nd set of specimens. Requirement: movement of the conductor < 1mm, no damage to conductor or component)	Conductor:	31355D		31355E		31355F					PASS
			"a"	"b"	"a"	"b"	"a"	"b"				
		Force (N):	906	906	906	906	906	906				
		Movement (mm):	0	0	0	0	0	0				
		Visual check:	Y	Y	Y	Y	Y	Y	Y			
6.5	Marking shall be durable and legible. The components shall be marked with (a) name or trade mark, (b) identifying symbol, (c) classification. Where this proves to be impractical (b) & (c) may be given on the smallest packing unit.		Only inspection performed as the marking (name/trade mark, classification) is made by engraving.									PASS
Comments:												
NO ADDITIONAL COMMENTS												

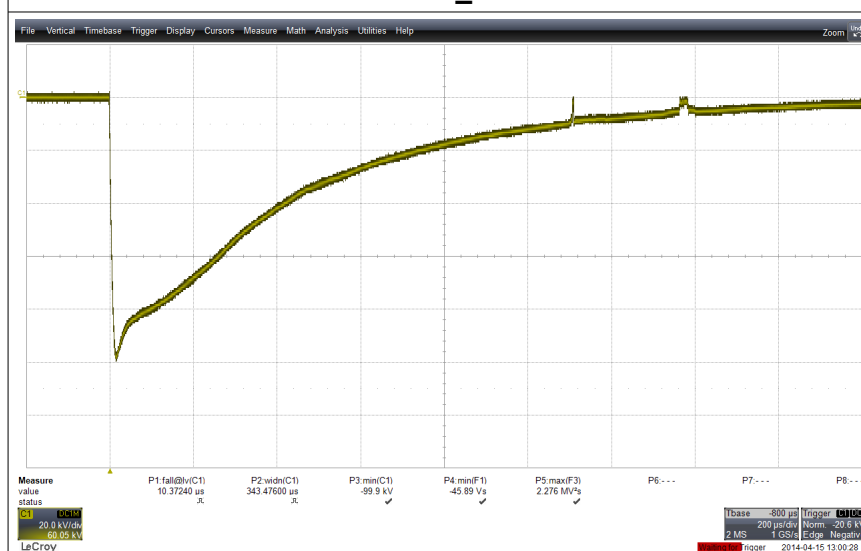
\* Not accredited for these tests Y: Fulfills the requirements. N: Do not fulfils the requirements. N/A: Not applicable



