

EARTHING & LIGHTNING PROTECTION

Furse CR319

IEC 62561-1:2017 test report

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PREPARED	STATUS		SECURITY LEVEL		
2019-02-12 A. Merrill	Approved		Public		
APPROVED	INTERNAL REPORT ID.	REV.	DOCUMENT KIND		
2019-02-12 A. Holling	CR319_TR_01	0	Test report		
OWNING ORGANIZATION	DOCUMENT ID.		REV.	LANG.	PAGE
EPIP GBNTG RnD	9AKK107492A0031		A	en	1/23

1. Introduction

This report details the testing of the Furse component CR319 [7TCA083870R1755]; 'U' BOLT ROD CLAMP (TYPE E) TO SUIT 16 mm (5/8") NOMINAL GROUND ROD AND 25 mm WIDE COPPER TAPE. in accordance with IEC 62561-1:2017 Lightning Protection System Components (LPSC) – Part 1: Requirements for connection components.

1.1. Declaration

The above product supplied by Furse has been successfully tested in accordance with IEC 62561-1:2017 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.

1.2. Scope of conformity

For use in a lightning protection system (LPS) for the connection of Copper tape to a 5/8" Copperbond rod in accordance with Furse literature.

In a parallel connection (B2).

For an impulse current withstand capability of 100kA (class H).

1.3. Variant part numbers

2. Main report

The body of the formal report follows.

STATUS	SECURITY LEVEL	DOCUMENT ID.	REV.	LANG.	PAGE
Approved	Public	9AKK107492A0031	A	en	2/23

**ELEMKO SA
LIGHTNING & HIGH VOLTAGE LABORATORY
THIVA GREECE**

TEST REPORT No. 31743

**OF "U" BOLT TAPE TO ROD CLAMP, PART NUMBER CR319
IN PARALLEL CONNECTION ARRANGEMENT (B2)**

**APPLICANT :
FURSE EARTHING & LIGHTNING PROTECTION (ABB EPIP) ABB LIMITED**



**APPLICABLE STANDARD:
IEC EN 62561-1:2017**



Certificate #3051.01

<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
ILAC – MRA : International Laboratory Accreditation Cooperation - Mutual Recognition Arrangement

This type test report may not be reproduced, except in full, without the prior written approval of the issuing testing laboratory. In any case, changes such as tags, additions, deletions, alterations of information, etc, in the text of test report, are not permitted.

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, the format of the headings kept the same as it is mentioned in clause 8 of the applicable 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.

1.2. (8.2) REPORT IDENTIFICATION

a) Subject of the report

Description and results presentation of laboratory type testing according to IEC EN 62561-1:2017 on clamp provided by FURSE with part number CR319.

b) Name, address and email or 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

c) Name, address and email or telephone number of the sub test laboratory where the test was carried out if different from the company which has been assigned to perform the test

There were no tests subcontracted by other laboratory.

d) Unique identification number of the test report : 31743

e) Applicant's name and address

Name:	Furse Earthing & Lightning Protection (ABB EPIP) ABB Limited
Address:	Wilford Road, Nottingham NG2 1EB, United Kingdom
Request number:	299

f) Total number of pages: 19

g) Date of issue of report: 2018/12/21

h) Dates of performance the tests

Initiation date: 2018/12/07	Closing date: 2018/12/21
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i) Signature and title, or an equivalent identification of the person authorized to sign for the testing laboratory for the content of the report

Dr. N. KOKKINOS

Electrical Engineer Beng, MSc, PhD, CEng

Laboratory Technical Manager

j) The tests were conducted by

L. KATSIKOGIANNIS

Electrical Engineer

Test engineer

S. MARKOU

Laboratory Technician

1.3. (8.3) SPECIMEN DESCRIPTION

a) Sample description

Clamp of FURSE company, for connection of tape to earth rod. For details see drawing in ANNEX B, page 19.

b) Detailed description and unambiguous identification of the test sample and/or assembly

Each clamp was connected with copper solid tape conductor 25x3 mm dimensions and copper coated steel earth rod 14,2 mm diameter. For traceability, the specimens were marked with the identification numbers 31743 A, 31743 B & 31743 C

Specimen configuration is illustrated in clause 1.3.f.

c) Characterization and condition of the test sample and/or test assembly

The received specimens were new and in good condition.

d) Sampling procedure, where relevant

Not relevant.

e) Date of receipt of test items : 2018/11/14

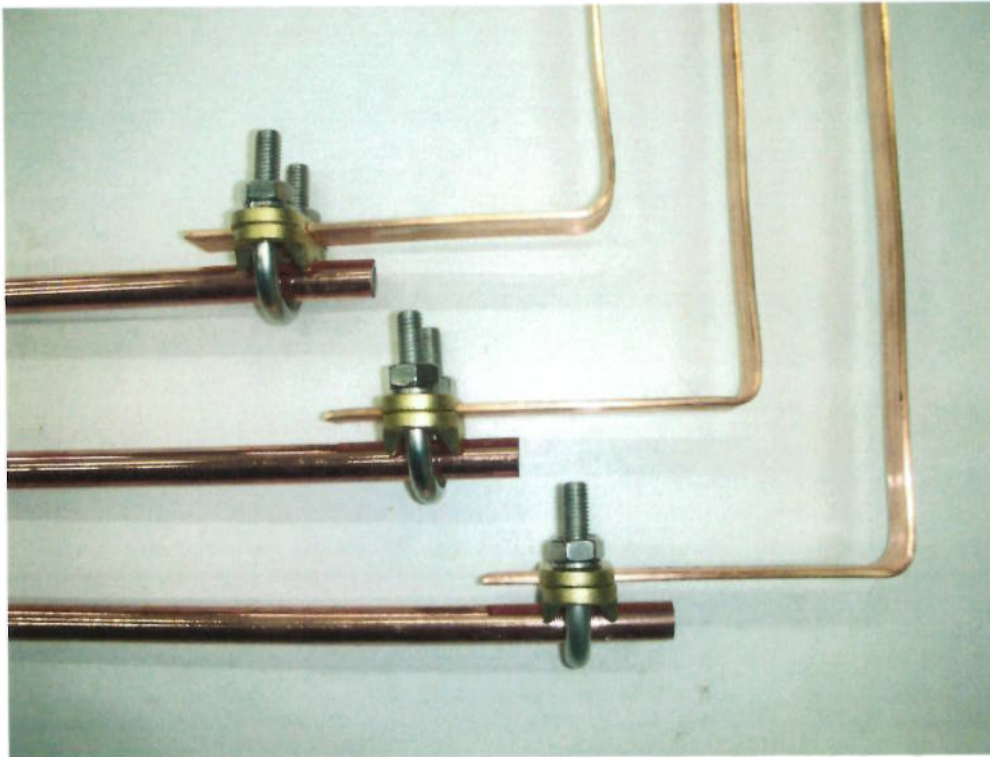
f) Photographs, drawings or any other visual documentation, if available

