ECOLD VTSI - 2463R/E

COMPONENTS DESCRIPTION

Code	**FN17419A1**
Highest Voltage Um	**24 kV**
Rated voltage Uo/U	12/20 kV
Termination description	Single core indoor termination cold-shrinkable type with mechanical lug supplied in the kit: - for single core XLPE or EPR insulated cable with Aluminum tube metallic screen. - for single core XLPE or EPR insulated cable with Copper wires metallic screen.

Cable size

Min cable insulation (mm)	Max outer cable diameter (mm)	Cable cross section (*) (mm^2)
23,2	**40**	**95 ÷ 240 Cu/Al**
(*) Indicative information. Check the cable diameters dimensions for the right application.		

ID	Q.TY	COMPONENTS DESCRIPTION
1	1	M.V. mechanical conductor lug
2	1	Termination body TS 04-16-320/57A
3	1	ELCOSTRESS 87 (pad) 188 x 120 mm
4	1	Sealing tape Elcomastic 36 - 20 mm x 1,5 m
5	1	PVC tape ELCOPLAST 51 - 15 mm x 10 m
6	1	Earthing plate Ø 26 equipped with 16 mm² braid - L = 600 mm
7	1	Silicone grease 10 g
8	1	L.V. earthing lug. 25 mm² Cu
9	1	Mastic for lug 15 g
10	2	Cleaning tissue
11	1	Abrasive cloth - L = 300 mm
12	2	Tightening strap FE 250
13	1	Gloves pair
14	1	Installation instruction N° 962PVR/E

Date 09/03/2018
signature G.D.S./N.R.

ECOLD VTSE - 2464R/E

COMPONENTS DESCRIPTION

Code	**FN17427A1**
Highest Voltage Um	**24 kV**
Rated voltage Uo/U	12/20 kV
Termination description	Single core outdoor termination cold-shrinkable type with mechanical lug supplied in the kit: - for single core XLPE or EPR insulated cable with Aluminum tube metallic screen. - for single core XLPE or EPR insulated cable with Copper wires metallic screen.

Cable size

Min cable insulation (mm)	Max outer cable diameter (mm)	Cable cross section (*) (mm^2)
23,2	**40**	**95 ÷ 240 Cu/Al**
(*) Indicative information. Check the cable diameters dimensions for the right application.		

ID	Q.TY	COMPONENTS DESCRIPTION
1	1	M.V. mechanical conductor lug
2	1	Termination body VTSE - 16,5/57A/370
3	1	ELCOSTRESS 87 (pad) 188 x 120 mm
4	1	Sealing tape Elcomastic 36 - 20 mm x 2 m
5	1	PVC tape ELCOPLAST 51 - 15 mm x 10 m
6	1	Earthing plate Ø 26 equipped with 16 mm² braid - L = 600 mm
7	1	Silicone grease 10 g
8	1	L.V. earthing lug. 25 mm² Cu
9	1	Mastic for lug 15 g
10	2	Cleaning tissue
11	1	Abrasive cloth - L = 300 mm
12	2	Tightening strap FE 250
13	1	Gloves pair
14	1	Installation instruction N° 963PVR/E

Date 07/01/14

signature NR - FP/MR

ELCOTERM GLM - 1266/EW-R

HEAT SHRINKABLE TRANSITION JOINT FROM THREE SINGLE CORE PLASTIC OR RUBBER INSULATED CABLES WITH WIRE SCREEN TO BELTED OR SCREENED PAPER INSULATED CABLE

-Suitable for connector with shear bolts –

Code	***FN18143***
Section	***3 x (1) x 95 ÷ 240 mm² Cu/Al***
Highest Voltage Um	***12 kV***
Rated Voltage Uo/U	6/10 – 6,35/11 kV

Bill of Material

ITEM	Q.TY	MATERIAL DESCRIPTION
1	**3**	M.V. Connector with shear bolts
2	**3**	Transparent tube MTC 25,4 length = 320 mm **(to use on paper cable section 95 ÷ 120 mm²)**
3	**3**	Transparent tube MTC 38,1 length = 320 mm **(to use on paper cable section 150 ÷ 240 mm²)**
4	**3**	Stress control tube MCC 55/21 length = 400 mm
5	**3**	Insulating - semiconductive tube GIS 66/20 length = 440 mm
6	**3**	Semiconductive tube MSC 1638 – 44/16 length = 190 mm
7	**1**	Sealing tube MPS20 130/36 length = 1000 mm
8	**1**	Sealing breakout TES 0154/3
9	**1**	Semiconductive breakout SCB 75/33
10	**4**	Stress control tape ELCOMASTIC 85 length = 2 m
11	**3**	Sealing mastic ELCOMASTIC 75 length = 0,6 m
12	**3**	Semiconductive paper ELCOBLACK 47 length = 5 m
13	**3**	Tinned copper tape ELCOSHIELD 49 60 mm x 4 m
14	**6**	Sealing mastic ELCOFIL 62 length = 0,5 m
15	**1**	P.V.C. tape ELCOPLAST 51
16	**1**	Copper wire length = 3 m
17	**1**	Screw clip
18	**1**	Constant force spring
19	**1**	Mastic (for sheared-off bolts) 90 g
20	**6**	Cleaning tissue - bag
21	**3**	Abrasive cloth
22	**2**	Glove -pair
23	**1**	Drawing N° 670/E-R with installation instruction

Important : Please keep note of following data for correct installation

DIMENSION FOR CABLE PREPARATION (mm)				
A	B	C	MAX DIMENSION OF CONNECTOR	
			LENGTH	DIAMETER
280	**160**	**550**	**140**	**38**

Date 11/05/2023

Signature G.DS./G.DA.

RPc YQ T Yg ; AEFf f

P y ° ² vw– x vx v²÷° ² ² ° a 7j 7w –y x –x G
6 Ø a 7j 7 ² ÷–x –l YdR ² v –y xvw– ² ° v ² ² w– x –– H
6 Ø a 7j 7 ² ÷–x –l YdR ² v –y xvw– ² ° v ² ² w– x –– v y a 7j 7 ² ÷–x – l YdR Rdf ² v –y xvw– ² ° x – ² – x –– H
6 Ø a 7j 7 ² ÷–x –l YdR Rdf ² v –y xvw– ² ° x – ² – x –– H

P y– Sb: D=A: R
g–x ² : FB ; A9 P 8N
U²÷° – j v÷– i ; A j
f v –y j v÷– i 8 : ; 8 9 j
a ² ² V v ² y²v – – ; ;

O² Ø v – ²v

VhRa e h7m a NhRf WNY QRgPf VdhVc b

: : O –y x –x ² ° °–v v w–v
; : Sa dgf PN; BQBD =C9 W² w y
= : RYPc ghf Rgg ; B : F = 6g – x v –
A B RYPc a NghVP DB ; 9 95C 6g–v² ÷ v –
B : RYPc gRa AC : F : 6g– ²x y x² – v –
C : RYPc dYNgh B: : B : 9 6d7j 7P7 v –
D ; RYPc hNdR CA B9 95A g– Øv v ÷v v² ÷ v –
E ; T y v –
F A Ov y x²
: 9 ; P v Ø x– ² ÷
: : : Nw v² – x ° – ÷ ° J =99
: ; ; P –v² ÷ ² – wv÷
: = : g²²x – ÷ –v – : 9 ÷
: A : Ny° – ² – x – v – :
: B ; a v ²x : B ÷
: C : P °
: D : W – ²²Øxv² vw–
: E : T – y² vw– v²
: F : Q v ² ÷ b FC9f f RbT ² ° ² v v² ² x²

V v Gd –v – –– – ØØ ² ÷yv v Ø x –x ² v v²

QVa RbgVc b Sc f PNOYR df RdNf NhVc b 1 2			a NlVa i a QVa RbgVc b cS Pc bbRPhc f 1 2	
c i hRf WNPXRh f Ra c j NY	gRa VPc bQi Phc f f Ra c j NY	QVNa RhRf c S hUR hNdR c b hUR c i hRf WNPXRh		
N	O	P	YRbT hU	QVNa RhRf
; A9	: BB	=B	: =9	=B

Qv –G i E8: 98; 9: F g²÷ v –GT 7Q7g78P X7

ELCONEXT 24C-K1-LT 1923TWR1/E

Outer cone asymmetric separable TEE connector with insulation cap and shear bolts lug

For single core XLPE insulated cable with wire screen

Code	**FN21332**
Highest voltage Um	**24 kV**
Rated voltage Uo/U	**12,7/22 kV**
Nominal current In	**630 A**
Interface type	**C**
Cable insulation range	**21,0 ÷ 32,0 mm**
Cable conductor cross section	**24 kV 70-240 mm²**

BILL OF MATERIAL

Item	Q.ty	Description		
1	**1**	**SCE-24C-K1**	Separable connector body complete of equipotential conductor and protection cap	
2	**1**	**CREK 70-59**	Insulation cap	
3	**1**	**AC-Ø19-110**	Cable adapter **(cable insulation range: 21,0 ÷ 25,5 mm)**	
4	**1**	**AC-Ø23-110**	Cable adapter **(cable insulation range: 25,0 ÷ 32,0 mm)**	
5	**1**	**K-M16/M12 L64**	Screw tightening	
		Bolts	Nut, washer, spring washer	
6	**1**	**MV lug**	Shear bolts lug	
7	**1**	**Silicon grease**	Lubricating	
8	**1**	**Abrasive cloth**	Strip	
9	**2**	**Cleaning tissue**	Bag	
10	**1**	**Positioning to buckle**		
11	**1**	**Elcoplast 51**	Roll	
12	**1**	**Gloves**	Pair	
13	**1**	Installation instructions N.1008/E K1		

Date: 12/10/2023 Signature: M.R.-G.DA. / G.D.S.

ECOLD VTSI - 2463R/E

Installation instruction

SINGLE-CORE INDOOR TERMINATION COLD-SHRINK TYPE

WITH MECHANICAL CONDUCTOR LUG

SECTION 1

for

single core XLPE or EPR insulated cable with Aluminum tube metallic screen

SECTION 2

for

single core XLPE or EPR insulated cable with Copper wires metallic screen

Highest voltage Um: 24 kV

ELCON MEGARAD S.p.A.
HEADQUARTER and FACTORY: ARCELLA (AV) ITALY
Tel. +39 0825/6077 - Fax +39 0825/607782
Web site:www.elconmegarad.com e-mail: elcon@elconmegarad.com

DRAWING N°	Code MP17843	Drawn	Update	Approved
962PVR/E	Date	27/11/13	09/03/18	
	Signature	N.R.	N.R.	G.DS.

ECOLD VTSE - 2464R/E

Installation instruction

SINGLE-CORE OUTDOOR TERMINATION COLD-SHRINK TYPE

WITH MECHANICAL CONDUCTOR LUG

SECTION 1

for

single core XLPE or EPR insulated cable with Aluminum tube metallic screen

SECTION 2

for

single core XLPE or EPR insulated cable with Copper wires metallic screen

Highest voltage Um: 24 kV

ELCON MEGARAD S.p.A.
HEADQUARTER and FACTORY: ARCELLA (AV) ITALY
Tel. +39 0825/6077 - Fax +39 0825/607782
Web site:www.elconmegarad.com e-mail: elcon@elconmegarad.com

DRAWING N°	Code MP17845	Drawn	Update	Approved
963PVR/E	Date	07/01/14		
	Signature	N.R.		M.R. F.P.

ECOLD VTSE - 2464R/E

COMPONENTS DESCRIPTION

Code	**FN17427A1**
Highest Voltage Um	**24 kV**
Rated voltage Uo/U	12/20 kV
Termination description	Single core outdoor termination cold-shrinkable type with mechanical lug supplied in the kit: - for single core XLPE or EPR insulated cable with Aluminum tube metallic screen. - for single core XLPE or EPR insulated cable with Copper wires metallic screen.

Cable size

Min cable insulation (mm)	Max outer cable diameter (mm)	Cable cross section (*) (mm^2)
23,2	**40**	**95 ÷ 240 Cu/Al**
(*) Indicative information. Check the cable diameters dimensions for the right application.		

ID	Q.TY	COMPONENTS DESCRIPTION
1	1	M.V. mechanical conductor lug
2	1	Termination body VTSE - 16,5/57A/370
3	1	ELCOSTRESS 87 (pad) 188 x 120 mm
4	1	Sealing tape Elcomastic 36 - 20 mm x 2 m
5	1	PVC tape ELCOPLAST 51 - 15 mm x 10 m
6	1	Earthing plate Ø 26 equipped with 16 mm² braid - L = 600 mm
7	1	Silicone grease 10 g
8	1	L.V. earthing lug. 25 mm² Cu
9	1	Mastic for lug 15 g
10	2	Cleaning tissue
11	1	Abrasive cloth - L = 300 mm
12	2	Tightening strap FE 250
13	1	Gloves pair
14	1	Installation instruction N° 963PVR/E

Date 07/01/14

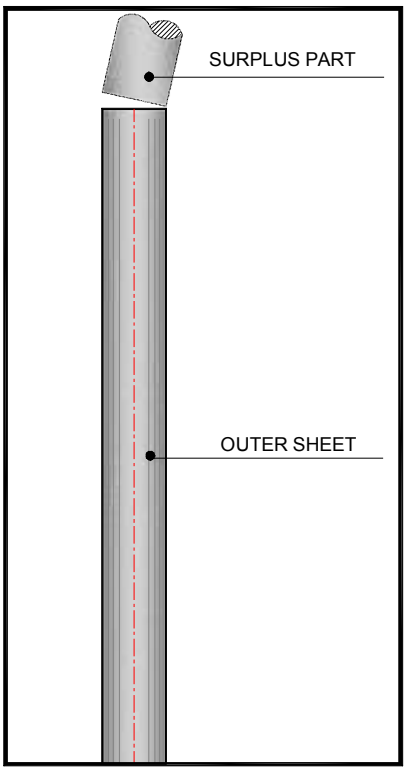
signature NR - FP/MR

GENERAL INFORMATION

* **Check if all the components listed in the bill of materials are available in the kit**

* **Read carefully the installation instruction before starting the cable preparation.**

-- **CABLE WITH ALUMINUM TUBE METALLIC SCREEN**

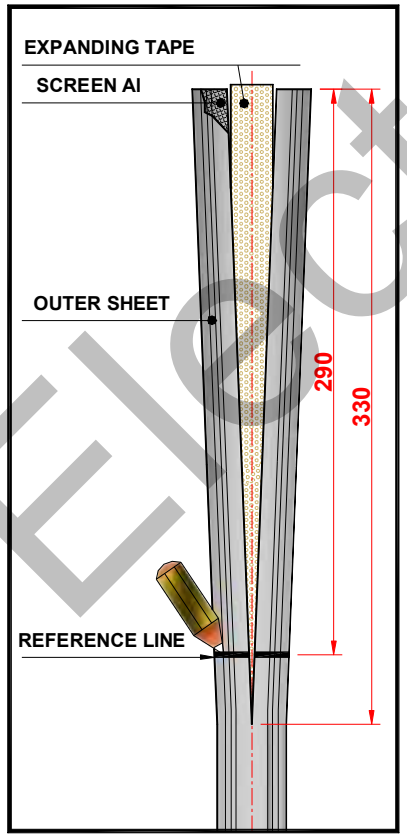


SECTION 1

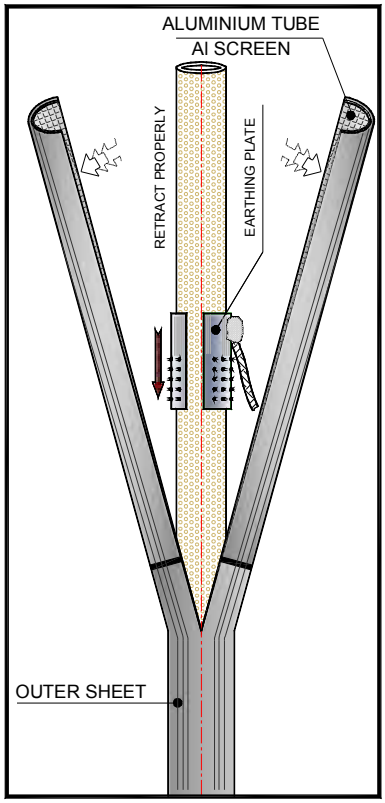
1. CABLE PREPARATION

- Make in position the cable in such a way to simulate the final position and cut its end to remove any defects.

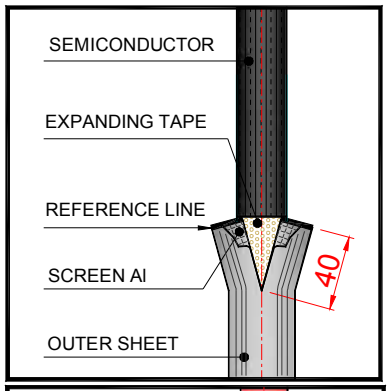
- Clean the cable outer sheet for at least **0,5 m** by means of the cleaning tissue supplied in the kit.



1.1 On the cable outer sheet make **a reference line** at **290 mm** from the cable end.
1.2 Using a proper tool (like that ones in the photo), cut longitudinally the cable outer sheet and the aluminum tube for a length of **330 mm** from the cable end.

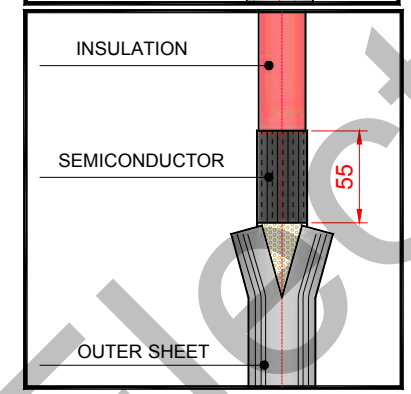


1.3 Open wide the two parts of the cable outer sheet and aluminum tube and check if the earthing plate can be easily positioned.



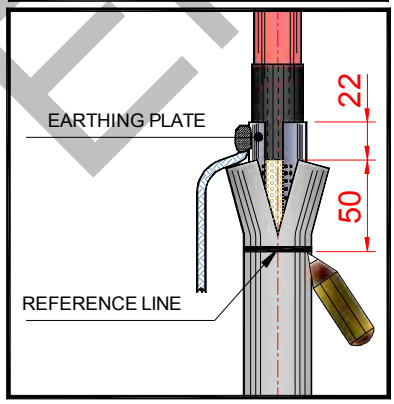
1.4 Take temporaly apart the earting plate. Cut the cable outer sheet and the aluminum tube in correspondence of the **reference line** by means of electrician clippers.

1.5 Remove any tape contained in the cable until the outer sheet cut.



— *Use a proper tool* (like that one in the photo) to remove the cable semiconductor .

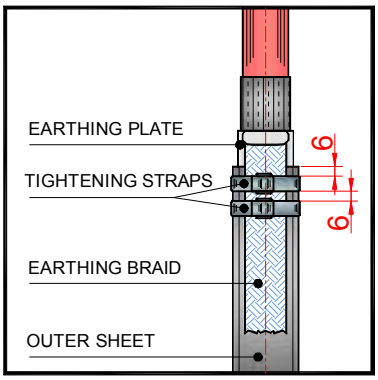
1.6 Remove the cable semiconductor by means of suitable tools, leaving exposed a length of **55 mm** from the cable outer sheet cut.



1.7 Fix the earthing plate (equipped with the braid) under the aluminum tube leaving exposed a length of about **22 mm**.

1.8 Make a sign on the cable outer sheet at **50 mm** from the cable outer sheet cut.

WARNING: THE ABOVE SIGN AT 50 mm IS THE REFERENCE LINE FOR THE FOLLOWING TERMINATION BODY INSTALLATION, THE DISTANCE OF 50 mm IS THEREFORE MANDATORY.



1.9 Beat the cable outer sheet against the earthing plate, to fix them tight.

Laid the earthing braid on the cable outer sheet.

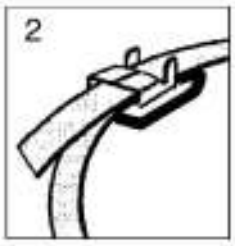
Make in position the **first tightening strap** around the braid at about **6 mm** from the cable outer sheet edge.

Tighten the strap by means of the tool showed below and according to the instructions in the picture.

1.10 Tighten the **second strap** at about **6 mm** from the first strap, repeating the same steps carried out before.

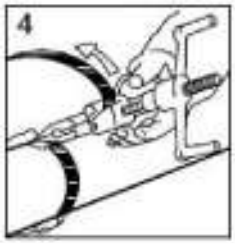
OPERATIONS TO PERFORM THE TIGHTENING STRAP

1. Wrap the strap on the cable.

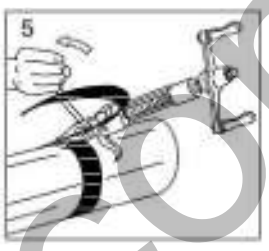


2. Insert the end of the strap in the support.

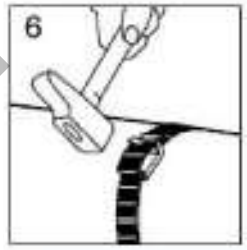
3. Tighten the strap.



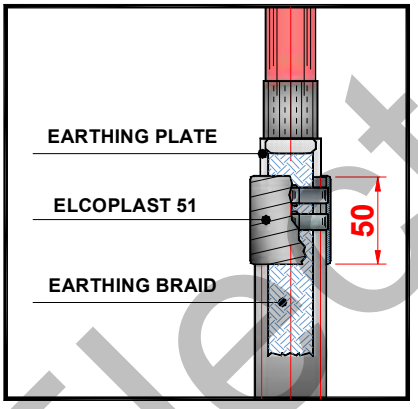
4. Fold back the strap.



5. Cut the exceding part of the strap.

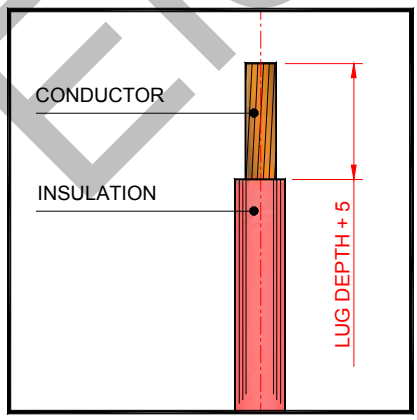


6. Beat and lock the strap end.



1.11 Apply one layer of PVC tape, **ELCOPLAST 51,** for a length of **50 mm,** not beyond the reference line on the cable outer sheet (see paragraph 1.8), covering the tightening straps and the cable outer sheet edge.

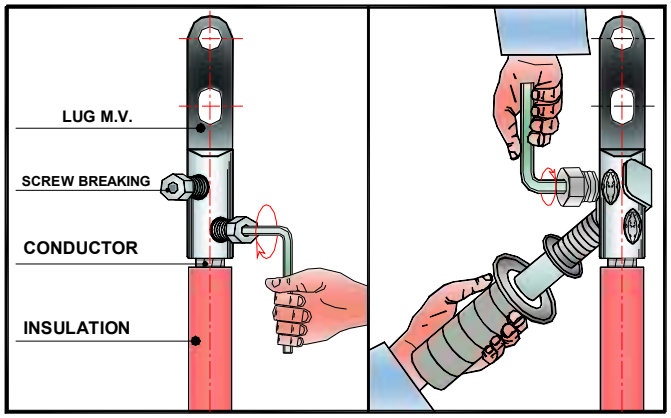
— *Use a proper tool* (like that one in the photo) to cut the cable primary insulation.



1.12 Remove the primary insulation from the end of the cable for a length equal to the **lug depth + 5 mm**. Pay attention to not engrave the conductor.

1.13 Remove all the tracks of semiconductor layer from the exposed cable insulation, using the abrasive cloth in the kit, without touching the cable semiconductor. Make the primary insulation smooth and free from coarseness.

— *To install the conductor lug use the proper tool indicated in the picture to properly hold the lug during the screws tightening.*

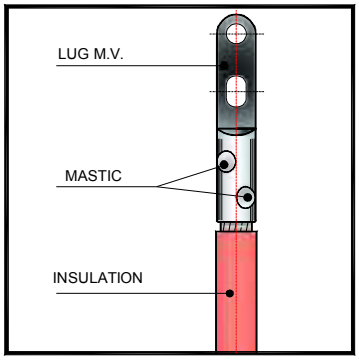


1.14 Install the screwed lug according to its installation instruction.

Notes:

— remove any anti-oxidant paste escaping from the lug;

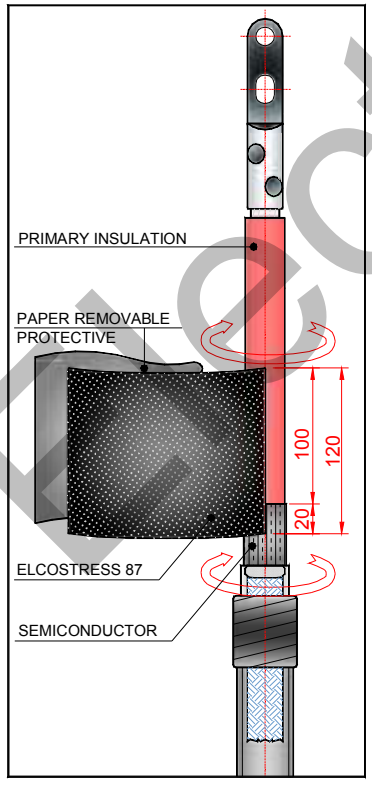
— abrade any coarseness on the lug by means of the abrasive cloth.



1.15 Clean the cable primary insulation by means of the cleaning tissue supplied in the kit. Start from the top towards the semiconductor without touching the cable semiconductor.

Allow any residual solvent to evaporate before continuing the installation.

Fill the lug holes with the mastic gray supplied in the kit.



2. ELECTRICAL STRESS CONTROL PAD AND SEALING MASTIC APPLICATION.

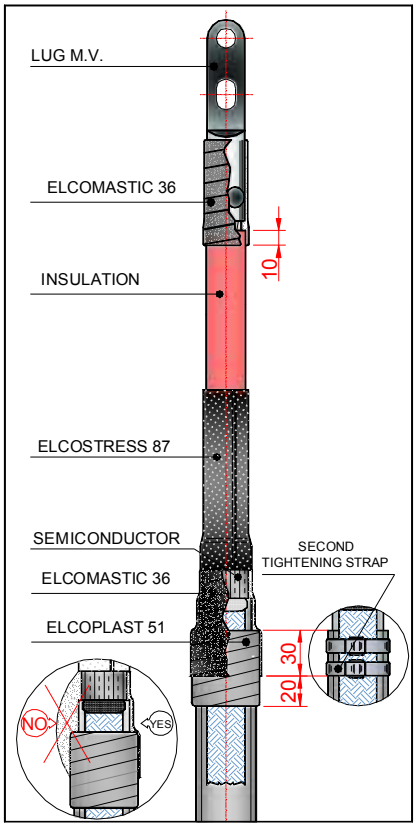
WARNING: Apply the ELCOSTRESS 87 (electrical stress control pad) according to the following instruction:

a) remove the adhesive protective layer;

b) wrap the pad making it in position with the longer side (120 mm) in the same direction of the cable (see the picture);

c) wrap the pad compressing it by the hand to assure it tightly adheres to the cable

2.1 Install the pad **ELCOSTRESS 87** as shown in the picture aside, overlapping for **20 mm** the cable semiconductor and for **100 mm** the cable insulation.



WARNING:

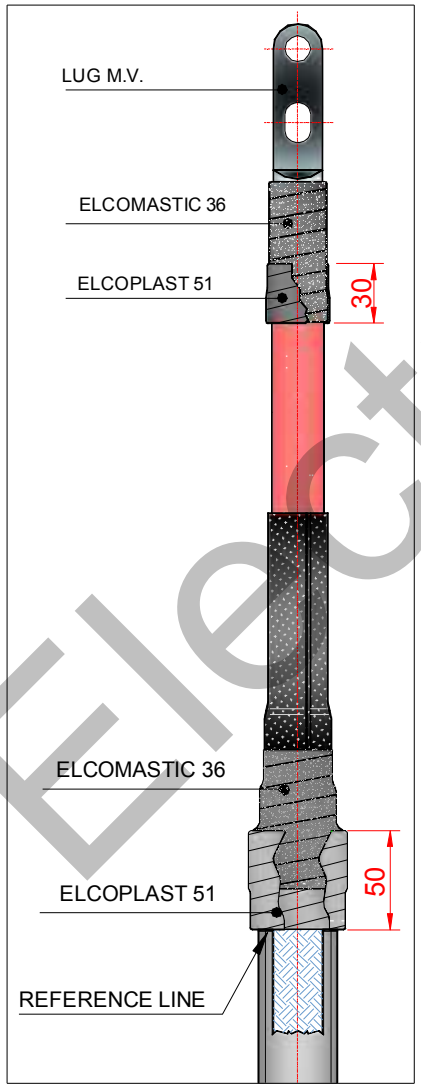
*- apply the sealing mastic **ELCOMASTIC 36** stretching it up to reduce its original width of the half and overlapping it approximately of the 50%*

*- do not make too thick the taping of **ELCOMASTIC 36**.*

2.2 Apply the **Elcomastic 36** at the exposed conductor between the lug and the cable insulation, leveling them. Continue covering the lug by two layers of Elcomastic 36 and the cable insulation for about **10 mm**.

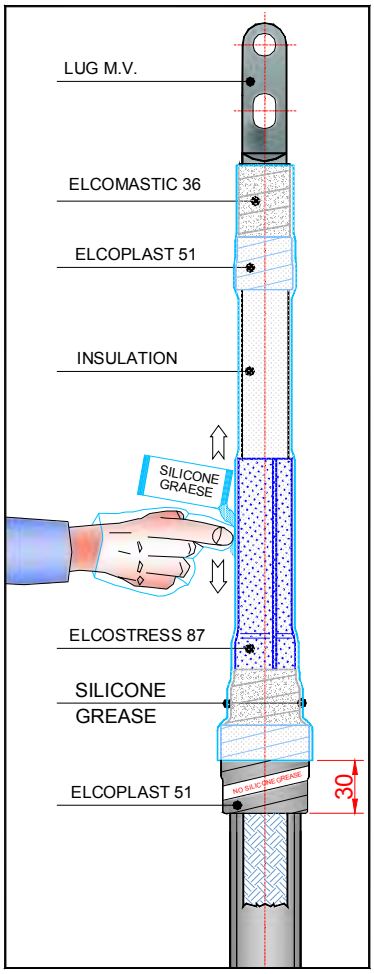
2.3 Apply the Elcomastic 36 on the cable semiconductor between the pad and the outer sheet edge, leveling the area. Continue applying one layer of ELCOMASTIC 36 over the cable outer sheet for a length of about **30 mm**, on the PVC tape previously applied, until covering the second tightening strap.

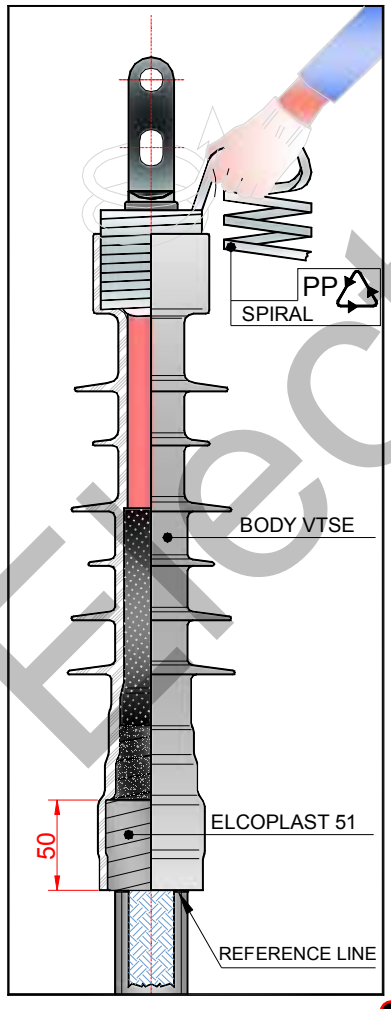
A length of about 20 mm of PVC will remain exposed *(see the picture aside)*.



2.4 Apply one layer of PVC **ELCOPLAST 51** on the ELCOMASTIC 36 at the cylindrical lug body for a distance of **30 mm**.

2.5 Apply one layer of **ELCOPLAST 51** for a length of **50 mm** on the Elcomastic 36 previously applied on the cable outer sheet, starting from the cable outer sheet edge until the reference line previously marked (see paragraph 1.8).



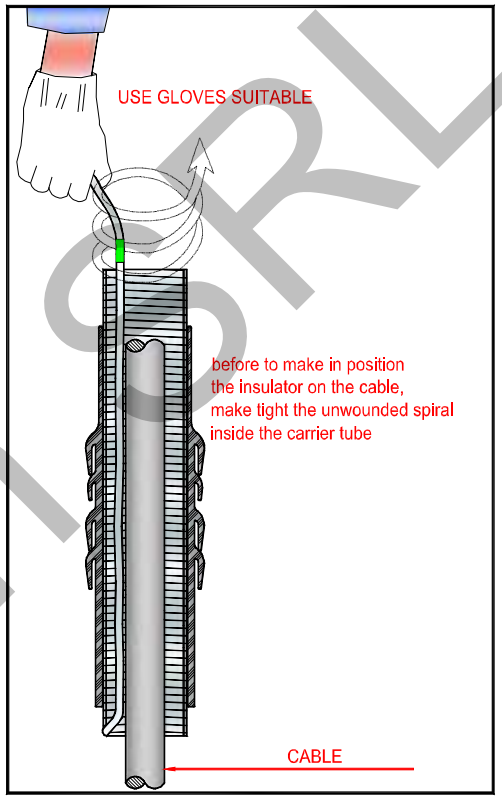


3. TERMINATION BODY INSTALLATION

3.1 Wear the gloves supplied in the kit.

Lubricate the cable as shown in the picture.

Note: DO NOT LUBRICATE THE PVC AT THE BOTTOM OF THE TERMINATION



— **WARNING:** before to make in position the insulator on the cable, make tight the unwounded spiral inside the carrier tube, following the indicated direction, as shown in the picture.

3.2 Holding tight the unwounded spiral, make in position the insulator on the cable, with the unwounded spiral length in the up direction.

Make in position the end of the insulator in correspondence of the reference line previously marked on the cable outer sheet (see paragraph 1.8).

3.3 Holding in one hand the insulator at the position indicated in the above point 3.2, unwind the spiral with the other hand, pulling and rotating it according to the indicated wise.

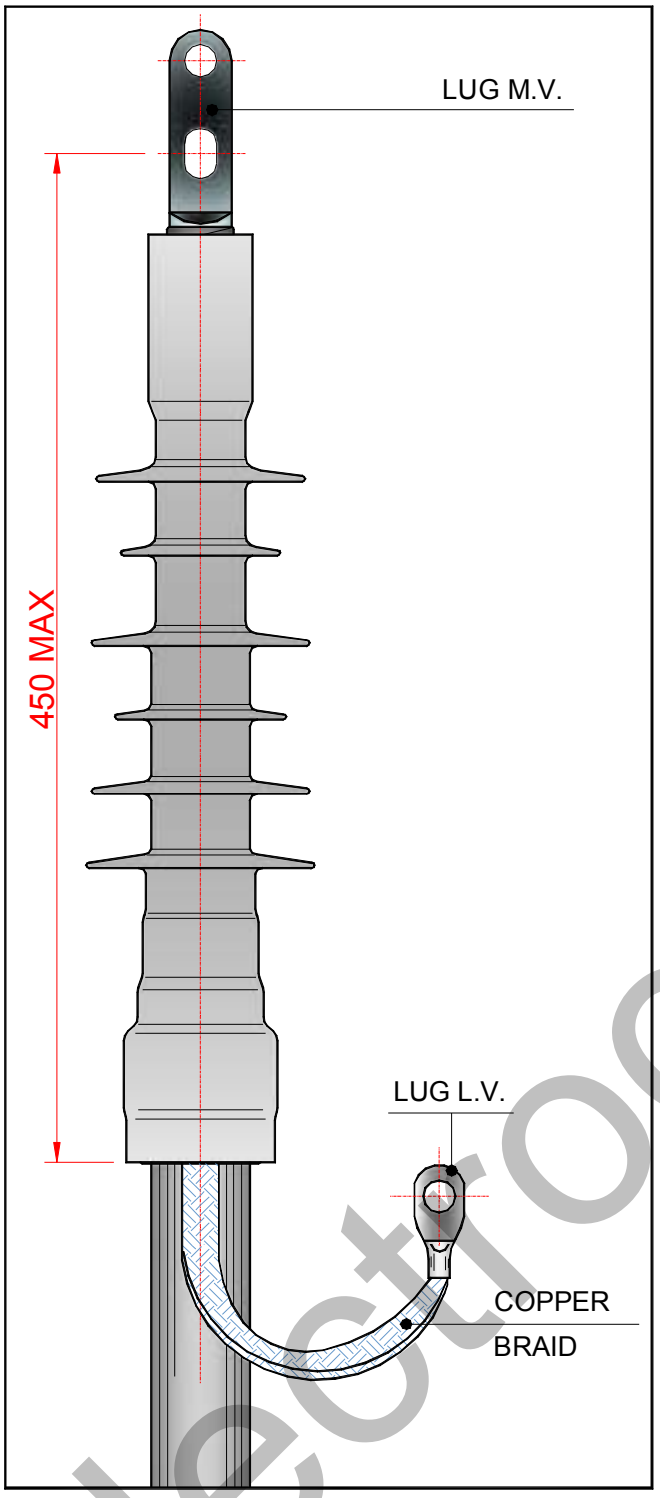
As the insulator starts to collapse, adjust eventually its position so to have its collapsed end at the reference line.

