

EARTHING & LIGHTNING PROTECTION

Furse RB210

IEC 62561-2:2018 test report

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1. Introduction

This report details the testing of the Furse component RB210 [7TCA083870R1755]; Copperbond earth rod (threaded). 5/8" (14.2mm dia.), 1,500 mm long. in accordance with IEC 62561-2:2018 Lightning Protection System Components (LPSC) – Part 2: Requirements for conductors and earth electrodes.

1.1. Declaration

The above product supplied by Furse has been successfully tested in accordance with IEC 62561-2:2018 Lightning Protection System Components (LPSC) – Part 2: Requirements for conductors and earth electrodes.

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

1.2. Scope of conformity

For use in a lightning protection system (LPS) as an earth electrode in accordance with Furse literature.

1.3. Variant part numbers

Valid for variant part numbers RB203, RB205-FU, RB213, RB215, RB216, RB217, RB220-FU, RB223, RB225 RB226, RB235 & RB236.

2. Main report

The body of the formal report follows.

STATUS	SECURITY LEVEL	DOCUMENT ID.	REV.	LANG.	PAGE
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**ELEMKO SA
LIGHTNING & HIGH VOLTAGE LABORATORY
THIVA GREECE**

TEST REPORT No. 31338b

**OF COPPER COATED STEEL SOLID ROUND EARTH ROD OF 14,2 mm DIAMETER
FOR USE IN EXTERNAL LIGHTNING PROTECTION SYSTEMS (LPS)
AS EARTH ELECTRODE**

COMPANY :



PART NUMBER : RB210

APPLICABLE STANDARD:

IEC / BS EN 62561-2:2012

Re-issuance of test report and statement of compliance with

IEC / BS EN 62561-2:2018



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

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**Re-issuance of test report and statement of compliance with
IEC / BS EN 62561-2:2018**

The specimens were tested according to the standard IEC / BS EN 62561-2:2012. The tests and requirements of IEC / BS EN 62561-2:2012 are the same with the ones of IEC / BS EN 62561-2:2018. Therefore, the tested specimens comply also with the requirements of standard IEC / BS EN 62561-2:2018.

The present report 31338b is cancelling and replacing the report 31338a dated 2015-08-24.

ABBREVIATIONS

IEC : International Electrotechnical Commission

ISO : International Standardization Organization

EN : European Norm

A2LA : American Association for Laboratory Accreditation

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issuing laboratory.***

1. (7.1) 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 62561-2 (edition 2012 & 2018), the format of the headings kept the same as it is mentioned in clause 7 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 (7.2) REPORT IDENTIFICATION

2.1 (7.2.a) Subject of the report

Description and results presentation of laboratory type testing according to IEC / BS EN 62561-2 (edition 2012 & 2018) on copper coated steel solid round earth rod, provided by FURSE with part number RB210.

2.2 (7.2.b) Name, address and telephone number of the test laboratory

ELEMKO SA, LIGHTNING & HIGH VOLTAGE LABORATORY, THIVA GREECE
2nd km Old National Road Thiva-Halkida GR 32200, Thiva, Greece
Tel: (0030) 2102845400
Fax : (0030) 2102840151
e-mail: elemko@elemko.gr

2.3 (7.2.c) Name, address and telephone number of the sub contracting test laboratory

Tensile strength and elongation tests were subcontracted by accredited laboratory (ESYD issue nr. 159-4):

T.C.L Co - Test & Control Laboratories
Head office : 116 Agias Eleousis Str., 151 25 Amarousion, Athens, Greece
Tel: (+30) 2105579375,
Fax : (+30) 2105579376
e-mail: info@ad-ndt.gr

2.4 (7.2.d) Number of test report **31338b**

2.5 (7.2.e) Applicant's name and address

Request number: 173
Name: W. J. FURSE Ltd.
Address: Wilford Road, Nottingham NG2 1EB,
United Kingdom

2.6 (7.2.f) Total number of pages 14

2.7 (7.1.g) Date of re-issue of report 2018/04/16

2.8 (7.1.h) Dates of performance the tests

Initiation date: 2014/03/13

Closing date: 2014/04/02

2.9 (7.1.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 (7.1.j) The tests were conducted by**L. KATSIKOIANNIS**

Electrical Engineer
Test engineer

S. MARKOU

Laboratory Technician

3. (7.3) SPECIMEN DESCRIPTION**3.1 (7.3.a) Specimen description**

Copper coated steel solid round earth rod of 14,2 mm nominal diameter and 1500 mm nominal length.