Figure f1. The assembled specimens before the initiation of the test sequence

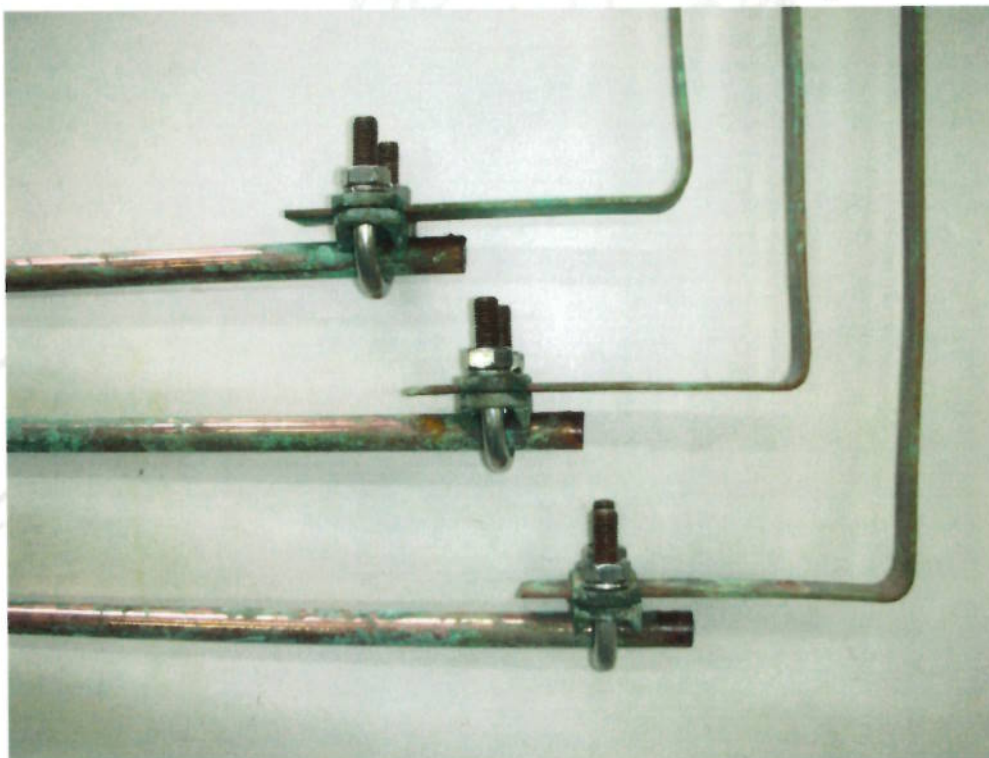


Figure f2. The specimens following the salt mist treatment and humid sulphurous atmosphere treatment tests

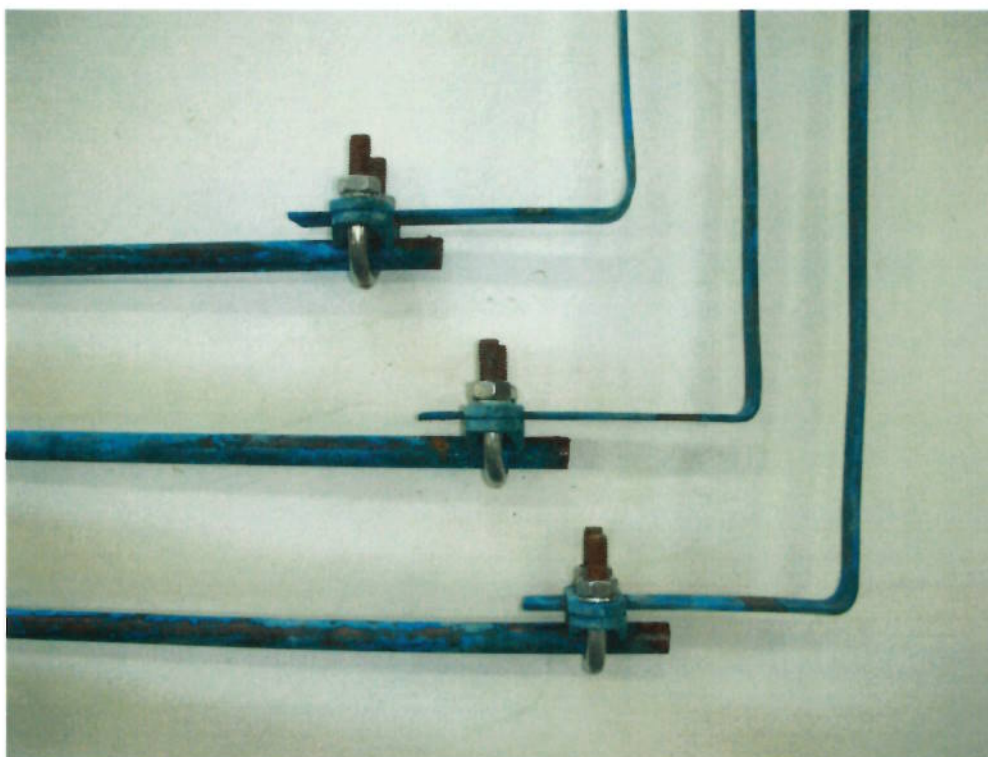


Figure f3. The specimens following the ammonia atmosphere treatment test.