Continue to unwind the spiral.

Pay attention the unwounded spiral length doesn't wrap around the cable.

3.4 Clean the insulator from any silicone grease residual by means of the cleaning tissue supplied in the kit.

- ***WARNING: if the insulator overlap the lug hole, drag it toward the bottom rotating and pulling it by a hand, until the hole is free.***

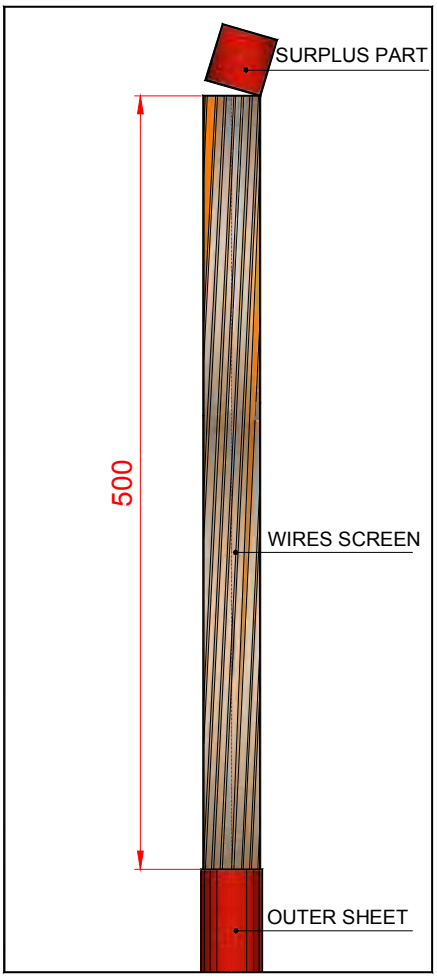


3.5 Apply the L.V. grounding lug at the end of the braid.

3.6 Connect the conductor lug to the M.V. grid.

3.7 Connect the L.V. lug to the grounding system.

3.8 **The termination is ready to be energized**.



SECTION 2

— CABLE TYPE WITH COPPER WIRES SCREEN.

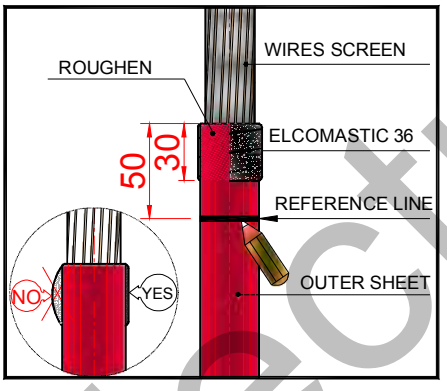
1. CABLE PREPARATION

1.1 Make in position the cable in such a way to simulate the final position and cut its end to remove any defects.

- Clean the cable outer sheet for at least **0,5 m** by means of the cleaning tissue supplied in the kit.

1.2 Remove the cable outer sheet for a length of **500 mm** from the cable end.

1.3 Make a sign on the cable outer sheet at **50 mm** from its edge.



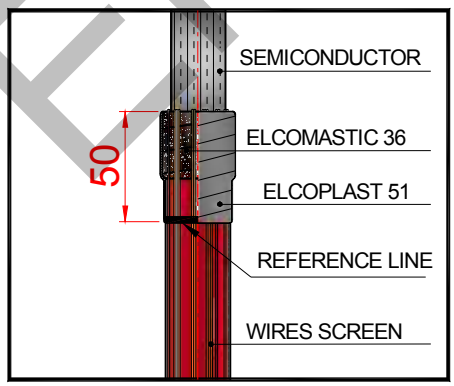
WARNING: THE ABOVE SIGN AT 50 mm IS THE REFERENCE LINE FOR THE FOLLOWING TERMINATION BODY INSTALLATION, THE DISTANCE OF 50 mm IS THEREFORE MANDATORY.

1.4 Smooth the cable outer sheet for about **30 mm** starting from the edge.

- ***WARNING:*** *apply the sealing mastic* ***ELCOMASTIC 36*** *stretching it up to reduce its original width of the half and overlapping it approximately of the 50%.*

- *Do not make too thick the taping of* ***ELCOMASTIC 36*** *on the outer sheet (see the sketch in the picture).*

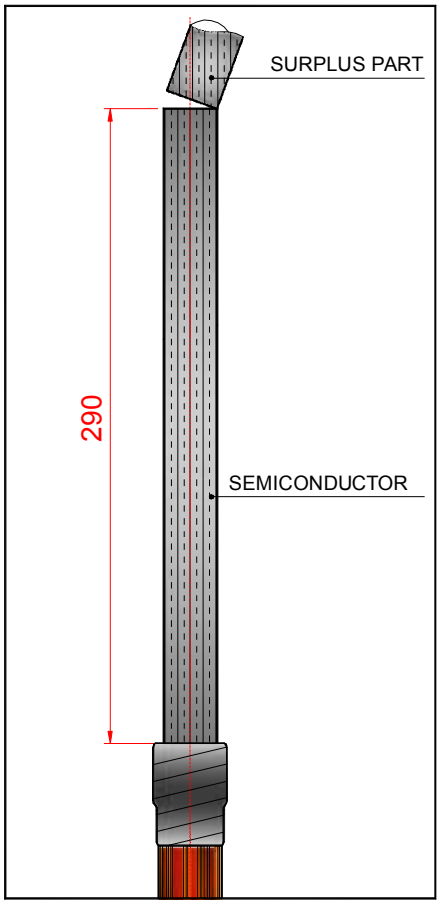
1.5 Apply two layers of **ELCOMASTIC 36** at the cable outer sheet for a length of **30 mm** starting from the edge.



1.6 Remove any tape contained in the cable and the equalizer copper tape.

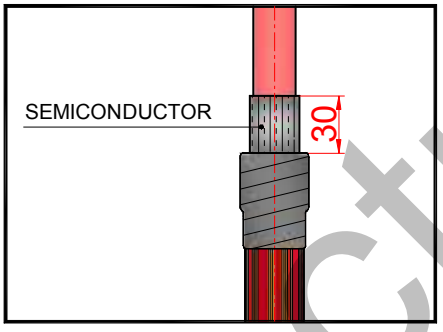
Do not cut the cable screen wires. Fold back them on the cable outer sheet and distribute them uniformly around the cable.

Fix the wires by means of some layers of PVC tape **ELCOPLAST 51** over a distance of **50 mm** from the cable outer sheet edge, not beyond the reference line previously signed (see paragraph 1.3).

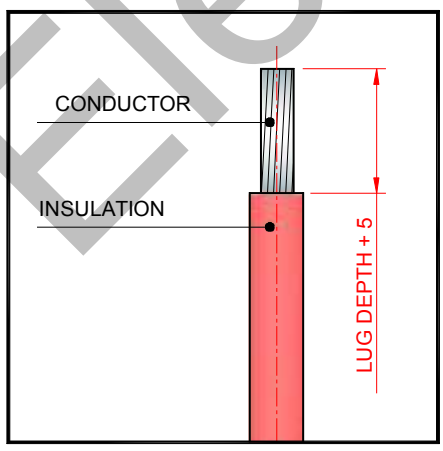


1.7 Cut the cable at a distance of **290 mm** from the cable outer sheet cut, removing the exceeding length.

1.8 Using a proper tool (like that ones in the photo), remove the cable semiconductor until **30 mm** from the cable outer sheet edge



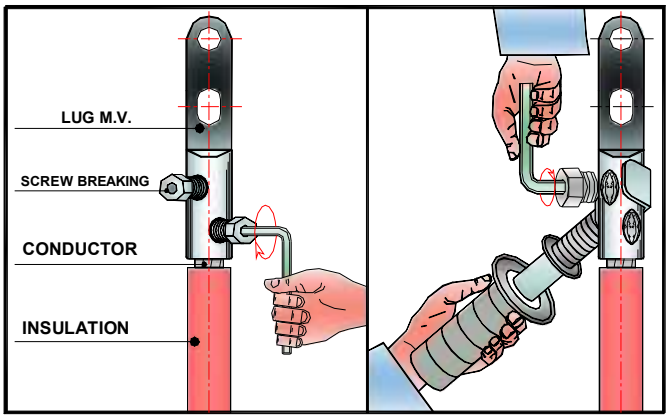
1.9 Using a proper tool (like that ones in the photo), cut the cable insulation for a length equal to the **lug depth + 5 mm**.



Pay attention to not engrave the conductor.

1.10 Remove all the tracks of semiconductor layer from the exposed cable insulation, using the abrasive cloth in the kit, without touching the cable semiconductor. Make the primary insulation smooth and free from coarseness.

— *To install the conductor lug use the proper tool indicated in the picture to properly hold the lug during the screws tightening.*

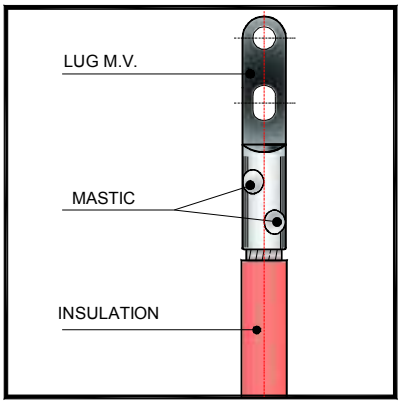


1.11 Install the screwed lug according to its installation instruction.

Notes:

— remove any anti-oxidant paste escaping from the lug;

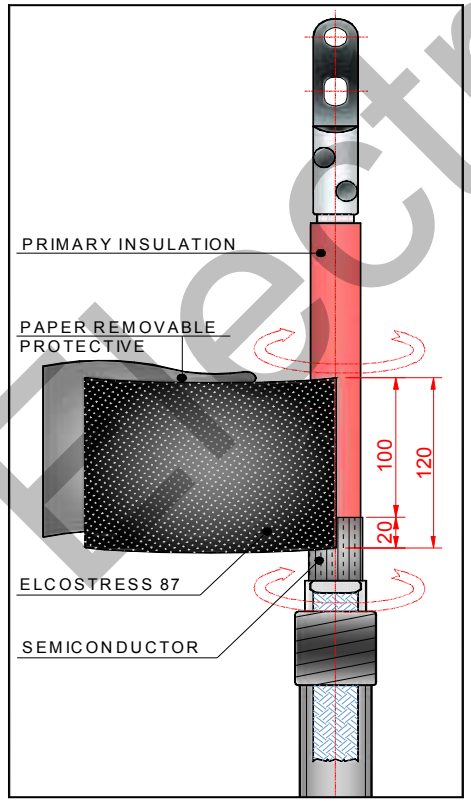
— abrade any coarseness on the lug by the abrasive cloth.



1.12 Clean the cable primary insulation by means of the cleaning tissue supplied in the kit. Start from the top towards the semiconductor without touching the cable semiconductor.

Allow any residual solvent to evaporate before continuing the installation.

Fill the lug holes with the mastic gray supplied in the kit.



2. ELECTRICAL STRESS CONTROL PAD AND SEALING MASTIC APPLICATION.

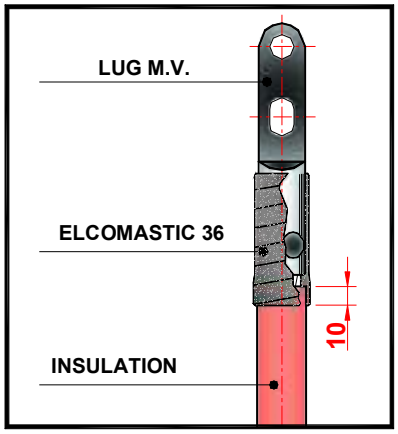
WARNING: Apply the ELCOSTRESS 87 (electrical stress control pad) according to the following instruction:

a) remove the adhesive protective layer;

b) make the pad in position with the longer side (120 mm) in the same cable direction (see the picture);

c) wrap the pad compressing it by the hand to assure it tightly adheres to the cable

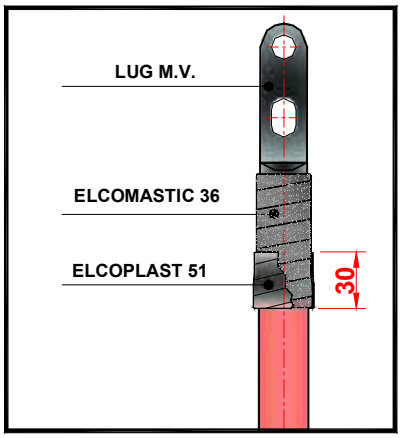
2.1 Install the pad **ELCOSTRESS 87** as shown in the picture aside, overlapping the cable semiconductor for **20 mm** and the cable insulation for **100 mm** and wrapping it all around the cable.



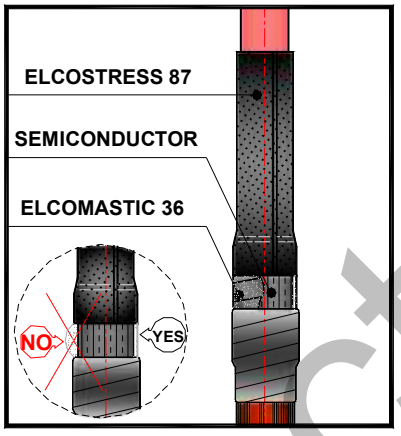
WARNING:
*- apply the sealing mastic **ELCOMASTIC 36** stretching it up to reduce its original width of the half and overlapping it approximately of the 50%*

*- do not make too thick the taping of **ELCOMASTIC 36**.*

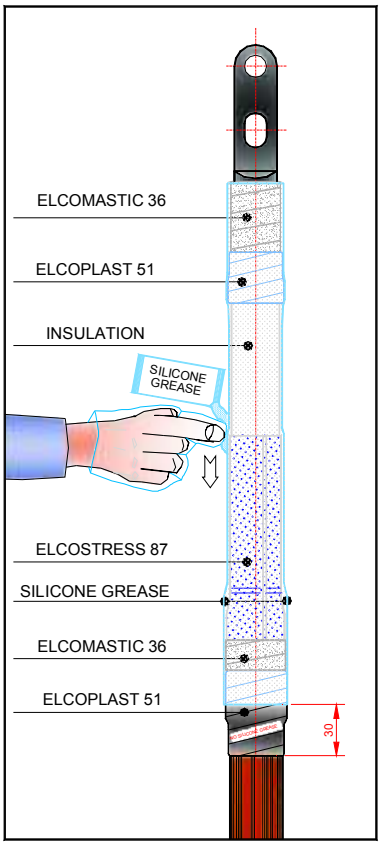
2.2 Apply the **Elcomastic 36** at the exposed conductor between the lug and the cable insulation, leveling them. Continue covering completely the cylindrical lug body by two layers of **Elcomastic 36** and the cable insulation for about **10 mm**.



2.3 Apply <u>one layer</u> of PVC **ELCOPLAST 51** for a 30 mm length on the Elcomastic 36 at the cylindrical lug body, starting from the lug bottom.



2.4 Apply the Elcomastic 36 on the cable semiconductor between the pad and the outer sheet edge, leveling the area.

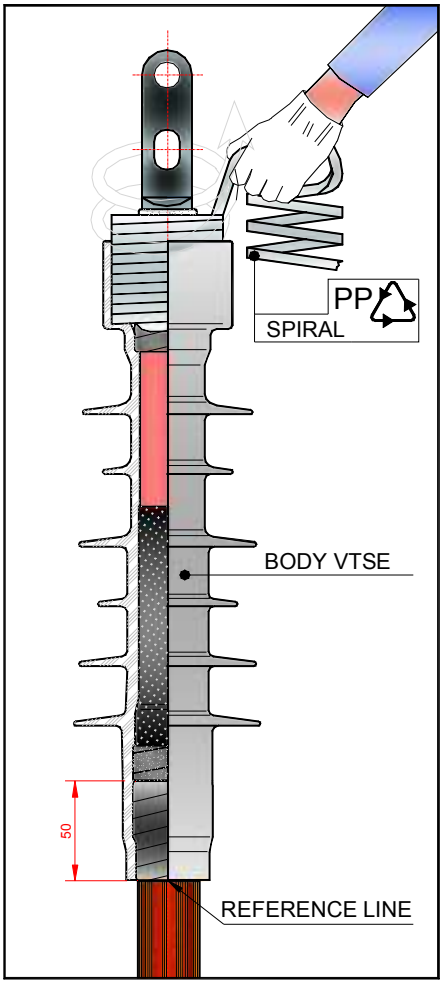


3. TERMINATION BODY INSTALLATION.

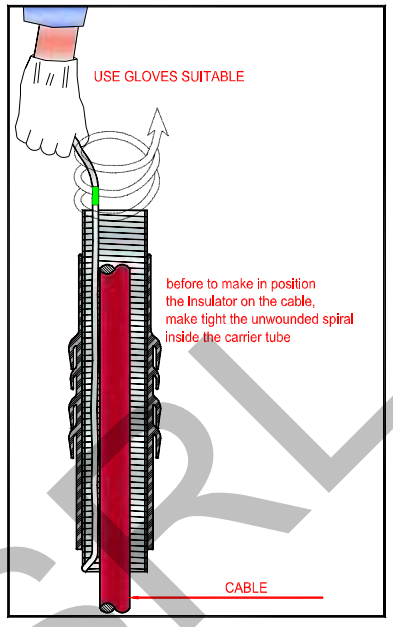
3.1 Wear the gloves supplied in the kit.

Lubricate the cable as shown in the picture.

<u>Note: DO NOT LUBRICATE THE PVC AT THE BOTTOM OF THE TERMINATION</u>



— **WARNING:** before to make in position the insulator on the cable, make tight the unwounded spiral inside the carrier tube, following the indicated direction, as shown in the picture.



3.2 Make in position the insulator on the cable, holding tight the unwounded spiral in the up direction.

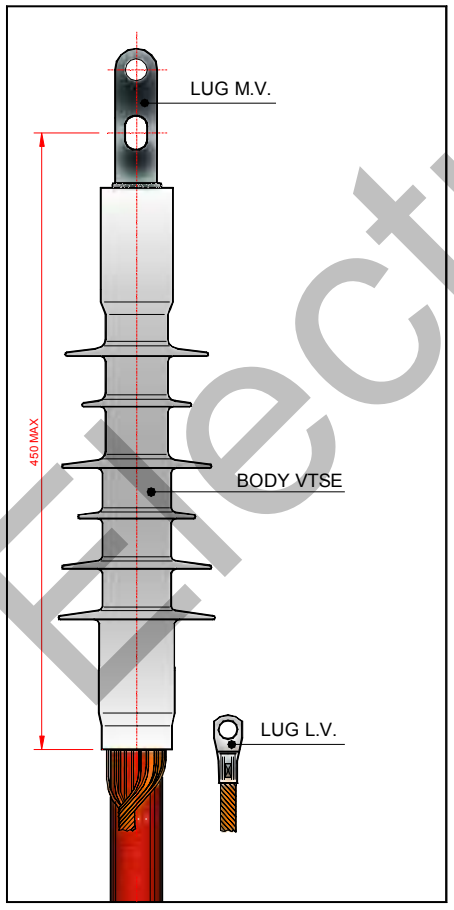
Make in position the end of the insulator in correspondence of the reference line previously marked on the cable outer sheet (see paragraph 1.3).

3.3 Holding in one hand the insulator at the position indicated in the above point 3.2, unwind the spiral with the other hand, pulling and rotating it according the indicated sense.

As the insulator starts to collapse, adjust eventually its position so to have its collapsed end at the reference line.

Continue to unwind the spiral.

Pay attention the unwounded spiral length doesn't wrap around the cable.



3.4 Clean the insulator from any silicone oil residual by means of the cleaning tissue supplied in the kit.

- ***WARNING: if the insulator overlap the lug hole, drag it toward the bottom rotating and pulling it by a hand, until the hole is free.***

3.5 Apply the L.V. grounding lug at the end of the braid.

3.6 Connect the conductor lug to the M.V. grid.

3.7 Connect the L.V. lug to the grounding system.

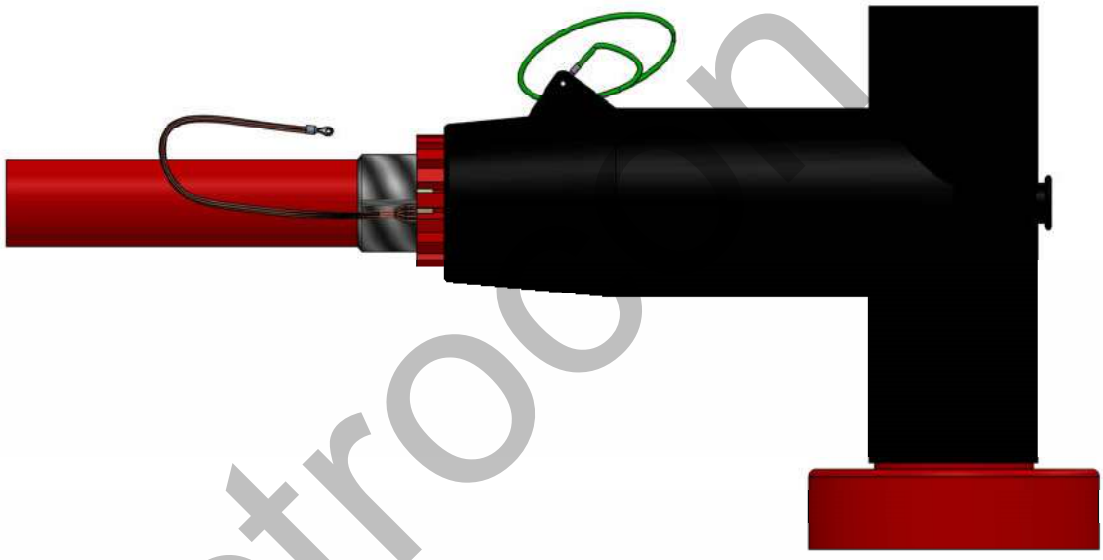
3.8 **The termination is ready to be energized.**

630A TEE CONNECTOR "C" INTERFACE

Installation instruction

ELCONEXT 24C–K1 Umax 24 kV

Outer cone asymmetric separable TEE connector for single core XLPE insulated cable with wire screen



ELCON MEGARAD S.p.A.
HEADQUARTER and FACTORY: ARCELLA (AV) ITALY
Tel. +39 0825/6077 – Fax +39 0825/607782
Web site: www.elconmegarad.com e-mail: elcon@elconmegarad.com

DRAWING N°	Code MP20581	Drawn	Revision	Approval
1008/E K1	Issuing date	19/06/2019	REV.2 03/11/2023	
	Author	LR	GDA	M.R. / G.D.S.

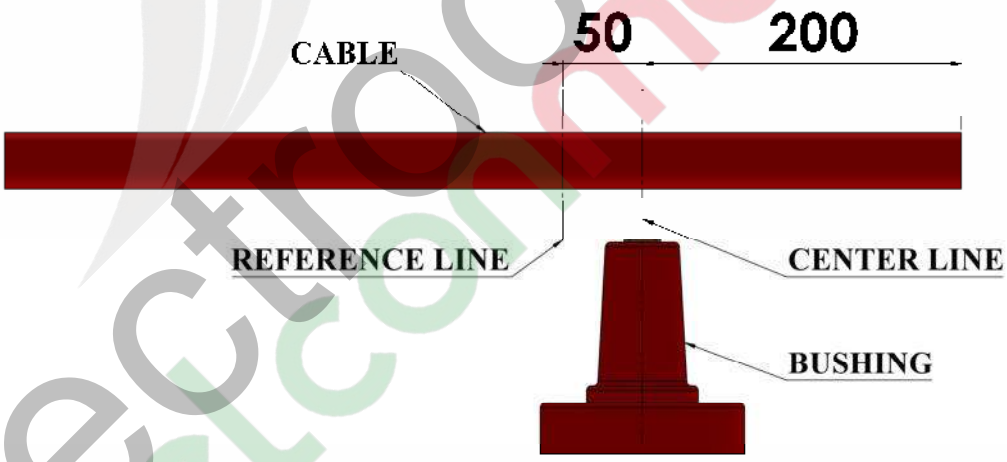
ALL ASSOCIATED APPARATUS **MUST BE DE-ENERGIZED** DURING THE INSTALLATION AND/OR MAINTENANCE!

- ✓ **The 630 A Deadbreak TEE separable connector system is designed to be operated in accordance with normal safe operating procedures.**
- ✓ **These instructions are not intended to supersede or replace existing safety and operating procedures.**
- ✓ **The connector should be installed and serviced only by personnel familiar with good safety practices and the handling of high-voltage electrical equipment.**
- ✓ **Check if all the components listed in the bill of materials are available in the kit.**
- ✓ **Read carefully the installation instruction before starting the cable preparation.**

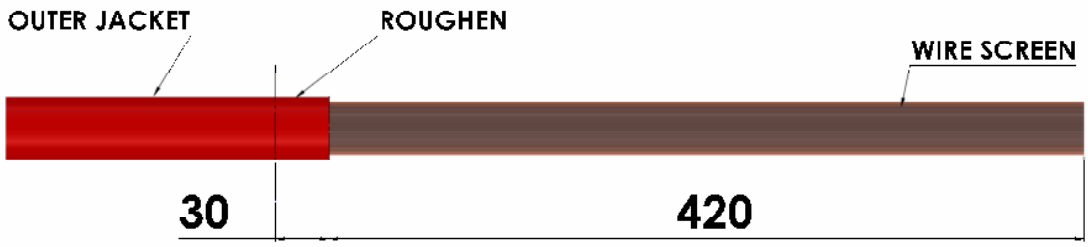
TOOLS REQUIRED:
Torque wrench up to **50 Nm**
10 mm hexagonal torque wrench with extension bar
Flat screwdriver

1. CABLE PREPARATION

1.1 Clean the cable outer jacket for at least **0,5 m** by means of the suitable solvent.
1.2 Make the cable in its final position with respect to the bushing.
1.3 Mark a sign on the cable and cut the cable see figure below.



1.4 Cut and remove the outer jacket for a length of **420 mm**.
1.5 Make rough the cable outer jacket for **30 mm** with abrasive cloth supplied in the Kit.



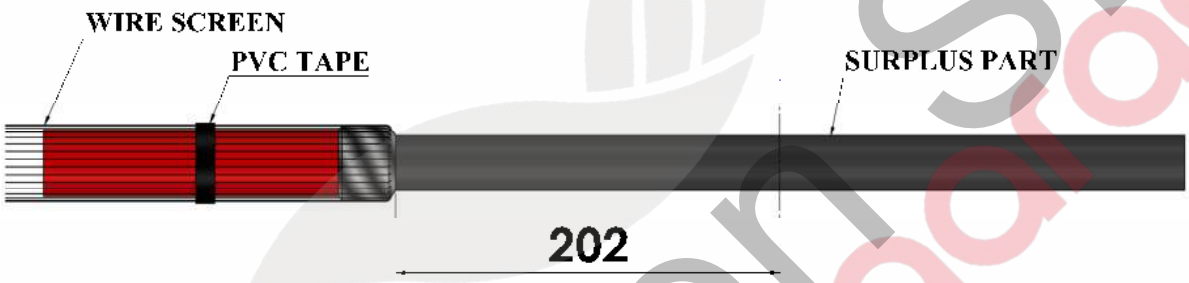
1.6 Apply one layer of **PVC TAPE** on the outer jacket**,** overlapping it of about the 50% of its width, for a length of **30 mm.**

1.7 Remove the metallic tape containing the cable screen wires.

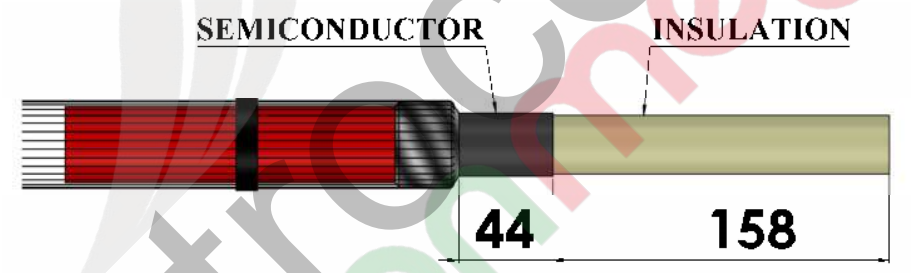
1.8 Fold back the cable screen wires pressing them into the **PVC TAPE** previously applied.

1.9 Fix the screen wires by means of some layers of **PVC TAPE**.

1.10 Cut and remove a length of cable, leaving exposed a length of cable of **202 mm** from the outer jacket edge.



1.11 Remove the cable semiconductor leaving exposed **44 mm** from the cable outer jacket cut.



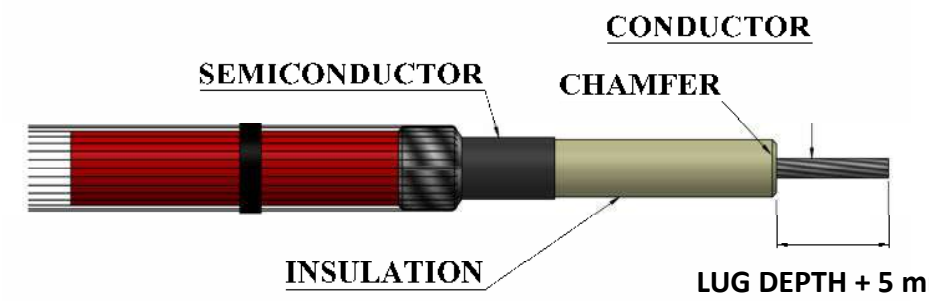
1.12 Remove the insulation from the top of the cable for **lug depth + 5 mm**. Take care not to nick the conductor.

1.13 Chamfer the insulation cutting edge.

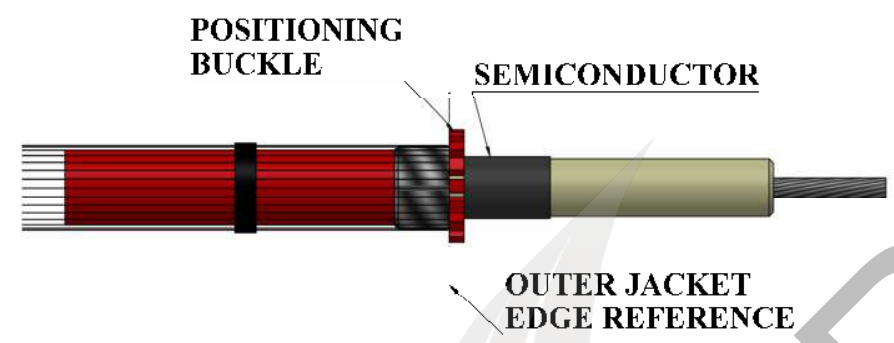
1.14 Smooth the insulation surface, making sure that all the semiconductor traces are removed, using the abrasive cloth supplied in the kit, without touching the cable semi conductive layer.

1.15 Clean the cable insulation by means of the cleaning tissue supplied in the kit. Start from the top towards the semiconductor without touching the cable semiconductor.

1.16 Clean the exposed conductors and apply on the tip some **PVC TAPE**.



1.17 Apply the **POSITIONING BUCKLE** on semiconductor layer up to the outer jacket reference line, as shown below.

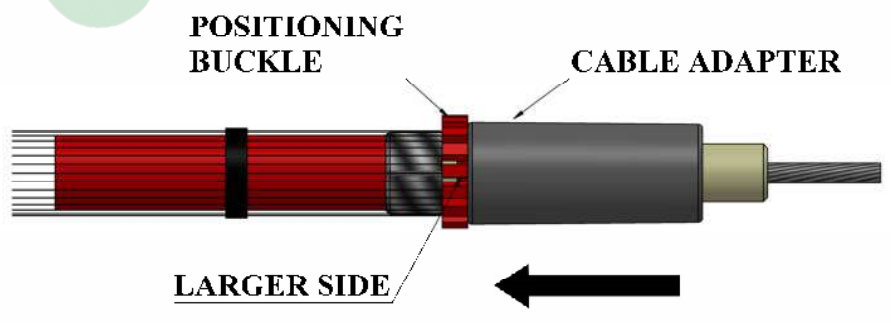


2. CABLE ADAPTER INSTALLATION

2.1 Wear the gloves supplied in the kit and lubricate the cable insulation, the cable semiconductor and the inner surface of the **CABLE ADAPTER** with the **SILICON GREASE** supplied in the kit.

2.2 Push the **CABLE ADAPTER (cone adapter)** with a slight rotation until his larger side abuts the positioning buckle. Clean any excess of grease deposits on the outer jacket and on the edge of the **CABLE ADAPTER**.

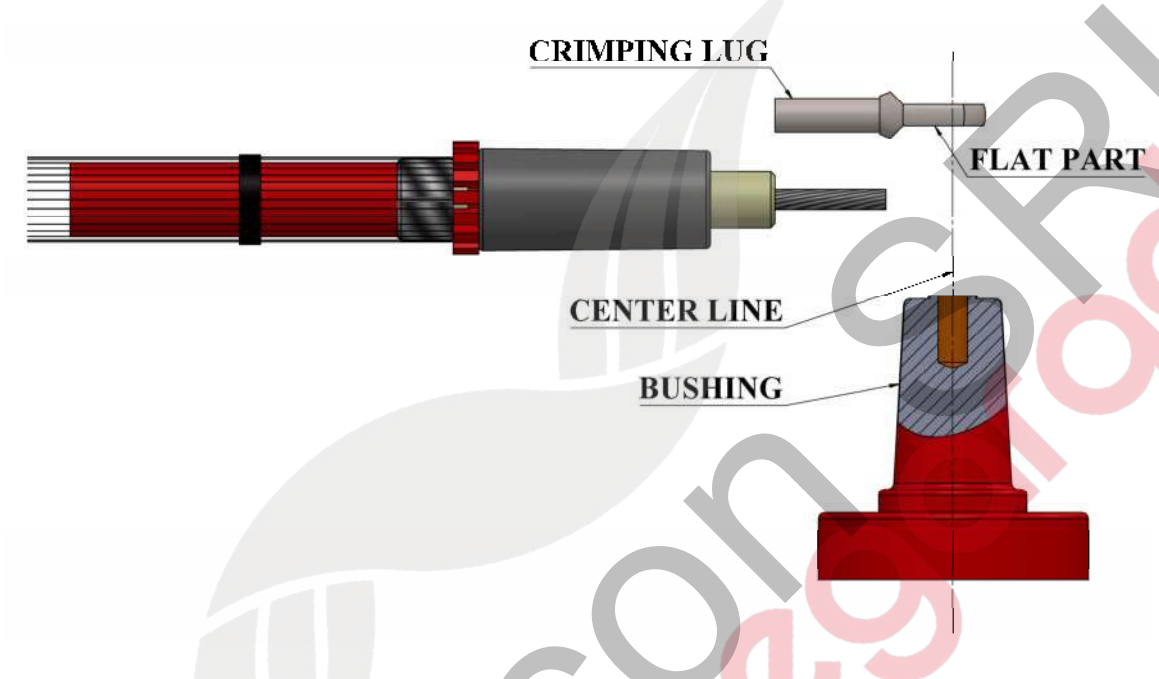
2.3 Remove the **PVC TAPE** applied on the conductor.



