




# Product Test Report

## BN005 to IEC 62561-1: 2012

## 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 BN005; Type 'B' bond 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 termination of Aluminium tape in accordance with Furse literature. In a 'T' connection arrangement (B6). For an impulse current withstand capability of 100kA (class H).

## 3 Variant Part Numbers

Valid for variant part numbers BN006.

	Document: Product Test Report Furse BN005 to IEC 62561-1:2012	Doc No: BN005_TR_02	
		Rev: 0	Date: 30/07/2014

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

**TEST REPORT No. 31361**

**OF TYPE "B" BOND MADE OUT FROM ALUMINIUM, PART NUMBER BN005  
IN "T" CONNECTION ARRANGEMENT (B6)**

**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 type "B" bond provided by FURSE (THOMAS & BETTS) with part number BN005.

### **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 :** 31361

### **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:** 17

**2.7 (8.2.g) Date of issue of report:** 2014/06/02

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

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

**Closing date:** 2014/05/29

**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. KATSIKOIANNIS**

Electrical Engineer

Test engineer

**S. MARKOU**

Laboratory Technician

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

Type "B" bond of FURSE (THOMAS & BETTS) company, for connection of tape conductor to metal installation. For more details see drawing in clause 3.6.

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

Six type "B" bonds, each connected with aluminium solid tape conductor 25x3 mm dimensions and metal (galvanized steel) installation in "T" connection arrangement (B6) as per Annex B of the standard. For traceability, the specimens were marked with the identification numbers 31361 A, 31361 B & 31361 C (specimens intended for the electrical test) and 31361 D, 31361 E & 31361 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.

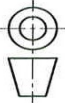
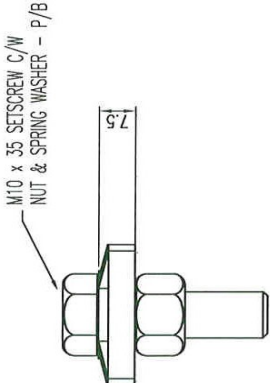
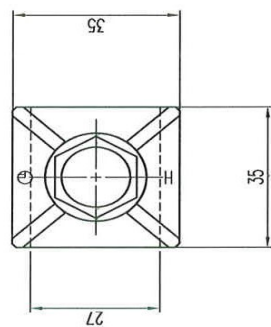
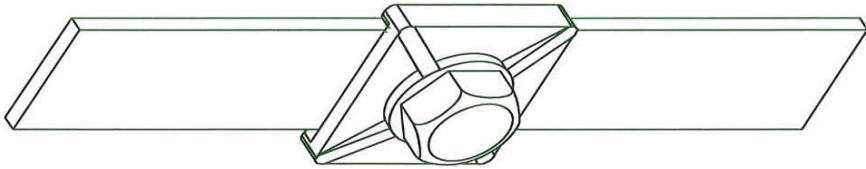
**3.4 (8.3.d) Sampling procedure**

Not relevant.

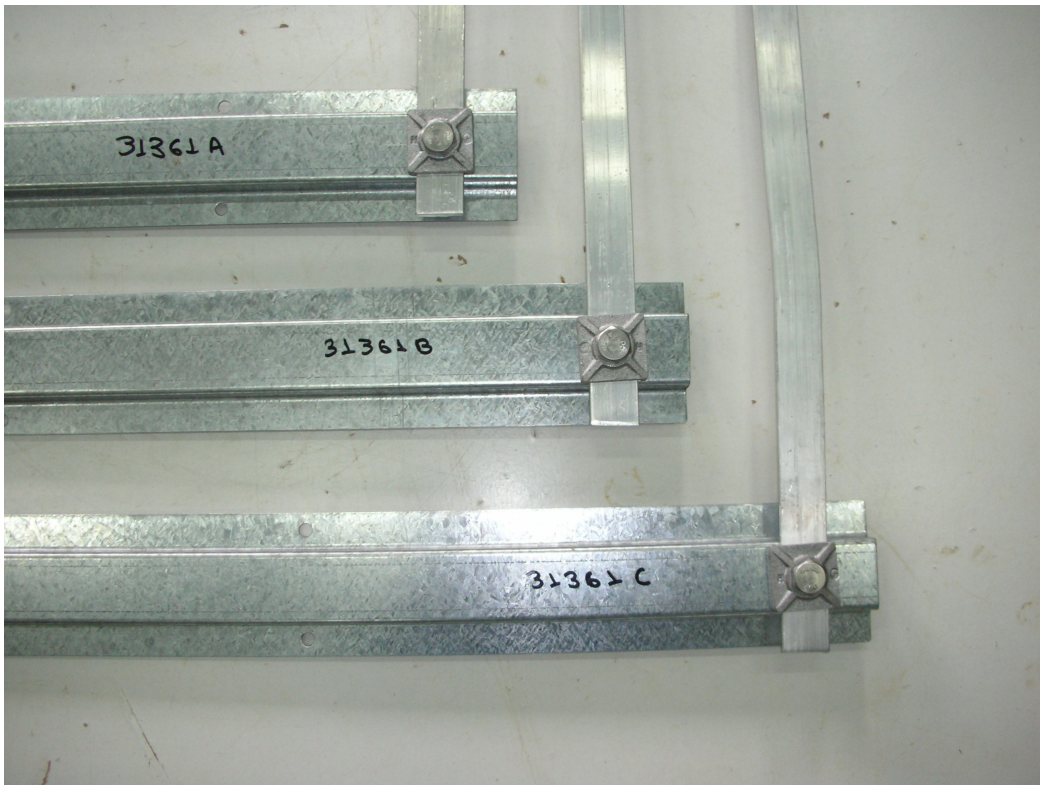
**3.5 (8.3.e) Date of receipt of test items : 2014/03/27**