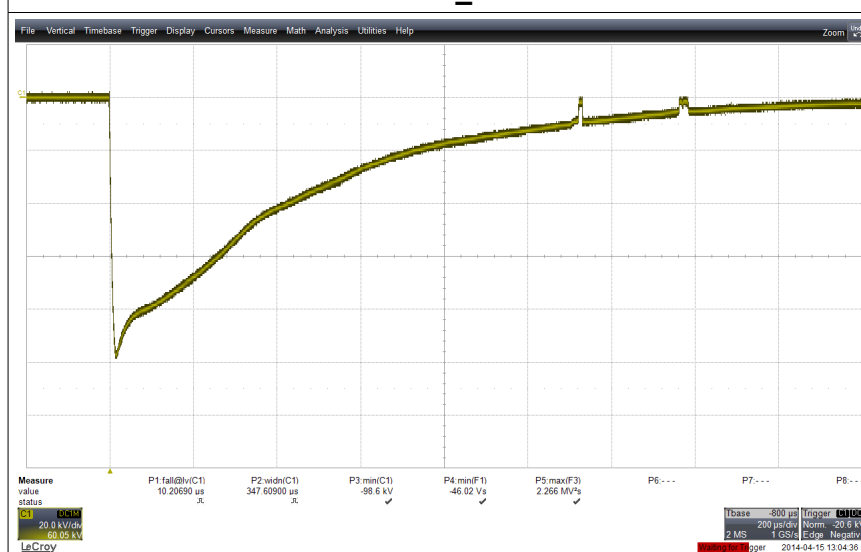
## OSCILLOSCOPE RECORDINGS OF THE IMPULSE CURRENT TESTS



31355\_A1

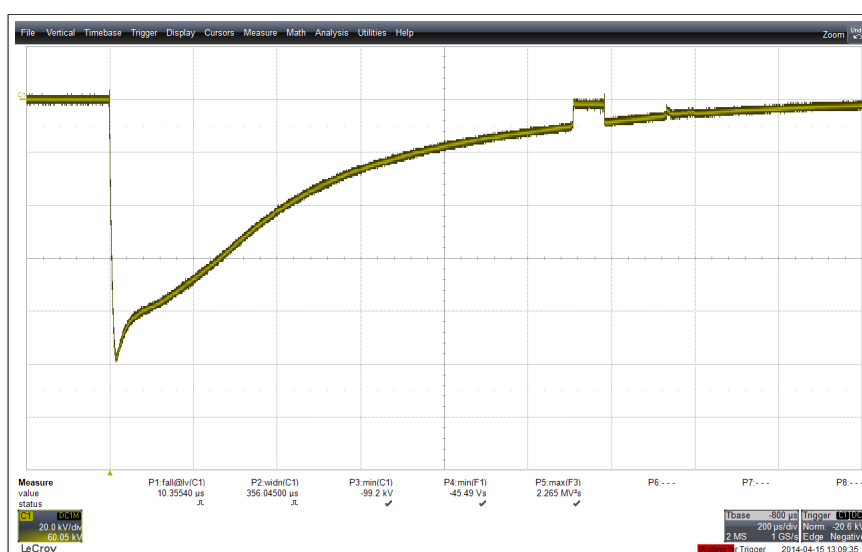


31355\_A2

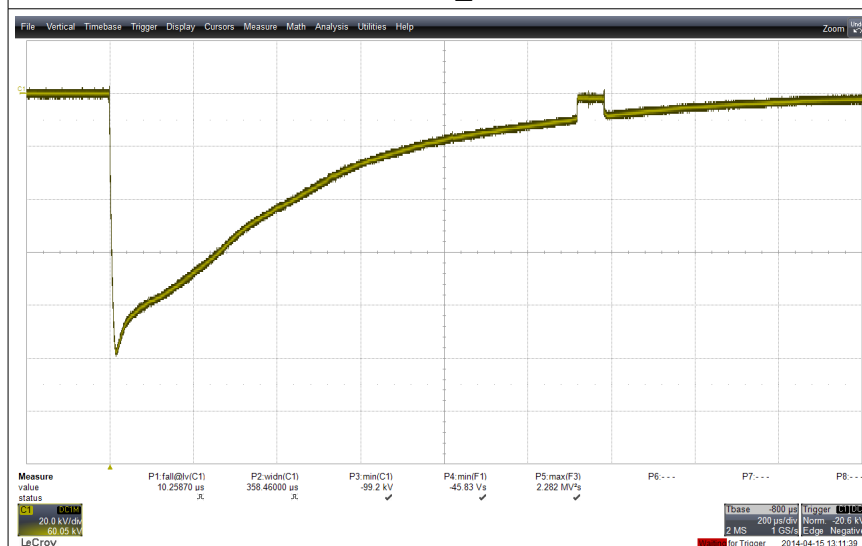


31355\_A3

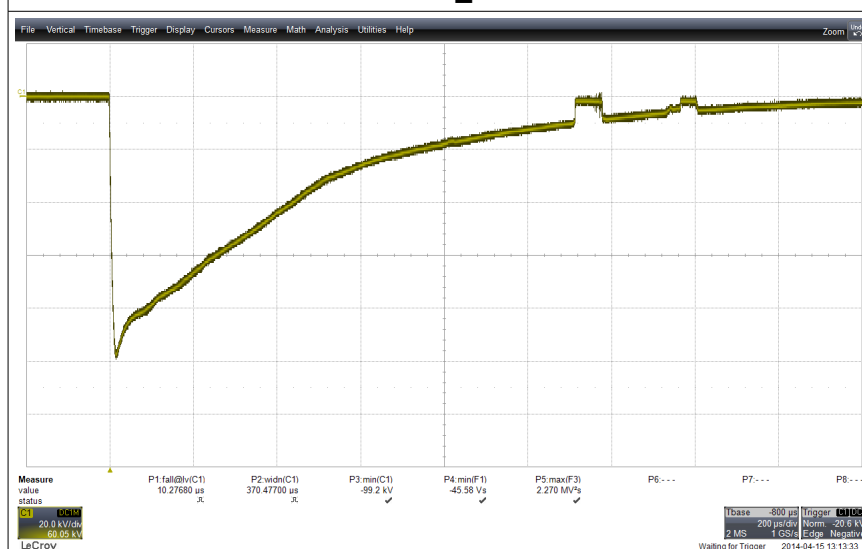




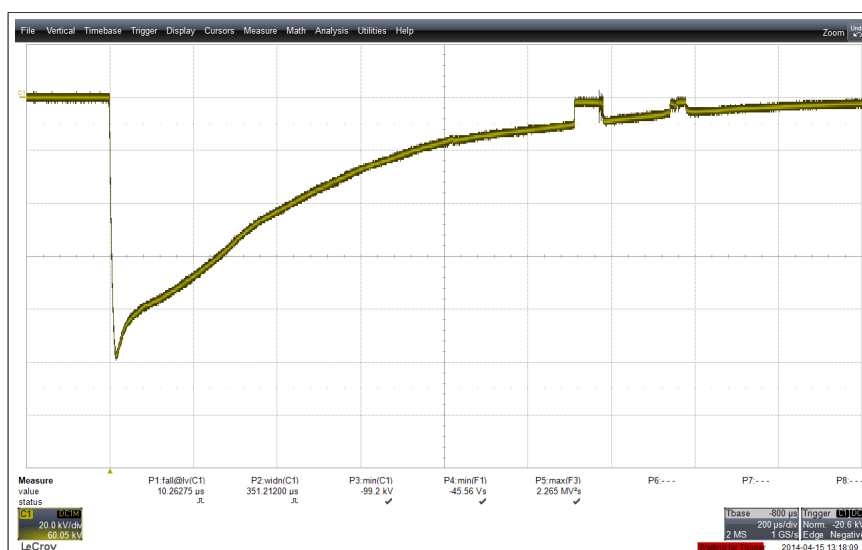
31355\_B1



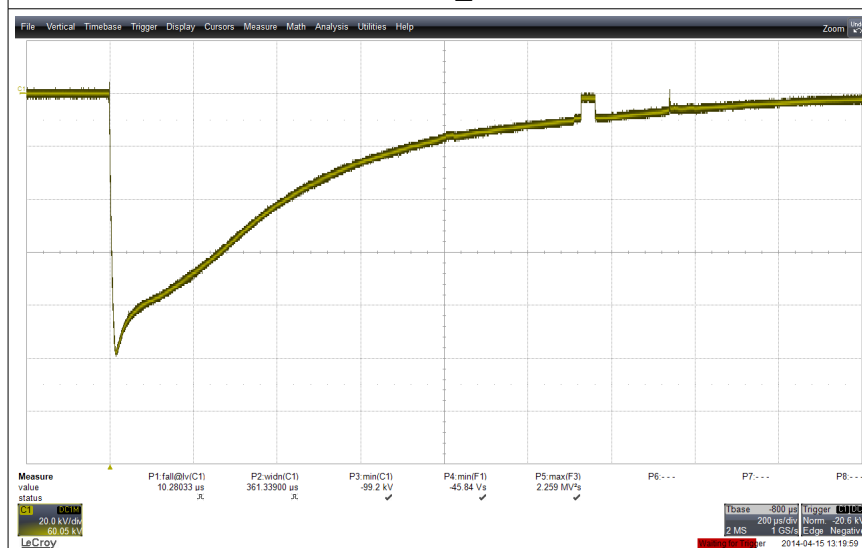
31355\_B2



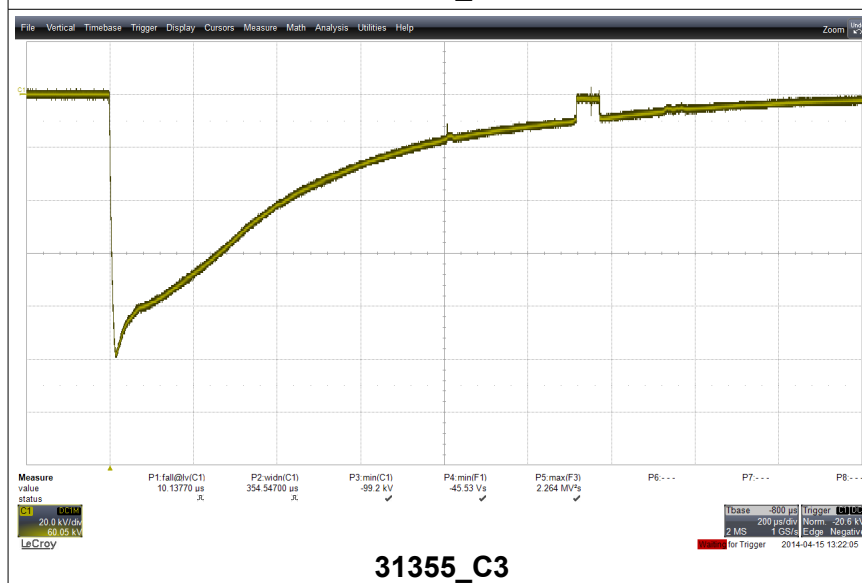
31355\_B3



31355\_C1



31355\_C2



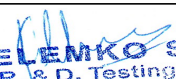
31355\_C3

## 10. (8.10) TESTS RESULT SUMMARY

The six connection components specimens, rebar to rebar clamp with part number RR1616, submitted for tests by FURSE (THOMAS & BETTS), have been subjected to the tests according to IEC/BS EN 62561-1:2012 for use in external lightning systems, in parallel connection arrangement (B2) between two 16 mm diameter steel rebars and have successfully passed the tests. Therefore they satisfy the standard's requirements according to IEC/BS EN 62561-1:2012 and are classified as per their:

- Installation as: to be exclusively and completely embedded in concrete,
- Lightning current carrying capability as: class H (100kA), see Table 1,
- Mechanical capability as: intended to carry static mechanical load.

Test results regarding this connection component specimen are displayed in clause 9 (8.9).

	<b>Laboratory Technical Manager</b>
<b>NAME</b>	<b>Dr. N. KOKKINOS</b> Electrical Engineer Beng, MSc, PhD
<b>SIGNATURE</b>	 <b>ELEMKO S.A.</b> R. & D. Testing Lab. THIVA - GREECE TEL: +30 210 2845400 e-mail: elemko@elemko.gr

This report only explains the specimens submitted for test and does not produce evidence for the quality for standard fabrication.