3.2 (7.3.b) Description and identification of the test specimen and /or test assembly

Three specimens of copper coated steel solid round rod of 14,2 mm nominal diameter cut to a length of approx. 1200 mm with identification numbers 31338 A, 31338 B & 31338 C.

3.3 (7.3.c) Characterization and condition of the test specimen and/or test assembly

The received specimens were new and in good condition.

3.4 (7.3.d) Sampling procedure

Not relevant.

3.5 (7.3.e) Date of receipt of test items:

2014/03/06

3.6 (7.3.f) Photographs



1. Photograph of first set of specimens before the test sequence



2. Photograph of first set of specimens after the bend test



3. Photograph of first set of specimens after the adhesion test



4. Photograph of first set of specimens after the environmental test



5. Photograph of second set of specimens after the tensile test

4. (7.4) CONDUCTOR – ROD – PLATE

4.1 (7.4.a) Material

Copper coated steel.

4.2 (7.4.b) Nominal cross-section area, dimensions and shape

Declared by the applicant 158 mm², 14,2 mm diameter, solid round rod. For actual dimensions see Table of clause 9.

5. (7.5) STANDARDS AND REFERENCES

5.1 (7.5.a) Test standard used

IEC / BS EN 62561-2 (edition 2012 & latest revision 2018 for report re-issue and state compliance with the requirements) "Lightning protection system components (LPSC) – Part 2: Requirements for conductors and earth electrodes".

5.2 (7.5.b) Other relevant documentation

- IEC EN 62561-1 "Lightning protection system components (LPSC) – Part 1: Requirements for connection components".
- IEC EN 62305-3 "Protection against lightning – Part 3: Physical damage to structures and life hazards".
- IEC EN 62305-4 "Protection against lightning – Part 4: Electrical and electronic systems within structures" (IEC 62305-4).
- Furse, Total Sollution Product Catalogue, as downloaded from the website, www.tnb.com in March 2014.

6. (7.6) TEST PROCEDURE

6.1 (7.6.a) Description of test procedure

According to IEC / BS EN 62561-2:2012 the following tests were performed:

- Inspection on installation instructions literature provided by applicant as per clause 4.2 of the standard.
- Material, configuration, minimum dimensions as per clause 4.4.1 and Table 3 of the standard.
- Test for thickness coating as per clause 5.3.2 and Table 3 of the standard.
- Adhesion test as per clause 5.3.3, of the standard.
- Bend test as per clause 5.3.4, of the standard.
- Environmental test as per clause 5.3.5, of the standard.
- Tensile test as per clause 5.3.6 and Table 4, of the standard.
- Yield/tensile ratio test as per clause 5.3.7, of the standard.
- Electrical resistivity test as per clause 5.3.8 and Table 4, of the standard.

For each test 3 specimens were used.

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 62561-2:2012. Requirements and results are illustrated in detail in clause 9 "Table of results and parameters recorded" of the present report.

6.2 (7.6.b) Justification for any deviations from, additions to or exclusions from the referenced standard

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

6.3 (7.6.c) Other information relevant to the tests

All information is tabled in clause 9 of this report.

6.4 (7.6.d) Configuration of the testing assembly

See photo 1 in clause 3.6 of this report.

6.5 (7.6.e) Location of the arrangement in the testing area and measuring techniques

Environmental – Electrical tests were performed in our laboratory's "conditioning test room".
Coating thickness test – Adhesion test – Bend test were performed in our laboratory's "Mechanical tests room".

Mechanical tests (tensile, elongation, yield / tensile ratio) in subcontractor's test room.

Measuring techniques used are illustrated in detail in clause 9 "Table of results and parameters recorded" of the present report.

7. (7.7) TESTING EQUIPMENT DESCRIPTION

1. Environmental chamber for salt mist ageing and humid sulphurous atmosphere ageing, serial nr. 4077.
2. 25.000kg press.
3. Elongation and tensile strength machine.



Photograph of environmental ageing chamber used for salt mist and humid sulphurous atmosphere ageing



Photograph of 25000kg press

8. (7.8) MEASURING INSTRUMENTS DESCRIPTION

Instrument	Calibration date	Calibration interval
1. Digital micro-ohmmeter, 5μΩ-400Ω, serial nr. 166423.	2013/05/30	1 year
2. Digital sliding callipers (thickness gauge), 0-150±0.01mm serial nr. 1U206306.	2013/08/19	1 year
3. Universal bevel protractor, 0-180° ±0.08°, serial nr. 060412.	2011/08/24	3 years
4. Digital balance, 4,200±0.01gr, serial nr. 077780190.	2013/11/05	1 year
5. Coating measurement instrument, 0 – 1250μm, serial nr. 12299	2014/03/13 (internal)	Before tests
6. 1m rule	2013/09/30 (internal)	1 year
7. Temperature and humidity meter, serial nr. 0004036360	2013/07/18	1 year