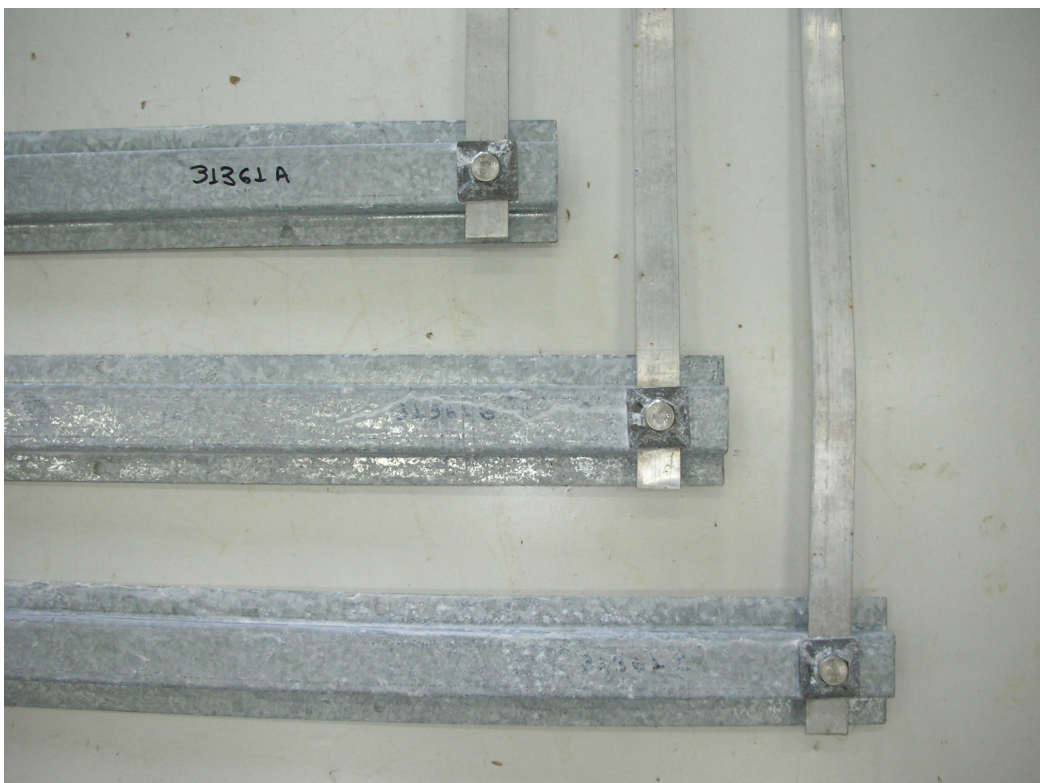
## 3.6 (8.3.f) Photographs and drawings

 <p>FIRST ANGLE PROJECTION</p>						 <p>FOR BONDING TAPE TO STEEL STRUCTURES</p>		<p>CUSTOMER DRAWING</p>	
								<p>COPY RIGHT RESERVED</p>	
<p>furse</p> <p>W.J. Furse &amp; Co. Ltd. Wilford Road, Nottingham, NG2 1EB. Tel: 0115 986 3471. Fax: 0115 986 0538.</p> <p><b>Thomas Betts</b></p>		<p>MATERIAL</p> <p>ALUMINIUM</p>		<p>TITLE</p> <p>'B' BOND FOR 25mm WIDE TAPE</p>		<p>DATE</p> <p>29.03.99</p>		<p>DRN</p> <p>J.B.</p>	
<p>FINISH</p> <p>SELFCOLOUR</p>		<p>CAD REF</p> <p>\cad\elp\customer\fixtures\</p>		<p>SCALE</p> <p>1:1</p>		<p>SHEET</p> <p>1 of 1</p>		<p>CHKD</p> <p>JLB</p>	
<p>GENERAL NOTES:</p> <p>1. All dimensions in mm unless stated otherwise.</p> <p>W.J.FURSE RESERVE THE RIGHT TO ALTER THE DESIGN OF ANY PRODUCT WITHOUT NOTICE.</p>		<p>REVISION</p> <p>583 JB JLB</p>		<p>DEPT</p> <p>E&amp;LP.</p>		<p>REV</p> <p>14</p>		<p>DRG.No.</p> <p>BN005-C</p>	
<p>THIS DRAWING IS THE PROPERTY OF W.J.FURSE &amp; Co. LTD., AND MAY NOT BE USED FOR ANY PURPOSE OTHER THAN FOR WHICH IT IS SUPPLIED.</p>									

Specimen's drawing

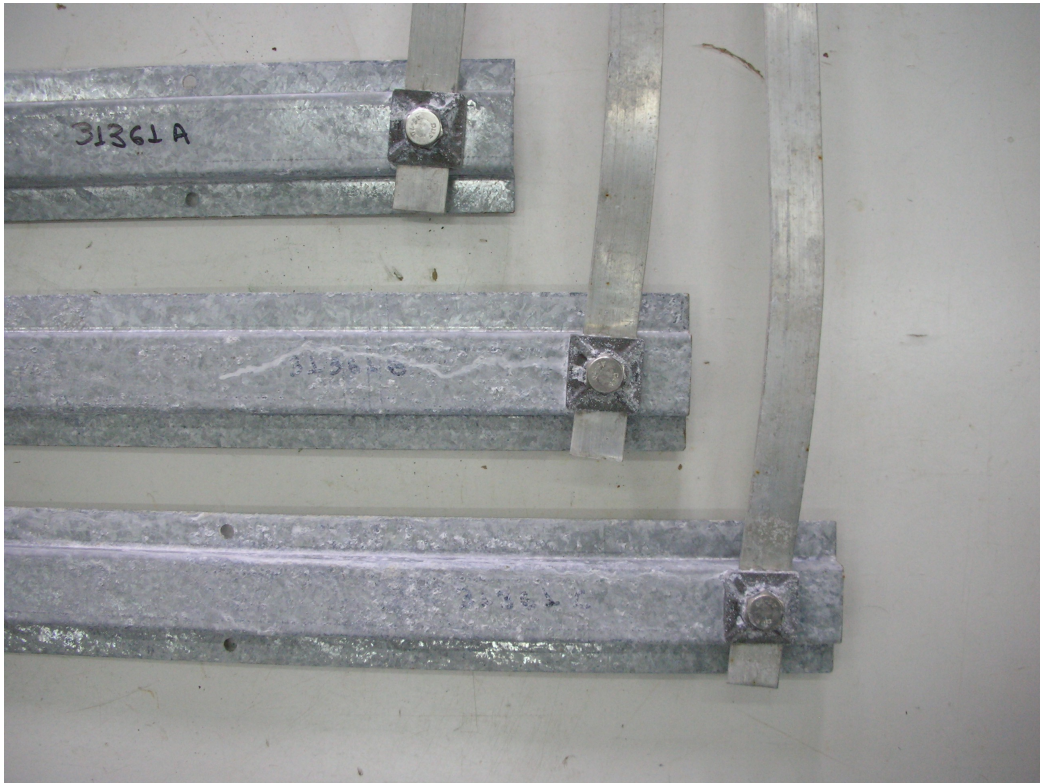


1. The assembled specimens before the initiation of the test sequence



2. The specimens following the salt mist treatment and humid sulphurous atmosphere treatment tests





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



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

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

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

Conductor "a": Aluminium.

Conductor "b": Galvanized steel.

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

Conductor "a": 75 mm<sup>2</sup>, 25x3 mm dimensions, solid tape conductor.

Conductor "b": 76mm max width, 16 mm height, omega "Ω" shaped metal installation.

## **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.  
This test is consisted of:
  - Conditioning / ageing test as per clause 6.2.2 of the standard.
  - Electrical test 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.
- 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.

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 'T' connection (B6) arrangement, according to IEC/BS EN 62561-1:2012 (see 6.4 "configuration of testing assembly"), using an aluminium solid tape conductor 25x3 mm dimensions and a metal (galvanized steel) installation.