3. LUG INSTALLATION

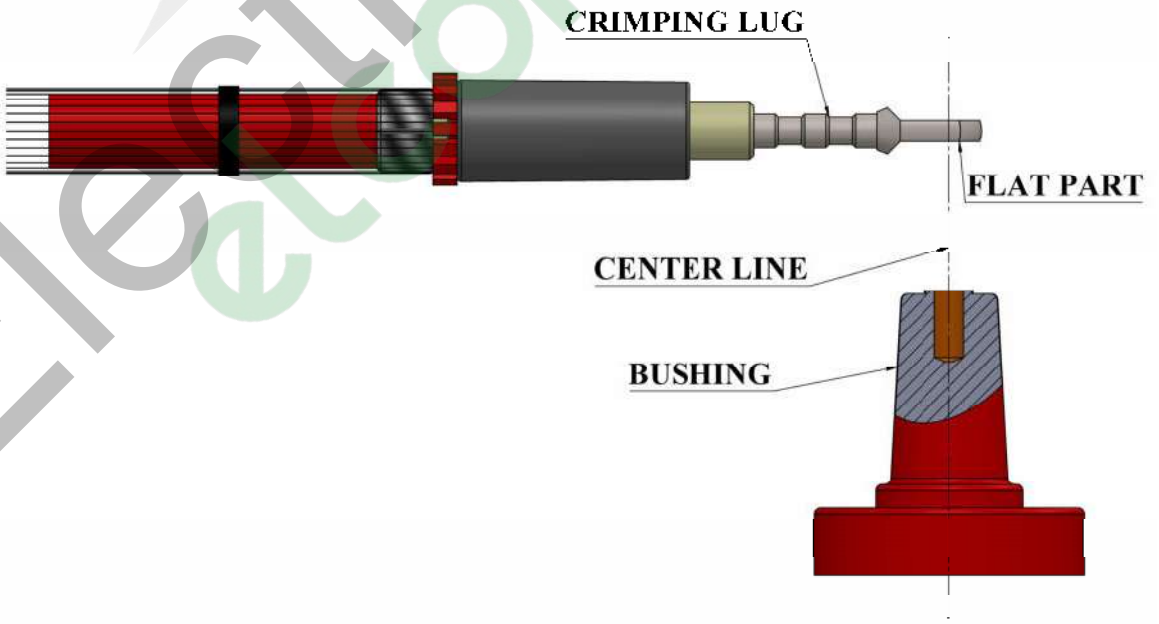
3.1 CRIMPING LUG

- Insert the lug over the conductor so that the lug hole position is perfectly correspondently to the hole inside the bushing.
- Ensure that the flat of the lug is parallel to the face of the bushing.



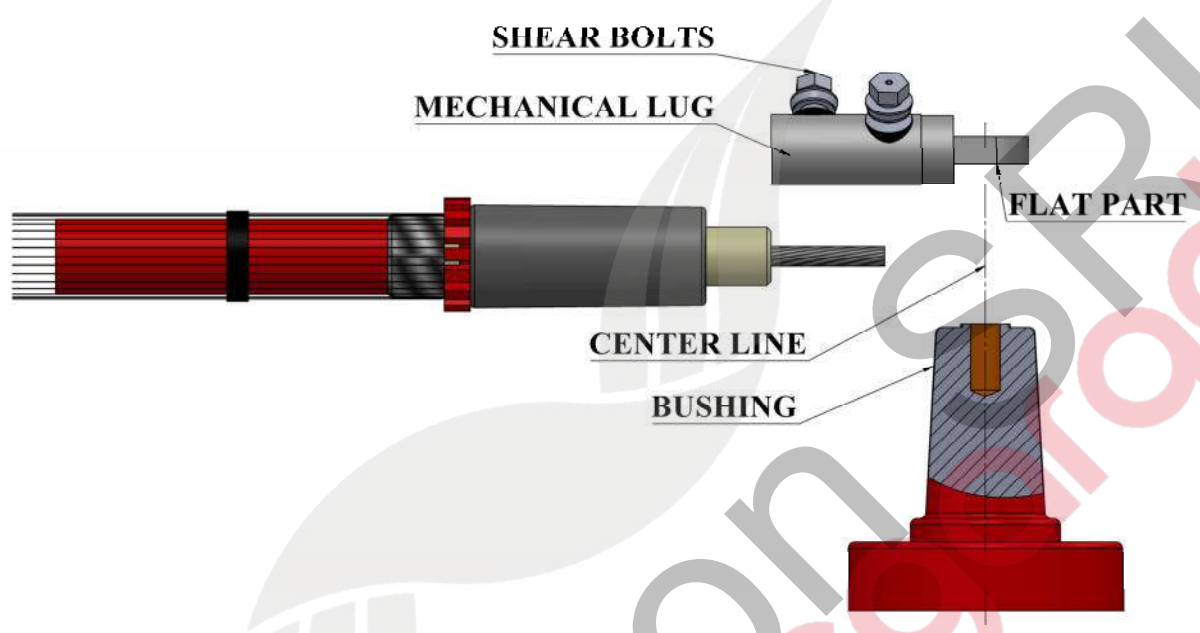
3.1.1 Crimp the lug with a suitable tool.

3.1.2 Remove the exceeding grease and any metallic burrs resulting from the compression and clean the adapter and the terminal using clean paper included in the kit.



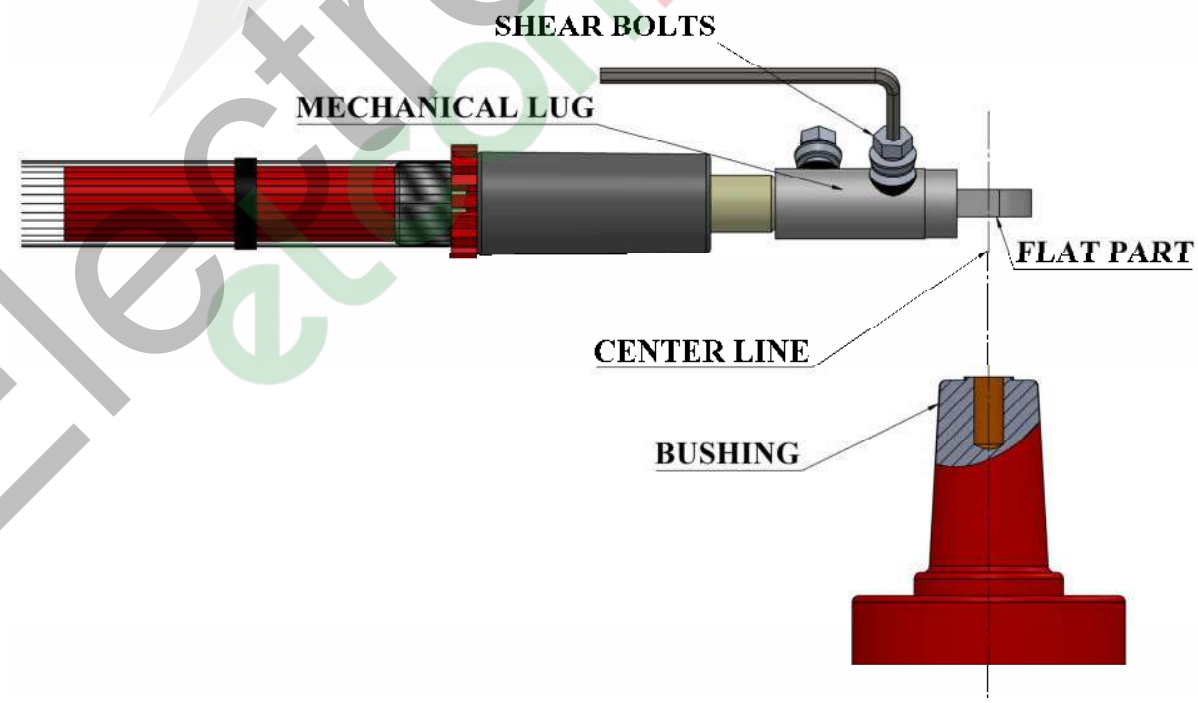
3.2 SHEAR BOLTS LUG

- Insert the lug over the conductor so that the lug hole position is perfectly correspondently to the hole inside the bushing.
- Ensure that the flat of the lug is parallel to the face of the bushing.



3.2.1 Install the lug according to its installation instruction.

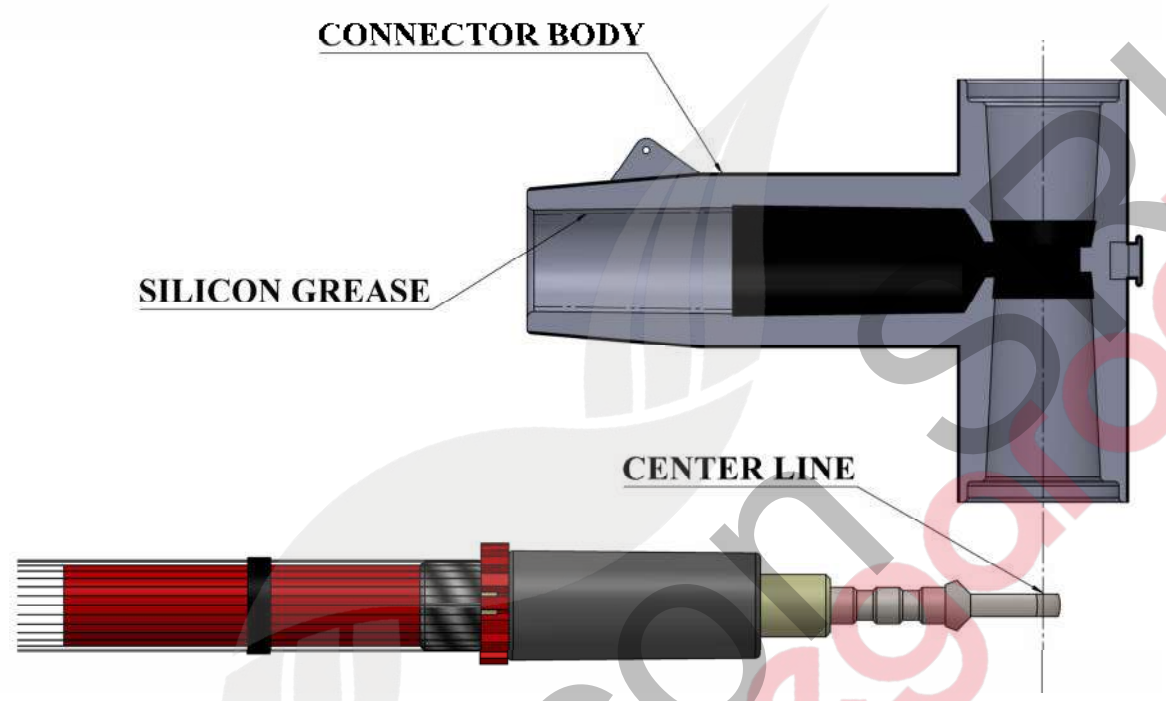
3.2.2 Remove the exceeding grease and any metallic burrs resulting from the screws break.



4. CONNECTOR BODY INSTALLATION

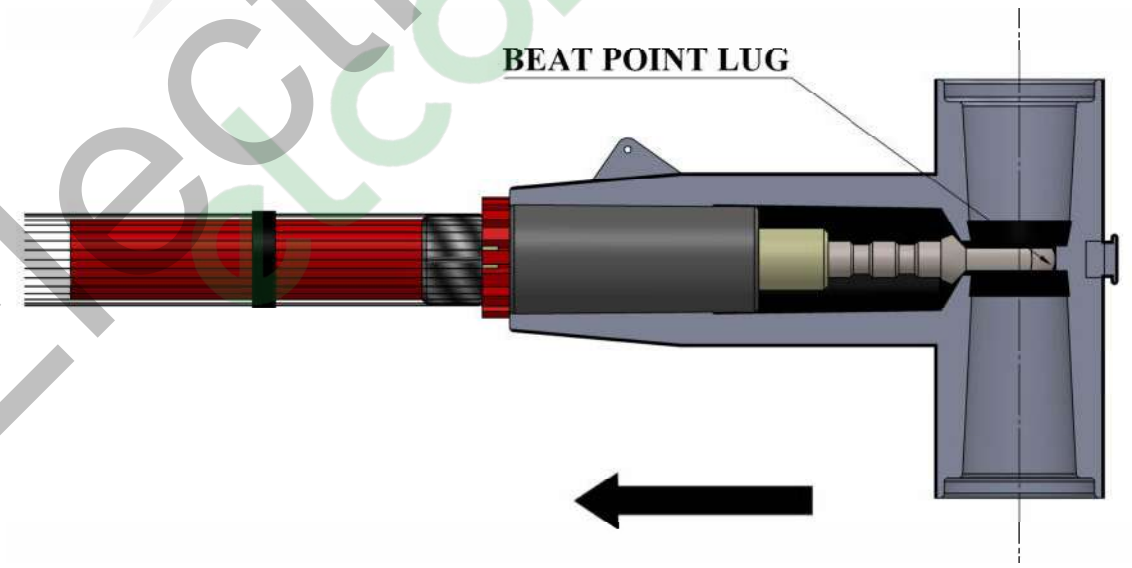
4.1 Clean the external surface of the Cable Adapter using the cleaning tissue included in the kit.

4.2 Wear the gloves supplied in the kit and lubricate with the **SILICON GREASE** the outer cable adapter surface and the inner surface of the connector body.



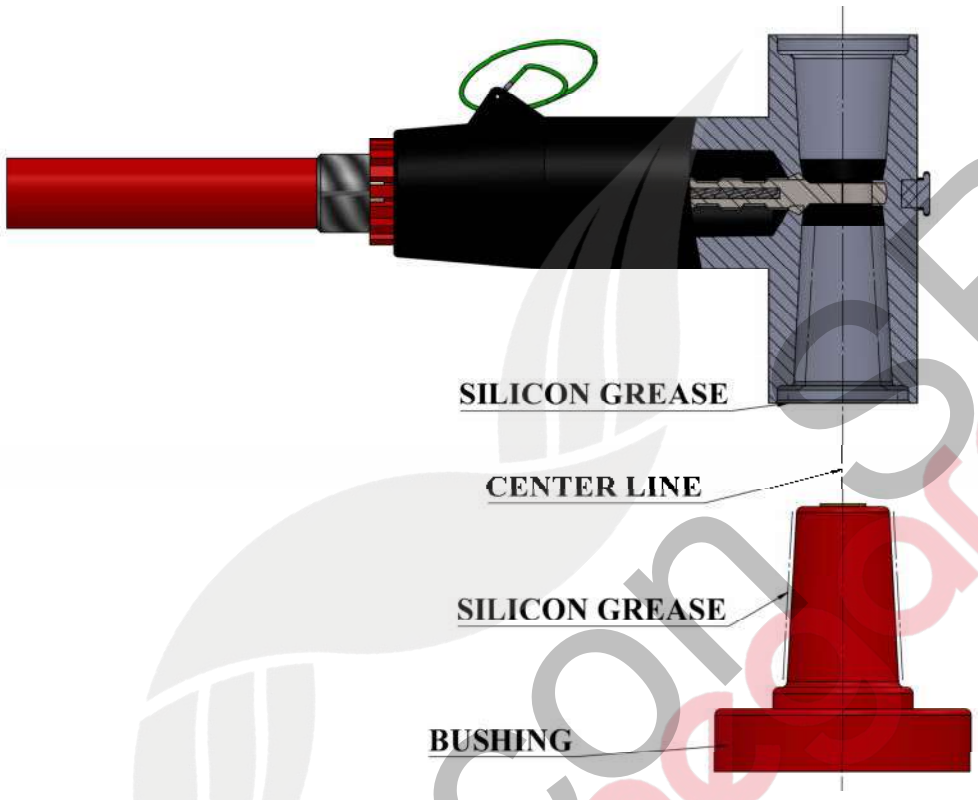
4.3 Push the **connector body** onto the cable adapter until the lug beats inside of the connector body.

4.4 Remove the exceeding **SILICON GREASE** from the end of the connector body.



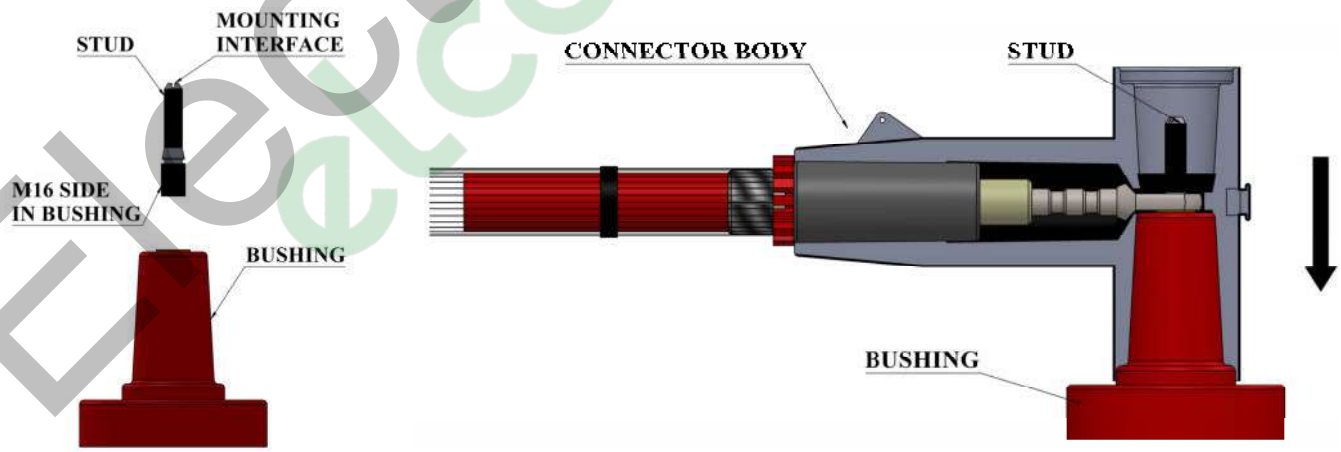
4.5 Clean and lubricate with the **SILICON GREASE** the outer surface of the bushing.

4.6 Clean and lubricate with the **SILICON GREASE** the inner surface of the connector body, see figure below.



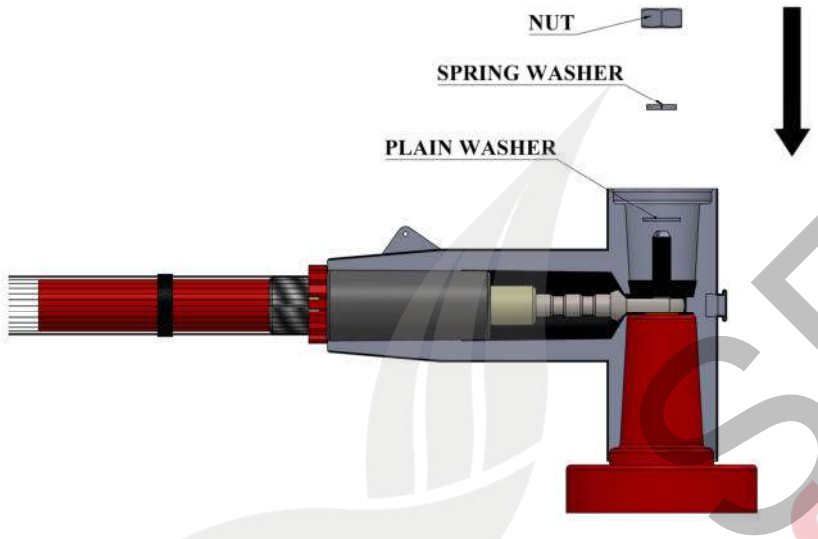
4.7 Clamp the stud in the threaded hole of the bushing by mounting interface, using an appropriate tool.

4.8 Push the connector body on the bushing.



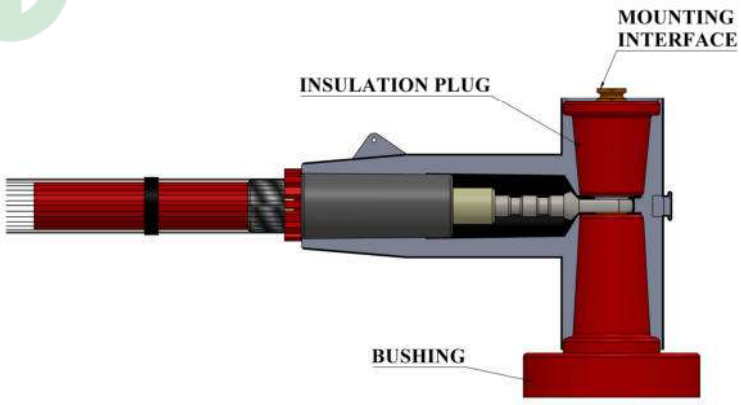
5. INSULATION PLUG INSTALLATION

5.1 Insert the **PLAIN WASHER**, the **SPRING WASHER** and **NUT**. Than clamp using an appropriate tool and by means of **30 Nm** torque.

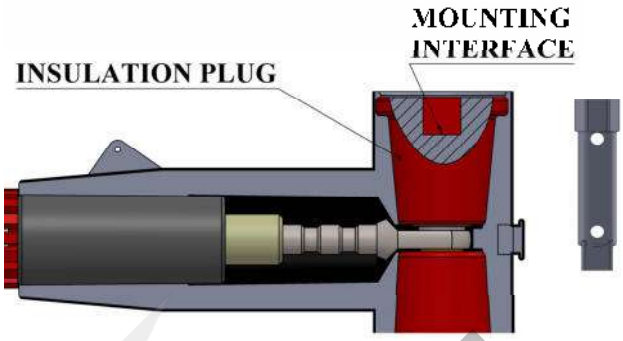


5.2 Clean and lubricate the outer surface of the **INSULATING PLUG** and the inner surface of the connector body.

5.3 Push the **INSULATED PLUG** inside the connector branch and screw it by mounting interface exerting a torque of **30 Nm**.



N.B.
For application with **INSULATED PLUG WITHOUT CAPACITIVE SOCKET**, this must be screwed using **TOOL INCLUDED INTO THE KIT** on mounting interface, exerting a torque of **30 Nm**.



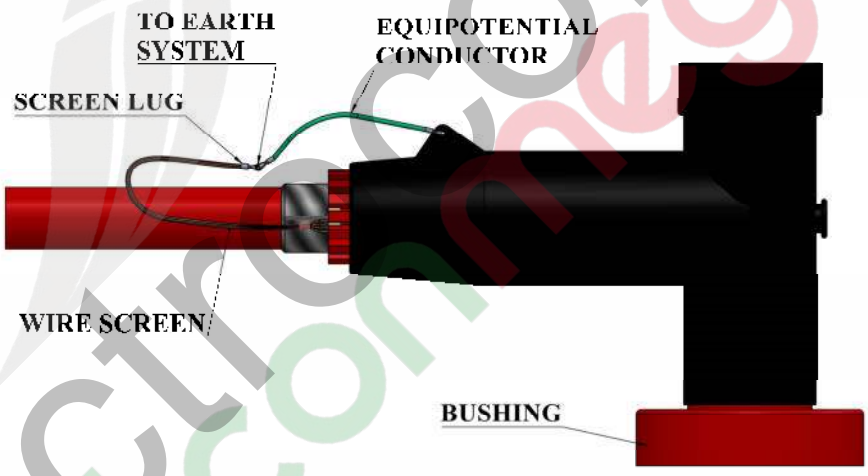
5.4 Position the PROTECTION CAP on the INSULATED PLUG.

6. EARTHING

6.1 Join and twist together the wires of the cable shield like a strand conductor. Trim the wires edge and crimp the low voltage lug.

6.2 Connect the earthing conductor to the earthing system of the cable shield.

- **The installation is complete.**



CAUTION:

THE APPARATUS BUSHING AND CONNECTOR SHOULD NOT SUPPORT THE WEIGHT OF THE CABLE. CLAMP THE CABLE IMMEDIATELY BELOW CABLE JACKET SEAL.

Installation instructions

HEAT SHRINKABLE INDOOR TERMINATION

for single core plastic or rubber insulated cables with wire or tape shield

Highest voltage Um: up to 42 kV

ELCOTERM TIS – 82/E series

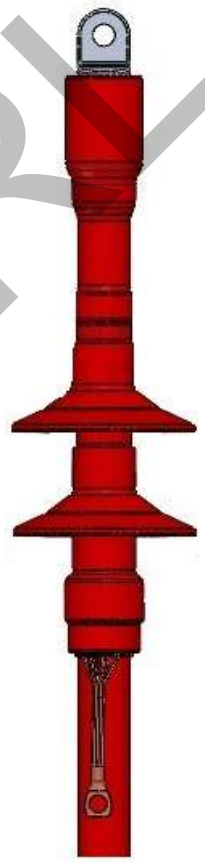


Figura illustrativa

ELCON MEGARAD S.p.A.
HEADQUARTER and FACTORY: ARCELLA (AV) ITALY
Tel. +39 0825/6077 - Fax +39 0825/607782
Web site:www.elconmegarad.com e-mail: elcon@elconmegarad.com

DRAWING N°	Code MP5256	Drawn	Updated	Approved
823/E	Date	22/11/1999	24/05/2022 Ed. 1 Rev 2	
	Signature	C.I.	L.M	G.DS.

- **THIS PRODUCT MUST BE INSTALLED BY COMPETENT PERSONAL WITH ELECTRICAL EQUIPMENT AND IN SAFETY CONDITIONS.**
- **READ CAREFULLY ALL THE INSTRUCTIONS BEFORE STARTING CABLE PREPARATION. CHECK THAT ALL COMPONENTS LISTED ON THE BILL OF MATERIAL ARE AVAILABLE. HEAT SHRINK THE TUBES FOLLOWING THESE GOLDEN RULES:**

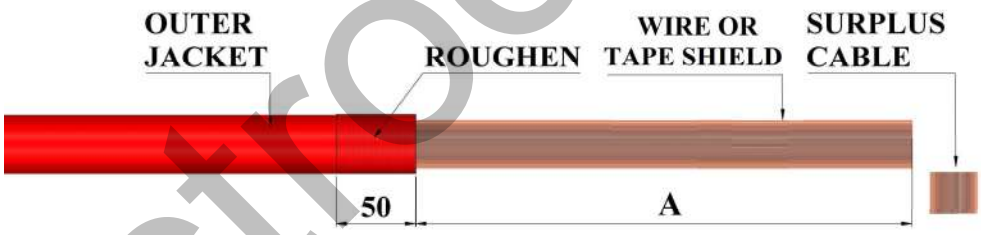
- Use only butan or propane gas torch.
- Flame must be soft.
- Heat the tubes uniformely.
- Move the flame all around the circumference of tubes.
- Start from the center of tube, and move slowly toward the end or **unless otherwise stated**.
- Do not insist on the same part.
- Stop when completely shrunk.

1. CABLE PREPARATION (COMMON OPERATIONS)

1.1 Prepare the cable in such a way to simulate the final position, find the point where it must be cut then remove the exceeding length.

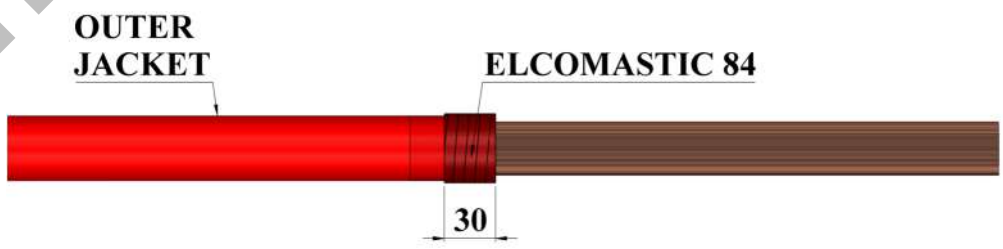
1.2 Remove, from the head of a cable, the **outer jacket** to the dimension **"A"** *shown on the bill of material enclosed.*

1.3 Roughen, by abrasive cloth contained in the kit, the outer jacket for about **50 mm**, starting from the edge.



The sealing tape ELCOMASTIC 84 must be applied stretching it up to reduce the original width to the half, approximately.

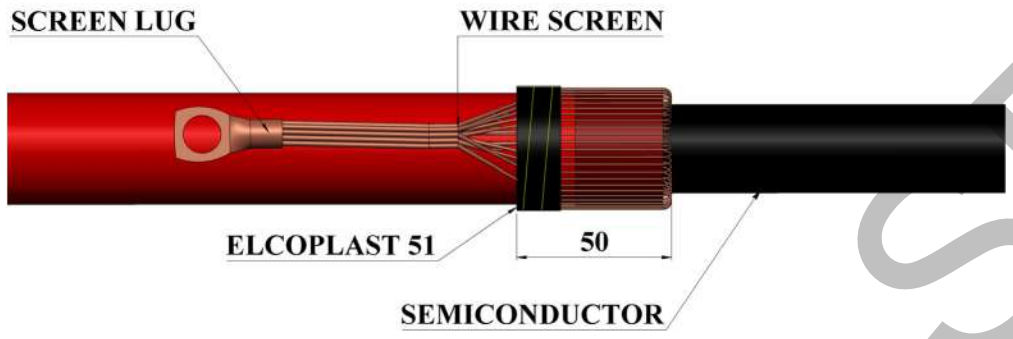
1.4 Apply one half-lapped layer of **ELCOMASTIC 84** on the outer jacket edge for a tract of **30 mm** starting from the edge.



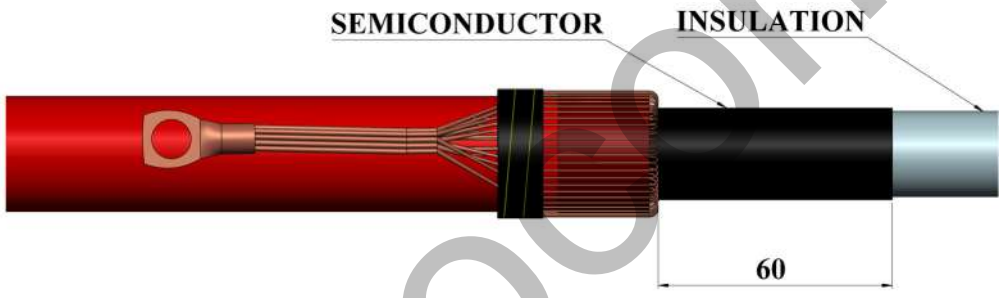
2. WIRE SHIELD CABLE

2.1 Remove eventual containing tape, the equalizer copper tape too. Don' t cut the wires of the metallic screen, but turn back completely on the outer jacket and fix them on to the cable at **50 mm** (lower tape edge) from the outer jacket edge, by some laps of **ELCOPLAST 51**.

2.2 Joint and twist the wires of the metallic screen together in order to obtain a strand-shape conductor, trim the wires edge, and apply to the end the **screen lug** available in the kit and crimp it with a suitable tool.



2.3 Remove the cable semiconductor (if necessary use the appropriate tool) leaving exposed **60 mm** from the outer jacket edge.

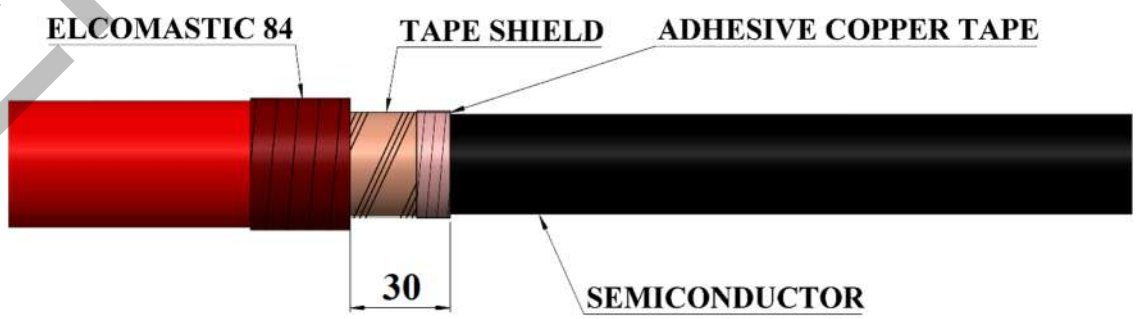


2.4 If necessary, smooth the insulation surface, to be sure that all semiconducting traces are removed, using the supplied abrasive cloth without touching the semiconductive layer.

3. TAPE SHIELD CABLE

3.1 Fix the tape shield, with the **adhesive copper tape**, to the distance of **30 mm** from outer jacket edge.

3.2 Cut and remove the tape shield from the cable end on the adhesive copper tape edge.

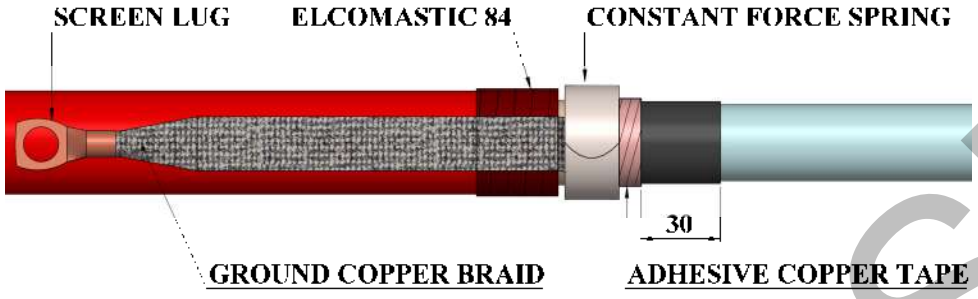


3.3 Remove the cable semiconductor (if necessary use appropriate tool) leaving exposed **30 mm** from the tape shield edge.

3.4 If necessary, smooth the insulation surface, to be sure that all semiconducting traces are removed, using the supplied abrasive cloth without touching the semiconductive layer.

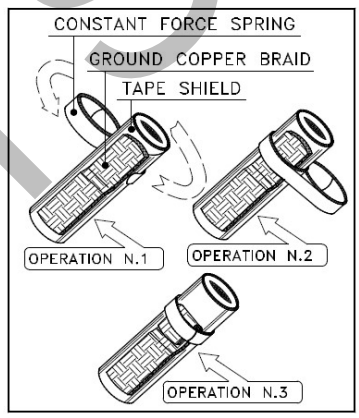
3.5 Position the **ground copper braid** to the tape shield and fix with the **constant force spring**.

3.6 Apply the **screen lug** available in the kit on the end of the braid and crimp it with a suitable tool.



-- CONSTANT FORCE SPRING APPLICATION

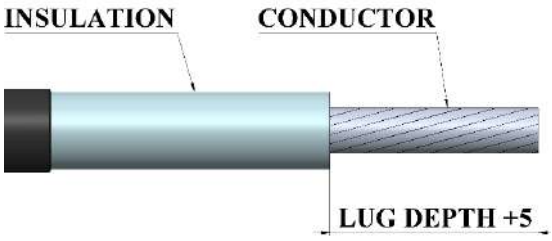
1) Apply the *ground copper braid* on the tape shield; fasten the constant force spring edge on the tape shield.
2) Fix the *ground copper braid* by two laps of the *constant force spring* in such a way that the extremity comes out for several mm, to let, successively, a lap on that extremity to be made.
3) Refold the *ground copper braid* and wrap the rest of the constant force spring on it.



4. COMMON OPERATIONS

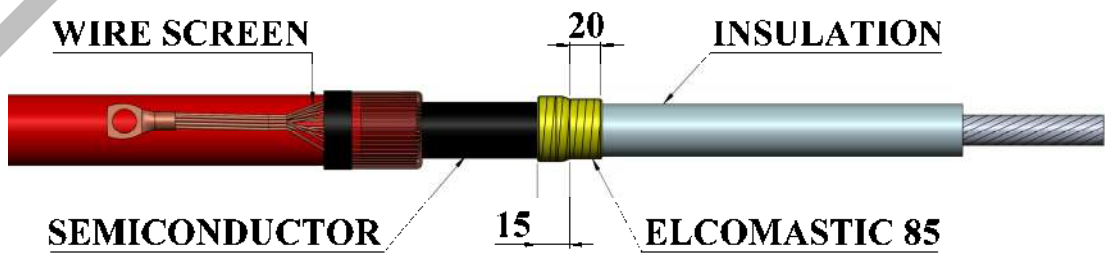
4.1 Remove the insulation in such a way to expose the cable conductor for a corresponding length of the **lug depth + 5 mm**. Pay attention to not damage the conductor.

4.2 Clean the insulation of the cable with the supplied **cleaning tissue**, proceeding from the insulation to the semiconductor to avoid dragging semi-conductive particles on the insulation.

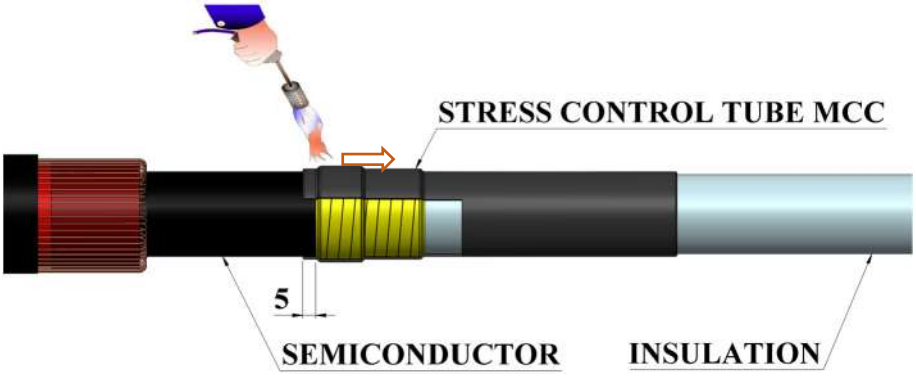


The stress control tape ELCOMASTIC 85 must be applied stretching it up to reduce the original width to the half, approximately.