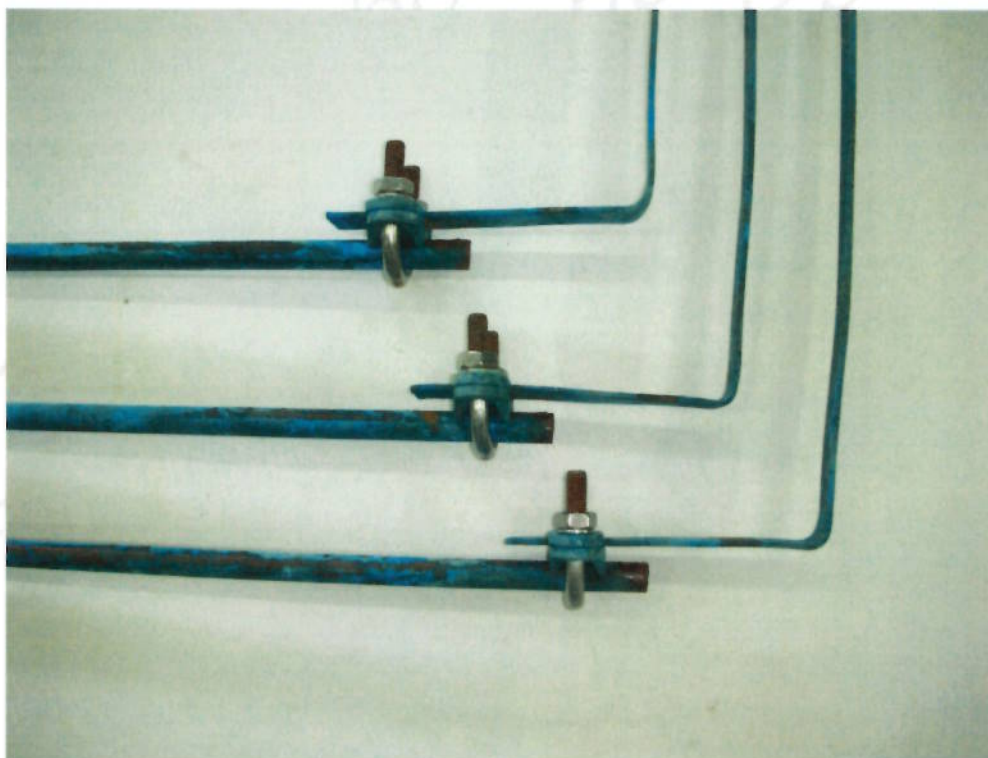


Figure f4. The specimens following the termination of the electrical tests.

1.4. (8.4) CONDUCTOR

See Figure d1

a) Conductor material

• Conductor:	"a"	"b"
• Material:	Copper	Copper coated steel

b) Nominal cross-section area, dimensions and shape

• Conductor:	"a"	"b"
• Nominal cross sectional area:	75 mm ²	158 mm ²
• Nominal dimensions:	25x3 mm	14,2 mm diameter
• Shape:	Solid tape	Solid round
• Actual cross sectional area:	74,7 mm ²	154,8 mm ²

1.5. (8.5) STANDARDS AND REFERENCES

a) Identification of the test standard used and the date of issue of the standard

IEC EN 62561-1:2017 "Lightning protection system components (LPSC) – Part 1: Requirements for connection components".

b) Other relevant documentation with the documentation date

- IEC EN 62561-2:2018 "Lightning protection system components (LPSC) – Part 2: Requirements for conductors and earth electrodes"
- IEC 60068-2-52:1996 "Environmental testing - Part 2-52: Tests - Test Kb: Salt mist, cyclic (sodium, chloride solution)"
- ISO 6988:1985 "Metallic and other non organic coatings - Sulfur dioxide test with general condensation of moisture"
- ISO 6957:1988 "Copper alloys – Ammonia test for stress corrosion resistance"
- Component's installation instructions, provided by FURSE.

1.6. (8.6) TEST PROCEDURE

a) Description of the test procedure

According to the applicable standard the following tests has to be performed:

- Inspection on installation instructions literature provided by the applicant as per clause 5.2 of the standard.
- Marking review as per clause 5.11 of the standard.
- Conditioning / ageing test as per clause 6.3.1 of the standard consisting of:
 - Salt mist treatment;
 - Humid sulphurous atmosphere treatment;
 - Ammonia atmosphere treatment, in case of specimens where any component part is made of copper alloy with a copper content less than 80%.

Conditioning / ageing tests as per clause 6.3.1 of the standard is not applicable on connection components designed to be completely embedded in concrete and bonding bars intended for indoor applications only, (clause 6.3.2).

- Electrical test as per clause 6.4 of the standard consisting of:
 - Three impulse discharge current shots at each specimen, of crest value limp of 50 kA for normal duty classification or 100 kA for heavy duty classification
 - Contact resistance measurement test as per clause 6.4.a of the standard.
 - Visual inspection of the specimens after the completion of the tests as per clause 6.4.b of the standard.
 - Loosening torque as per clause 6.4.c of the standard, in case of non-permanent connection component.
 - Measurement of the displacement of the component's conductors as per clause 6.4.d of the standard, in case of a non-permanent connection component except for connection arrangements B3 & B6.
 - Mechanical tensile force, in case of screw-less or permanent connection components.
- Static mechanical test to a second set of three new specimens as per clause 6.5 of the standard, if the connection component is intended to withstand a static mechanical load.
- Marking test as per clause 6.6 of the standard (not applicable in case of markings made by moulding, pressing or engraving).

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.

Requirements and results are illustrated in detail in clause 1.9 "Results and parameters recorded" of the present report.