9. (7.9) RESULTS AND PARAMETERS RECORDED

The performed tests, required for copper coated steel solid round earth rods and their results are shown in the below table:

Table or clause	Requirements and passing criteria for copper coated solid round earth rods according to IEC / BS EN 62561-2 (edition 2012 & 2018)	Recorded results and parameters	PASS/ FAIL
4.2	<u>Documentation:</u> Adequate information to ensure that the installer can select and install in suitable and safe manner in accordance to EN 62305-3.	<u>Documentation:</u> The information is ensuring that the selection of the tested specimens and its installation can be performed in a suitable and safe manner.	PASS
4.4.1 Table 3	<u>Material:</u> - copper or; - tin plated copper or; - steel (galvanized or copper coated) or; - stainless steel	<u>Material:</u> Copper coated steel	PASS
4.4.1 Table 3	<u>Configuration:</u> - solid round or; - pipe or; - cross profile.	<u>Configuration:</u> Solid round	PASS
4.4.1 Table 3	<u>Cross sectional area / diameter for copper coated steel earth rods:</u> ≥150 mm² / 14 mm (allowable tolerance -3%)	<u>Cross sectional area / diameter:</u> 31338A : 158,32 mm ² / 14,20 mm 31338B : 158,49 mm ² / 14,21 mm 31338C : 157,58 mm ² / 14,16 mm	PASS

Table or clause	Requirements and passing criteria for copper coated solid round earth rods according to IEC / BS EN 62561-2 (edition 2012 & 2018)	Recorded results and parameters	PASS/ FAIL
4.4.2	<u>Visual inspection of earth rods:</u> The threads on the rods shall be smooth and fully formed. For coated rods, the coating shall extend over the threads. A lead in chamfer or point is recommended to facilitate driving. For electroplated rods such as copper coated rods, it is desirable to thread roll the thread profile to ensure no copper is removed from the steel.	<u>Visual inspection of earth rods:</u> The threads on the rods are smooth and fully formed. The coating extend over the threads. There is a lead in chamfer or point to facilitate driving. The threads are formed by thread rolling.	PASS
5.3.2 Table 3	<u>Test for thickness coating:</u> Minimum radial copper coating : 250 µm Measuring technique: The copper coating on a steel cored earth rod should be measured using a magnetic method instrument complying with EN ISO 2178. Measurements should be taken at three positions along the length of the rod (500mm): One 50mm in from the top, one 50mm in from the bottom and one at the mid point. At each position detailed above, two additional measurements should be taken around the circumference of the rod approximately 120 degrees separation.	<u>Test for thickness coating:</u> Copper coating measured using a magnetic method instrument complying with EN ISO 2178: 31338 A : 256 µm 31338 B : 269 µm 31338 C : 260 µm	PASS
5.3.3	<u>Adhesion test for copper coated steel earth rods:</u> The copper coated steel earth rods specimens with one end cut to an angle of approximately 45° chamfer must be driven through two steel clamping plates or the jaws of a vice set $1^{+0.00}_{-0.25}$ mm less than the diameter of the specimens, so as to shear off sufficient metal to expose the bond between the coating and the parent metal. After the test, the coating of the specimens shall show adherence to the parent metal. Separation of the copper from the steel is not acceptable.	<u>Adhesion test:</u> The specimens with one end cut to an angle of approximately 45° chamfer were driven through two steel clamping plates $1^{+0.00}_{-0.25}$ mm less than their diameter. After the test, the coating of the specimens show adherence to the parent metal.	PASS
5.3.4	<u>Bend test for copper coated steel earth rods:</u> The specimens each approximately 500mm long shall be bend to an angle of 90°±5° and bending radius 5 times (±1mm) their diameter (for round conductors or copper coated earth rods) or their thickness (for tape conductors). After the test the specimens shall show no sharp edges, cracks or peeling around the bending area.	<u>Bend test:</u> Bending radius: 70 mm The specimens did not show sharp edges, cracks or peeling.	PASS