4.3 Wrap two half lapped layers of **ELCOMASTIC 85** tape, on the semiconductor edge, start the taping on the semiconductor overlapping it for about **15 mm,** continue on the insulation to overlap it for about **20 mm**.

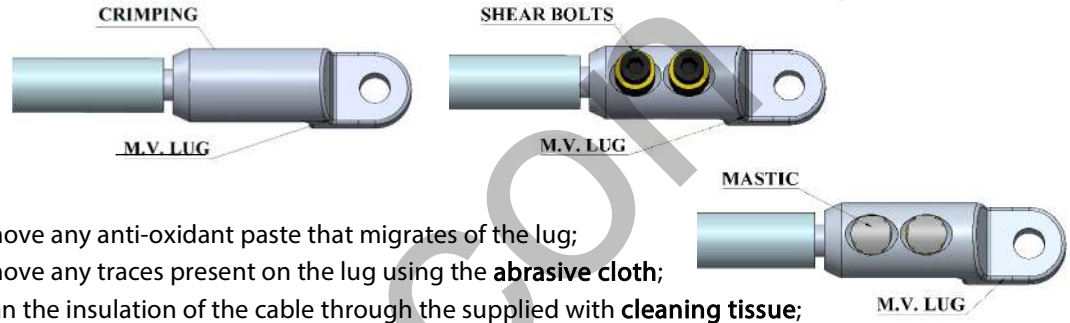


4.4 Apply the **stress control tube MCC** (black color) in such a way to overlap the semiconductor for **5 mm**. Heat shrink the tube by brings us heat from the edge locate on the semiconductor towards the opposite side. Moving it all around and do not insist on the same parts, and stop when completely shrunk.



4.5 Insert the lug onto the appropriate mating cores, ensuring that the lug is within the size specifications listed in the **bill of material enclosed** and control that those specifications comply with the MV rate.

4.6 Crimp or shear it with a suitable tool following any instructions together.



- Remove any anti-oxidant paste that migrates of the lug;
- Remove any traces present on the lug using the **abrasive cloth**;
- Clean the insulation of the cable through the supplied with **cleaning tissue**;
- Fill properly with mastic the surface irregularities formed on the lug, following the failure of the screws or crimp void.

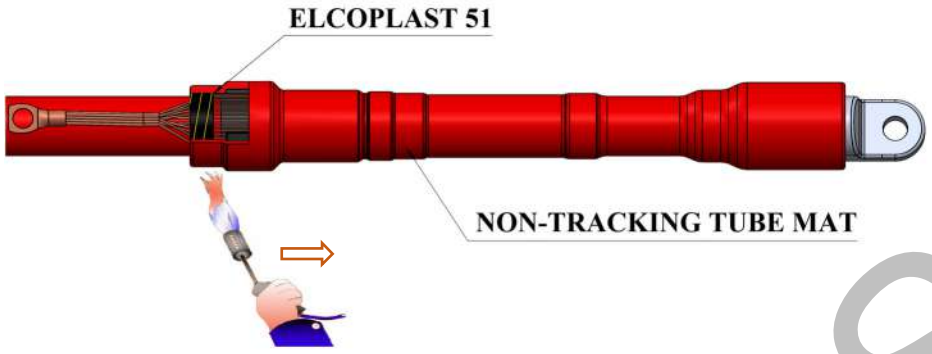
4.7 Apply the **ELCOMASTIC 85** on the insulation to the top edge of the **tube MCC** in order to fill up and smooth off the gap between the tube and the insulation.

4.8 Apply the **ELCOMASTIC 84** on the exposed conductor, which is between the insulation and the lug, in such a way to level these surfaces. Then continue to apply it with at least two half lapped layers until to overlap the cylindrical part of the lug itself, or however, reaching the insulation's diameter.

4.8 Apply, finally, the **ELCOMASTIC 84** on the exposed semiconductor which is between tube MCC and outer jacket, in such a way to level these surfaces and continue to overlap with one layer the **ELCOMASTIC 84** applied on the outer jacket (**30 mm** on the outer jacket).

4.10 Apply **the non tracking tube MAT** (red color) check that the lower edge of it corresponding with the lower edge of the **ELCOPLAST 51**, previously applied, on the outer jacket or to the distance of **50 mm** by outer jacket edge if the cable is with tape screen.

4.11 Heat shrink with the same caution previously indicate, starting from the outer jacket toward to opposite side. After the heat shrinking, cut eventually the exceeding tube in such a way to leave expose the lug hole.

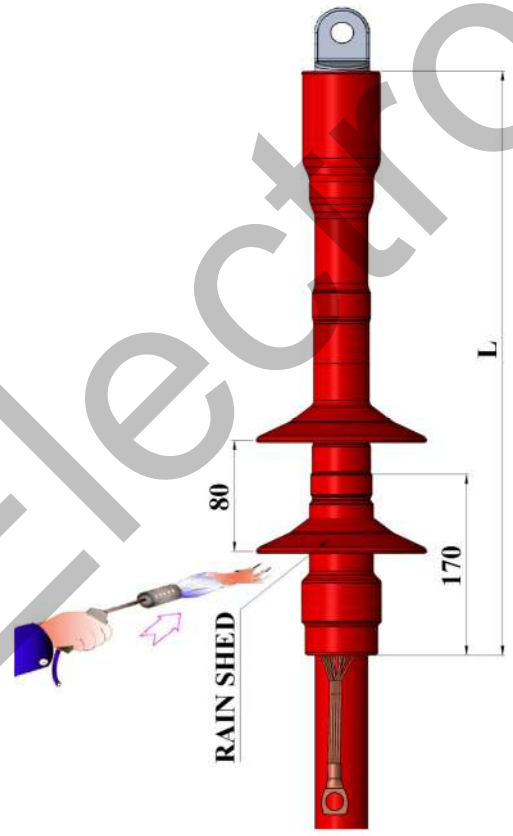


5. RAIN SHED APPLICATION

5.1 **Apply the rain shed just after the heat shrinking** of the **MAT** tube locating the upper rain shed edge at **170 mm** distance from the lower non tracking tube edge and heat shrink around the circumference orienting the heat only on the neck of the rain shed.

5.2 Apply the other rain shed (*the number of rain sheds to be applied is shown on the table*) in such a way to leave the dimension of **80 mm** from the upper rain shed edge.

5.3 Connect the medium voltage lug to the electrical system and the low voltage lug to the ground station.



KIT CODE ELCON MEGARAD	VOLTAGE Um (kV)	RAIN SHED N°
ELCOTERM TIS – 0782/E	7,2	0
ELCOTERM TIS – 1282/E	12	0
ELCOTERM TIS – 1782/E	17,5	0
ELCOTERM TIS – 2482/E	24	0
ELCOTERM TIS – 3682/E	36	2
ELCOTERM TIS – 4282/E	42	2

5.3 The termination is completed.

Installation instructions

ECOLD GLS - 2489RR and 3689RR

COLD SHRINK COMPACT STRAIGHT JOINT with M.V. bolted connector

PART 1-3

for M.V. single core XLPE insulated cables with aluminium tube screen

PART 1-2-3

for M.V. single core XLPE insulated cable with aluminium tube screen

and

M.V. single core XLPE insulated cable with copper wire screen

PART 2-3

for M.V. single core XLPE insulated cables with copper wire screen

Highest voltage: Um 36 kV

ELCON MEGARAD S.p.A.
HEADQUARTER and FACTORY: ARCELLA (AV) ITALY
Tel. +39 0825/6077 - Fax +39 0825/607782
Web site:www.elconmegarad.com e-mail: elcon@elconmegarad.com

Drawing N°	Code MP17340	Drawn	Updated	Approved
960RR ENG	Date	**19/09/2013**	**20/09/2023**	
	Signature	**C.I.**	**G.DA.**	**G.DS.**

GENERAL INFORMATIONS

* NOTE: This accessory can only be qualifed installers of medium voltage accessories.
* The mounting of the accessory is held exclusively by following these instructions.
* Using tools and equipment to meet their instructions.
* IMPORTANT: Before you begin installation, check that: the kit contains all materials in the amount indicated, which are in perfect condition and that the accessory to be installed is corresponds with the nature and dimensions of cable
* READ THESE INSTRUCTIONS COMPLETELY BEFORE BEGINNING THE ASSEMBLY.

NOTES FOR APPLICATION COLD SHRINK TUBES

* Before positioning the tube over the cable controlling the corect position of the unwinded spiral tract in according to the instructions will be provided below;
* Developing and rolling it by dropping the spirals in the sense indicated, never change the direction of rotation;
* be careful that the spiral tract developed not go to press on the same cable.

SUGGESTED USE TOOLS

* Tools for cutting the outer jacket and Al tube for XLPE or HPTE cable - ENEL unification tab. EA 0443, **- FIG. N. 1 and FIG. N. 2;**
* tool for removing of the semicondustor for XLPE or HPTE insulated cable - ENEL unification tab. EA 0094, - **FIG. N. 3;**
* tool for removing of the insulation of medium voltage cables - ENEL unification tab. EA 0104, - **FIG.N.4;**
* tool for band clamp application **FIG. N. 5 (see following pages);**
* Tent for jointers (for weather-specific environmental);
* Tool support for the installation of the connector.

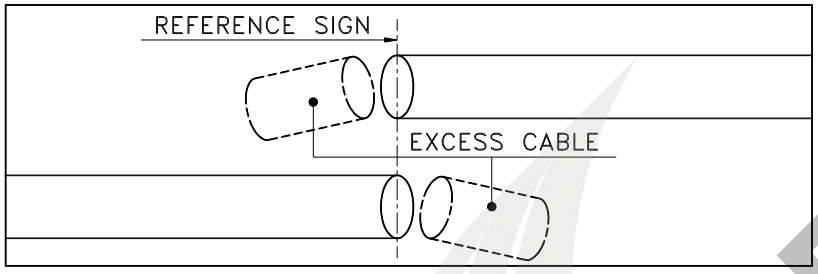
FIG. N. 1

FIG. N. 2

FIG. N. 3

FIG. N. 4

- ***CABLES PREPARATION***
- Overlap the cable ends at least for **300 mm.**
- Mark on the cables an **reference sign** (center of the joint).
- Cut the cables on the reference sign and remove the surplus parts.
  Make the cut cable with a hacksaw so as orthogonal to the axis of the cable, not damaging the ends of the cable for to allow an corect use of the removing-semiconductor tool.
- Thoroughly clean the outer jacket of the cable for a tract of at least **1,5 m** using suitable solvent (to avoid the use of clorotene, gasoline and other products trielinas toxic / harmful or flammable).

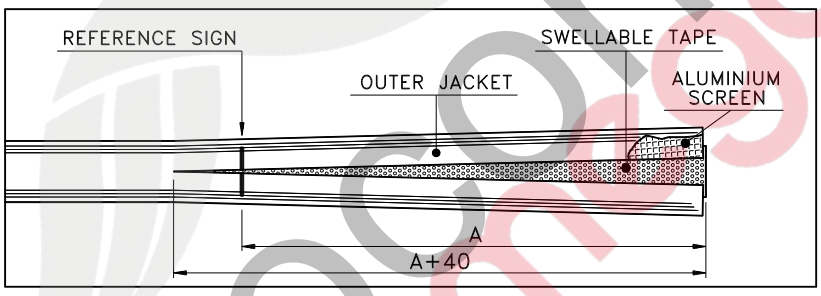


PART 1

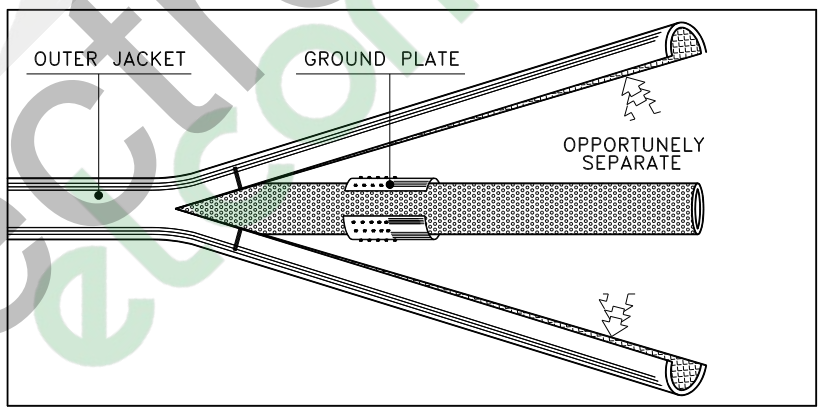
1. ALUMINIUM SCREEN CABLE PREPARATION
(In case of connecting cables of the same type the following operations must be carried out on both cables.)

1.1 Mark on the outer jacket an reference sign to the distance **"A" (shown on the bill of material enclosed)** from the cable end.

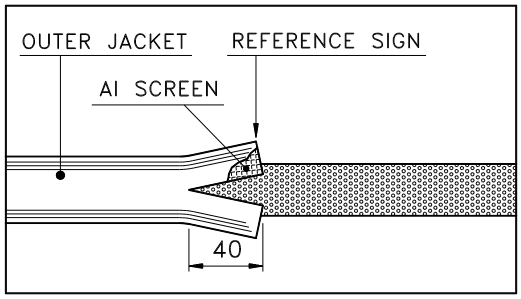
1.2 Using appropriate tool *(shown in the general information page - FIG. N. 1 or FIG N. 2 - ENEL unification tab. EA 0443),* make on the outer jacket/Al screen two or three opposing longitudinal cut, for the length **"A" (shown on the bill of material enclosed) + 40 mm** from the cable end.



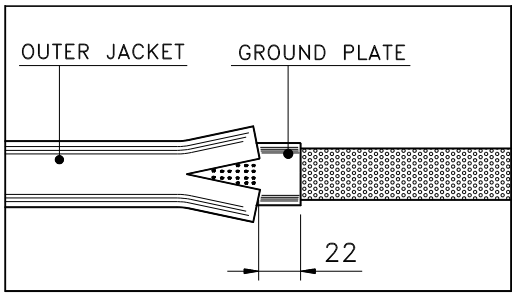
1.3 Separate opportune the two or three parts of the outer jacket / Al screen and verify that the ground plate enter completely on the cable without special efforts.



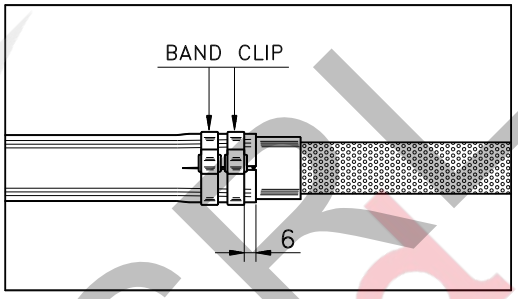
1.4 Remove momentarily by cable the ground plate and remove the outer jacket/Al screen on the **reference sign**, cut with scissors electrician.



1.5 Introduce the **ground plate** between the swellable tape and Al screen remain exposed a length of **22 mm.**



1.6 Retort the protective outer jacket/Al screen on the ground plate, so as to obtain a first temporary compaction, then apply to about **6 mm** from the edge, the **first band clip** wrapping on the cable. Fasten using **closing tool** that see in the **FIG. N. 5** and follow the instructions for use. Ensure the penetration of the teeth on the screen (this operation is essential because it is the only electrical contact between the screens and therefore the fault current path as well as eddy currents) then pull in the lever by the court the band, fold back the excess. Apply the **second band clip** to about **6 mm** from the first and meet the same operations described above.



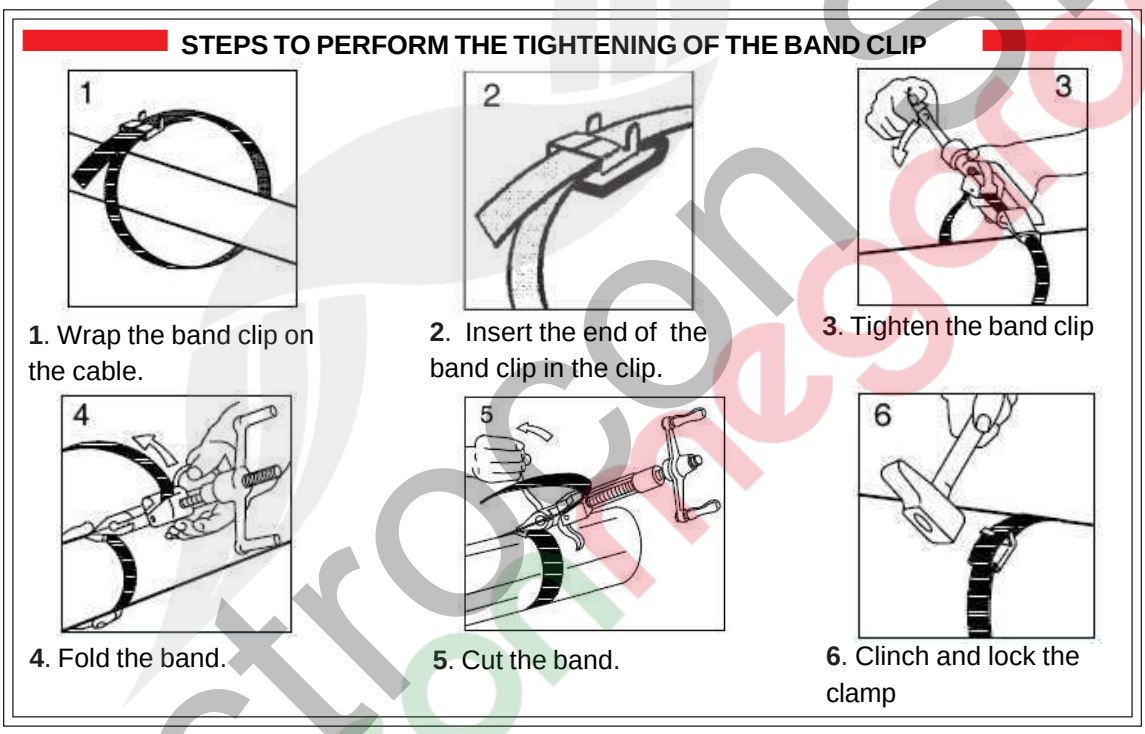
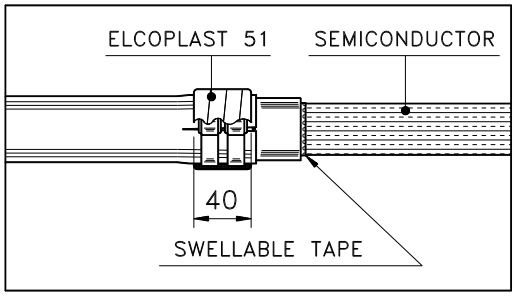


FIG. N. 5

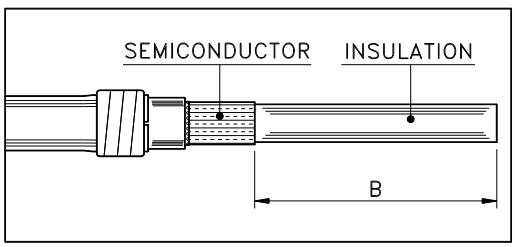
1.7 Cover the band clip and the outer jacket/Al screen with an layer of pvc tape **ELCOPLAST 51**.

1.8 Remove opportunely the svellable tape up to outer jacket/Al screen cutting.



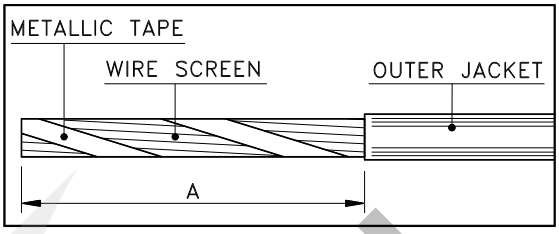
– *For semiconductor remove on XLPE or HPTE insulated cable use the tool (shown in the general information page FIG. N. 3 - ENEL unification tab. EA 0094)*

1.9 Remove the semiconductor for an length **"B" (shown on the bill of material enclosed)** from the cable end.

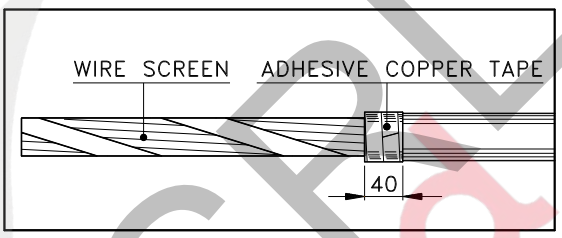


PART 2

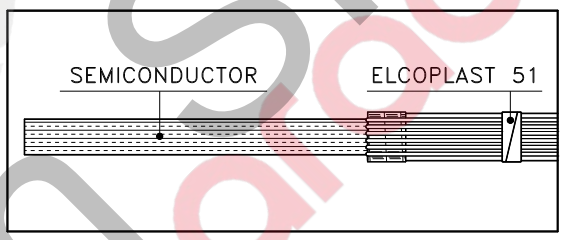
2. COPPER WIRE SCREEN CABLE PREPARATION.
(In case of connecting cables of the same type the following operations must be carried out on both cables.)



2.1 Remove the outer jacket from the cable end for the length **"A" (shown on the bill of material enclosed).**

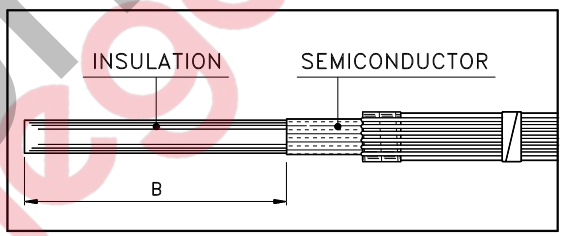


2.2 Apply on the outer jacket an layer of **adhesive copper tape** for **40 mm** starting from the cut.



2.3 Remove the metallic tape and don't cut the wire screen but bend them downwards the outer jacket. Fix them on the outer jacket by some layers of PVC tape **ELCOPLAST 51.**

– *For semiconductor remove on XLPE insulated cable use the tool (shown in the general information page - FIG. N. 3 - ENEL unification tab. EA 0094).*

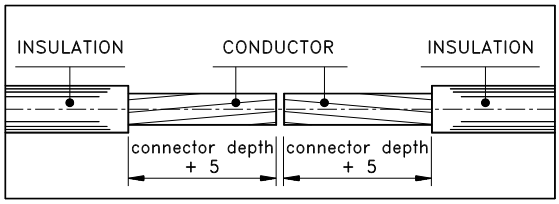


2.4 Remove the semiconductor for an length **"B" (shown on the bill of material enclosed)** from the cable end.

PART 3

3. COMMON OPERATIONS FOR ALL TYPES OF CONNECTION

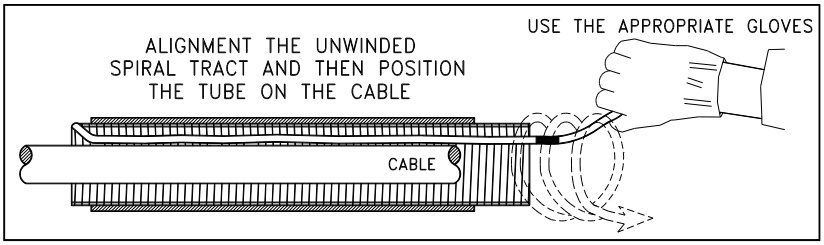
- *For remove the primary insulation on the HEPR, XLPE or HPTE cable use the tool (shown in the general information page - FIG. N. 4 - ENEL unification tab. EA 0104).*



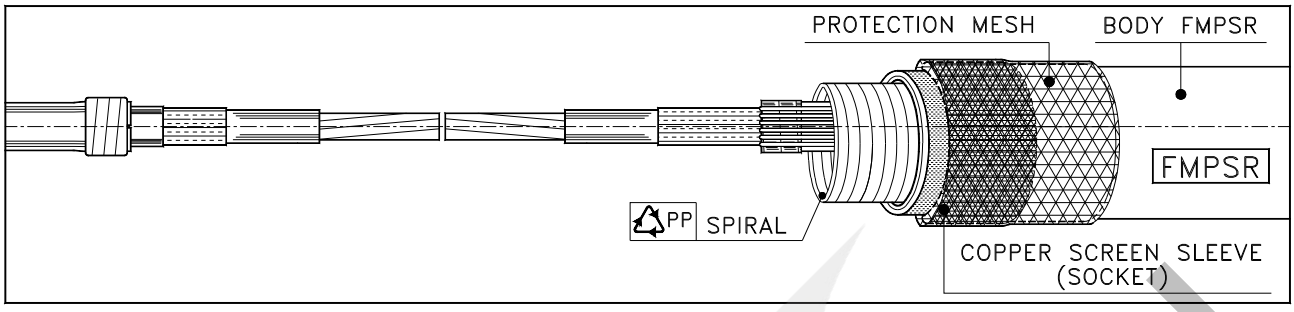
3.1 Remove the primary insulation from the cable end for the length equal to **CONNECTOR DEPTH + 5 mm**, so as to expose the conductor carefully not to affect it.

3.2 Remove any traces of semiconductor or irregularity using the supplied abrasive cloth. This operation should be made until the primary insulation is smooth and free of defects made by the tool. Clean the exposed conductor and applied on the top an layer of pvc tape **ELCOPLAST 51.**

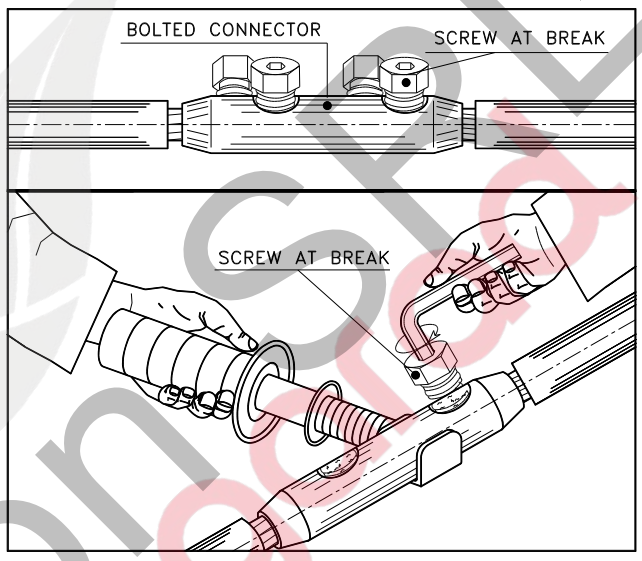
– **WARNING:** Before positioning the spiral tube on the cable, turn and pull the unwinded spiral tract in the **way indicated.** To make sure that the tract of spiral inside the tube appears in straight position, in parallel way towards the tube itself. Keeping the tract of unwinded spiral of the tube in traction, slip the tube on the cable paying attention that the unwinded spiral tract doesn' t wind around the cable.



3.3 **WARNING:** slip on the outer jacket the compact body **FMPSR** **with the piece of spiral unwinded opposite at the center joint.**
Protect them opportunely from dirtiness. Position the cables for the connection.

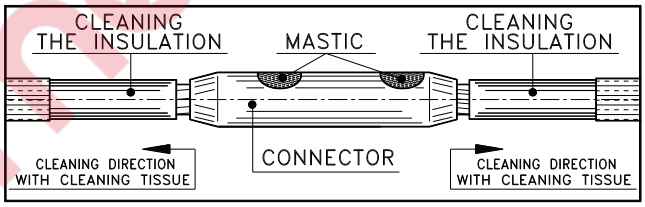


- *For the installation of the connector use the properly tools shown in order to support the connector when tightening the screws.*

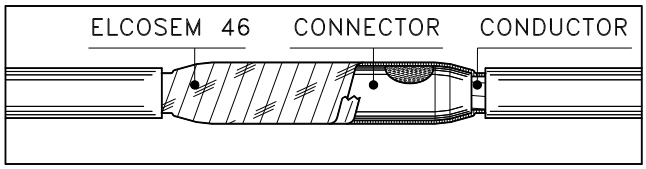


3.4 Remove the pvc tape applied on the conductors.
3.5 Connect the conductors with suitable **bolted connector with shear at break**, following any instructions together.

Notes:
- *Remove any anti-oxidant paste that migrates of the connector;*
- *Remove any traces present on the connector using the abrasive cloth;*
- *Clean the insulation of the cable through the supplied with **cleaning tissue**, proceeding from the connector to the semiconductor to avoid dragging semi-conductive particles on the insulation primary, if necessary, clean the semiconductor being careful not to touch the insulation clean before;*
- *Fill properly with **mastic** the surface irregularities formed on the connector, following the failure of the screws.*

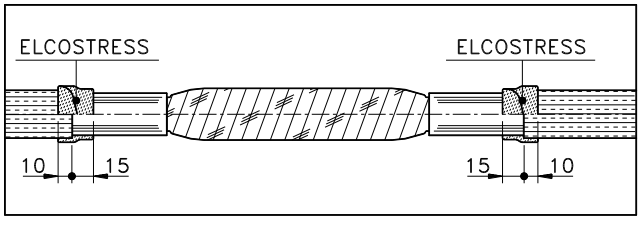


3.6 Apply an layer, overlap 50%, of semiconductive tape **ELCOSEM 46**, on the connector and on the exposed parts of the conductors. *The tape must be applied with a stretching it up to reduce the original width to the half, approximately.*

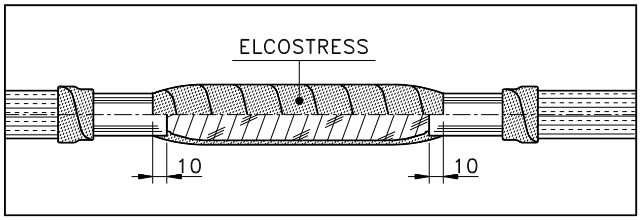


– ***Note**: the **ELCOSTRESS** tape must be applied stretching it up to reduce the original width to the half approximately and a overlap of the 50%.*

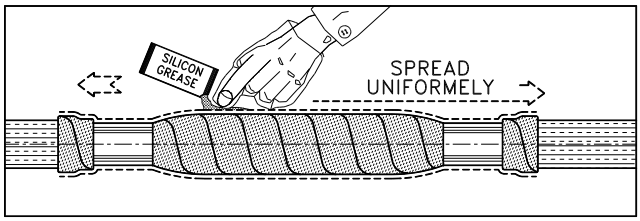
3.7 Apply two half lapped layers of **ELCOSTRESS** on the cable semiconductor edges overlapping it for **10 mm** and the insulation for **15 mm**.



3.8 Apply, **at least two layers** of **ELCOSTRESS** in connector area, filling uniformely the area between connector ends and primary insulation, which has to be overlapped for about **10 mm** the primary insulation.
At the end of the taping the diameter in connector area must be nearly equal to the diameter of the insulation of the cables.

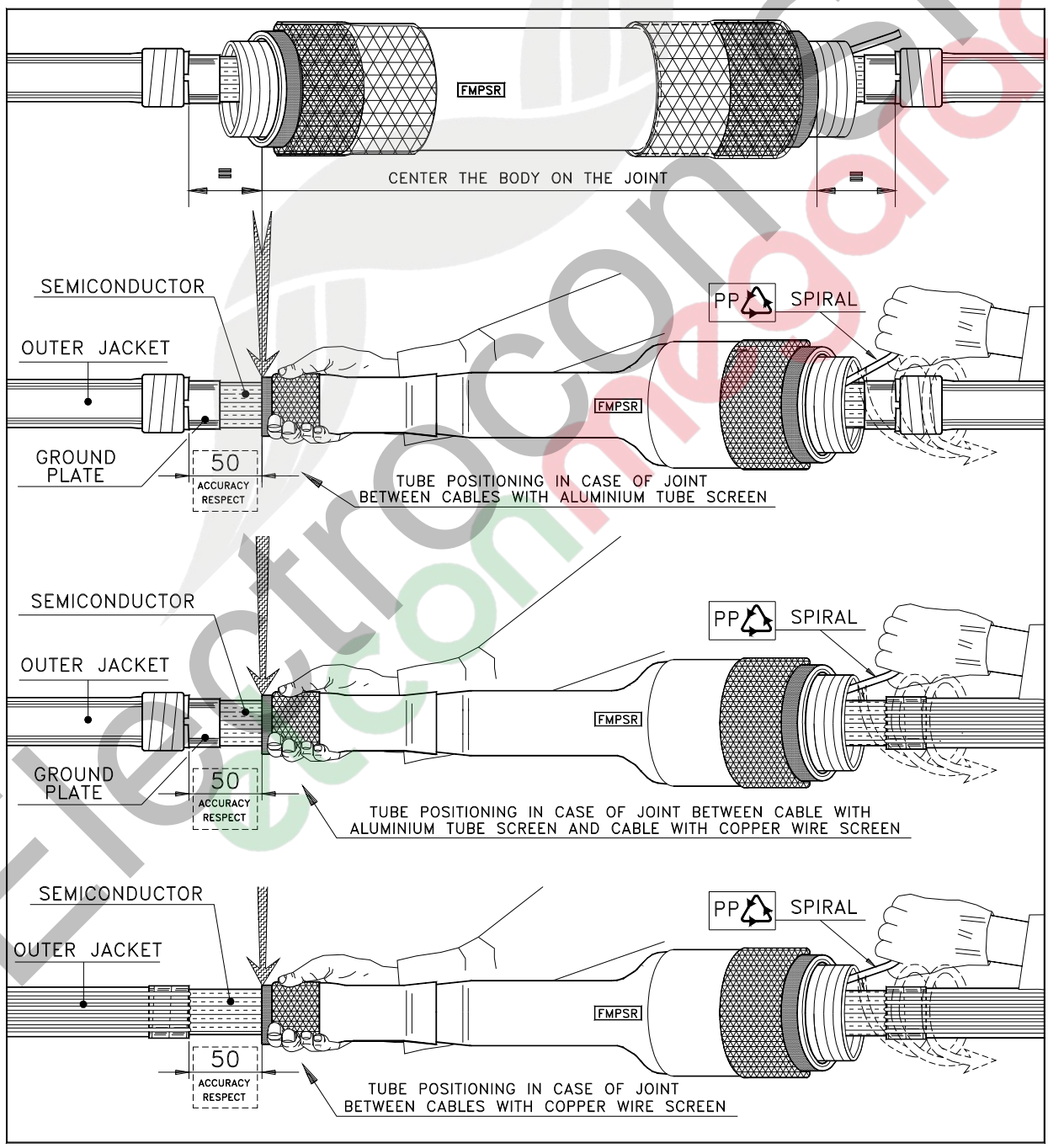


3.9 Apply, wear the gloves contained in the kit, a layer of **SILICON GREASE** on the ELCOSTRESS taping and on the exposed insulation.

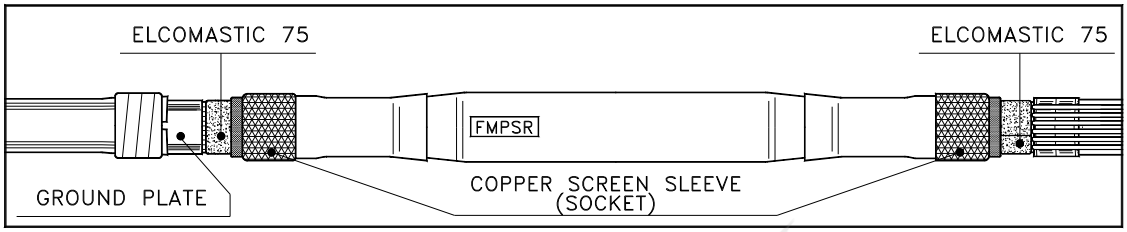


– ***COMPACT BODY FMPSR APPLICATION***

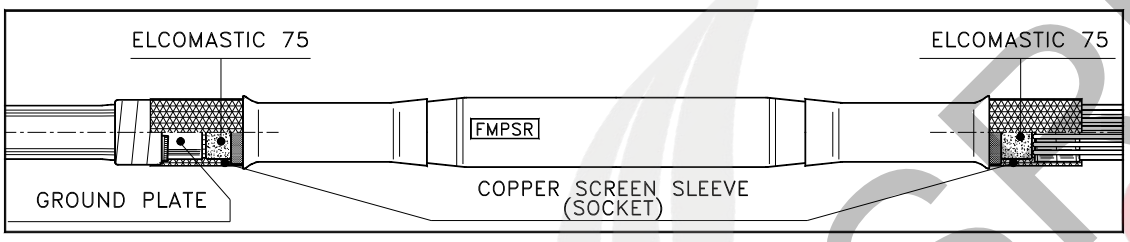
3.10 Remove the protection mesh by FMPSR tube edges. Keeping the tract of unwinded spiral tube in traction, slide the body **FMPSR** tube on the joint positioning the edge at **50 mm** from the outer jacket edge.
Place the tube in the prescribed position and, holding it in one hand, unwind and pull the spiral at same time with the other hand **unwinding it according to the indicate direction** in such a way the tract of the tube tightly on the semicoductor cable, check the position of the tube and continue the it application. Pay attention that the unwound spiral is not tightening around the cable. It may be cut when too long. Clean with clean tissue eventual silicon grease bunching in excess, continue the operations only after all traces of solvent used for cleaning has evaporated.