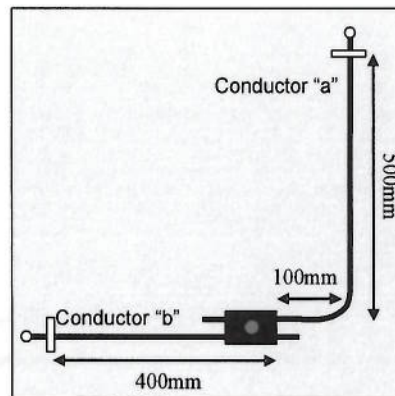
b) Justification for any deviations from, additions to or exclusions from the referenced standard

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

c) Any other information relevant to a specific test such as environmental conditions

All information is tabled in clause 1.9 of this report.

d) Configuration of testing assembly



B2: Parallel connector – Test Arrangement

Figure d1

e) Location of the arrangement in the testing area and measuring techniques

Environmental / Ageing tests are performed in our laboratory's "conditioning test room".
The electrical tests are performed in our laboratory's "high voltage area".
Mechanical tests are performed in our laboratory's "Mechanical tests room".

1.7. (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. Ammonia ageing chamber.
4. Impulse current generator 100kA, 65C, 187kJ.
5. 4-channel trigger / delay pulse generator serial nr. 09720.
6. Shunt 1 mΩ.



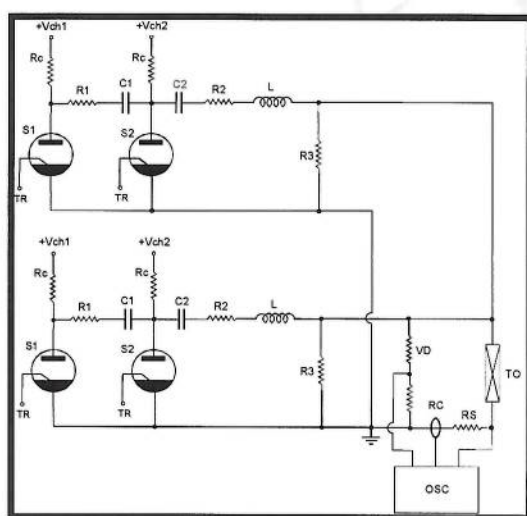
Photograph of the environmental ageing chamber used for salt mist ageing.



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



Photograph of the 100kA, 10/350μs 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.

1.8. (8.8) MEASURING INSTRUMENTS DESCRIPTION

Instrument	Verification date	Verification interval
1. Torque meter, 30Nm, serial nr. 0901610877	2018/06/26	6 months
2. Digital micro-ohmmeter, 5μΩ-400Ω, serial nr. 166423.	2018/07/13	6 months
3. 4-channel, digital oscilloscope, serial nr. LCRY3203N57222.	2018/01/26	1 year
4. Temperature, barometric pressure and humidity meter.	2018/08/24	1 year
5. Digital sliding callipers (thickness gauge), 150mm serial nr. 1U206306.	2018/09/11	6 months

1.9. (8.9) RESULTS AND PARAMETERS RECORDED

REQUIREMENTS			RESULTS									PASS/ FAIL
SUB- CLAUSE OF 8.9	TEST – INSPECTION & CLAUSE OF STANDARD	IDENTIFICATION OF SPECIMEN										
		31743A			31743B			31743C				
	<u>Electrical test</u> §6.4	Shot number:	A1	A2	A3	B1	B2	B3	C1	C2	C3	
a)	Imp: 100kA±10% W/R: 2500KJ/Ω±35% Front time ≤50µs Duration ≤5ms *Requested by the applicant.	Current peak limp (kA):	100,5	100,5	99,9	99,9	99,9	100,5	100,5	100,5	100,5	COMPLY
b)		Charge Q (As)	46,31	46,52	46,40	46,54	46,59	46,55	46,58	46,45	46,65	COMPLY
c)		Spec. energy W/R (kJ/Ω):	2336	2354	2354	2358	2377	2365	2346	2350	2353	COMPLY
d)		Impulse front time (µs)	10,3	10,2	10,1	10,2	10,17	10,2	10,1	10,1	10,0	COMPLY
e)		Impulse duration (ms)	1,8	1,8	1,8	1,8	1,8	1,8	1,8	1,8	1,8	COMPLY
f)	<u>Contact resistance Rc (mΩ), §6.4.a</u> (requirement Rc ≤ 1 mΩ or 3 mΩ for stainless)		Rc: 0,086			Rc: 0,058			Rc: 0,055			PASS
g)	<u>Tightening torque T_T (Nm) §6.4.c</u>		T_T : 12,0			T_T : 12,0			T_T : 12,0			PASS
h)	<u>Loosening torque T_L (Nm) §6.4.c</u> (requirement $0,25T_T < T_L < 1,5T_T$)		T_L : 8,0			T_L : 7,0			T_L : 7,0			
i)	<u>Visual inspection, §6.4.b</u> (requirement: no cracks, loose parts, deformation impairing its normal use)		Y			Y			Y			PASS
j)	<u>Conductors' length from connector, §6.4.d</u> (requirement: from 20 mm not less than 3 mm)		"a": 20,0 "b": 20,0			"a": 20,0 "b": 20,0			"a": 20,0 "b": 20,0			PASS
k)	<u>Tensile force, §6.4.e</u> (applicable to screw-less components)		-			-			-			N/A
l)	<u>Installation instructions shall contain, §5.2:</u> a) classification of the component b) recommended tightening torque c) range of conductor sizes - materials d) connection configuration		Inspection's results: a) provided b) provided c) provided d) provided									PASS
m)	<u>Conditioning, §6.3.1, Annex D</u> a) Salt mist treatment (IEC 60068-2-52) severity (2), three spray periods (three days) b) Humid sulphurous atm. treatment (ISO 6988) for 7 cycles (days) c) Ammonia atmosphere treatment (ISO 6957) for 24 h, moderate atmosphere with pH 10		a) Start : 2018/12/10 End : 2018/12/13 b) Start : 2018/12/13 End : 2018/12/20 c) Start : 2018/12/20 End : 2018/12/21									COMPLY COMPLY COMPLY
n)	<u>Static mechanical test 900N±20N for 1 min, §6.5</u> (On a 2 nd set of specimens. Requirement: movement of the conductor < 1mm, no damage to conductor or component)		-			-			-			N/A
o)	<u>Marking shall contain, §5.11 & §6.6:</u> (a) name or trade mark, (b) identifying symbol*, (c) classification*. * If impractical to be on the component may be given on the smallest packing unit label or on the accompanying documentation. Marking shall be durable and legible.		Inspection's results: (a) engraved (durable and legible) (b) on the accompanying documentation (c) on the accompanying documentation									PASS
Environmental conditions during electrical tests (humidity, temperature, atm. Pressure): 52,5%, 17,7° C, 999 mbar												
Comments: No additional comments												