Table or clause	Requirements and passing criteria for copper coated solid round earth rods according to IEC / BS EN 62561-2 (edition 2012 & 2018)	Recorded results and parameters	PASS/FAIL																
5.3.5	<p><u>Environmental test:</u> The specimens must be subjected to a salt mist ageing test (3 days) followed by a humid sulphurous atmosphere test (7 days). Salt mist test is performed according to standard EN 60068-2-52:1996 (except clauses 7, 10 and 11 which are not applicable) Test is carried out using severity (2). Humid sulphurous atmosphere treatment is performed according to standard EN ISO 6988:1994 (except clauses 9 and 10 which are not applicable) with seven cycles with a concentration of sulphur dioxide of (667±25) ppm (in volume). Each cycle which has a duration of 24h is composed of a heating period of 8h at a temperature of (40±3)°C in the humid saturated atmosphere which is followed by a rest period of 16h. After that, the humid sulphurous atmosphere is replaced.</p> <p>After the test, the specimens shall satisfy the following criteria :</p> <ul style="list-style-type: none"> - the base metal shall not exhibit any visual corrosive deterioration; - the specimens shall be of good visual appearance and have no rough edges or burrs throughout their length. - the electrical resistance over a 100mm length measured after the tests shall not exceed the resistance value measured before the tests by more than 50%. <p>Note 1: White rust is not considered as corrosive deterioration. Note 2: 100mm from both ends of the specimens are excluded from inspection.</p>	<p><u>Environmental test:</u> The specimens were subjected to the tests as follows:</p> <ul style="list-style-type: none"> - Salt mist ageing test: 2014/03/21-2014/03/24 - Humid sulphurous atmosphere test: 2014/03/24-2014/03/31 <p>After the test:</p> <ul style="list-style-type: none"> - the base metal of the specimens did not exhibit any visual corrosive deterioration. - the specimens were of good visual appearance and have no rough edges or burrs throughout their length. <table border="1"> <thead> <tr> <th>Specimen</th><th>Rbefore (μΩ)</th><th>Rafter (μΩ)</th><th>Difference %</th></tr> </thead> <tbody> <tr> <td>31338 A</td><td>76</td><td>85</td><td>12</td></tr> <tr> <td>31338 B</td><td>78</td><td>88</td><td>13</td></tr> <tr> <td>31338 C</td><td>77</td><td>70</td><td>-9</td></tr> </tbody> </table>	Specimen	Rbefore (μΩ)	Rafter (μΩ)	Difference %	31338 A	76	85	12	31338 B	78	88	13	31338 C	77	70	-9	<p>PASS</p> <p>PASS</p> <p>PASS</p>
Specimen	Rbefore (μΩ)	Rafter (μΩ)	Difference %																
31338 A	76	85	12																
31338 B	78	88	13																
31338 C	77	70	-9																
5.3.6 Table 4 5.3.7 Table 2	<p><u>Tensile strength test:</u> Tensile strength for copper coated steel earth rods: 600 – 770 N/mm² 350 – 770 N/mm²</p> <p>Measuring technique: Tensile strength should be performed according to standard EN ISO 6892-1. The specimens should be tested un-machined as per D.1.</p>	<p><u>Tensile strength test:</u> The tests were performed according to standard EN ISO 6892-1 and the specimens were tested un-machined.</p> <p>Tensile strength: 31338 A : 655 N/mm² 31338 B : 654 N/mm² 31338 C : 656 N/mm²</p>	PASS																
5.3.7 Table 4 5.3.8 Table 2	<p><u>Test for yield/tensile ratio for copper coated steel earth rods</u> Yield/tensile ratio: 0,80 – 0,95</p> <p>The yield/tensile ratio is determined by ascertaining the upper yield strength (R_{eH}) and dividing the result by the tensile strength (R_m).</p>	<p><u>Yield/tensile ratio:</u> 31338 A : 0,87 31338 B : 0,87 31338 C : 0,87</p>	PASS																

Note: The clauses and requirements of IEC BS EN 62561-2 standard edition 2018, where there are differences with IEC BS EN 62561-2 edition 2012, are mentioned in italics and blue.