3.11 Apply an layer, slightly stretching of **ELCOMASTIC 75** on the semiconductor of the cable. Taping at ground plate edge in case of cable with Al screen, being careful not to cover the same ground plate or outer jacket edge in case of cable with copper wire screen.



3.12 Turn round on both sides of the junction, the **copper screen sleeve (socket).**

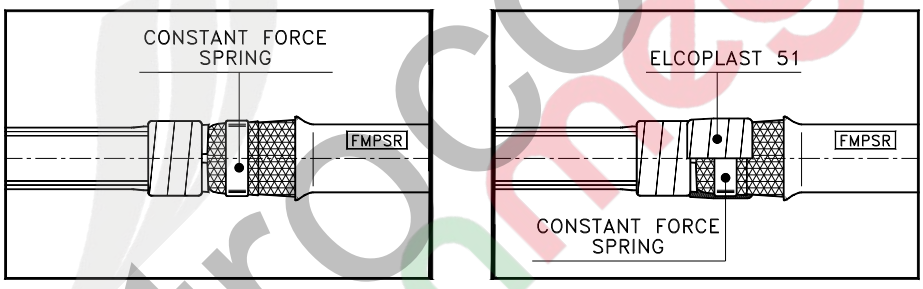


a) ***OPERATIONS FOR THE APPLICATIONOF THE CONSTANT FORCE SPRING ON THE ALUMINIUM SCREEN CABLE.*** **(in case of connecting cables of the same type the following must be made on each cable)**

3.13a Apply the **constant force spring** on the copper screen sleeve (socket), making a first round in **correspondence of ground plate below.**

3.14a Refold the surplus end of the socket (from constant force spring edge) disribuite them uniformly on the unwind surface costant force spring.

3.15a Complete the application of the **constant force spring** on the socket wrapping completely the remaining laps, remove eventual wire of socket in excess, cover the applied constant force spring with some layers of pvc tape **ELCOPLAST 51**.

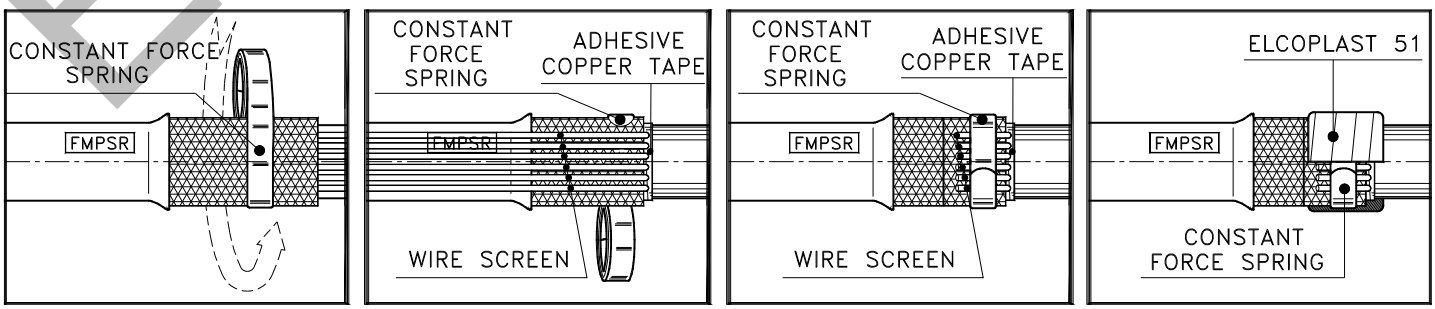


b) ***OPERATIONS FOR THE APPLICATIONOF THE CONSTANT FORCE SPRING ON THE COPPER WIRE SCREEN CABLE.*** **(in case of connecting cables of the same type the following must be made on each cable)**

3.13b Apply the **constant force spring** on the copper screen sleeve (socket), making a first round in **correspondence of the adhesive copper tape below.**

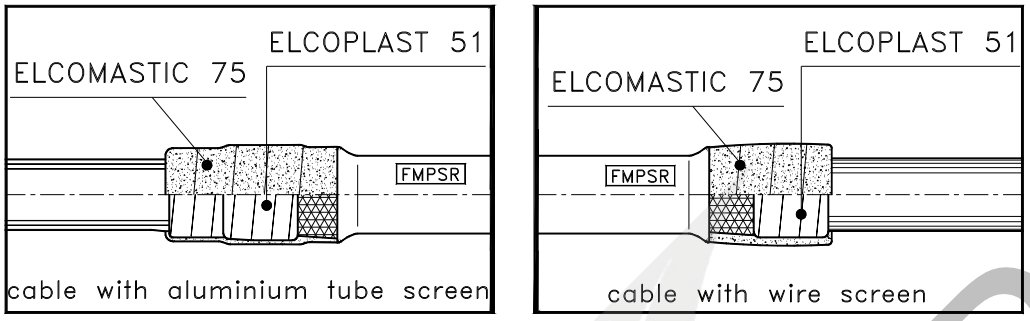
3.14b Remove the pvc tape ELCOPLAST 51 applied provisionally for fix the wire shield on the outer jacket.
Refold, at the same time, the surplus end of the copper screen sleeve (from constant force spring edge) and the wire shield, disribuite them uniformly on the unwind surface costant force spring.

3.15b Wrap the rest layers of the **constant force spring** on the refolded copper screen sleeve and wire shield. Cut the surplus of the wire screen and wire of the socket on the constant force spring edge, cover on the applied constant force spring with some layers of pvc tape **ELCOPLAST 51**.



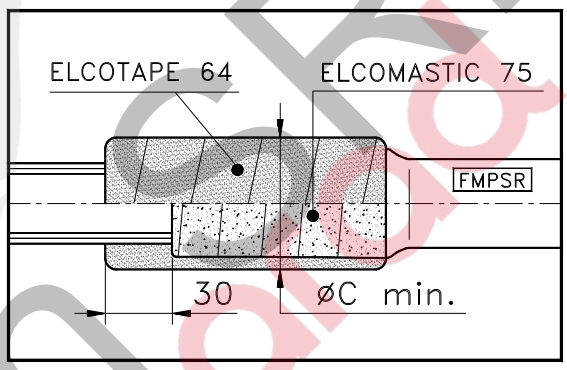
COMMON OPERATIONS FOR ANY TYPE OF CONNECTION.

3.16 Apply two layers of **ELCOMASTIC 75**, at the ends of the tube FMPSR, starting the taping from the outer jacket and continue on the area of the spring roll until reaching the edge tube FMPSR, leveling and making such cylindrical area.

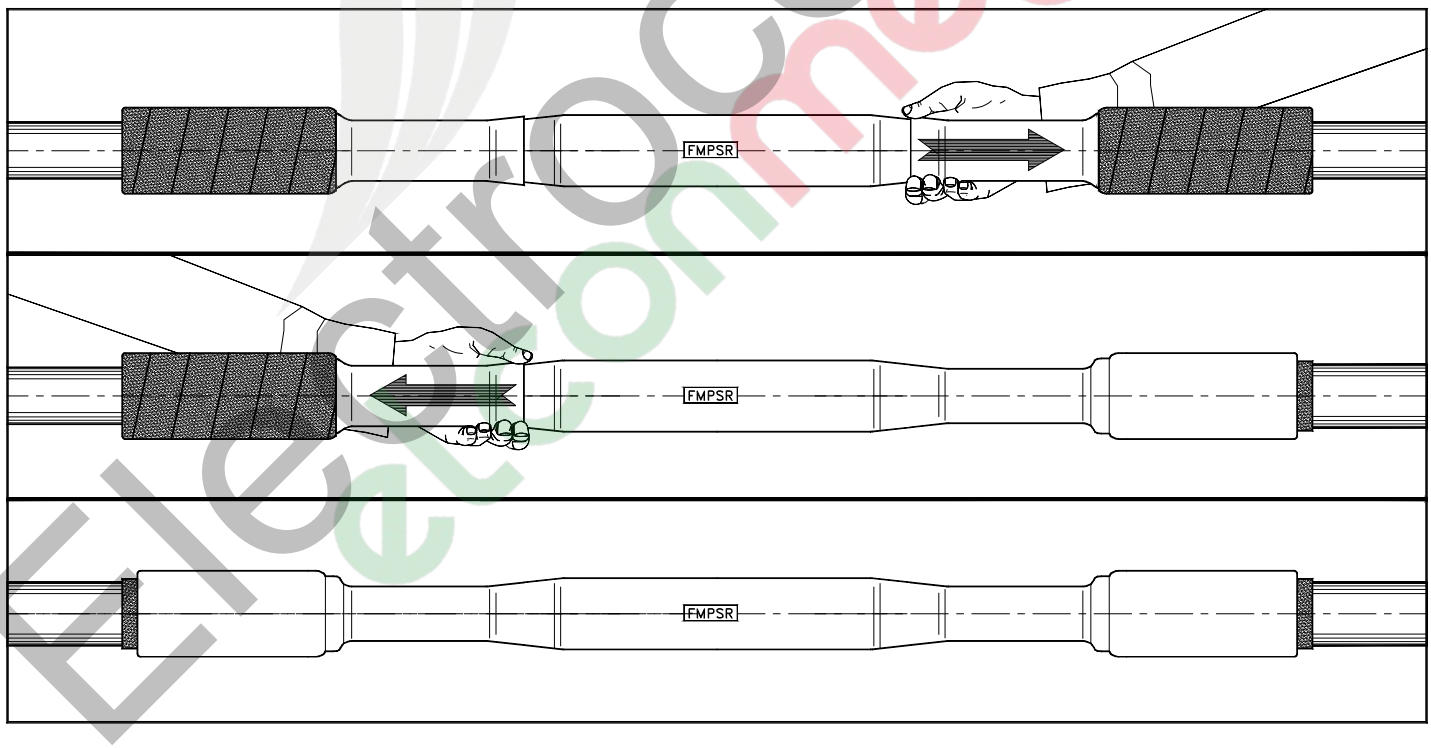


3.17 Apply the tape **ELCOTAPE 64**, overlap of 50%, at both ends of the juncion body.
Starting on the outer jacket overlap it for about **30 mm**, continue the tapping until reaching the edge of junction body, the surface obtained must be **leveling and cylindrical with a mimimum diamiter "C" (shown on the bill of material enclosed).**

On the outer jacket with diameter bigger than "C" (shown on the bill of material enclosed) apply at least one layer of ELCOTAPE 64



3.18 Turn on the junction, the parts of tube **FMPSR (turned over itself)**, paying attention for you to go to unfold completely on the tape ELCOTAPE 64 and on the cable. Clean the tube FMPSR with the cloth supplied.



3.19 The joint is ready to be energized.

elconmegarad

CONFORMITY DECLARATION

We **ELCON MEGARAD S.p.A.**, having our legal office in:
Via Amoretta 6/E- Parco S. Nicola 83100, Avellino (AV), Italy

Who are official manufacturers of Power Cable Accessories, having factories at:
1. Via Nazionale, 110 - 83030 Arcella (AV) – Italy.
2. Via Provinciale Moscuso – Zona Industriale – 81049 Mignano Montelungo (CE) – Italy.

do hereby declare that our offered/proposed items to ELECTROCON Ltd (MD-2052, 19, Maria Dragan str., Chisinau, Republic of Moldova, IDNO-1003600025379), Against the tender:
RED-Nord SA
Code:46/14/26 Terminal connectors and adapter sleeves (id 21574800)

Nr. Lotului	Cod articol	Elcon Megarad Proposed Item	Conform to Standard
10	FN17419A1	ECOLD VTSI-2463R/E 1X95/240mmq Cu/Al	HD 629 1 S1
20	FN17427A1	ECOLD VTSE-2464R/E 1X95/240mmq Cu/Al	HD 629 1 S1
30	FN18143	ELCOTERM GLM-1266/EW-R 3X(1)X95/240Cu/Al	HD 629 1 S1
40	FN17341E	ECOLD GLS-2489RR 1X95/240 Cu/Al	HD 629 1 S1
50	FN21332	ELCONEXT 24C-K1-LT 1923TWR1/E	EN 50181

Signed:

Name: Dr, Eng. Rosario Ruggiero
Address: Via Nazionale, 110 - 83030 Arcella (AV) – Italy.
Email: rosario.ruggiero@eleconmegarad.com
Title: Sales Area Manager
Date: 12/03/2026

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CERTIFICATE N.

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ISO 9001:2015

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Progettazione, sviluppo, fabbricazione, assistenza di: guaine in poliolefine termorestringenti e tubi elastomerici per applicazioni elettriche ed elettroniche mediante processi di compoundazione, estrusione, reticolazione, espansione, verniciatura e marcatura superficiale. Progettazione e produzione di corredi per giunti e terminali per cavi elettrici di energia e telecomunicazioni, di sistemi di collegamento per apparati di segnalamento, di resine e isolatori per l'isolamento elettrico. Produzione di miscele, mastici e nastri per l'isolamento elettrico
Design, development, production, assistance for heat shrinkable polyolefine and elastomeric sleeves svitable for electronic and electrotechnical applications through compounding, extrusion, cross linking, expansion, coating and surface marking. Design and production of kits and joints and terminals for energy electric cables and telecommunications, connection systems for measure and signalling equipments, of resins and insulators for the electric insulation. Production of mixtures, mastic and tapes for electric insulation

Ulteriori informazioni riguardanti l'applicabilità dei requisiti ISO 9001:2015 possono essere ottenute consultando l'organizzazione
Further clarifications regarding the applicability of ISO 9001:2015 requirements may be obtained by consulting the organization

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	31/03/2003	23/03/2024	13/05/2027

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has implemented and maintains a

Quality Management System

for the following scope:

Design, development, production, assistance for heat shrinkable polyolefine and elastomeric sleeves svitable for electronic and electrotechnical applications through compounding, extrusion, cross linking, expansion, coating and surface marking. Design and production of kits and joints and terminals for energy electric cables and telecommunications, connection systems for measure and signalling equipments, of resins and insulators for the electric insulation. Production of mixtures, mastic and tapes for electric insulation

which fulfils the requirements of the following standard:

ISO 9001:2015

Issued on: **2024/03/23**

Expires on: **2027/05/13**

Registration Number: **IT-31034-9105.ELCN**

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President of IQNET

Mario Romersi
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Progettazione, sviluppo, fabbricazione, assistenza di: guaine in poliolefine termorestringenti e tubi elastomerici per applicazioni elettriche ed elettroniche mediante processi di compoundazione, estrusione, prove chimico-fisiche di laboratorio, reticolazione, espansione, verniciatura e marcatura superficiale. Progettazione e produzione di corredi, con prove elettriche di laboratorio in media e alta tensione, per giunti e terminali per cavi elettrici di energia e telecomunicazioni, di sistemi di collegamento per apparati di segnalamento, di resine e isolatori per l'isolamento elettrico. Commercializzazione e produzione di miscele, mastici e nastri per l'isolamento elettrico

Design, development, production, assistance for heat shrinkable polyolefin and elastomeric sleeves suitable for electronic and electrotechnical applications through compounding, extrusion, chemical-physical laboratory tests, cross linking, expansion, coating and surface marking. Design and production of kits, with electrical laboratory tests in medium and high voltage, for joints and terminals for energy electric cables and telecommunications, connection systems for measure and signalling equipments, of resins and insulators for the electric insulation. Marketing and production of mixtures, mastic and tapes for electric insulation

Certificazione rilasciata in conformità al Regolamento Tecnico ACCREDIA RT-09

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	09/01/2012	19/12/2023	19/12/2026

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Management Systems Division - Flavio Ornago

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Environmental Management System

for the following scope:

Design, development, production, assistance for heat shrinkable polyolefin and elastomeric sleeves suitable for electronic and electrotechnical applications through compounding, extrusion, chemical-physical laboratory tests, cross linking, expansion, coating and surface marking. Design and production of kits, with electrical laboratory tests in medium and high voltage, for joints and terminals for energy electric cables and telecommunications, connection systems for measure and signalling equipments, of resins and insulators for the electric insulation.
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Expires on: **2026/12/19**

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Certificate

CISQ/IMQ has issued an IQNet recognized certificate that the organization:

ELCON MEGARAD SPA

VIA NAZIONALE 110 - LOC. ARCELLA - 83030 MONTEFREDANE (AV) Italy

ZONA INDUSTRIALE - LOC. MOSCUSO - 81049 MIGNANO MONTE LUNGO (CE) Italy

VIA NAZIONALE-PLANT 2 110 - 83030 MONTEFREDANE (AV) Italy

has implemented and mantains a

Occupational Health and Safety Management System

for the following scope:

Design, development, production, assistance for heat shrinkable polyolefin and elastomeric sleeves suitable for electronic and electrotechnical applications through compounding, extrusion, chemical-physical laboratory tests, cross linking, expansion, coating and surface marking. Design and production of kits, with electrical laboratory tests in medium and high voltage, for joints and terminals for energy electric cables and telecommunications, connection systems for measure and signalling equipments, of resins and insulators for the electric insulation

which fulfills the requirements of the following standard:

ISO 45001:2018

Issued on: **2023/12/20**

Expires on: **2026/12/30**

Registration Number: **IT-97164-9192.ECMG**

Alex Stoichitoiu
President of IQNET

Mario Romersi
President of CISQ

CISQ

This attestation is directly linked to the IQNET Member's original certificate and shall not be used as a stand-alone document.

IQNET Members*:
AENOR Spain **AFNOR Certification** France **APCER** Portugal **CCC** Cyprus **CISQ** Italy **CQC** China **CQM** China **CQS** Czech Republic **Cro Cert** Croatia **DQS Holding GmbH** Germany **EAGLE Certification Group** USA **FCAV** Brazil **FONDONORMA** Venezuela **ICONTEC** Colombia **ICS** Bosnia and Herzegovina **INTECO** Costa Rica **IRAM** Argentina **JQA** Japan **KFQ** Korea **LSQA** Uruguay **MIRTEC** Greece **MSZT** Hungary **Nemko AS** Norway **NSAI** Ireland **NYCE-SIGE** México **PCBC** Poland **Quality Austria** Austria **SII** Israel **SIQ** Slovenia **SIRIM QAS International** Malaysia **SQS** Switzerland **SRAC** Romania **TSE** Türkiye **YUQS** Serbia

* The list of IQNET Members is valid at the time of issue of this certificate. Updated information is available under www.iqnet-certification.com

ELECTROCON Ltd
MD-2052, 19, Maria Dragan str.,
Chisinau,
Republic of Moldova

LETTER OF AUTHORIZATION

We, **Elcon Megarad S.p.a., ia Nazionale, 110 - 83030 Arcella (AV) - Italy,,** as a reputable manufacturer of electrical power cables accessories, do hereby duly authorize

ELECTROCON Ltd
MD-2052, 19, Maria Dragan str.,
Chisinau, Republic of Moldova
IDNO-1003600025379

to represent our products for the tender:
SA „RED- NORD„
Nr. 46/14/26 Capete terminale, manșoane

Rosario Ruggiero
Sales Area Manager 20.03.2026

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DL0935L/005

CERTIFICATO DI ACCREDITAMENTO
Accreditation Certificate

ACCREDITAMENTO N. / *ACCREDITATION N.* **0935L** REV. **05**

EMESSO DA / ISSUED BY **DIPARTIMENTO LABORATORI DI PROVA**

SI DICHIARA CHE / *WE DECLARE THAT* **Laboratorio SVEPPI di Siemens Energy S.r.l**

Appartenente all'ente/Belonging to the organization:
Siemens Energy S.r.l.
Sede/Headquarters:
- Via Cornarotta 65 (ingresso da Via Alessandro Volta 34/A) - 30030 Salzano VE

È CONFORME AI REQUISITI DELLA NORMA / *MEETS THE REQUIREMENTS OF THE STANDARD* UNI CEI EN ISO/IEC 17025:2018 / *ISO/IEC 17025:2017*

QUALE / *AS* **Laboratorio di Prova** / ***Testing Laboratory***

Data di 1ª emissione *1st issue date* **06-05-2009**	Data di revisione *Review date* **24-03-2021**	Data di scadenza *Expiring date* **02-05-2025**

L'accreditamento attesta la competenza tecnica, l'imparzialità e il costante e coerente funzionamento del Laboratorio relativamente al campo di accreditamento riportato nell'Elenco Prove allegato al presente certificato di accreditamento.
Il presente certificato non è da ritenersi valido se non accompagnato dagli Elenchi Prove, che possono variare nel tempo e può essere sospeso o revocato o ridotto in qualsiasi momento nel caso di inadempienza accertata da parte di ACCREDIA.
La vigenza dell'accreditamento può essere verificata sul sito web (www.accredia.it) o richiesta al Dipartimento di competenza.
I requisiti di sistema della ISO/IEC 17025 sono scritti in un linguaggio attinente alle attività di laboratorio e sono generalmente in accordo con i principi della norma ISO 9001 (si veda comunicato congiunto ISO-ILAC-IAF dell'Aprile 2017).
The accreditation attests competence, impartiality and consistent operation in performing laboratory activities, limited to the scope detailed in the attached Enclosure.
The present certificate is valid only if associated to the annexed Lists and can be suspended, withdrawn or reduced at any time in the event of non fulfilment as ascertained by ACCREDIA.
Confirmation of the validity of accreditation can be verified on the website (www.accredia.it) or by contacting the relevant Department.
The management system requirements in ISO/IEC 17025 are written in language relevant to laboratories operations and generally operate in accordance with the principles of ISO 9001 (refer joint ISO-ILAC-IAF Communiqué dated April 2017).

Il QRcode consente di accedere direttamente al sito www.accredia.it per verificare la validità del certificato di accreditamento rilasciato al CAB.
La data di revisione riportata sul certificato corrisponde alla data di aggiornamento / di delibera del pertinente Comitato Settoriale di Accreditamento. L'atto di delibera, firmato dal Presidente di ACCREDIA, è scaricabile dal sito www.accredia.it, sezione 'Documenti'
The QRcode links directly to the website www.accredia.it to check the validity of the accreditation certificate issued to the CAB.
The revision date shown on the certificate refers to the update / resolution date of the Sector Accreditation Committee. The Resolution, signed by the President of ACCREDIA, can be downloaded from the website www.accredia.it, 'Documents' section.

ACCREDIA è l'Ente Unico nazionale di accreditamento designato dal governo italiano, in applicazione del Regolamento Europeo 765/2008.
ACCREDIA is the sole national Accreditation Body, appointed by the Italian government in compliance with the application of REGULATION (EC) No 765/2008.

MD-CA-01 rev. 05

ACCREDIA - Dipartimento Laboratori di prova
Sede operativa, legale e amministrativa: Via Guglielmo Saliceto, 7/9 | 00161 Roma - Italy
Tel. +39 06 8440991 | Fax +39 06 8841199
info@accredia.it | www.accredia.it | Partita IVA - Codice Fiscale 10566361001

NEMZETI AKKREDITÁLÓ HATÓSÁG

AKKREDITÁLÁSI OKIRAT
ACCREDITATION CERTIFICATE

A NEMZETI AKKREDITÁLÓ HATÓSÁG
The National Accreditation Authority

a 2015. évi CXXIV. törvény és a 424/2015. (XII.23.) Kormányrendeletben foglalt felhatalmazás alapján elismeri, hogy az
authorized by Act No. CXXIV of 2015 and Government Decree No. 424/2015. (XII.23.), recognizes, that

VEIKI-VNL Villamos Nagylaboratóriumok Kft.
Vizsgáló Laboratórium
1158 Budapest, Vasgolyó u. 2-4.

megfelel az MSZ EN ISO/IEC 17025:2018 szabvány követelményeinek és a
complies with criteria of Standard MSZ EN ISO/IEC 17025:2018 as

vizsgálólaboratórium
TESTING LABORATORY
kategóriába az alábbi számon bejegyzi
and has been assigned registration number

NAH-1-1251/2019

Az akkreditálás területét az akkreditálási határozat tartalmazza.
The scope of accreditation is specified in the accreditation decision.

Az akkreditált státusz kezdetének napja:
Start date of the accredited status
2019. április 25.

Az akkreditált státusz lejáratának napja:
Expiry date of the accredited status
2024. április 25.

(p. h.)

Budapest, 2019. április 25.

Devecz Miklós
A Nemzeti Akkreditáló Hatóság főigazgatója
Director General of the National Accreditation Authority

A NAH ebben a kategóriában aláírója az Európai Akkreditálási Együttműködés (EA) megállapodásának.
The NAH is a signatory in this field of the European co-operation for Accreditation (EA) Multilateral Agreement (MLA) for accreditation.

Tested products	Tested parameters, types of tests, ranges	Test methods
Power transformers		
Oil immersed transformers	Coil D.C resistance measurement: 100 μΩ – 1 kΩ Ratio measurement: 1-100 Short-circuit impedance, Load loss, No-load current and loss measurement Test equipment limits: Umax=800 V AC-50 Hz Imax=50 A AC 50 Hz	IEC 60076-1 IEC 60310
	Temperature rise test: I ≤ 6500 A, T≤200 °C	IEC 60076-2 IEC 60076-13 HN 52-S-24 HN 52-S-27 HN 52-S-28 HN 52-S-29 IEC 60310
	Dielectric test $U_{50Hz} \leq 1400\ kV_{RMS}$ (1.5 A) $U_{100Hz} \leq 3000\ V_{RMS}$ $U_{lightning} \leq 3400\ kV_{pk}$ $U_{switching} \leq 2800\ kV_{pk}$	IEC 60076-3 IEC 60076-4 IEC 60076-13 HN 52-S-24 IEC 60310
	Partial discharge test $U_{100Hz} \leq 100\ kV_{RMS}$, q ≤ 10000 pC	IEC 60076-3 IEC 60076-13 IEC 60270 HN 52-S-24 HN 52-S-27
	Short-circuit test Max 140 kV / 40 000 kVA up to rated transformer parameters	IEC 60076-5 IEC 60076-13 HN 52-S-24 HN 52-S-27 HN 52-S-28 HN 52-S-29 IEC 60310
	Acoustic noise measurement (Sound pressure method) L_{pA} = 20...120 dB(A) Sound power level calculation L_{WA} = 20...120 dB(A)	IEC 60076-10 ISO 3744
	Test of HV terminals: Bending: F ≤ 1 kN Torsion: M ≤ 200 Nm	HN 52-S-24
	IP Protection tests	IEC 60529
	IK Protection tests	IEC 62262 IEC 60068-2-75
Dry transformers	Coil D.C resistance measurement: 100 μΩ – 1 kΩ Ratio measurement: 1-100 Short-circuit impedance, Load loss, No-load current and loss measurement Test equipment limits: Umax=800 V AC-50 Hz Imax=50 A AC 50 Hz	IEC 60076-1 IEC 60076-11
	Temperature rise test: I ≤ 6500 A, T≤200 °C	IEC 60076-2 IEC 60076-11
	Dielectric test $U_{50Hz} \leq 1400\ kV_{RMS}$ (1.5 A) $U_{100Hz} \leq 3000\ V_{RMS}$	IEC 60076-3 IEC 60076-4 IEC 60076-11

Tested products	Tested parameters, types of tests, ranges	Test methods
	$U_{lightning} \leq 3400\ kV_{pk}$ $U_{switching} \leq 2800\ kV_{pk}$	
	Partial discharge test $U_{100Hz} \leq 100\ kV_{RMS}$, $q \leq 10000\ pC$	IEC 60076-3 IEC 60076-11 IEC 60270
	Short-circuit test Max 36 kV / 10 000 kVA up to rated transformer parameters	IEC 60076-5 IEC 60076-11
	Acoustic noise measurement (Sound pressure method) L_{pA} = 20...120 dB(A) Sound power level calculation: L_{WA} = 20...120 dB(A)	IEC 60076-10 IEC 60076-11 ISO 3744
	IP Protection tests	IEC 60076-11 IEC 60529
Reactors	Temperature rise test: $I \leq 6500$ A, T≤200 °C	IEC 60076-6 IEC 60310
	Dielectric test $U_{50Hz} \leq 1400\ kV_{RMS}$ (1.5 A) $U_{lightning} \leq 3400\ kV_{pk}$	IEC 60076-6 IEC 60310
	Short-circuit test $I \leq 40\ kA_{RMS}$	IEC 60076-6
	Acoustic noise measurement (Sound pressure method) L_{pA} = 20...120 dB(A) Sound power level calculation L_{WA} = 20...120 dB(A)	IEC 60076-6
	Coil D.C resistance measurement: 100 μΩ – 1 kΩ Impedance measurement, Loss measurement Test equipment limits: Umax=800 V AC-50 Hz Imax=50 A AC 50 Hz	IEC 60076-6 IEC 60310
Measuring transformers		
Voltage and current transformers	Dielectric test $U_{50Hz} \leq 1400\ kV_{RMS}$ $U_{lightning} \leq 3400\ kV_{pk}$ $U_{lightning,\ chopped} \leq 1400\ kV_{pk}$ $U_{switching} \leq 2800\ kV_{pk}$ RIV test $U_{50Hz} \leq 700\ kV_{RMS}$, RIV ≤ 88 dB(μV) IP and IK protection test of enclosure Partial discharge test $U_{50Hz} \leq 700\ kV_{RMS}$, $q \leq 10000$ pC Capacitance and tgδ measurement U< 700 kV, C: 10-10000 pF Verification of marking	IEC 61869-1 IEC 61869-2 IEC 61869-3 IEC 61869-4 IEC 61869-5 IEC 60044-7 IEC 60044-8 IEC 61869-10 IEC 61869-11
Current transformers	Temperature rise test $I \leq 6500$ A, T≤200 °C Short-circuit test $I \leq 150$ kA (1s)	IEC 61869-1 IEC 61869-2 IEC 60044-8 IEC 61869-10
	Short-circuit test $I \leq 150\ kA_{RMS}$	IEEE C57.13
	Secondary coil resistance R ≤ 1 kΩ Knee-point voltage U ≤ 2000 V	IEC 61869-2

Tested products	Tested parameters, types of tests, ranges	Test methods
	Insulation test of winding $U \leq 10$ kV	
Voltage transformers	Temperature rise test $U \leq 700$ kV_{RMS}, Imax=0.5A $T \leq 200$ °C Short-circuit test $U \leq 72.5$ kV_{RMS} (1s)	IEC 61869-1 IEC 61869-3 IEC 61869-5 IEC 60044-7 IEC 61869-11
Combined measuring transformers	Short-circuit test $I \leq 150$ kA_{RMS} (1s) $U \leq 130$ kV_{RMS} (1s)	IEC 61869-4
HV Switchgears	Dielectric test $U_{50Hz} \leq 1400$ kV_{RMS} $U_{lightning} \leq 3400$ kV_{pk} $U_{switching} \leq 2800$ kV_{pk} DC resistance $I_{DC} = 20 \ldots 200$ A $R = 20$ μΩ … 2.4 Ω Temperature rise test $I \leq 6500$ A, $T \leq 200$ °C Short-circuit test $I \leq 80$ kA (3s)	IEC 62271-1 IEC 62271-100 IEC 62271-102 IEC 62271-103 IEC 62271-104 IEC 62271-105 IEC 62271-106 IEC 62271-107 IEC 62271-108 IEC 62271-110 IEC 62271-200 IEC 62271-201 IEC 62271-202 IEC 62505-1 IEC 62505-2
	RIV test $U_{50Hz} \leq 700$ kV_{RMS}, RIV ≤ 88 dB(μV)	IEC 62271-1 IEC 62271-100 IEC 62271-102 IEC 62271-104 IEC 62271-105 IEC 62271-108 IEC 62271-110
	Mechanical endurance test operation time: 1 ms … 60 s	IEC 62271-100 IEC 62271-102 IEC 62271-103 IEC 62271-104 IEC 62271-105 IEC 62271-106 IEC 62271-107 IEC 62271-108 IEC 62271-110 IEC 62271-200 IEC 62271-201 IEC 62505-1 IEC 62505-2
	Making and breaking test: 36 kV / 630 A inductive 36 kV / 50 A capacitive	IEC 62271-100 IEC 62271-102 IEC 62271-103 IEC 62271-104 IEC 62271-105 IEC 62271-106 IEC 62271-107 IEC 62271-108 IEC 62271-110 IEC 62271-200 IEC 62271-201 IEC 62505-1 IEC 62505-2

Tested products	Tested parameters, types of tests, ranges	Test methods
	Short-circuit making and breaking test: 600 MVA / 3-Phase 1100 MVA / 1-Phase	IEC 62271-100 IEC 62271-101 IEC 62271-102 IEC 62271-103 IEC 62271-104 IEC 62271-105 IEC 62271-106 IEC 62271-108 IEC 62271-110 IEC 62505-1 IEC 62505-2
	Synthetic tests 1100 MVA / 1F up to 245 kV rated voltage	IEC 62271-101
	Busbar transfer switching test I ≤ 1600 A, U = 10…100 V operation time: 1 ms … 60 s	IEC 62271-102
	Induced current switchning tests on earthing switches 245 kV Class B	IEC 62271-102
	Internal arc test: I ≤ 31.5 kA/1s	IEC 62271-200 IEC 62271-201 IEC 62271-202
	IP protection test	IEC 62271-1 IEC 60529
	IK protection test	IEC 62271-1 IEC 62262 IEC 60068-2-75
Tests of earthing/damping resistors	Dielectric test $U_{50Hz} \leq 1400\ kV_{RMS}$ $U_{lightning} \leq 3400\ kV_{pk}$; R>230 Ω $U_{switching} \leq 3200\ kV_{pk}$ DC resistance I_{DC} = 20…200 A R = 20 μΩ … 2.4 Ω Temperature rise test I ≤ 20000 A, T≤1400 °C Impedance and loss measurement	IEEE Std 32 IEEE C57.32
LV Switchgears	Dielectric test $U_{50Hz} \leq 20\ kV_{RMS}$ $U_{lightning} \leq 20\ kV_{pk}$ Temperature rise test I ≤ 6500 A, T≤200 °C Short-circuit test: I ≤ 170 kA/1s I ≤ 120 kA/3s Making and breaking test: 550V / 120 kA 1000V / 100 kA Mechanical tests	IEC 60947-1 IEC 60947-2 IEC 60947-3 IEC 60947-4-1 IEC 61439-1 IEC 61439-2 IEC 61439-3 IEC 61439-5 IEC 61439-6
	Electrical power drive systems: Dielectric test $U_{50Hz} \leq 120\ kV_{RMS}$ $U_{lightning} \leq 250\ kV_{pk}$ Temperature rise test I ≤ 6500 A, T≤200 °C Short-circuit test: I ≤ 150 kA/3s	IEC 61800-5-1

Tested products	Tested parameters, types of tests, ranges	Test methods
	Creeping distances and clearances 1…500 mm	IEC 60947-1 IEC 61439-1 IEC 61800-5-1
	Corrosion protection and thermal stability test of insulating materials Chamber (0.7x0.7x0.7 m, m<15 kg) Temperature = -40…+100 °C, Humidity = 10…100 % Lifting, m ≤ 5000 kg Verification of marking	IEC 61439-1 IEC 61439-2 IEC 61439-3 IEC 61439-5 IEC 61439-6 IEC 62208
	Mechanical tests m ≤ 500 kg	IEC 61439-6
	Heat cycle test I ≤ 8000 A, T≤200 °C	IEC 61439-6
	Vertical flammability test air: (77,7±4,8) l/min propane: (13,5±0,5) l/min	IEC 61439-6 IEC 60332-3-10
	Power arc test 120 kA / 3s	IEC/TR 61641
	IP protection test	IEC 60529 IEC 61439-1 IEC 62208
	IK protection test	IEC 60068-2-75 IEC 62208 IEC 62262
Fuses		
LV fuses	Dielectric test $U_{50Hz} \leq 20\ kV_{RMS}$ $U_{lightning} \leq 20\ kV_{pk}$ Short-circuit breaking test: up to 190 MVA Temperature rise test: I ≤ 6500 A, T≤200 °C DC resistance measurement I_{DC} = 20…200 A R = 20 μΩ … 2.4 Ω	IEC 60269-1 IEC 60269-2
HV fuses	Dielectric test $U_{50Hz} \leq 1400\ kV_{RMS}$ $U_{lightning} \leq 3400\ kV_{pk}$ Temperature rise test: I ≤ 6500 A, T≤200 °C Short-circuit breaking test: up to 1000 MVA	IEC 60282-1 IEC 60282-2 IEC 60549
Over-voltage protection equipment	Dielectric test (enclosure) $U_{50Hz} \leq 1400\ kV_{RMS}$ $U_{lightning} \leq 3600\ kV_{pk}$ $U_{switching} \leq 2800\ kV_{pk}$ Short-circuit test: I ≤ 80 kA Partial discharge test $U_{50Hz} \leq 700\ kV_{RMS}$, q≤10000 pC RIV test $U_{50Hz} \leq 700\ kV_{RMS}$, RIV ≤ 88 dB(μV) Salt-fog aging test: Umax=24 kV	IEC 60099-4 IEC 60099-6 IEC 60099-8
	UV-test UVA-340 lamp Wavelength: 340 nm	IEC 60099-4 ISO 4892-1 ISO 4892-3