Y: Fulfils the requirements. **N:** Do not fulfils the requirements. **N/A:** Not applicable


1.10. (8.10) STATEMENT OF PASS/FAIL

The connection components specimens, "U" bolt tape to rod clamp with part number CR319, submitted for tests by FURSE, have been subjected to the tests according to IEC EN 62561-1:2017 for use in external lightning protection systems, in parallel connection arrangement (B2) between copper solid tape conductor 25x3 mm dimensions and copper coated steel earth rod 14,2 mm diameter and have successfully passed the tests.

Therefore they satisfy the standard's requirements for the above assembly and are classified as per their:

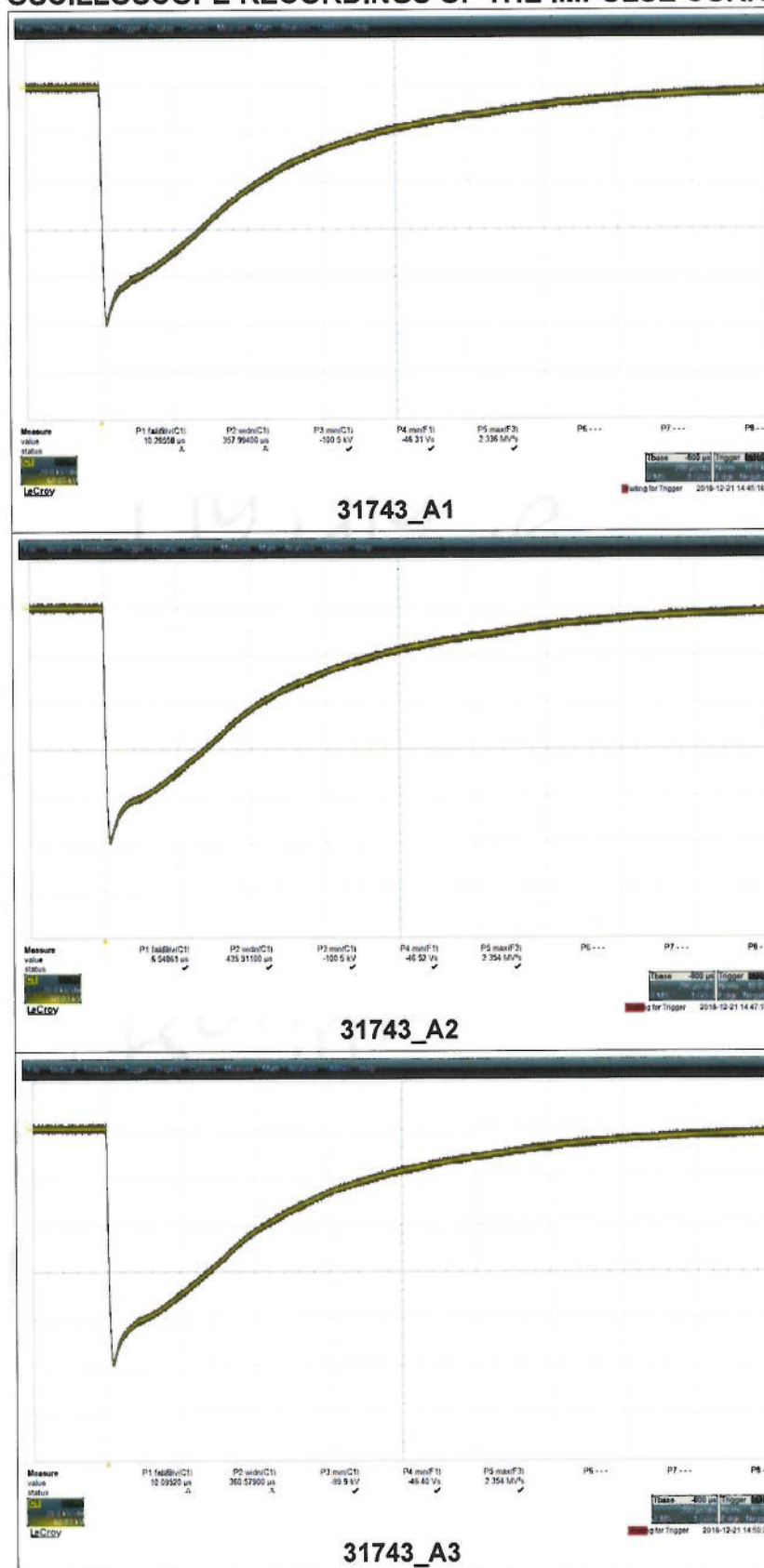
- Lightning current carrying capability as: class H (100kA).
- Installation location as : for general use.
- Mechanical behaviour as: not intended to withstand a static mechanical load.
- Connection type as: non-permanent.