Table or clause	Requirements and passing criteria for copper coated solid round earth rods according to IEC / BS EN 62561-2 (edition 2012 & 2018)	Recorded results and parameters	PASS/FAIL
5.3.8 Table 4 5.3.6 Table 2	<p><u>Electrical resistivity test:</u></p> <p>Maximum electrical resistivity for copper coated steel earth rods:</p> <p style="text-align: center;">0,25 $\mu\Omega\text{m}$</p> <p>Measuring technique: A sample length approximately 1,2 m should be used for the test. The resistance (R) measurement should be taken over a 1000 ± 1 mm distance, using proprietary microohmmeter and the reading corrected to 20 °C using appropriate correction factors. The sample should then be weighted. The resistivity of the sample length can then be found by the formula:</p> $(\rho)=R \times A / \ell$ <p>Where: R = Resistance in microohms ($\mu\Omega$) over 1m length. A = Cross sectional area (m^2) ℓ = Unit length (m)</p>	<p><u>Electrical resistivity test:</u></p> <p>Electrical resistivity : 31338 A : 0,105 $\mu\Omega\text{m}$ 31338 B : 0,107 $\mu\Omega\text{m}$ 31338 C : 0,105 $\mu\Omega\text{m}$</p> <p>Temperature during electrical resistivity measurements : A : 25,3 °C B : 25,3 °C C : 25,3 °C</p>	PASS
4.5 5.5	<p><u>Marking test</u></p> <p>The specimens shall be marked with:</p> <ul style="list-style-type: none"> - the manufacturer's or responsible vendor's name, logo or trademark; - identifying symbol. <p>The marking is checked by inspection and by rubbing it by hand for 15 sec, with a piece of cloth soaked in water and again for 15 sec with a piece of cloth soaked with white spirit/mineral spirit.</p> <p>The specimens are deemed to have passed the test if the marking remains legible.</p> <p>Note 1: Where marking proves to be impractical, it may be given on the smallest packing unit.</p> <p>Note 2: Marking made by moulding, pressing or engraving is not subjected to this test.</p>	<p><u>Marking test:</u></p> <p>The marking was made by engraving. Therefore only the visual inspection has been performed.</p> <p>Each specimen was marked with the manufacturer's name and trademark.</p> <p>The product identification is given on the smallest packing unit.</p>	PASS

Note: The clauses and requirements of IEC BS EN 62561-2 standard edition 2018, where there are differences with IEC BS EN 62561-2 edition 2012, are mentioned in italics and blue.


10. (7.10) SUMMARY STATEMENT

Three specimens of copper coated steel solid round earth rod Ø14,2 mm, part number RB210, were submitted for testing by FURSE and have been subjected to all the applicable tests required by Standard IEC / BS EN 62561-2 (edition 2012 & 2018), which are mentioned in the clauses 4.2, 4.4.1, 4.4.2, 4.5, 5.3.2, 5.3.3, 5.3.4, 5.3.5, 5.3.6, 5.3.7, 5.3.8 & 5.5 of the standard and found that :

The above three specimens have successfully passed the tests and therefore they satisfy the criteria according to IEC / BS EN 62561-2 (edition 2012 & 2018) for use in external Lightning Protection Systems (LPS) as earth electrode.

Note: The results of the performed tests are valid and for the other rods of the same type and diameter but with different length variants. Particularly the results of the performed tests are valid for the following earth electrodes:

- RB203: Unthreaded earth electrode 14,2 mm diameter & 1200 mm length,
- RB205-FU: Threaded earth electrode 14,2 mm diameter & 1200 mm length,
- RB210: Threaded earth electrode 14,2 mm diameter & 1500 mm length,
- RB213: Unthreaded earth electrode 14,2 mm diameter & 1500 mm length,
- RB215: Threaded earth electrode 14,2 mm diameter & 1800 mm length,
- RB216: Unthreaded earth electrode 14,2 mm diameter & 1800 mm length,
- RB217: Unthreaded earth electrode 14,2 mm diameter & 2000 mm length,
- RB220-FU: Threaded earth electrode 14,2 mm diameter & 2100 mm length,
- RB223: Unthreaded earth electrode 14,2 mm diameter & 2100 mm length,
- RB225: Threaded earth electrode 14,2 mm diameter & 2400 mm length,
- RB226: Unthreaded earth electrode 14,2 mm diameter & 2400 mm length,
- RB235: Threaded earth electrode 14,2 mm diameter & 3000 mm length,
- RB236: Unthreaded earth electrode 14,2 mm diameter & 3000 mm length.

	Laboratory Technical Director
NAME	Dr. N. Kokkinos Electrical Engineer BEng, MSc, PhD
SIGNATURE	 ELEMKO S.A. R. & D. Testing Lab. THIVA - GREECE TEL: +30 210 2845400 e-mail: elemko@elemko.gr

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

3. Revisions

Rev.	Page (P) Chapt. (C)	Description	Date Dept./Init.
0	All	Original issue.	2014/07/30 EPIP GBNTG/ APM
1	All	Additional variant part numbers	2015/10/15 EPIP GBNTG/ APM
A	All	Revised in line with IEC 62561-2:2018 (edition 2).	2018/05/21 EPIP GBNTG/ APM

4. Notices

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Furse Earthing & Lightning Protection
Wilford Road
Nottingham
NG2 1EB
United Kingdom
E-mail: enquiry@furse.com

www.furse.com

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