The bolts of the specimens were tightened with a torque wrench. The tightening torque given by the applicant was 17 Nm.

The specimens identified as A, B and C were subjected to a conditioning /ageing test according to IEC/BS EN 62561-1:2012 consisting of:

- salt mist treatment for 3 days according to IEC 60068-2-52:1996, except clauses 7, 10 and 11 which are not applicable;
- humid sulphurous atmosphere treatment for 7 days according to ISO 6988:1985, except clauses 9 and 10 which are not applicable.

After conditioning/ageing test and without cleaning the specimens A, B & C, each one 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 (I<sub>imp</sub>) 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 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**

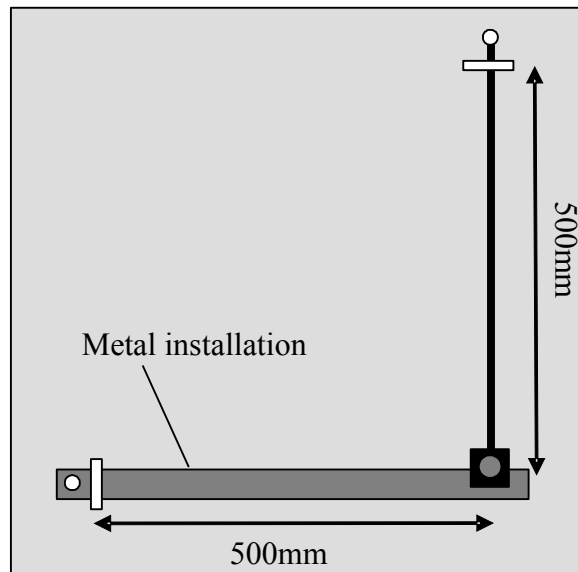
There are no deviations from, additions to or exclusions from the referenced standard.

## **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



*B6: Clamp for T-connection – Test Arrangement*

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

Environmental / Ageing tests were performed in our laboratory's "conditioning test room".  
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. Environmental chamber for salt mist ageing, serial nr. 4318.
2. Environmental chamber for humid sulphurous atmosphere ageing, serial nr. 4317.
3. Impulse current generator 0-100kA, 0-65C, 0-187kJ.
4. 4-channel trigger / delay pulse generator serial nr. 09720.
5. Shunt 1 mΩ.
6. 20kg weights.



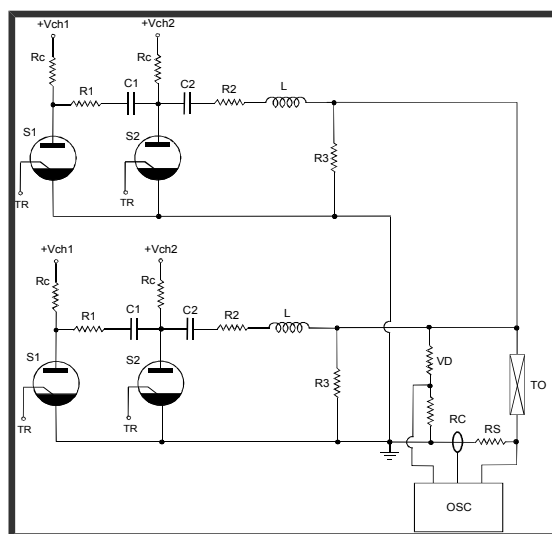
Photograph of the environmental ageing chamber used for salt mist ageing.



Photograph of the environmental ageing chamber used for humid sulphurous atmosphere ageing.



Photograph of the 100kA, 10/350 $\mu$ s 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, 10/350 $\mu$ s 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, 5 $\mu\Omega$ -400 $\Omega$ , 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 $\pm$ 0.01mm serial nr. 1U206306.	2013/08/19	1 year
6. Balance, serial number 83017901.	2011/11/21	3 years