Tested products	Tested parameters, types of tests, ranges	Test methods
	Radiation: 0.76 W/m^2 Temperature: 60 °C	IEC 60099-6 IEC 60099-8
Cables	Insulation resistance test U ≤ 5kV$_{DC}$	HD 605 IEC 60840 EN 50395 IEC 60502-1 IEC 60502-2 IEC 60502-4
	Leakage current test I ≤ 1 A	IEC 60502-4
	Dielectric test U ≤ 1400 kV	IEC 60840 HD 605 EN 50395 IEC 60502-1 IEC 60502-2 IEC 60502-4
	Dielectric test U ≤ 200kV$_{DC}$	EN 50395 IEC 60502-2 IEC 60502-4 IEC 60840 HD 605
	Lightning impulse test: U$_{lightning}$ ≤ 3400 kV	IEC 60230 IEC 60840 HD 605 IEC 60502-1 IEC 60502-2 IEC 60502-4
	Visual inspection, verification of dimensions: ≤ 5 m	IEC 60840 IEC 60502-4
	Water tightness test	IEC 60840
	Partial discharge test Umax 700 kV (Imax = 0.5A) Qmax 10000pC	IEC 60885-2 IEC 60502-2 IEC 60502-4
	Dielectric loss (tgδ) test U< 700 kV, C: 10-10000 pF	IEC 60840 HD 605 IEC 60502-2
	Capacitance measurement U< 700 kV, C: 10-10000 pF	IEC 60502-4 IEC 60840
	Heat cycle test Umax 75 kV 267 mA Imax 2000 A	IEC 60840 IEC 60502-2 IEC 60502-4
	Clean and salt fog test Umax 30 kV	IEC 60502-4
	Short-circuit test I ≤ 63 kA	HD 605 IEC 60502-4
	Smoke emission test Vertical flammability test of electric and optic cables (A, B, C, D) Integrity test T=750..830°C	IEC 60331-1 IEC 60331-2 IEC 60331-3 IEC 60331-11 IEC 60332-1-1 IEC 60332-1-2 IEC 60332-1-3 IEC 60332-2-1 IEC 60332-2-2 IEC 60332-3-10 IEC 60332-3-21 IEC 60332-3-22 IEC 60332-3-23 IEC 60332-3-24

Tested products	Tested parameters, types of tests, ranges	Test methods
		IEC 60332-3-25 IEC 61034-1 IEC 61034-2
Cable assemblies	Dielectric test (AC) $U \leq 1400$ kV	EN 50393 IEC 61442 HD 629.1 HD 629.2 HD 632 IEC 60243-1 IEC 60502-4 IS 13573-1 IS 13573-2 IS 13573-3
	Dielectric test (DC) $U \leq 200kV_{DC}$	HD 629.1 IEC 61442 HD 629.2 HD 632 IEC 60243-2 IEC 60502-4 IS 13573-2 IS 13573-3
	Lightning impulse test $U_{lightning} \leq 1600$ kV	EN 50393 IEC 61442 IEC 60502-4 HD 629.1 HD 629.2 HD 632 IEC 60243-3 IS 13573-1 IS 13573-2 IS 13573-3
	Insulation resistance test $U \leq 5kV_{DC}$	EN 50393 IEC 61442 HD 629.1 IEC 60502-4 HD 629.2 HD 632 IS 13573-1 IS 13573-2 IS 13573-3
	Capacitance measurement U< 700 kV, C: 10-10000 pF	IEC 61442 HD 629.1 IEC 60502-4 HD 629.2 HD 632 IS 13573-2 IS 13573-3
	Dielectric loss (tgδ) test U< 700 kV, C: 10-10000 pF	HD 632
	Verification of dimensions ≤ 5 m	HD 629.1 IEC 60502-4 HD 629.2 HD 632 EN 50393 IS 13573-1 IS 13573-2 IS 13573-3
	Impact test Energy ≤ 10 J	EN 50393 IEC 61442

Tested products	Tested parameters, types of tests, ranges	Test methods
		HD 629.1 IEC 60502-4 HD 629.2 IS 13573-1 IS 13573-2 IS 13573-3
	Heat cycle test Umax 75kV 267mA Imax 2000A	EN 50393 IEC 61442 HD 629.1 IEC 60502-4 HD 629.2 HD 632 IS 13573-1 IS 13573-2 IS 13573-3
	Short-circuit test I ≤ 63 kA	IEC 61238-1-1 IEC 61238-1-2 IEC 61238-1-3 IEC 61442 HD 629.1 IEC 60502-4 HD 629.2 HD 632 EN 50393 IEC 61914 IS 13573-1 IS 13573-2 IS 13573-3
	Screen fault current initiation test U_{Rated} ≤ 36 kV	IEC 61442 IEC 60502-4 IS 13573-2 IS 13573-3
	Partial discharge test Umax 700kV Qmax 10000pC	IEC 61442 IEC 60502-4 HD 629.1 HD 632 IS 13573-2 IS 13573-3
	Clean and salt fog test Umax 30kV	IEC 61442 IEC 60502-4 HD 629.1 HD 629.2 HD 632 IS 13573-2 IS 13573-3
	Leakage current test I ≤ 1 A	HD 629.1 IEC 60502-4 IEC 61442 HD 629.2 IS 13573-2 IS 13573-3
	Aging test T =20-250 °C; I ≤ 8000 A R = 10 … 10000 μΩ	IEC 61238-1-1 IEC 61238-1-2 IEC 61238-1-3

Tested products	Tested parameters, types of tests, ranges	Test methods
Insulators		
Glass and ceramic insulators	Lightning impulse test $U_{lightning} \leq 3400\ kV_{pk}$	IEC 60060-1 IEC 60060-2 MÁVSZ 2180 IEC 60168 IEC 60383-1 IEC 60383-2 IEC 60797 IEC 61211 NEMA ANSI C29.1 NEMA ANSI C29.2A NEMA ANSI C29.2B NEMA ANSI C29.3 NEMA ANSI C29.4 NEMA ANSI C29.5 NEMA ANSI C29.6 NEMA ANSI C29.7 NEMA ANSI C29.8 NEMA ANSI C29.9 NEMA ANSI C29.10
	Switching impulse test $U_{switching} \leq 2800\ kV_{pk}$	IEC 60060-1 IEC 60060-2 IEC 60168 IEC 60383-2
	Industrial-frequency test $U_{50Hz} \leq 1400\ kV_{RMS}$	IEC 60060-1 IEC 60060-2 IEC 60168 IEC 60383-1 IEC 60383-2 MÁVSZ 2180 NEMA ANSI C29.1 NEMA ANSI C29.2B
	Partial discharge test $U_{50Hz} \leq 700\ kV_{RMS}, q \leq 10000\ pC$	IEC 60270
	Mechanical tests Tensile : 0-300 kN Bending: 0-50 kN (max 0.8m)	IEC 60168 IEC 60383-1 IEC 60797 MÁVSZ 2180 NEMA ANSI C29.1 NEMA ANSI C29.2B
	Thermo-mechanic test 300 kN / -40 … +65°C	IEC 60383-1 NEMA ANSI C29.2B
	Electro-mechanic test 300 kN / 50 kV	IEC 60383-1 NEMA ANSI C29.1 NEMA ANSI C29.2B
	Corona / RIV test $U_{50Hz} \leq 700\ kV_{RMS}$, RIV ≤ 88 dB(μV)	IEC 60168 IEC 60437
	Zinc coating test 5 … 300 μm	IEC 60168 ISO 1461 IEC 60383-1 MÁVSZ 2180
	Verification of dimensions ≤ 5 m	IEC 60168 IEC 60383-1 MÁVSZ 2180 NEMA ANSI C29.2B

Tested products	Tested parameters, types of tests, ranges	Test methods
	Power arc test $I \leq 50$ kA	IEC 61467
Composite insulators	Lightning impulse test $U_{lightning} \leq 3400$ kV_{pk}	IEC 60060-1 IEC 60060-2 IEC 61109 IEC 61952 IEC 62217 EN 50151 IEC 60383-1 IEC 60383-2 IEC 62231 NEMA ANSI C29.12 NEMA ANSI C29.17 NEMA ANSI C29.11 IEC 60660
	Switching impulse test $U_{switching} \leq 2800$ kV_{pk}	IEC 60060-1 IEC 60060-2 IEC 60383-2 IEC 61109 IEC 61952
	Industrial-frequency test $U_{50Hz} \leq 1400$ kV_{RMS}	IEC 61109 IEC 61952 IEC 62217 IEC 62231 NEMA ANSI C29.12 NEMA ANSI C29.17 NEMA ANSI C29.11 IEC 60060-1 IEC 60060-2 IEC 60383-1 IEC 60383-2 IEC 60660
	Partial discharge test $U_{50Hz} \leq 700$ kV_{RMS}, $q \leq 10000$ pC	IEC 60660 IEC 60270
	Water absorption test $U \leq 1400$ kV_{RMS} Thermal cycle test -25 °C , +50°C Thermo-mechanical tests 300 kN / -40 … +65°C	IEC 60660
	Design test- Test on interfaces and connections of end fittings 300 kN / -40 … +65°C 1000 kV/ msec, 500 kV_{RMS}	IEC 61109 IEC 62217 IEC 62231 IEC 61952 NEMA ANSI C29.12 NEMA ANSI C29.11 NEMA ANSI C29.17
	Design test - Assembled core load test $F \leq 300$ kN	IEC 61109 IEC 62231 IEC 61952 NEMA ANSI C29.12 NEMA ANSI C29.11 NEMA ANSI C29.17
	Design test- Test on shed and housing material	IEC 61109 IEC 61952 IEC 62231 IEC 62217 NEMA ANSI C29.11 NEMA ANSI C29.12

Tested products	Tested parameters, types of tests, ranges	Test methods
		NEMA ANSI C29.17
	Hardness test Shore A: 10-100 ShA	ISO 868
	Accelerated weathering test Method A, Cycle 1	ISO 4892-1 ISO 4892-3 ISO 4582
	Tracking and erosion - 1000 h salt fog test 20 mm/kV creeping distance max. 30kV 8 kg/m3 Na Cl content	IEC 60068-2-11
	Flammability test 50 W flame	IEC 60695-11-10
	Design test- Test of core material Dye penetration (10 mm sample) Water diffusion test (30 mm sample) 12 kV	IEC 61109 IEC 61952 IEC 62231 IEC 62217 NEMA ANSI C29.11 NEMA ANSI C29.12 NEMA ANSI C29.17
	5000 hour accelerated aging test 20 mm/kV creeping distance max. 30kV, 7 kg/m^3 Na Cl content 50 °C, 6500 W Xenon lamp	IEC/TR 62730 IEC 60068-2-11
	Power arc test I ≤ 50 kA	IEC 61467
	Corona / RIV test U_{50Hz} ≤ 700 kV_{RMS}, RIV ≤ 88 dB(µV)	IEC 60437
Insulator strings	Power arc test I ≤ 50 kA	MSZ-09-00.0342 IEC 61467
Insulator assemblies	Tests of connections Galvanizing test 5 … 300 µm	IEC 60372 ISO 1461 ISO 2178
Overhead line conductors and hardware		
Phase conductors and OPGW, OPPC	Verification of dimension length ≤ 5 m diameter ≤ 150 mm mass ≤ 10 kg	EN 50182 EN 50540 IEC 61089 IEC 62219
	Tensile break test F ≤ 300 kN, L ≤ 14 m Modulus of elasticity F ≤ 300 kN, L ≤ 14 m, nyúlás ≤ 1 m Stringing test 400 m, max. 100 kN	EN 50182 EN 50540 IEC 61089 IEC 62219 IEEE 1138
	Compression test F ≤ 50 kN Impact test Energy ≤ 10 J	IEC 60794-1-2 IEC 60794-1-21 IEC 60794-4-20 IEEE 1138
	Heat cycle test: -50 … +250 °C Water penetration test 1 m water gauge	IEC 60794-1-22 IEC 60794-4-20 IEEE 1138
	Short-circuit test I ≤ 63 kA Lightning test I ≤ 400 A	IEC 60794-1-24 IEEE 1138

Tested products	Tested parameters, types of tests, ranges	Test methods
	DC resistance measurement R = 10 … 10000 μΩ	IEC 60468 ASTM B193 ASTM D257
	AC resistance measurement R = 10 … 10000 μΩ	EN 50540
	Corona / RIV test: $U_{50Hz} \leq 700\ kV_{RMS}$, RIV ≤ 88 dB(μV)	IEC 61284
	Creep test T = 20 °C, F ≤ 70 kN creep = 0.01 … 10 mm	IEC 61395
	Self-damping test: 5 … 500 Hz	IEEE 563
	Test of wires: Verification of dimensions diameter ≤ 10 mm Tensile break test F ≤ 50 kN Torsion and wrap test speed: 0 … 100 RPM DC resistance measurement R = 0.5 … 1000 mΩ	EN 50182 EN 50183 EN 50189 IEC 60104 IEC 60888 IEC 60889 IEC 61089 IEC 61232 IEC 62004 IEC 62219 ASTM A938 ASTM B230/B230M ASTM B398/B398M
Covered conductors	Insulation resistance test $U \leq 5kV_{DC}$ Leakage current test I ≤ 1 A Dielectric test U ≤ 1400 kV Zinc coating thickness test 5 … 300 μm Water tightness test Test of marking Short-circuit test I ≤ 63 kA	EN 50397-1
Railway contact wires	Verification of dimensions length ≤ 5 m diameter ≤ 150 mm mass ≤ 10 kg Resistance measurement R = 10 … 10000 μΩ Tension, bending F ≤ 300 kN Wrap, torsion	EN 50149
Overhead-line hardware	Verification of dimensions ≤ 5 m Test of galvanisation 5 … 300 μm Magnetic loss test I ≤ 2000 A	IEC 61284
	Heat cycle test T =20-250 °C I ≤ 8000 A, $I_{SC} \leq 63$ kA R = 10 … 10000 μΩ Tension, slip, bending test F ≤ 300 kN	IEC 61284 ANSI/NEMA CC1 ANSI C 119.4 BS 3288-1

Tested products	Tested parameters, types of tests, ranges	Test methods
	Bolt tightening test M ≤ 200 Nm.	
	Corona / RIV test: $U_{50Hz} \leq 700\ kV_{RMS}$, RIV ≤ 88 dB(μV)	IEC 61284 ANSI/NEMA CC1
	Short-circuit test I ≤ 63 kA	STL Procedure 4
Covered conductor hardware	Tension and slip test F ≤ 300 kN Bolt tightening test M ≤ 200 Nm Dielectric test $U_{50Hz} \leq 10kV$	EN 50483-1 EN 50483-2 EN 50483-3 EN 50483-4 NFC 33-020 NFC 33-040 NFC 33-041
	Aging test Chamber (0,7x0,7x0,7 m) Temperature = -40…+100 °C, Humidity = 10…100 % Salt-fog test Salt-content: 1…10 kg/m^3	EN 50483-2 EN 50483-3 EN 50483-4 EN 50483-6 NFC 33-003 NFC 33-020 NFC 33-040 NFC 33-041
	Electrical aging T =20-250 °C; I ≤ 6500 A, $I_{SC} \leq 63$ kA R = 10 … 10000 μΩ	EN 50483-4 EN 50483-5 NFC 33-004 NFC 33-020
Railway contact wire assemblies	Verification of dimensions Corrosion protection test 5-300 μm Tensile test F ≤ 300 kN Short-circuit test I ≤ 63 kA Electrical aging U ≤ 24 kV	RFI DMAIM TE SP IFS 016A RFI DMAIM TE SP IFS 024A RFI DPRIM STF IFS TE064A
Vibration dampers	Slip test F ≤ 50 kN Attachment of weights/clamp to messenger cable F ≤ 10 kN Corrosion protection test 5-300 μm Clamp bolt tightening test M ≤ 200 Nm Fatigue test: 10…300 Hz Damper characteristic test 3…300 Hz	IEC 61897
	Corona / RIV test: $U_{50Hz} \leq 700\ kV_{RMS}$, RIV ≤ 88 dB(μV)	IEC 61897 IEC 61284
	Damper performance test 3…300 Hz	IEEE 664
Spacers	Corrosion protection test 5-300 μm Slip test F ≤ 50 kN Clamp bolt tightening test M ≤ 200 Nm Real short-circuit test	IEC 61854

Tested products	Tested parameters, types of tests, ranges	Test methods
	I ≤ 50 kA Simulated short-circuit test (Compression/tension) F ≤ 30/20 kN Characterisation of elastic and damping properties 1…2 Hz, 10…500 N Fatigue test Aeolian: 5…100 Hz Sub-span: 1-10 Hz / 50 mm Electrical resistance test: 100 Ω…100 MΩ	
	Corona / RIV test: U_{50Hz} ≤ 700 kV_{RMS}, RIV ≤ 88 dB(μV)	IEC 61854 IEC 61284
Equipment for live line working		
Aerial devices with insulating boom	Dielectric test on boom: Tests at U_0, $2U_0$, $3U_0$ Leakage current: 1 μA/kV (U=200÷462 kV) Switching impulse test Dielectric test on platform and liner: Platform: U=20 kV_{RMS} AC Liner: U=50 kV_{RMS} AC Dielectric test of platform surface U=50 kV_{RMS} AC Low-voltage tests U_{DC}=1500 V, U_{AC}=1000 V I_{max}=3,5 mA (to lower boom pin) I_{max}=0,5mA (to ground)	IEC 61057 ANSI/SIA A92.2 DIN VDE 0682-742
Voltage detectors and phase comparators	Verification of dimensions Durability of marking Drop test Shock resistance test (Energia ≤ 10 J) Functional tests (Threshold voltage measurement Clear indication, response time, power source dependability, check of testing elements, non-response to DC voltage) Temperature and humidity dependence	IEC 61243-1 IEC 61243-3 IEC 61481-1 IEC 61481-2
Insulating sticks and tubes	Verification of dimensions Test of marking Mechanical test Tensile, bend: F ≤ 30 kN Torsion: M≤ 200 Nm Drop test Impact test (Energia ≤ 10 J) Environmental test T = -40 … +100 °C Penetration test Temperature rise test U ≤ 1400 kV, T ≤ 200 °C Dielectric test with leakage-current measurement U ≤ 1400 kV, I ≤ 1 A	IEC 60832-1 IEC 60855-1 IEC 62193
Helmets	Flammability test Dielectric test U ≤ 1200 V	EN 397

Tested products	Tested parameters, types of tests, ranges	Test methods
Portable fire extinguisher	Dielectric test U ≤ 70 kV	EN 3-7
Earthing, earthing-short-circuiting devices	Mechanical test Tensile, bend: F ≤ 30 kN Torsion: M≤ 200 Nm Verification of dimensions ≤ 5 m Short-circuit test I ≤ 120 kA Test of marking Dielectric test U ≤ 100 kV_{RMS}	IEC 61230 IEC 61230 IEC 61219 IEC 61138 IEC 61230 IEC 61219 IEC 61219 IEC 61138
Protective devices	Power arc test I ≤ 10 kA (0.5s)	IEC 61482-1-1 IEC 61482-1-2 IEC 61482-2
Insulating ropes	Dimensional checking Dielectric test U ≤ 100 kV_{RMS} Leakage current under dry conditions I ≤ 500mA Tests after water conditioning Water absorption Capillary Elongation and creep Durability of marking	IEC 62192
Environmental tests for nuclear power plant	Environmental tests	IEEE/IEC 60780-323
Cables, Cable penetration elements, Cable assemblies	Leakage test	IEEE 317 IEC 60772
	Dielectric test 1600-36000 V 50 Hz 60 – 90 kV 1/50 lightning Insulation resistance test SELV/PELV U:250V_{DC}; R≥500kΩ U≤500V, U:500V_{DC};R≥1MΩ U≥500V U:1000V_{DC};R≥1MΩ Insulation resistance test 5 kV DC R≥500 MΩ/km (6/10..20.8/36 kV) Partial discharge test Dielectric test 45..65 Hz; 2U_0/60 min (max 1000 V) 700 kV 0.5 A 50 Hz 30..1400 kV 1 A 50 Hz	IEEE 317 HD 60364-6 IEC 60772 IEC 60270 IEC 60502-1 MSZ 13207
	Simulation of operating environment: Heat cycle test Temperature: 15..150 °C Thermal aging Temperature: 30..250 °C	IEEE 317
	Load tests: Short-time over-current test I_{max}=150 kA / 1 sec Dynamic short-circuit test I_{max}=330 kA Thermal short-circuit test I_{max}=150 kA / 1 sec	IEEE 317 EN 60439-1

Tested products	Tested parameters, types of tests, ranges	Test methods
	DBE simulation: Temperature: 230 °C_{max} Pressure: 6 bar_{max} Chemicals Flood test Post LOCA condition	IEEE 317 IEEE/IEC 60780-323
Class-1E motors for continuous operation	Simulation of operating environment: Thermal aging Temperature: 30..250 °C DBE simulation: Temperature: 230 °C_{max} Pressure: 6 bar_{max} Chemicals Flood test Post LOCA condition	IEEE 334 IEEE/IEC 60780-323
Safety-related, motor operated devices	Functional tests Thermal aging Cyclic aging Pressure test LOCA simulation: Temperature: 230 °C_{max} Pressure: 6 bar_{max} Chemicals Flood test Post LOCA condition	IEEE 382 IEEE/IEC 60780-323
Class-1E cables and assemblies	Functional tests Thermal aging DBE simulation: Temperature: 230 °C_{max} Pressure: 6 bar_{max} Chemicals Flood test Post LOCA condition	IEEE 383 IEC 60502-1
Class-1E connectors	Functional tests Continuity test Insulation resistance test Dielectric test Test of connections Mechanical test Accelerated aging Heat cycle test DBE simulation: Temperature: 230 °C_{max} Pressure: 6 bar_{max} Chemicals Flood test Post LOCA condition Special DBE simulation	IEEE 572 IEEE/IEC 60780-323 IEC 60502-1

SIEMENS

ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO

LAB N° 0935

SVEPPI
LABORATORY

TEST REPORT

N° RP LS 14/114

CESI
PROTOCOLLO DATA
B4006091 - 6.03.2014
Firma Boni

SVEPPI LABORATORY	TEST REPORT	SIEMENS
ilac-MRA ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO LAB N° 0935	N° RP LS 14/114	PAGE 1 OF 15

CLIENT: ELCON MEGARAD S.p.A.
Via Nazionale, 110
Nucleo Industriale 83030 – Arcella (AV)

DEVICES UNDER TEST: MV single core cable accessories

TYPES: ECOLD VTSI-2463R; ECOLD GLS-2489RR; ECOLD VTSI-2463R

PURPOSE OF THE TEST: Type test

TEST PERFORMED ACCORDING TO: CEI EN 61442: 2006 clause 10 and 11

TEST PERFORMED AT: Power Test Section of SVEPPI Laboratory
Via Alessandro Volta, 34/A - 30037 Scorzè (VE)
ITALY

LIST OF TESTS PERFORMED: Thermal short circuit test on main conductor and screen

RECEIPT'S DATE OF TEST OBJECT: 18th February 2014

Siemens S.p.A.
Laboratorio SVEPPI

PERIOD OF TEST: 27th February 2014

TEST WITNESSED BY: - -

THIS TEST REPORT IS COMPOSED BY:
Nr. total pages 15 Nr. oscillograms 06 Nr. Drawings --

The data necessary to permit repetition of the tests are contained in the document marked "TEST'S DOCUMENTATION" n. LS 14/114.

Issue	Charged of test	Laboratory's manager
March 2014	*Lorenzo Milan*	*Giuseppe Canonico*

MANUFACTURER: ELCON MEGARAD S.p.A.
Via Nazionale, 110
Nucleo Industriale 83030 – Arcella (AV)

SERIAL NUMBER OF DEVICE UNDER TEST: Line ENEL nr. B7; B8; B9

The sampling has been carried out by the customer

RATINGS ASSIGNED BY MANUFACTURER OF DEVICE UNDER TEST

Rated voltage U0/U	12/20 kV
Maximum system voltage	24 kV

IDENTIFICATION OF DEVICE UNDER TEST

The test object has not been identified by SVEPPI laboratory, but the samples tested were marked by sticker labels CESI.

CONTENTS

1. TESTS PERFORMED

On the screen conductor and main conductor of a set of three lines composed by cold shrink indoor terminal type ECOLD VTSI – 2463R and cold shrink joints type ECOLD GLS – 2489RR for single-core cables up to 24kV. The three lines are composed of two different cables type ARP1H5EX 12/20kV 1x185 mm² joined at cables ARE4H5EX 12/20kV 1x185 mm², in series connected.

2. TEST ON SCREEN CONDUCTOR

2.1. Short circuit tests on screen conductors

Before the test the cables were heated to a stabilized temperature on main conductor of extruded cables of 90 +/- 2.5 °C and kept for two hours at this temperature. The corresponding temperature on sheath at maximum cable temperature was 59-61 °C with ambient temperature of 11-13 °C.
The setting of temperature was determined by six thermocouples applied at distance of 0.5 meter of the terminals under tests in the sheath of the cables (see photos below).

Photo 1: thermocouple positions

2.2. Oscillogram table

Oscillogram *Nr*	*Current* *r.m.s. value*[1] *[kA]*	I^2t *[(kA)^{2}s]*	*duration* *[s]*	*note*
164434	5.1	2.9	0.111	Calibration current
164435	5.1	13.3	0.511	First test on screen conductors
164412	5.1	13.5	0.511	Second test on screen conductors

2.3. Conditions of test object after tests

A visual inspection did not show deteriorations; see also photos 6-7-8.

2.4. Measurement of the resistance of the screen conductor

The resistance measurement was carried out at ambient temperature with 100 A_{dc}.

Note		Measured phase			External air temperature
		B7	B8	B9	°C
Before test	Resistance [mΩ]	6.62	6.73	5.89	11.0
After test	Resistance [mΩ]	6.80	6.87	5.98	11.5

The measure reported is the total resistance of one phase of the test arrangement.

3. TEST ON MAIN CONDUCTOR

Before first tests the test object was at ambient temperature of 12 °C.

For determination of energy of the test was applied the formula reported on CEI EN 61442 par. 11.2

$$I^2t = 2{,}19 * 10^4 * S^2 * \ln\frac{(\theta_{sc} + 228)}{(\theta_i + 228)}$$ (for aluminium conductors)

I	*r.m.s. value of short-circuit current*	*23400*	*A*
t	*Duration of short-circuit*	*0.95*	*s*
S	*Section of the conductor*	*185*	mm^2
θ_{sc}	*Final temperature of conductor*	*250*	°C
θ_i	*Initial temperature of conductor*	*12*	°C
ln	log_e		

$I^2t = 516$ $(kA)^2s$

3.1. Oscillogram table

Oscillogram	*Current*		*duration*	*note*
Nr	*r.m.s. value[1] [kA]*	I^2t *[(kA)^{2}s]*	*[s]*	
164438	23.4	60.7	0.111	Calibration current
164439	23.4	519.0	0.951	First test on screen conductors
164440	23.4	519.7	0.950	Second test on screen conductors

Note: between the two short-circuits, the test loop shall be allowed to cool to a temperature less than 10 K above its temperature prior to the first short-circuit (θ_i).

3.2. Conditions of test object after tests

A visual inspection did not show deteriorations; see also photos 13-14-15.

3.3. Measurement of the resistance of the main conductor

The resistance measurement was carried out at ambient temperature with $100A_{dc}$.

Note		Measured phase			External air temperature
		B7	B8	B9	°C
Before test	Resistance [mΩ]	0.953	1.025	0.932	11.0
After test	Resistance [mΩ]	0.968	1.033	0.945	12.0

The measure reported is the total resistance of one phase of the test arrangement.

4. LIST OF INSTRUMENTS USED

4.1. Short-circuit tests

Quantities	*Symbol used on oscillogram*	*Symbol used on circuit diagram*	*Instrument's tag*	*Uncertainty*
Test current phase	I	I	CM 852	±3% of the reading
Voltage phase	U	U	CM 881	±3% of the reading

Note: Expanded uncertainty with coverage factor K=2, confidence level = 95 %

4.2. Measurement of phase resistance

Measure	*Measure chain tag*	*Uncertainty*
Resistance	MI 850 (Current) MU 082 (Voltage)	± 2%

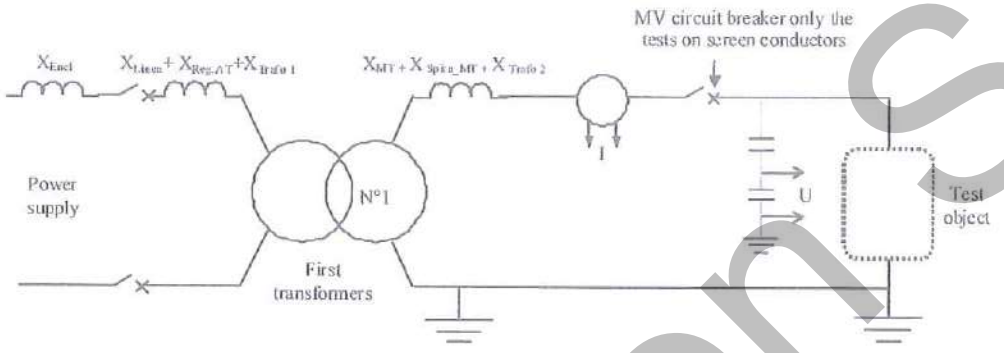
Note: Expanded uncertainty with coverage factor K=2, confidence level = 95 %

4.3. Measurement of temperature

Measure chain tag	*Uncertainty*
TE 003 AT	± 1,6 °C

Note: Expanded uncertainty with coverage factor K=2, confidence level = 95 %

5. CIRCUIT DIAGRAM



Power supply

230 kV 50 Hz

First transformers

Primary	132+132 (winding)
Secondary	11//11 (winding)
Ratio	24
Output voltage	9,5 kV

X_{Enel} [Ω]	X_{Linea} [Ω]	$X_{Reg.AT}$ [Ω]	$X_{Trafo\ 1}$ [Ω]	X_{MT} [Ω]	$X_{Spira\ MT}$ [Ω]	Note
2 x 5,5	2 x 25	12 x 5,2	2 x 5,5	0.820 + 0,772	0,02	Test on screen conductors
2 x 5,5	2 x 25	12 x 5,2	2 x 5,5	3 x 0,054	0,02	Test on main conductors

6. PHOTOS

6.1. Test on screen conductors

Photo 2: arrangement for short-circuit tests

Photo 3: before tests

Photo 4: before tests

Photo 5: before tests

Photo 6: after tests

Photo 7: after tests

Photo 8: after tests

6.2. Test on main conductors

Photo 9: arrangement for short-circuit tests

Photo 10: before tests

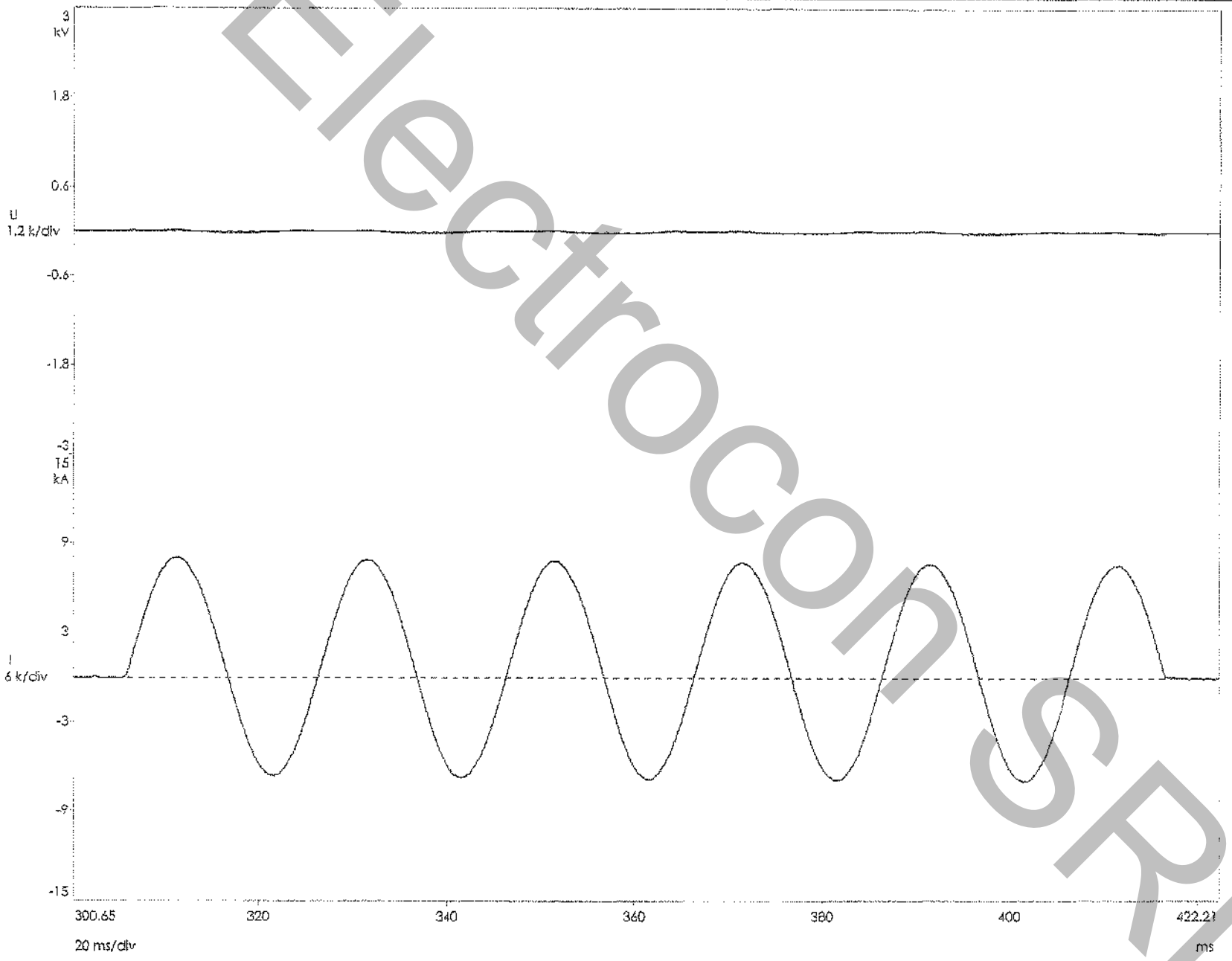
Photo 11: before tests

Photo 12: before tests

Photo 13: after tests

Photo 14: after tests

Photo 15: after tests



results

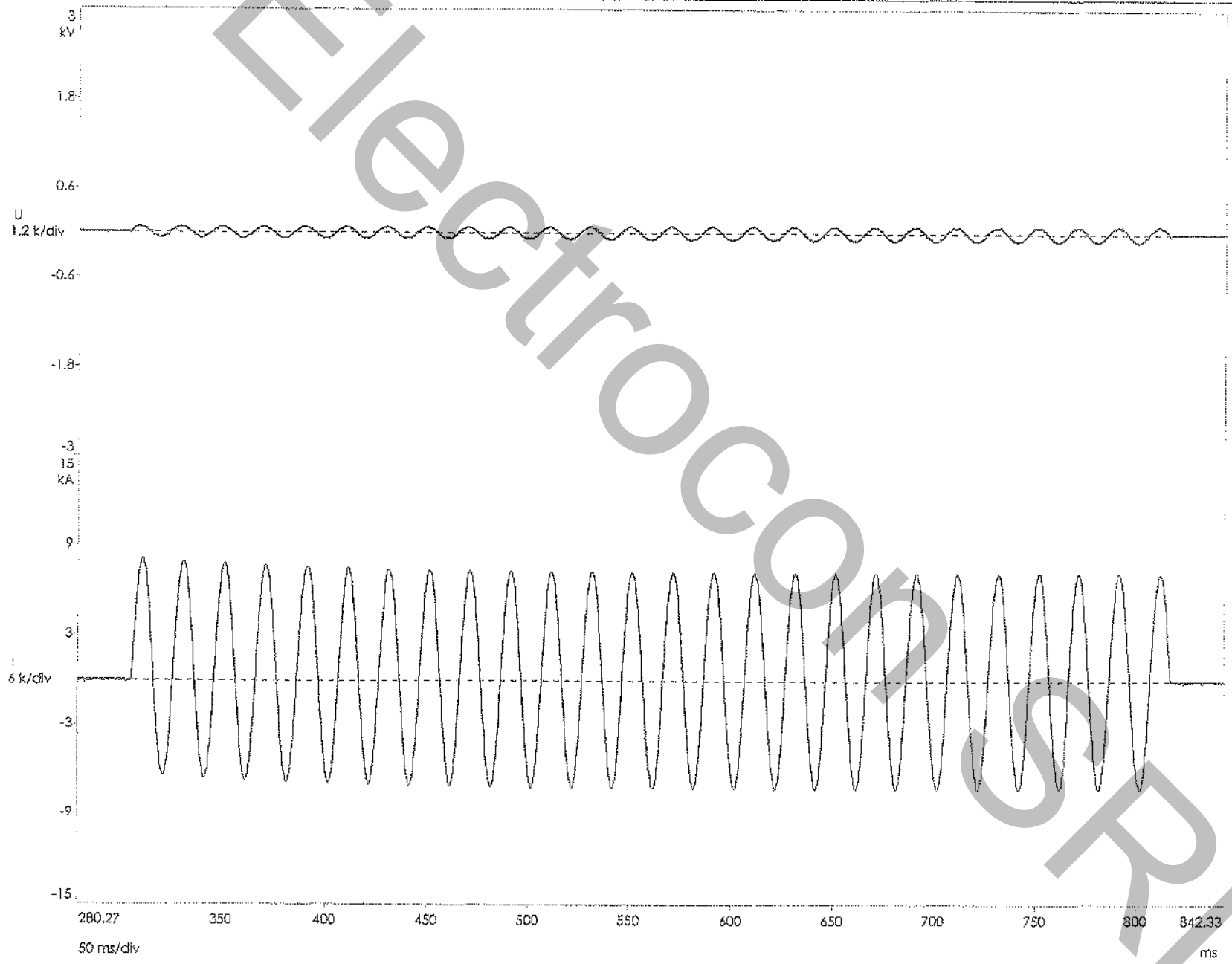
test current	
equivalent r.m.s. value	5.1 kA
peak value	8.1 kA
I²t	2.9 MA²s
Duration	0.111 s