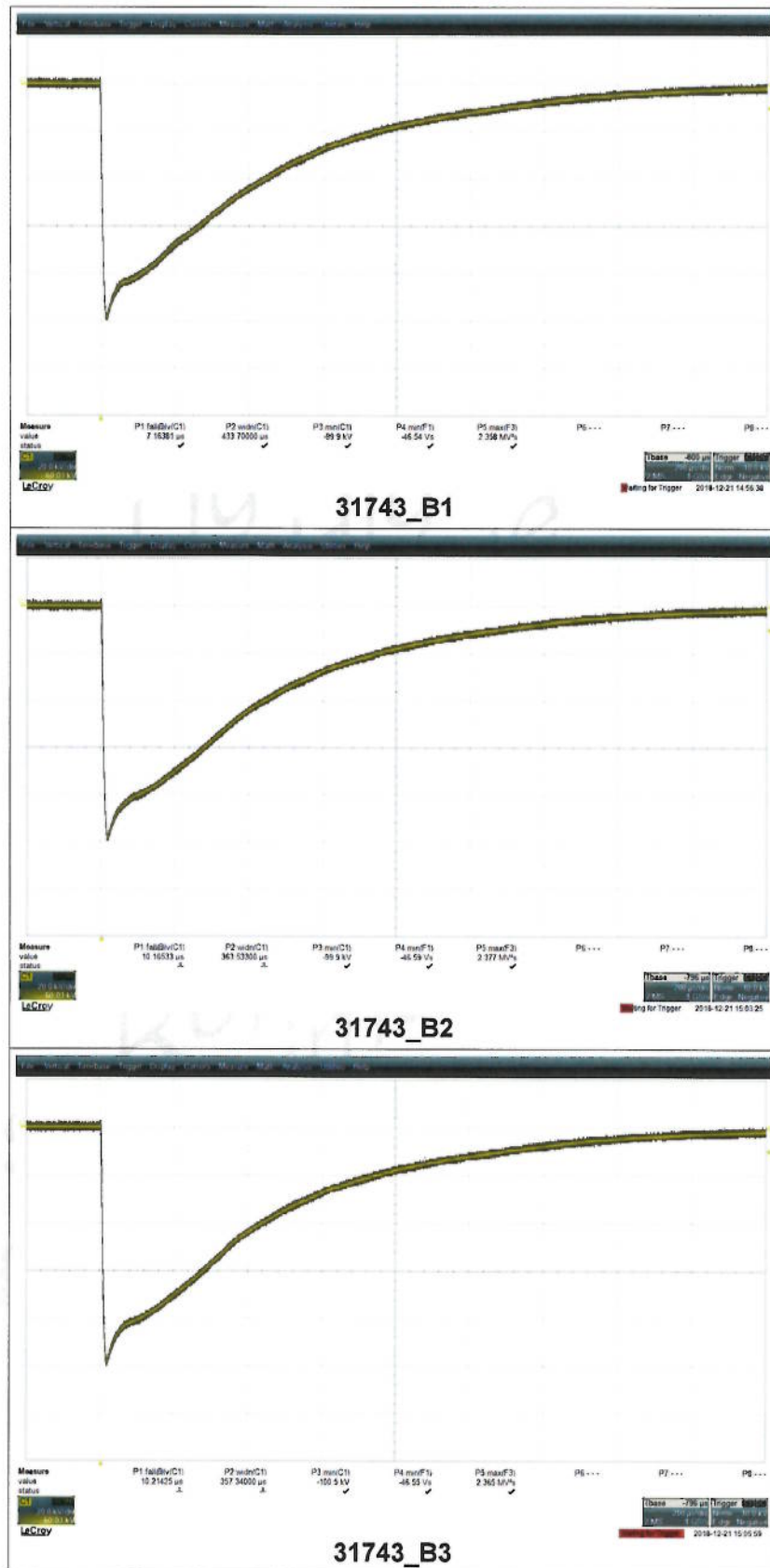
Test results regarding this connection component specimen are displayed in clause 1.9 (8.9).

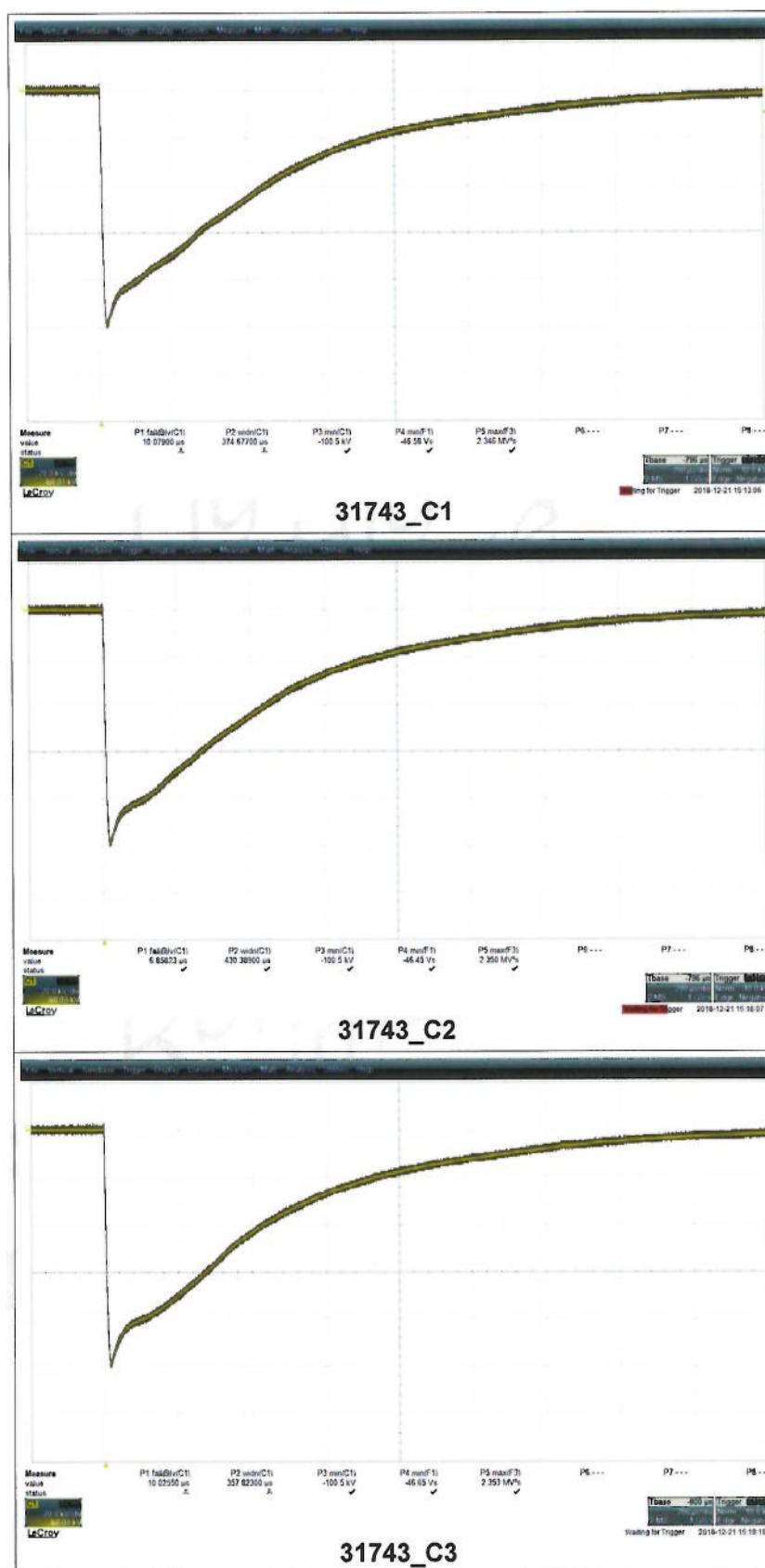
	Laboratory Technical Manager
NAME	Dr. N. KOKKINOS Electrical Engineer Beng, MSc, PhD, CEng
SIGNATURE	 ELEMKO S.A. R. & D. Testing Lab. THIVA - GREECE TEL: +30 210 2845400 e-mail: elemko@elemko.gr