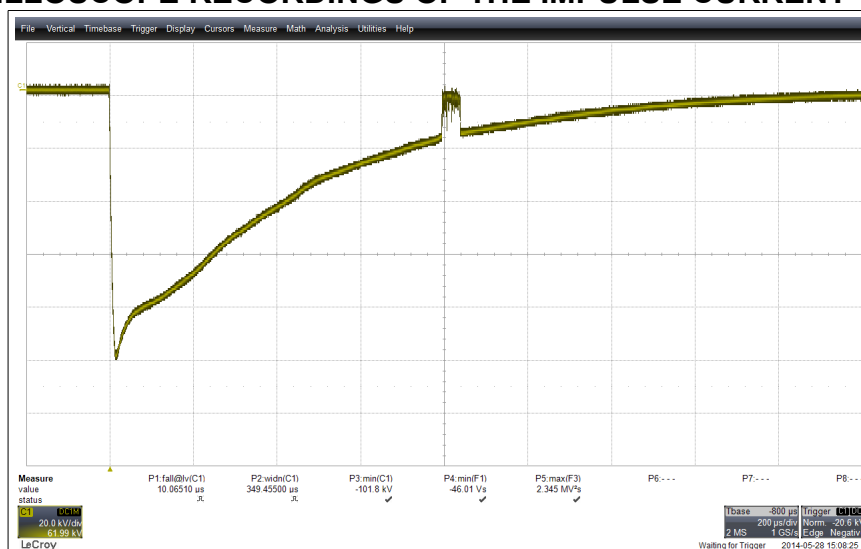
## 9. (8.9) RESULTS AND PARAMETERS RECORDED

REQUIREMENTS			RESULTS									PASS/ FAIL
CLAUSE	TEST - INSPECTION		IDENTIFICATION OF SPECIMEN									
			31361A			31361B			31361C			
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 : <b>2014/05/06</b> End : <b>2014/05/09</b>									PASS
6.2.2; Annex C2	Conditioning/ageing Humid sulphurous atm. treatment (ISO 6988)		Start : <b>2014/05/09</b> End : <b>2014/05/16</b>									PASS
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):	<b>101,8</b>	<b>101,8</b>	<b>101,8</b>	<b>101,8</b>	<b>101,8</b>	<b>101,8</b>	<b>101,8</b>	<b>101,8</b>	<b>101,8</b>	
		W/R (MJ/Ω):	<b>2,345</b>	<b>2,349</b>	<b>2,339</b>	<b>2,347</b>	<b>2,333</b>	<b>2,352</b>	<b>2,355</b>	<b>2,350</b>	<b>2,353</b>	
		shot nr:	<b>8562</b>	<b>8563</b>	<b>8564</b>	<b>8565</b>	<b>8566</b>	<b>8567</b>	<b>8568</b>	<b>8569</b>	<b>8570</b>	
		Environmental conditions: Humidity – Temper. - Atm. pres.	<b>53% - 29°C - 993mbar</b>									
6.3.a	<u>Contact resistance Rc (μΩ)</u> (requirement Rc ≤ 1000 μΩ) ( Rc <sub>before</sub> : before ageing, Rc <sub>after</sub> : after ageing)		Rc <sub>before</sub> : 142  Rc <sub>after</sub> : <b>156</b>			Rc <sub>before</sub> : 158  Rc <sub>after</sub> : <b>153</b>			Rc <sub>before</sub> : 156  Rc <sub>after</sub> : <b>142</b>			PASS
6.3.d	<u>Length of the conductor from connector (mm)</u> (requirement: not less than 3 mm)		“a”: -- “b”: --		“a”: -- “b”: --		“a”: -- “b”: --		“a”: -- “b”: --		N/A	
6.3.c	<u>Loosening torque T<sub>L</sub> (Nm)</u> (requirement 0,25T <sub>T</sub> ≤ T <sub>L</sub> ≤ 1,5T <sub>T</sub> ) (T <sub>T</sub> :tightening torque)		T <sub>T</sub> : <b>17,0</b>  T <sub>L</sub> : <b>8,0</b>			T <sub>T</sub> : <b>17,0</b>  T <sub>L</sub> : <b>10,0</b>			T <sub>T</sub> : <b>17,0</b>  T <sub>L</sub> : <b>9,0</b>			PASS
6.3.b	<u>Visual inspection</u> (requirement: no cracks or loose parts or deformation impairing its normal use, no damage to the conductors and/or metal installations)		<b>Y</b>			<b>Y</b>			<b>Y</b>			PASS
6.3.g*	<u>Tensile force 900N±20N for 1 min</u> (applicable to screw-less components. Requirement: conductor's movement < 1mm, no damage to conductor or component)		-			-			-			N/A
6.4*	<u>Static mechanical test 900N±20N for 1 min</u> (On a 2 <sup>nd</sup> set of specimens. Requirement: movement of the conductor < 1mm, no damage to conductor or component)	Conductor:	31361D		31361E		31361F					PASS
			“a”	“b”	“a”	“b”	“a”	“b”				
		Force (N):	<b>906</b>	<b>906</b>	<b>906</b>	<b>906</b>	<b>906</b>	<b>906</b>				
		Movement (mm):	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>				
		Visual check:	<b>Y</b>	<b>Y</b>	<b>Y</b>	<b>Y</b>	<b>Y</b>	<b>Y</b>	<b>Y</b>			
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												