Remarks

Sampling : B1= 60.0 k S/s

Bandwith (-1dB) : U= 1.00 kHz ; I= 1.00 kHz ; 15...nS= 1.00 kHz

test date 27/02/2014 time 10.55.48 - Test report no. RP-LS-14/114 - Test no. 00164434



results

test current

equivalent r.m.s. value	5.1 kA
peak value	8.2 kA
I²t	13.3 MA²s
Duration	0.511 s

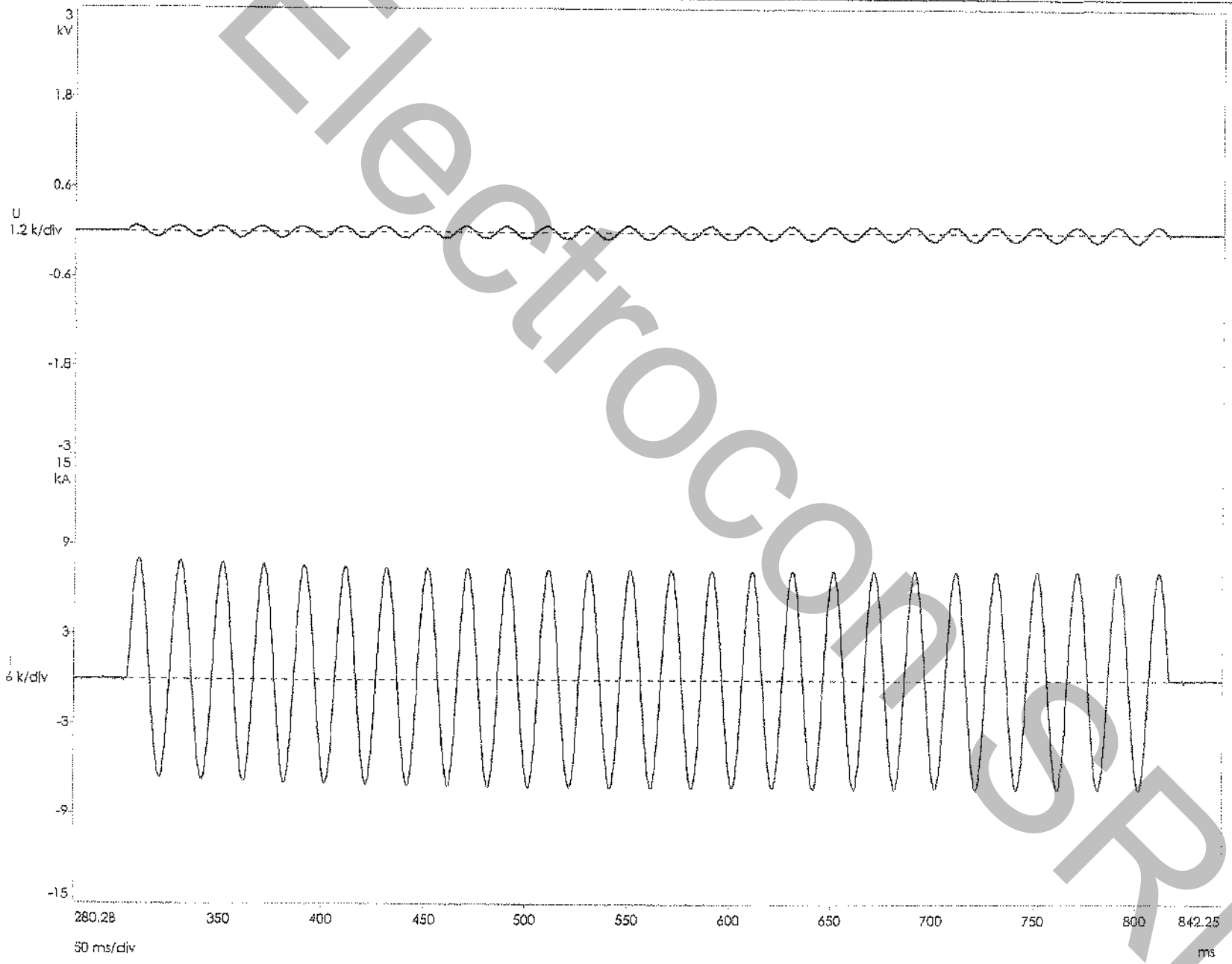
Remarks

-

Sampling : S1 = 60.0 k S/s

Bandwith (-3dB) : U= 1.00 kHz ; I= 1.00 kHz ; 15...nS= 1.00 kHz

test date 27/02/2014 time 11.06.33 - Test report no. RP-LS-14/114 - Test no. 00164435



results

test current

equivalent r.m.s. value	5.1 kA
peak value	8.1 kA
I²t	13.5 MA²s
Duration	0.511 s

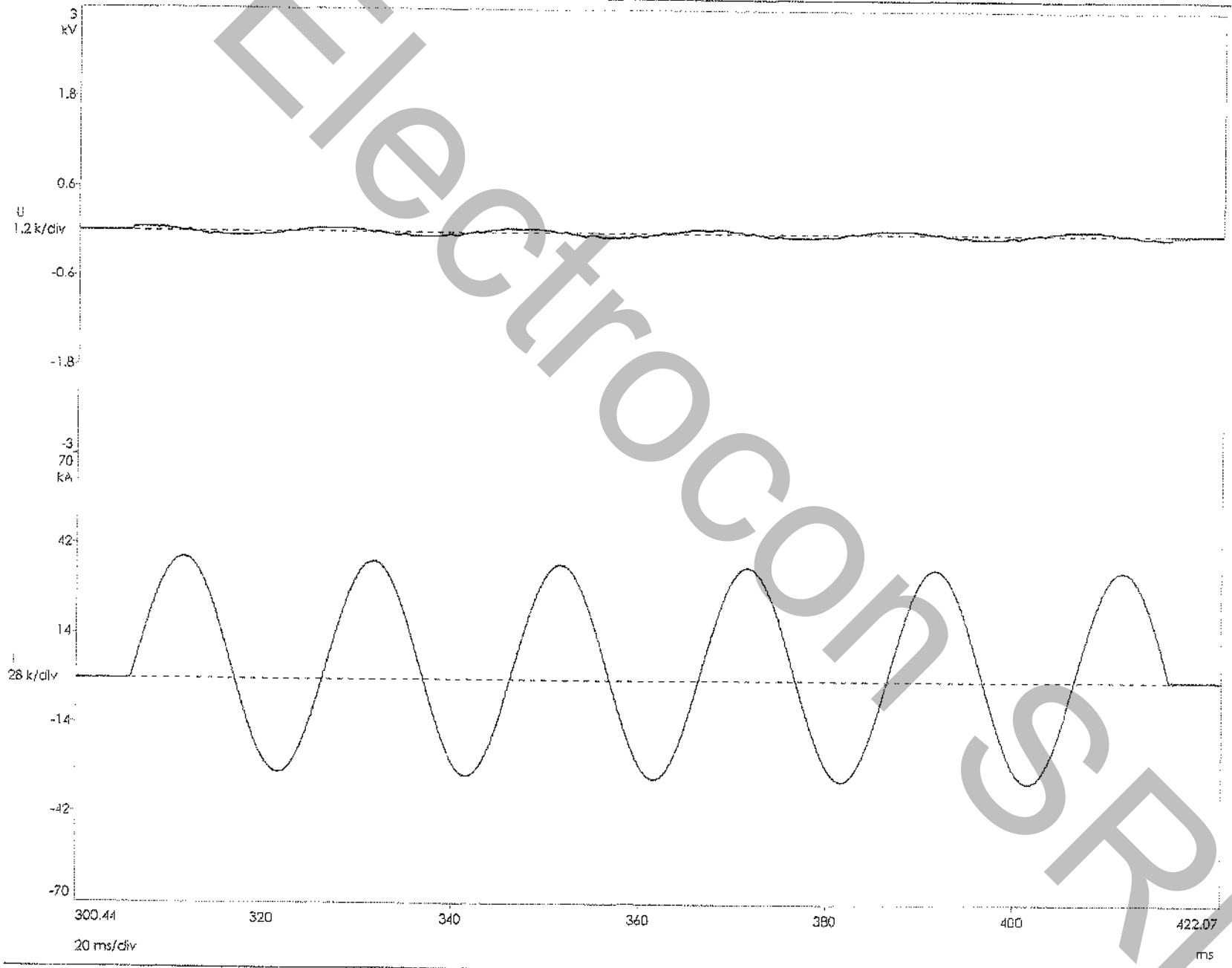
Remarks

.

Sampling : 81= 60.0 k S/s

Bandwith (-1dB) : U= 1.00 kHz : I= 1.00 kHz : 1S..nS= 1.00 kHz

test date 27/02/2014 time 12.29.37 - Test report no. RP-LS-14/114 - Test no. 00164436



results

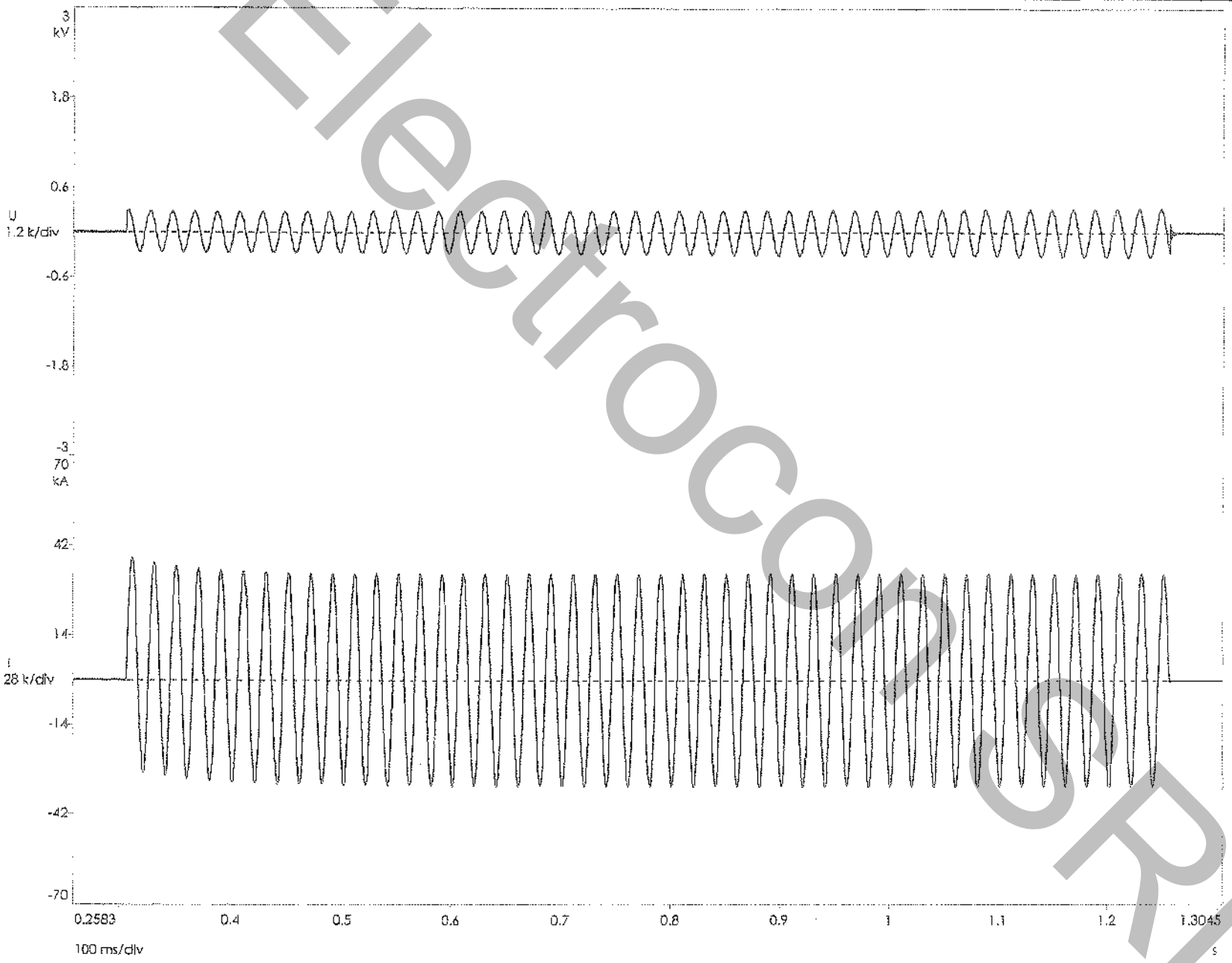
test current	
equivalent r.m.s. value	23.4 kA
peak value	38.1 kA
I²t	60.7 MA²s
Duration	0.311 s

Remarks

Sampling : B1 = 60.0 k S/s

Bandwith (-1dB) : U= 1.00 kHz ; I= 1.00 kHz ; IS...nS= 1.00 kHz

test date 27/02/2014 time 12.57.42 - Test report no. RP-LS-14/114 - Test no. 00164438



results

test current

equivalent r.m.s. value	23.4 kA
peak value	38.3 kA
I²t	519.0 MA²s
Duration	0.951 s

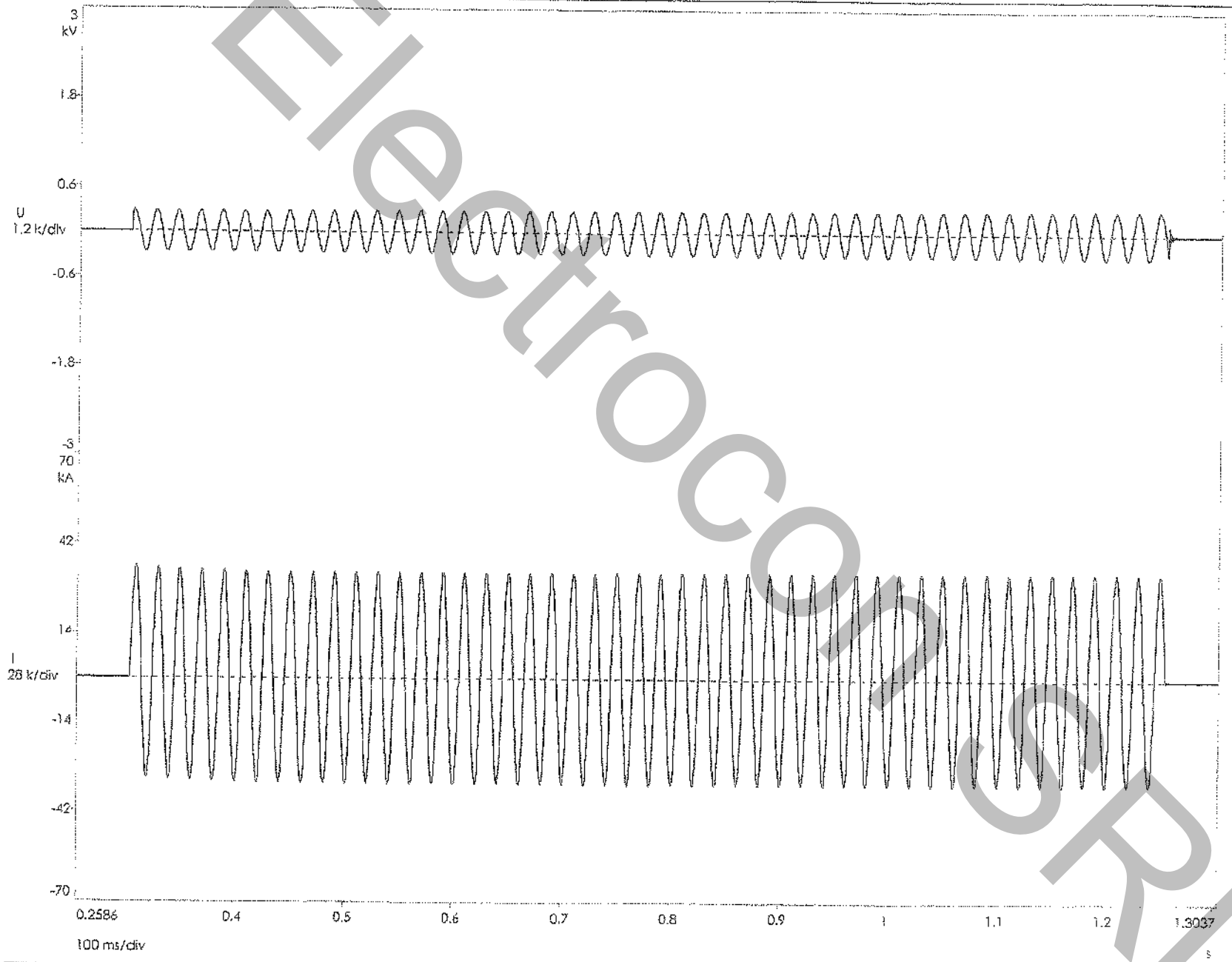
Remarks

.

Sampling : S1= 60.0 k S/s

Bandwith (-1dB) : U= 1.00 kHz ; I= 1.00 kHz ; TS...nS= 1.60 kHz

test date 27/02/2014 time 14.27.32 - Test report no. RP-LS-14/114 - Test no. 00164439



results

test current

equivalent r.m.s. value	23.4 kA
peak value	35.3 kA
I²t	519.7 MA²s
Duration	0.950 s

Remarks

Sampling : B1= 60.0 k S/s

Bandwith (-1dB) : U= 1.00 kHz ; I= 1.00 kHz ; IS...nS= 1.00 kHz

test date 27/02/2014 time 15.45.47 - Test report no. RP-LS-14/114 - Test no. 00164440

LABORATORIO
SVEPPI

Via Volta, 34/A
30037 Scorzè (Ve)
tel. 041/8945092
fax. 041/8945065

SIEMENS energy

ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO

LAB N° 0935 L

SVEPPI LABORATORY

TEST REPORT

N° RP LS 23/309

SVEPPI LABORATORY	TEST REPORT	SIEMENS energy
ilac-MRA ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO LAB N° 0935 L	N° RP LS 23/309	PAGE 1 OF 48

CLIENT: ElconMegarad S.p.A.
Via Nazionale, 110
83030- Montefredane (AV) – Loc. Arcella - Italy

DEVICE UNDER TEST: TEE screened separable connectors – Interface C – 630A

TYPE: ElconMegarad ELCONEXT 24C-K1-LT

PURPOSE OF THE TEST: Compliance with Table 14 of HD 629-1 S3:2019 seq. D1

TEST PERFORMED ACCORDING TO: CEI EN 61442:2006 items 4, 6, 7, 8, 9

TEST PERFORMED AT: Dielectric Test Section of SVEPPI Laboratory
Via Alessandro Volta, 34/A – 30037 Scorzè (VE)
ITALY

LIST OF TESTS PERFORMED: See page 02

RECEIPT DATE OF TEST OBJECT: 03 May 2023

PERIOD OF TEST: From 8 May 2023 to 13 July 2023

TEST WITNESSED BY: Mr. G. De Simone ElconMegarad S.p.A.

THIS TEST REPORT IS COMPOSED BY:

Nr. total pages: 62 Nr. Oscillograms: 0 Nr. Drawing: 1 (see page 2)

The data necessary for the repetition of the tests are stored in the dossier marked. LS 23/309.

Issue	Charged of test	Laboratory's manager
July 2023	*Gianmarco Gregorio* GREGORIO Gianmarco Firmato digitalmente da GREGORIO Gianmarco DN: cn=GREGORIO Gianmarco, c=DE, o=Siemens, email=gianmarco.gregorio@siemens-energy.com	*Giuseppe Canonico* Firmato digitalmente da Canonico Giuseppe Data: 24/July/2023 Versione dell'editor: PDF-XChange-Pro 9.4.363.0

MANUFACTURER: ElconMegarad S.p.A.
Via Nazionale, 110
83030- Montefredane (AV) – Loc. Arcella - Italy

SERIAL NUMBER OF DEVICE UNDER TEST: Separable connector of LOOP 01: s.n. 0024 (Prod. Date 04/2023);
Separable connector of LOOP 02: s.n. 0023 (Prod. Date 04/2023);
Separable connector of LOOP 03: s.n. 0022 (Prod. Date 04/2023);
Separable connector of LOOP 04: s.n. 0025 (Prod. Date 04/2023);

The sampling has been carried out by the customer.

RATINGS ASSIGNED BY MANUFACTURER OF DEVICE UNDER TEST

Maximum voltage U_0/U (U_m) 12/20 (24) **kV**

LIST OF TESTS PERFORMED

N°	Test	Item CEI EN 61442:2006	Date	Results
1	AC voltage withstand test dry	4	8 May 2023	Passed
2	Partial discharge at ambient temperature	7	8 May 2023	Passed
4	Impulse voltage tests at elevated temperature	6	22 May 2023	Passed
5	Heating cycles voltage test in air	9.2	From 23 May to 14 June 2023	Passed
6	Heating cycles voltage test in water	9.3	From 15 June to 6 July 2023	Passed
7	Disconnection/connection	-	6 July 2023	
8	Partial discharge at elevated and ambient temperature	7	7 July 2023	Passed
8	Impulse voltage tests at ambient temperature	6	11 July 2023	Passed
9	Dry AC Voltage test	4	11 July 2023	Passed
10	Partial discharge at ambient temperature	7	From 12 to 13 July 2023	Passed
11	Visual inspection	-	13 July 2023	Passed

Note 1: The tests reported above were carried out in sequence

IDENTIFICATION OF DEVICE UNDER TEST

The test object has been identified by SVEPPI Laboratory by means of an assembly instruction reported below.

Drawing N°	Title	Ed.	Rev.	Date
1008OM K1-W-A	TEE screened separable connectors – Interface C – 630A	1	1	2/05/2023

CONTENTS

INTRODUCTION

Four screened separable connectors for extruded insulation cables, identified as LOOP 01, LOOP 02, LOOP 03, LOOP 04, were tested in compliance with Table 14 of HD 629-1 S3:2019 "Screened separable connectors for extruded insulation cables" sequence D1, according to relevant items of IEC 61442:2005
The voltage level of the assembly under test is 12/20 (24) kV.
Each of these four assemblies is made by one separable connector type ElconMegarad ELCONEXT 24C-K1-LT 26TAR3/E (Outer cone asymmetric separable TEE connector, $U_m/U/U_0$ = 24kV/22 kV/12,7 kV, 240-300 mm^2) one piece of cable FG GREECE 2012 - ARE4H5E 12/20kV 1X300 (Isolated XLPE) and one termination for a total length of about 3,3 m.

1. DRY AC VOLTAGE TEST

All loops (01-02-03-04) were together submitted to a dry AC voltage test at 4,5 U_0 (54 kV) with positive result (no puncture neither surface discharges occurred during the test). The test arrangement is reported in Figure 3 and Photo 4.

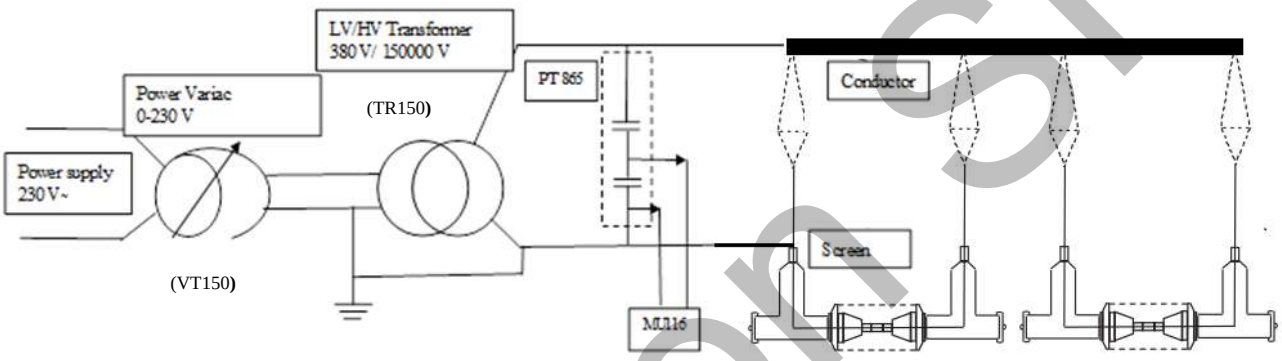


Figure 1: Test circuit for dry AC voltage test

Photo 1: Test arrangement for dry AC voltage test

Note: The Low voltage-Peak [Vp] ÷ Low voltage [Vrms] ratio is, as required by IEC 60060-1 item 6.2, within the values 1,344 – 1,485.

2. PARTIAL DISCHARGE AT AMBIENT TEMPERATURE

Each loop (01-02-03-04) underwent individual AC voltage testing at 2 U0 (24 kV), with subsequent measurement of partial discharge. The test arrangement is shown in Photo 4.
Prior to testing, calibration was performed by applying a fixed value of PD (10 pC) to calibrate the instrument and verify the test circuit.
Background noise measured was 1 pC.
Table 1 displays the PD measured at different voltage levels for each loop.
The PD level on each loop did not exceed the standard-defined limit of 10pC.
The test yielded positive results.

	12 kV	20 kV	24 kV	20 kV	12 kV
Loop 1	1 pC	1 pC	3 pC	1 pC	1 pC
Loop 2	1 pC	1 pC	2 pC	1 pC	1 pC
Loop 3	1 pC	1 pC	1 pC	1 pC	1 pC
Loop 4	1 pC	1 pC	1 pC	1 pC	1 pC

Table 1 - Partial Discharge measurements at different voltage levels

Photo 2 - Test arrangement for partial discharge test

3. IMPULSE VOLTAGE TEST AT ELEVATED TEMPERATURE

All loops 01-02-03-04 underwent an impulse voltage test, consisting of 10 negative and 10 positive impulses at a peak voltage of 125 kV. To prepare for the test, the conductors were connected to form a loop and a current was induced to heat up the conductors and separable connectors. The current was adjusted to approximately 720 A to reach a stable temperature on the outer sheath (65 °C), equivalent to a conductor temperature of 5 K to 10 K above the maximum cable conductor temperature (90 °C) in normal operation for extruded insulation cables (with an ambient temperature of 20 °C).
Stabilization was achieved as soon as the temperature remained constant within 2 K for 2 hours (see paragraph 4.1, "Relation between conductor and sheath temperature").
Measurement points and temperature values on the outer sheath of the loops are detailed in Tables 2 and 3, respectively. The test circuit was arranged as shown in Figure 2 and Photo 3.
Oscillograms of the test are provided on the following pages.
The Marx Generator (A.M.E. 400 kV, 10 kJ – "APE 1332") was utilized to carry out the test.

N. of thermocouple	Description
1	Loop 01 temperature
2	Loop 02 temperature
3	Loop 03 temperature
4	Loop 04 temperature
5	Ambient temperature

Table 2 - Description of measurements points

	N. of thermocouple				
Time	**1 [°C]**	**2 [°C]**	**3 [°C]**	**4 [°C]**	**5 [°C]**
22/05/2023 15.35	67,2	67,3	66,5	67,7	24,2
22/05/2023 16.35	67,6	67,9	67,2	68,5	24,3
22/03/2023 17.35	67,7	67,8	67,3	68,4	24,3
ΔT @ 2h	0,5	0,5	0,8	0,7	-

Table 3 - Value in the last three hour

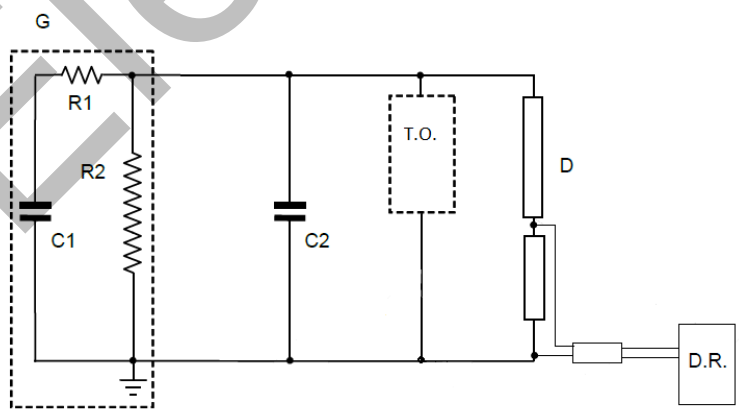


Figure 2 - Test circuit for impulse voltage test

G = impulse generator A.M.E. 400 kV 10 kJ 4 stages - 0,5 µF - 100 kV for stage, used with four stages in series

T.O. = Test object under test
D = ohmic divider
DR = digital recording system

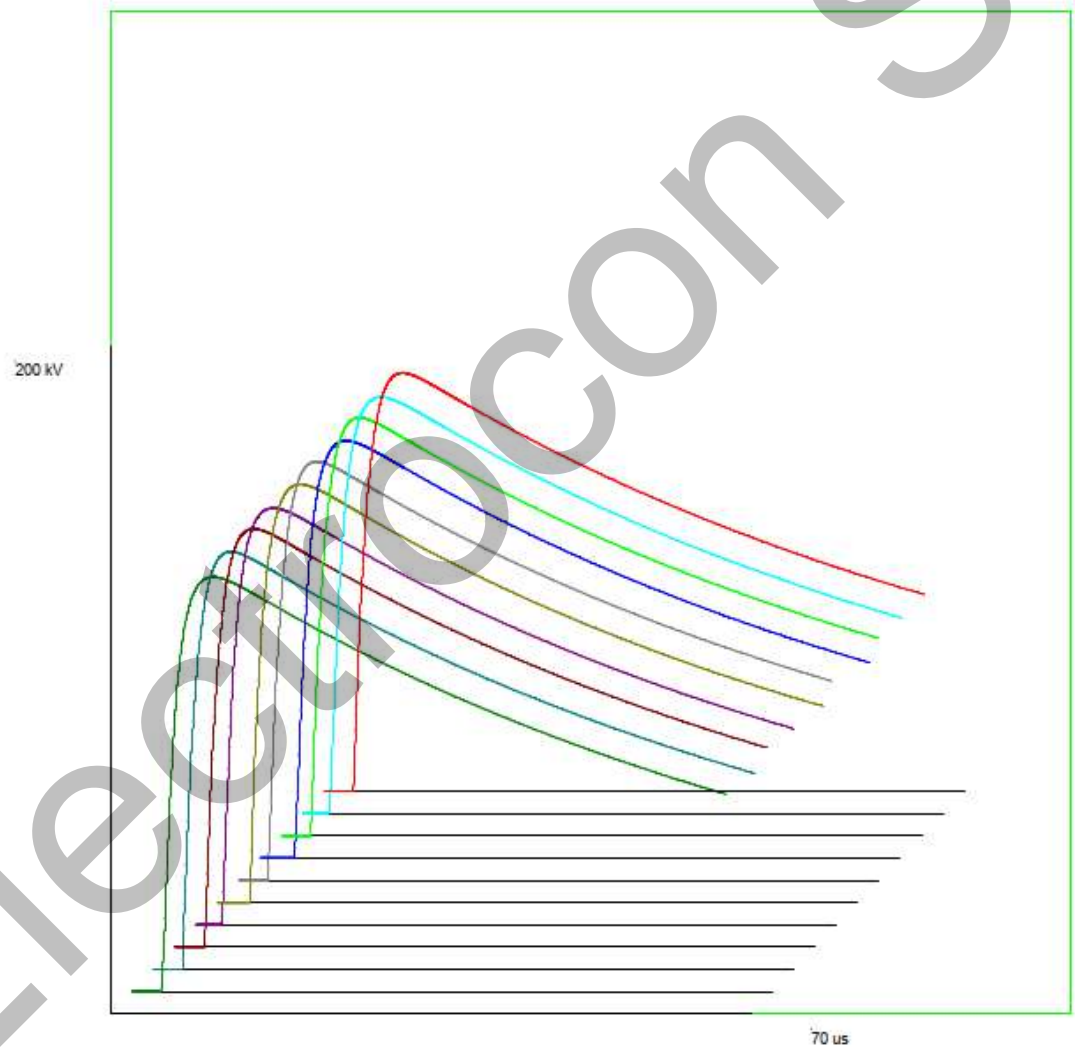
R1 = 240 Ω
R2 = 600 Ω
C1 = 0,5 µF
C2 = 2000 pF

Photo 3: Test arrangement for impulse voltage test at elevated temperature

3.1. Oscillograms

22/05/2023 16:47:41 - Converter: TEKTRONIX,TDS3012C - Channel: 1
Optimized Impulses - Scale Factor = 6097

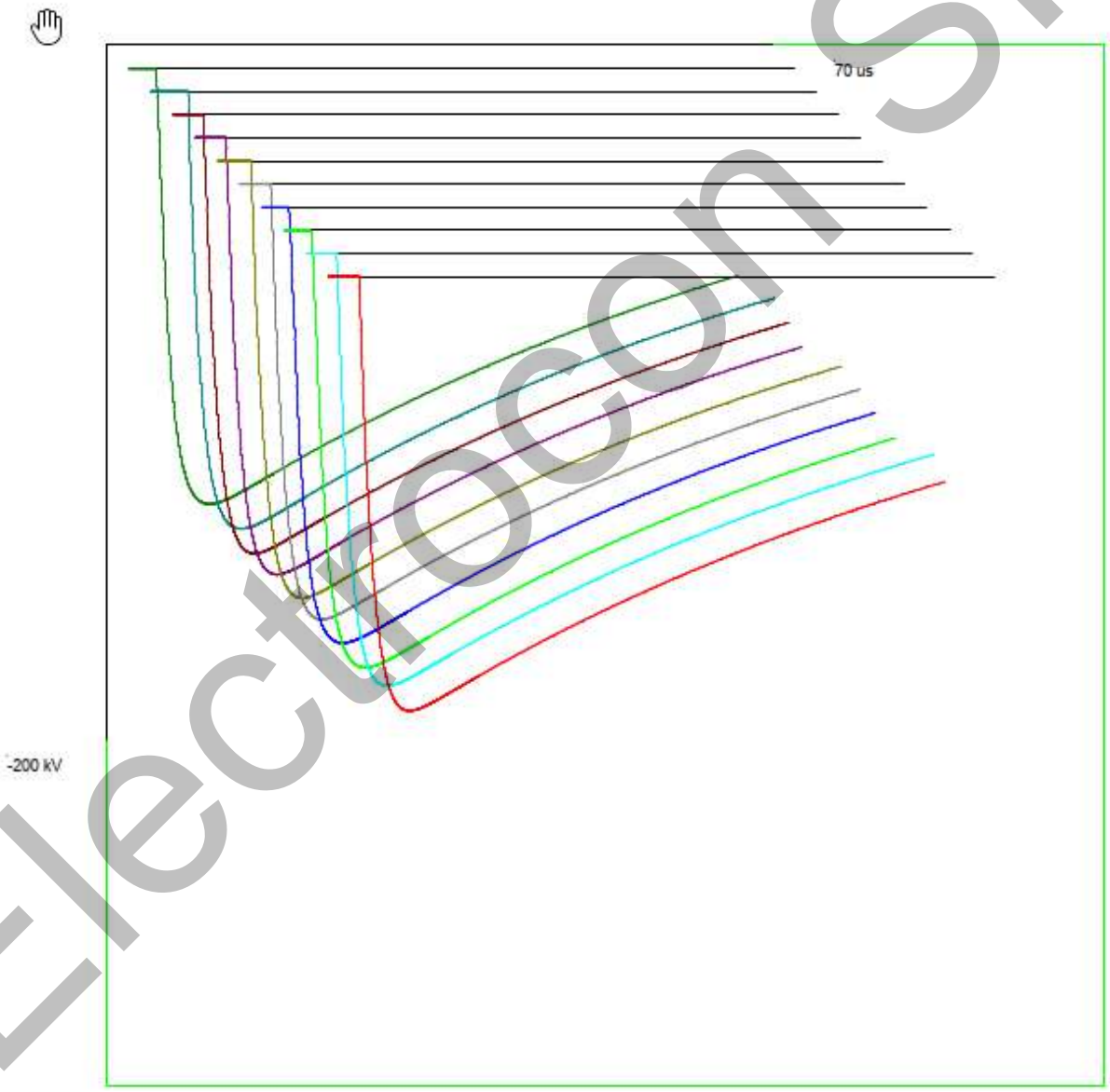
	Mean Value	Dev Std Abs	Dev Std %	
t1 [0.84-1.56] (us)	3,55	4,75E-02	1,34E+00	[10]
t2 [40-60] (us)	58,542	5,30E-02	9,06E-02	[10]
Vp (kV)	124,96	3,63E-01	2,91E-01	[10]



n.	Vp (kV)
1)	124,14
2)	125,01
3)	125,22
4)	124,75
5)	125,19
6)	125,34
7)	124,90
8)	125,15
9)	124,66
10)	125,25

22/05/2023 16:29:26 - Converter: TEKTRONIX,TDS3012C - Channel: 1
Optimized Impulses - Scale Factor = 6097

	Mean Value	Dev Std Abs	Dev Std %	
t1 [0.84-1.56] (us)	3,57	5,34E-02	1,50E+00	[10]
t2 [40-60] (us)	58,138	7,42E-02	1,28E-01	[10]
Vp (kV)	-125,67	5,28E-01	4,20E-01	[10]



n.	Vp (kV)
1)	-125,57
2)	-126,04
3)	-126,49
4)	-125,84
5)	-125,98
6)	-125,46
7)	-125,58
8)	-126,02
9)	-124,63
10)	-125,12

4. HEATING CYCLE VOLTAGE TEST

4.1. Relation between conductor and sheath temperature

Before starting with the sequence, a preliminary test was performed to know which temperature of the outer sheath corresponded to a temperature of the internal conductor of 95 °C. The method used is described in Annex A.2 of IEC 61442:2005 .
The test has been done on a piece of cable FG GREECE ARE4H5E 12/20 kV 1x300 and of about 3,5 m length, named “reference cable” that was connected to form a closed loop. In the inner conductor of the “reference cable” were installed thermocouples type T at about 0,5 m from each termination of the cable. The temperature of outer sheath were measured at about 0,5 m from each terminations.
A current of 740 A, was let flow on the circuit, ensuring stabilization of temperature before subsequent raising up, without changing more than 2 K in 2 hours. The values relating to the conductor / outer sheath temperature of the reference cable in steady are reported in table 5.
Measurement points are detailed in table 4.