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

ANNEX A: OSCILLOSCOPE RECORDINGS OF THE IMPULSE CURRENT TESTS

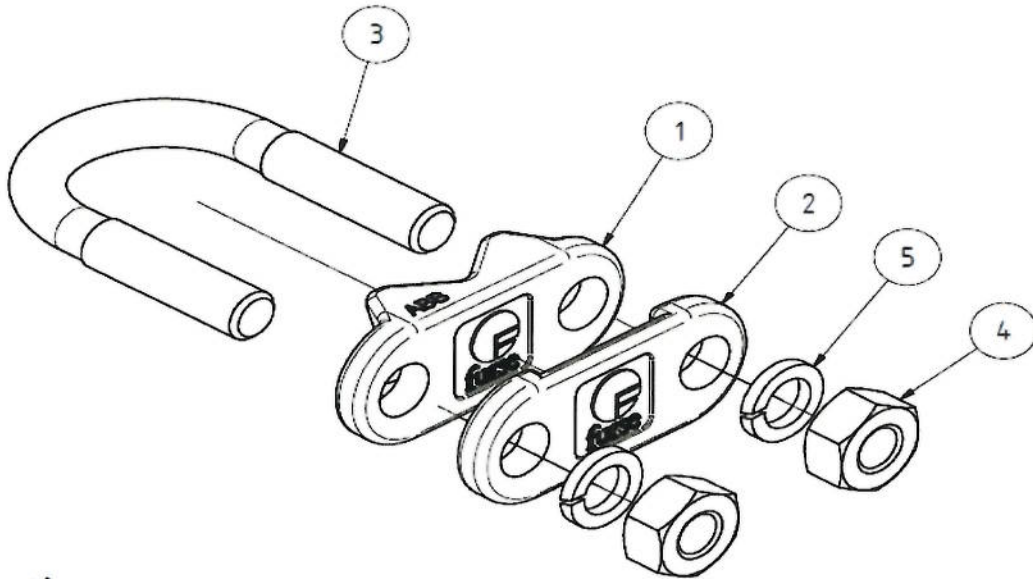






ANNEX B: SPECIMEN'S INSTALLATION INSTRUCTIONS



PARTS LIST			
ITEM	QTY	DESCRIPTION	MATERIAL
1	1	U' BOLT ROD CLAMP TYPE E, BODY FORGING.	Copper, Alloy, UNS C35330
2	1	U' BOLT ROD CLAMP TYPE E, TAPE CLAMPING PLATE, FORGING.	Copper, Alloy, UNS C35330
3	1	U' BOLT ROD CLAMP TYPE E, STAINLESS STEEL 'U' BOLT.	Stainless Steel
4	2	FULL NUT, M10, STAINLESS STEEL GRADE A2-70	Stainless Steel
5	2	WASHER, SPRING, M10, STAINLESS STEEL GRADE A2-70	Stainless Steel



Application

Manufactured from high quality copper alloy for excellent corrosion resistance. Simple to install, providing a secure lightning protection system connection between a copper tape and an earth rod.

Suitable for 25 mm wide, 3-4 mm thick copper tape. Suitable for 5/8" (Ø14.2 mm shank) copperbonded steel earth rods.

furse  Earthing & Lightning Protection		ABB	
		ABB Ltd. Wilford Road, Nottingham, NG2 1EB United Kingdom	
ISSUED FOR: INFORMATION		TITLE: U' bolt rod clamp type 'E'. with frontplate for copper tape.	
PRODUCT LINE: FURSE E & LP		DRAWING NUMBER: CR319 CD 01	
MATERIAL: SEE PARTS LIST		REV: C	
FINISH: SELF COLOUR		SHEET 1 OF 3	
FIRST ANGLE PROJECTION 		FILE: W:\Technical\2. ELP Documents\Controlled Documents\1. Production\CR319\CR319_CD_01_C.dwg	
1. DO NOT SCALE 2. ALL DIMENSIONS SHOWN ARE BEFORE STATED FINISH. 3. REMOVE ALL BURRS AND SHARP EDGES.		CAD (INVENTOR) GENERATED DRAWING DO NOT CHANGE MANUALLY	
ORIGINAL	DATE	NAME	SHEET REF: QADC4_A4 Rev 6.1
DRAWN	07/01/2019	A. MERRILL	SIZE: A4
CHECK'D	07/01/2019	J. MATTHEWS	
APPR'D	07/01/2019	A. HOLLING	

Standards

Furse part number CR319 is tested in accordance with IEC 62561-1 Lightning Protection System Components (LPSC) - Part 1: Requirements for connection components. Testing was carried out on an arrangement of 25 mm wide by 3 mm thick copper tape to a 5/8" (Ø14.2 mm) copperbonded earth rod.