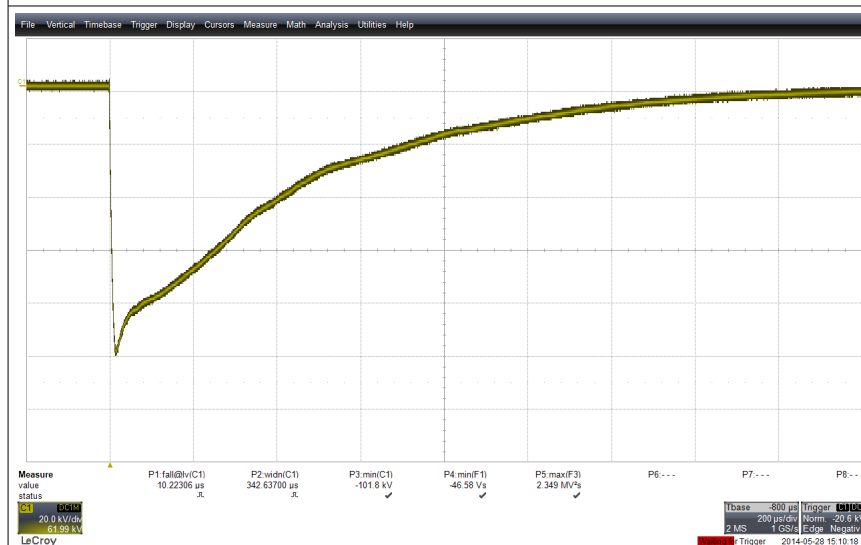
\* Not accredited for these tests Y: Fulfills the requirements. N: Do not fulfill the requirements. N/A: Not applicable