IEC 62561-1 Classification:

- According to the ability to withstand lightning current - Class H
- According to the installation location - General use.
- According to the mechanical behaviour - Not intended to withstand a static load.
- According to whether or not connection is permanent - Non-permanent connection.

Other information

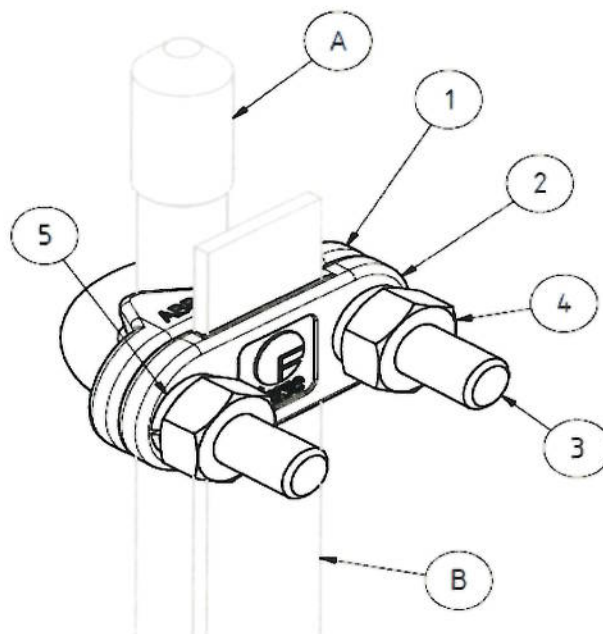
- Metallic (Copper alloy with 80-83% Copper content)
- Test arrangement B2.

Installation instructions

Tools Required:

17 mm spanner or socket.

- Place the 'u' bolt [3] around the earth rod [A] at the point where the connection is to be made.
- Place the clamp body [1] and the clamp frontplate [2] on to the 'u' bolt with the copper tape [B] between the two parts.
- Place a spring washer [5] and a hex nut [4] on to each leg of the 'u' bolt and tighten until all parts are loosely held in place.
- Ensure all parts and conductors are correctly aligned then tighten hex nuts [4] evenly to specified torque (12 Nm).
- Finished connections should be protected by application of corrosion resistance tape (part no. TD005)



DRAWING NUMBER:

CR319 CD 01 C

REV:

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SHEET 2 OF 3

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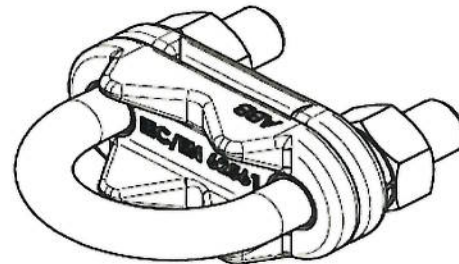
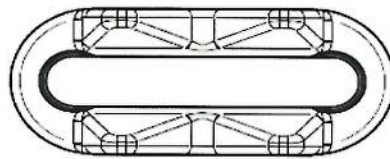
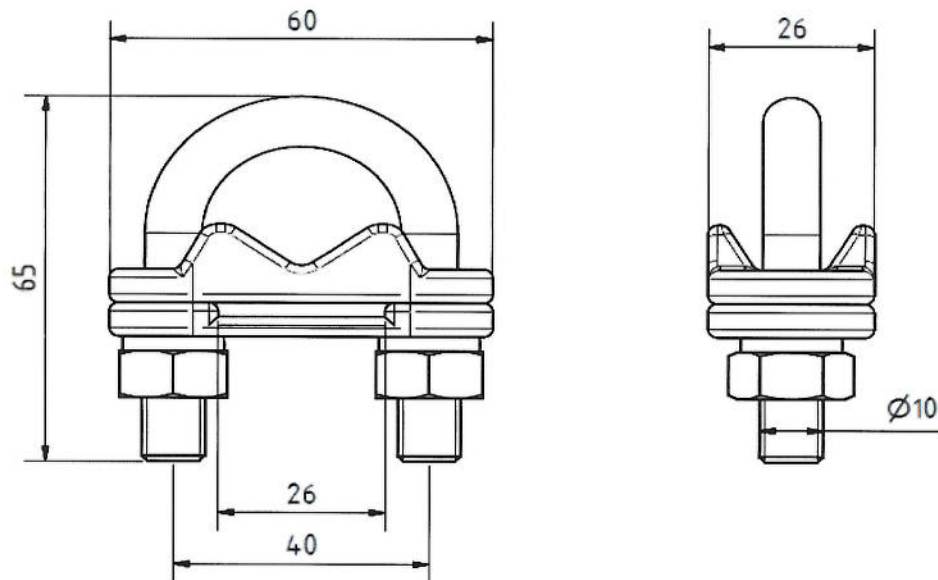
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Dimensions

All dimensions shown in millimetres.



DRAWING NUMBER:

CR319 CD 01 C

REV:

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SHEET 3 OF 3

CAD (INVENTOR) GENERATED DRAWING DO NOT CHANGE MANUALLY

SHEET REF: QADC4_A4 Rev 6.1

SIZE: A4

3. Revisions

Rev.	Page (P) Chapt. (C)	Description	Date Dept./Init.
A	All	Original issue.	2018/02/12 APM

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Approved	Public	9AKK107492A0031	A	en	22/23

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STATUS	SECURITY LEVEL	DOCUMENT ID.	REV.	LANG.	PAGE
Approved	Public	9AKK107492A0031	A	en	23/23