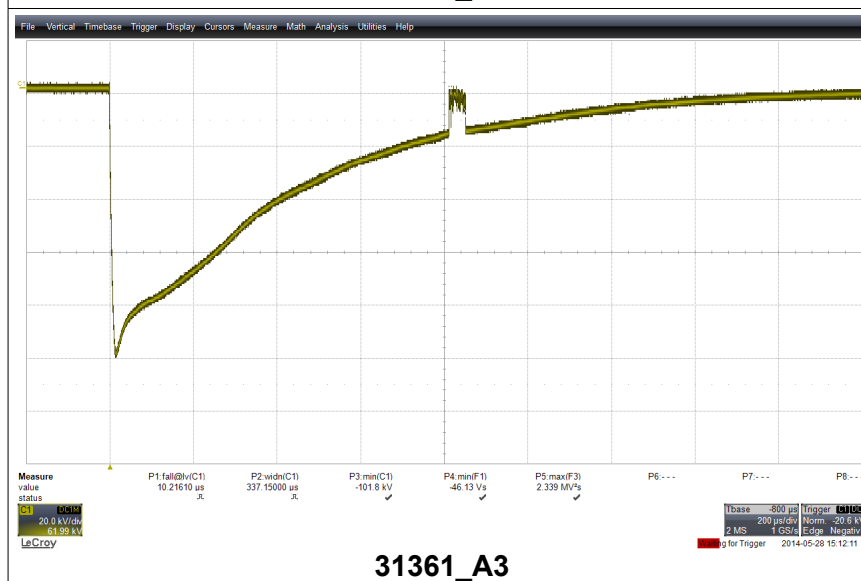
## OSCILLOSCOPE RECORDINGS OF THE IMPULSE CURRENT TESTS



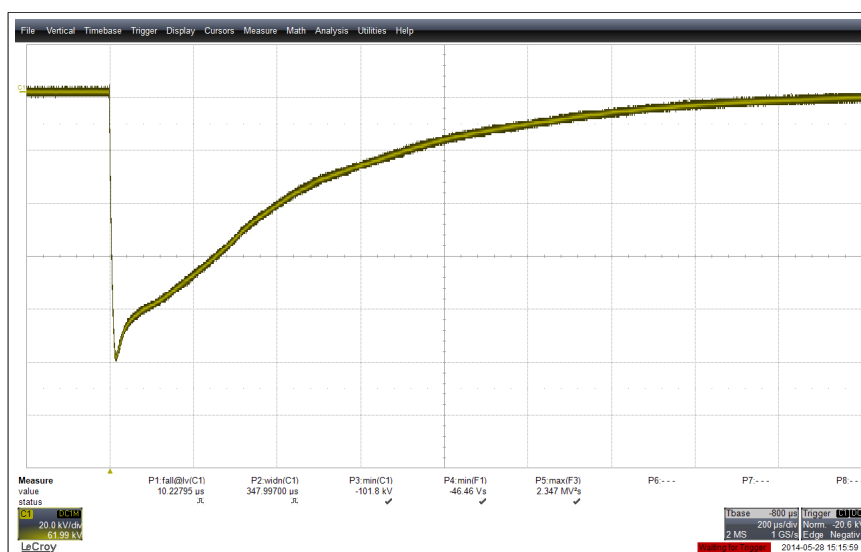
31361\_A1



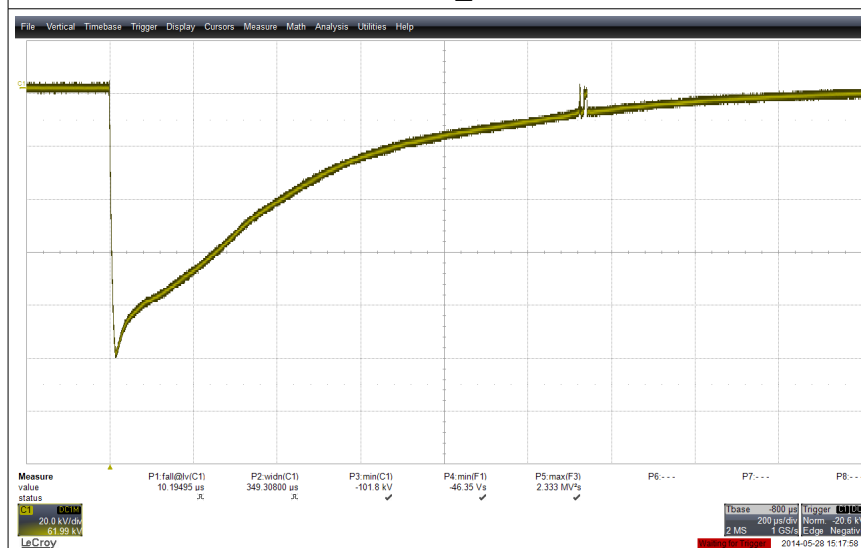
31361\_A2



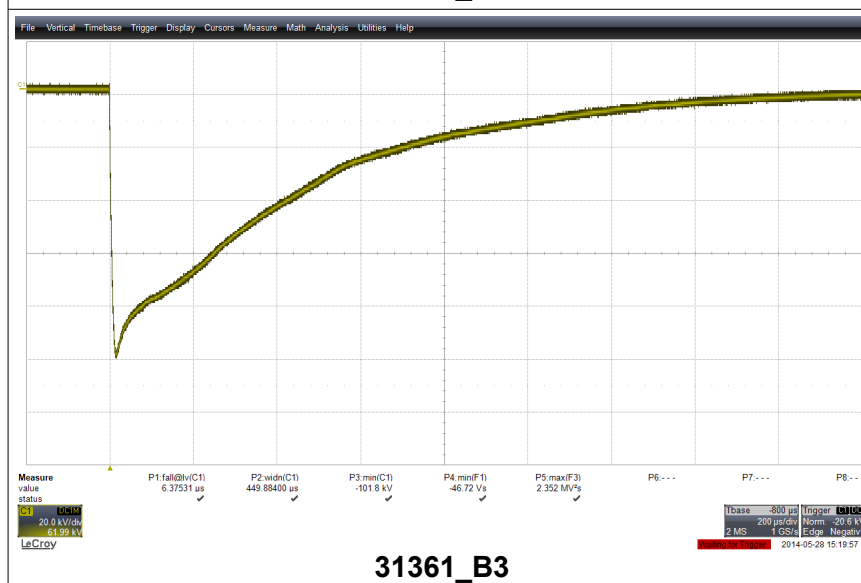
31361\_A3



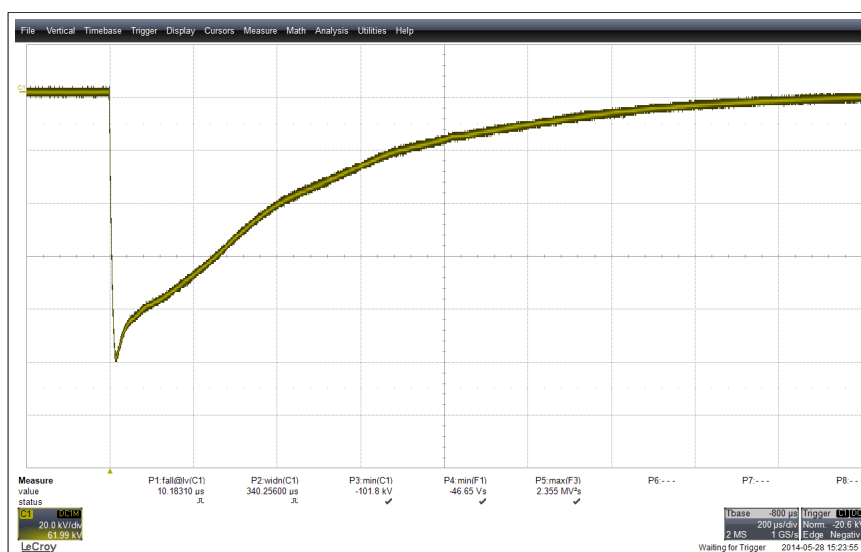
31361\_B1



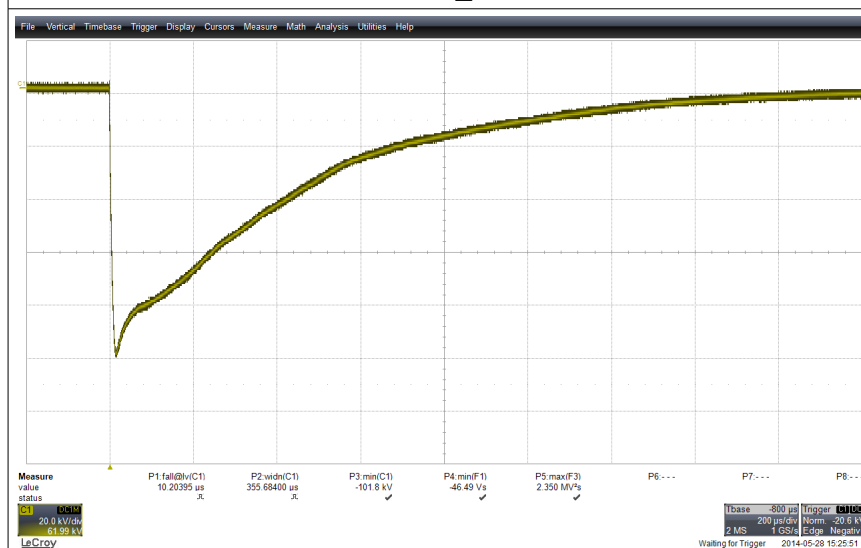
31361\_B2



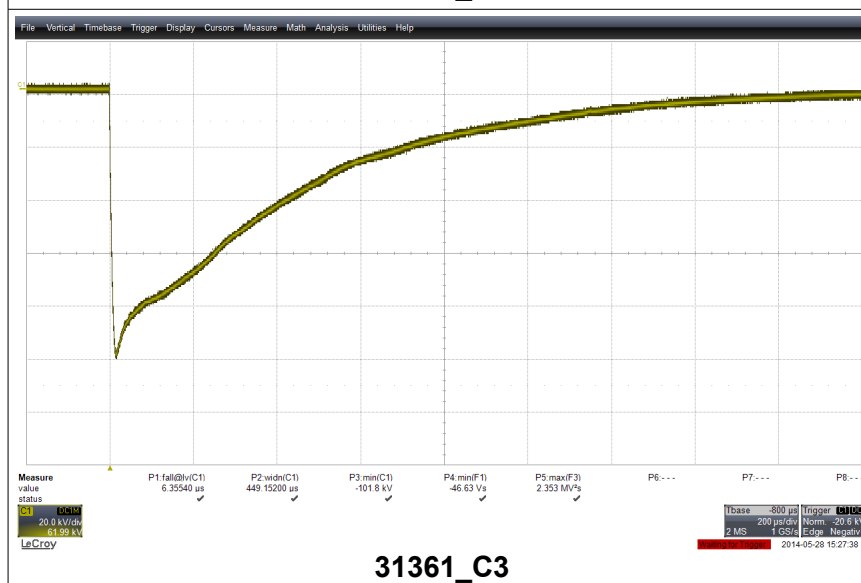
31361\_B3



31361\_C1



31361\_C2




31361\_C3

## 10. (8.10) TESTS RESULT SUMMARY

The six connection components specimens, type "B" bond with part number BN005, 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 "T" connection arrangement (B6) between aluminium solid tape conductor 25x3 mm dimensions and metal (galvanized steel) installation 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:

- Lightning current carrying capability as: class H (100kA), see Table 1,
- Installation as: not embedded in concrete,
- Mechanical capability as: intended to carry static mechanical load.

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

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