N. of thermocouple	Description
1	Conductor temperature at 0,5m from terminal A
3	Conductor temperature at 0,5m from terminal B
4	Sheath temperature at 0,5m from terminal A
5	Sheath temperature at 0,5m from terminal B
6	Ambient temperature

Table 4 - Description of measurements points

	N. of thermocouple				
Time	**1 [°C]**	**3 [°C]**	**4 [°C]**	**5 [°C]**	**6 [°C]**
10/05/2023 15.35	95,7	95,5	64,3	64,7	19,6
10/05/2023 16.35	96,4	96,5	65,2	65,2	19,8
10/03/2023 17.35	97,1	97,3	65,9	66,3	20,2
ΔT @ 2h	1,4	1,8	1,6	1,6	-

Table 5 - Value in the last three hour

4.2. Heating cycle voltage in air test

Sixty-three heating cycles with the loops in air were performed according to IEC 61442:2005 item 9. The cables, provided with the separable connectors, were connected in series to make a loop. The current necessary to heat up the cables was supplied by means of a current transformers controlled by a PLC unit.
A voltage of 2,5 U_0 (30 kV) was applied between the cable conductor and the screen (which was earthed) by means of a LV/HV transformer. All heating cycles were carried out with this voltage applied uninterruptedly. The test circuit is reported on figure nr. 3 and on photo nr. 4.
The description of measurement point are reported in Table 6.
The positioning of the thermocouples on the outer sheath were performed according to IEC 61442:2005 item 8.2.2 figure 3.

Channel	Unit	Description
1	°C	Temperature of LOOP 01
2	°C	Temperature of LOOP 02
3	°C	Temperature of LOOP 03
4	°C	Temperature of LOOP 04
5	°C	Ambient temperature
6	°C	Ambient temperature)
7	V	Current transducer
8	V	Voltage transducer

Table 6 - Description of measurements points

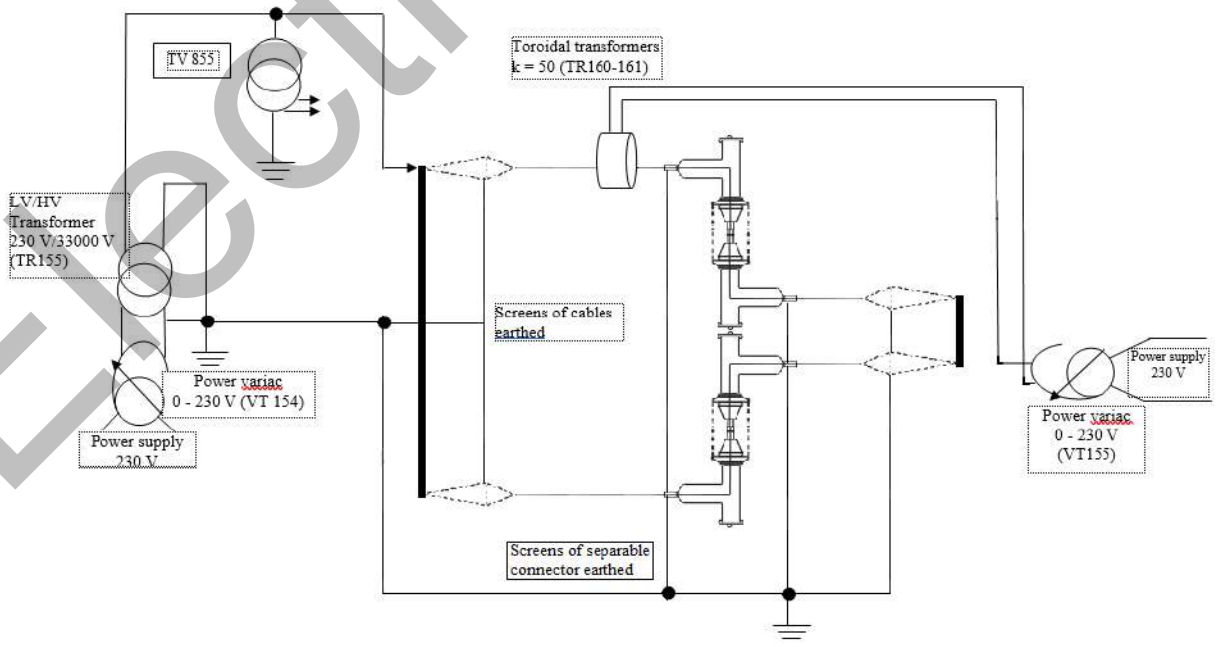


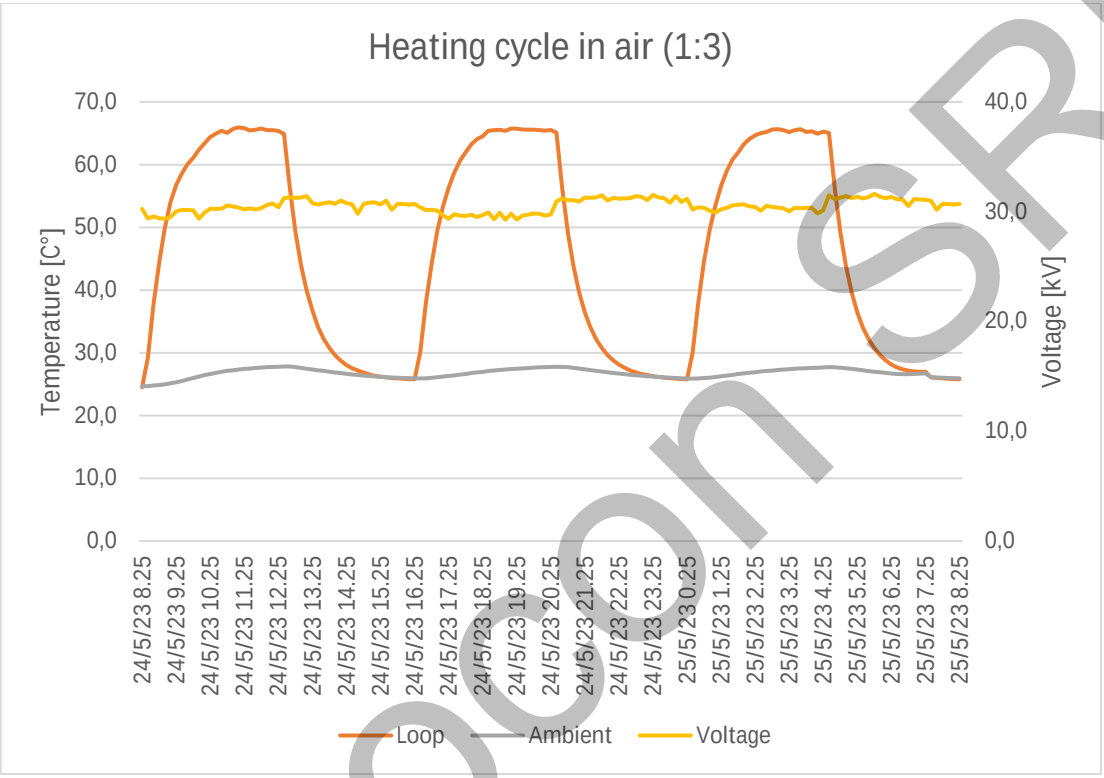
Figure 3: Test circuit for heating cycles voltage tests

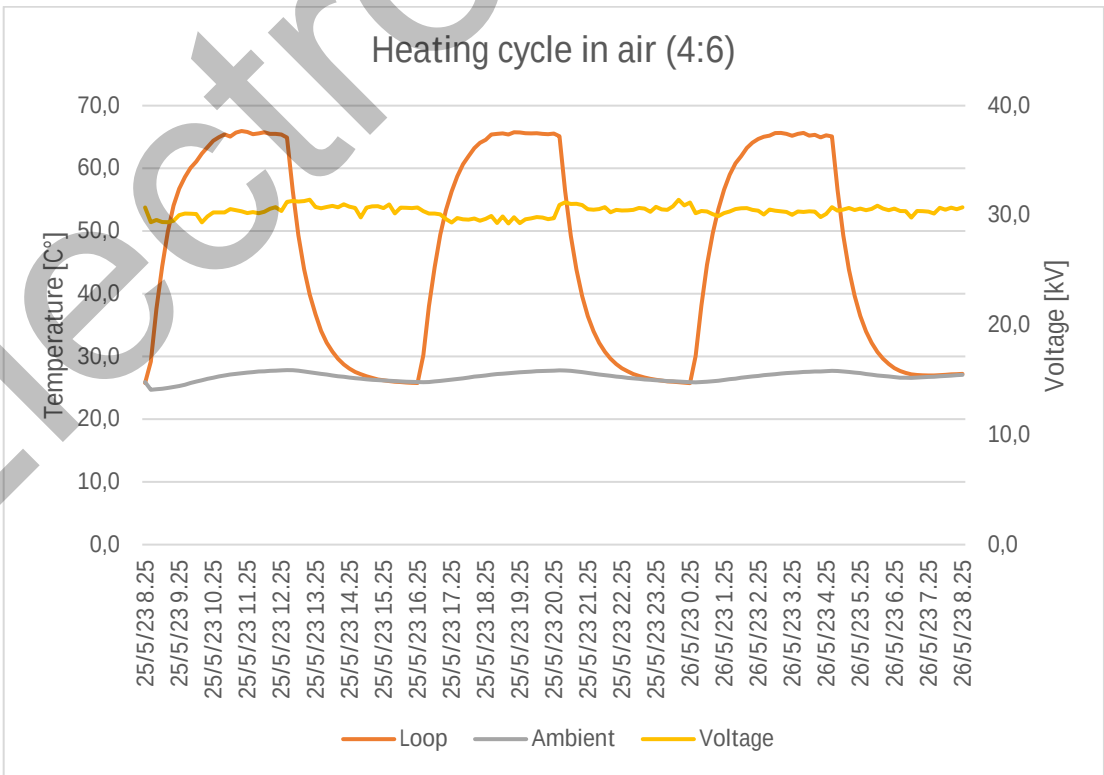
T9

Photo 4: Test arrangement for heating cycle voltage in air tests

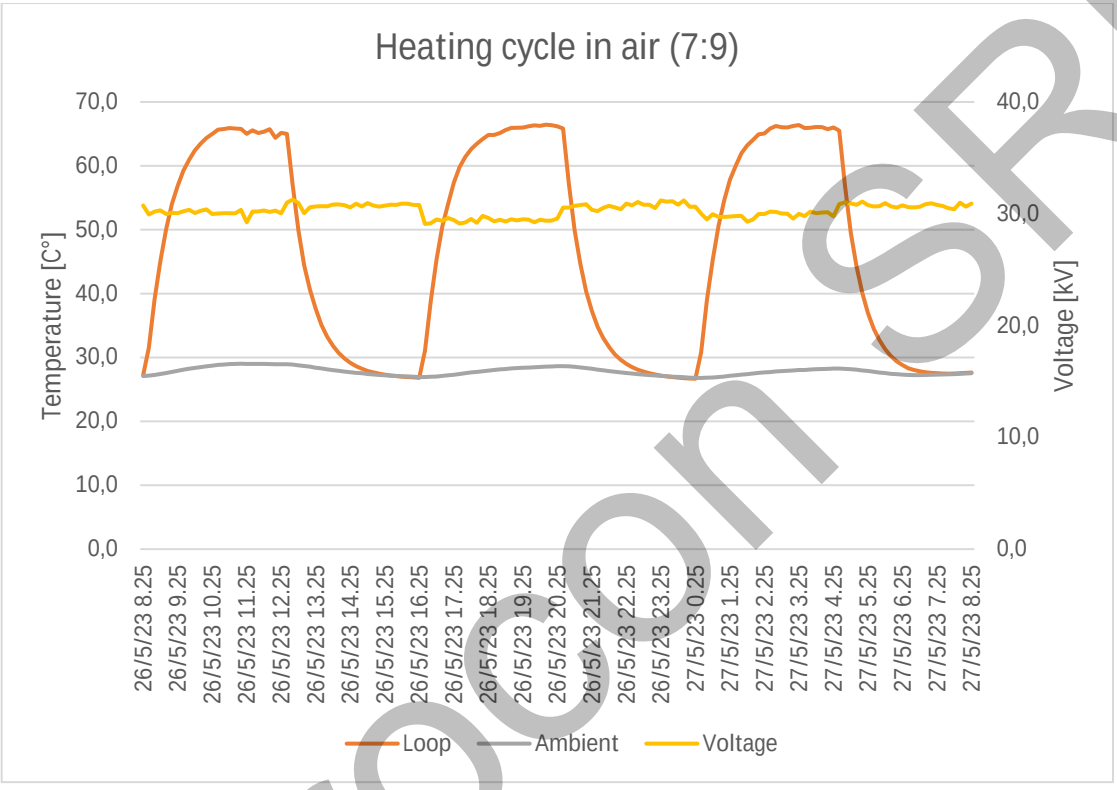
Note:

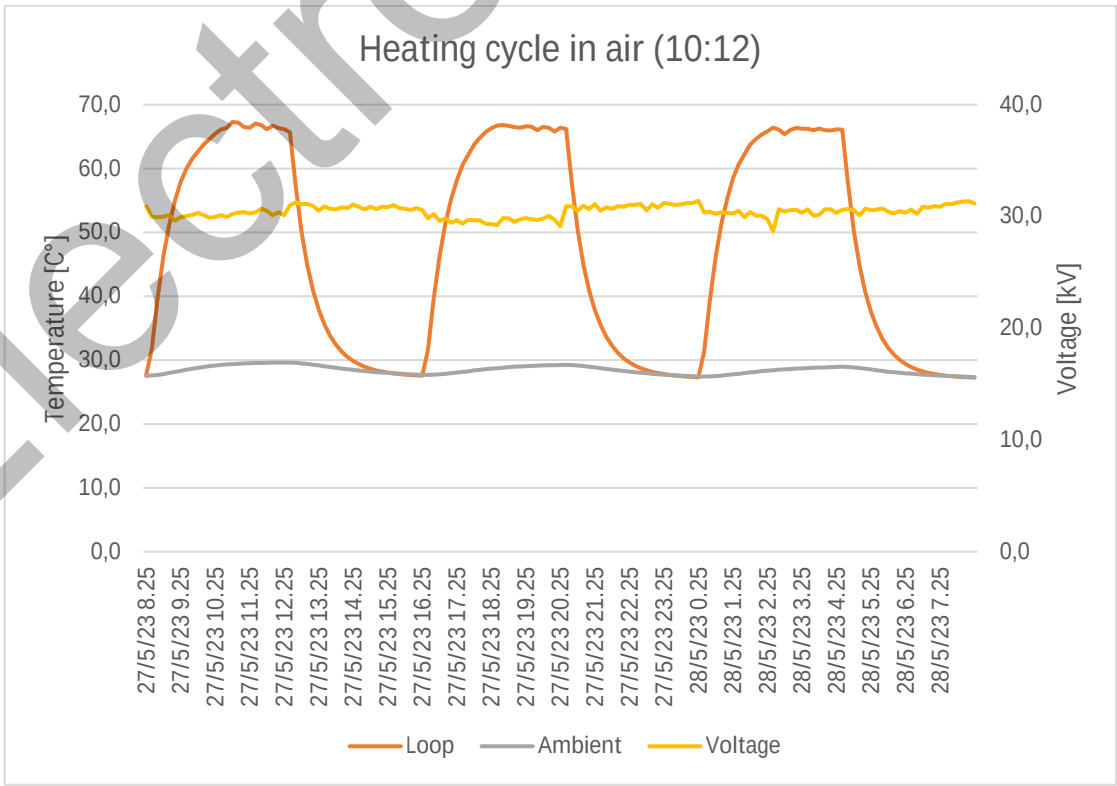
- "Loop" is the average temperature of the four thermocouples positioned at 0,5 m from each terminations;
- "Ambient2" is the average ambient temperature;
- "Voltage" is the voltage applied to the loops (2,5 U_0).

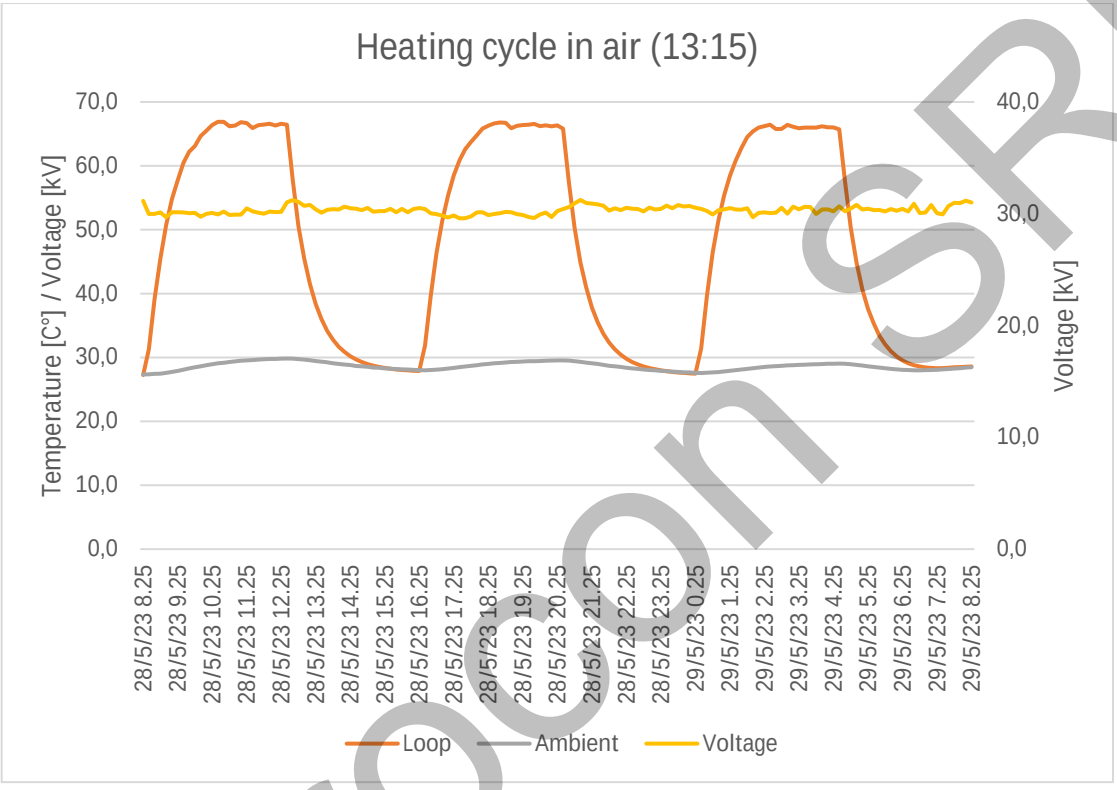


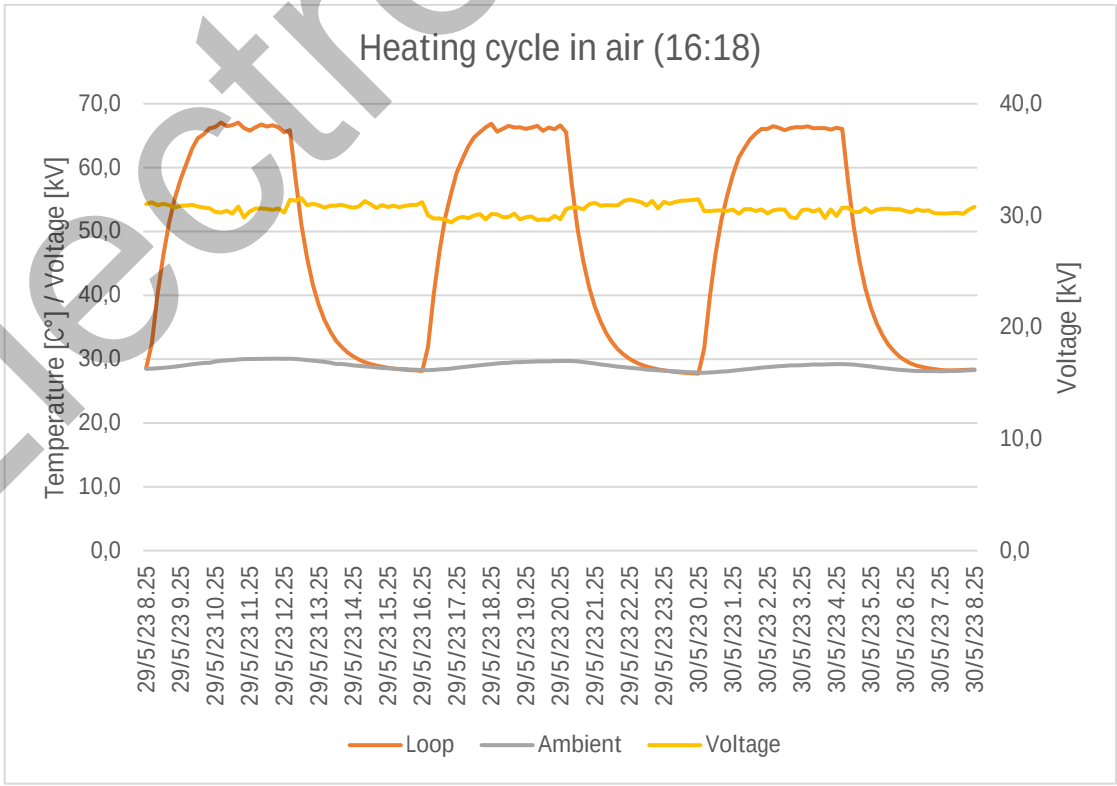


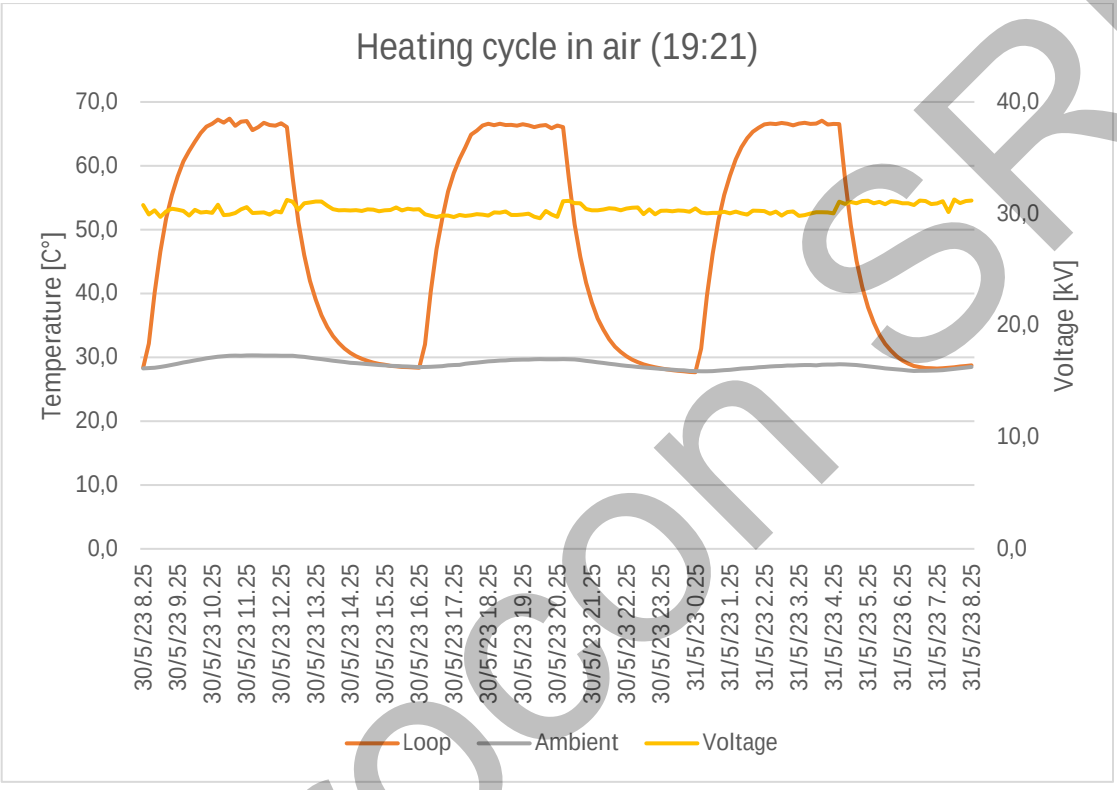
Note: Loop describe the mean outer sheath temperature of Loop EL01, EL02 , EL 03, EL04

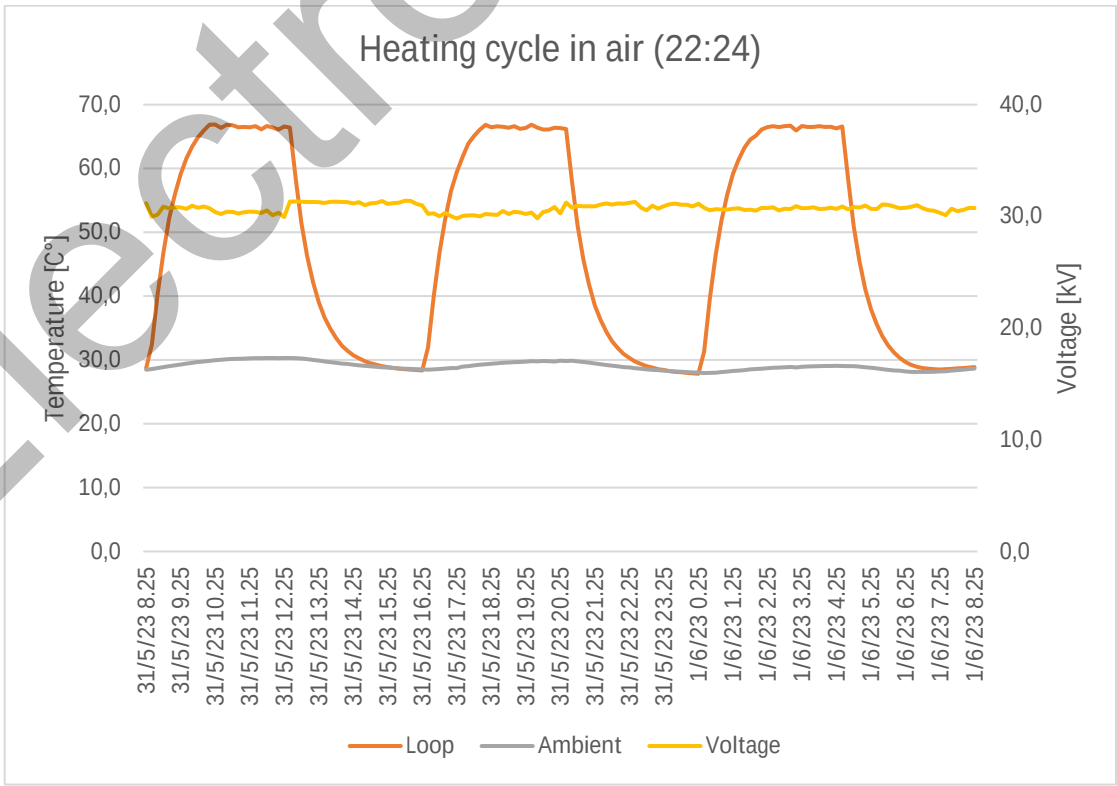


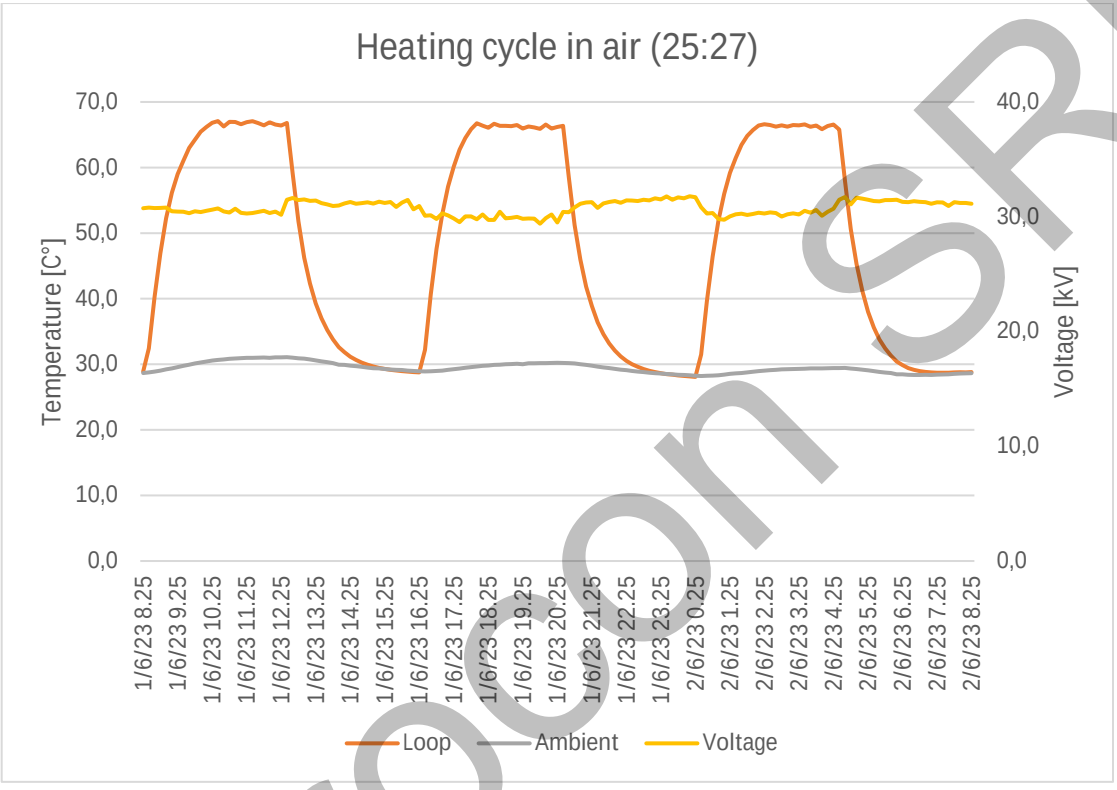


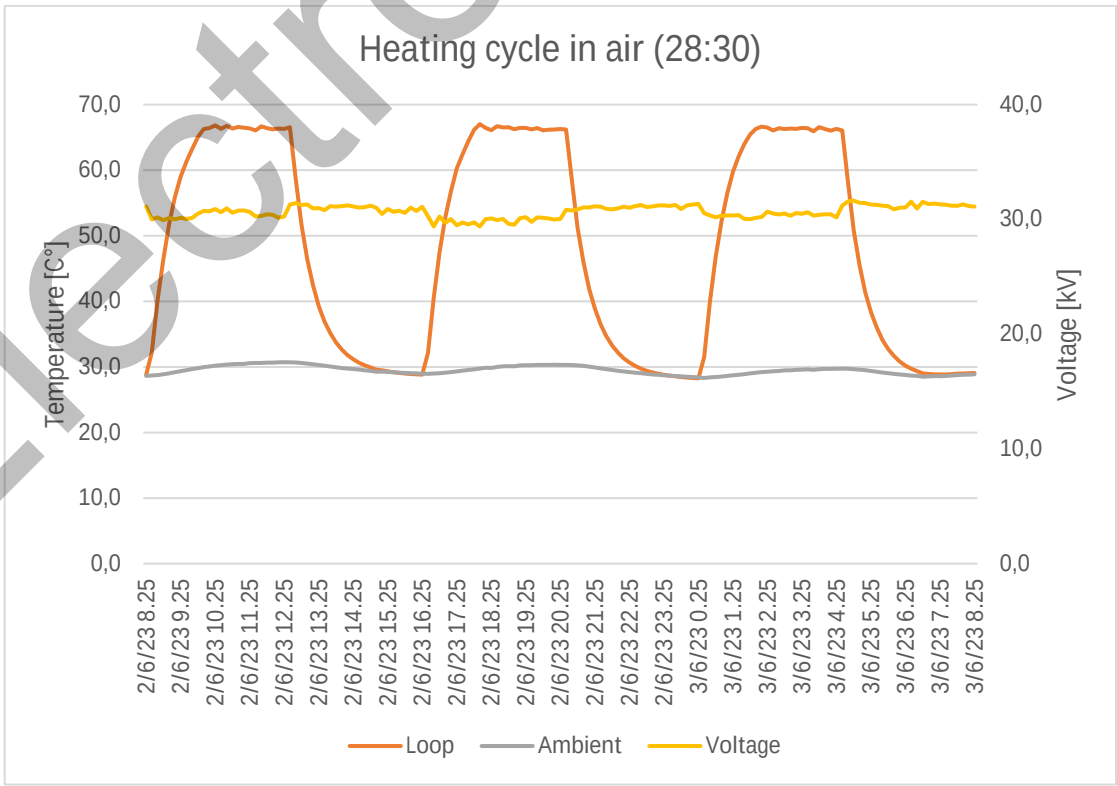


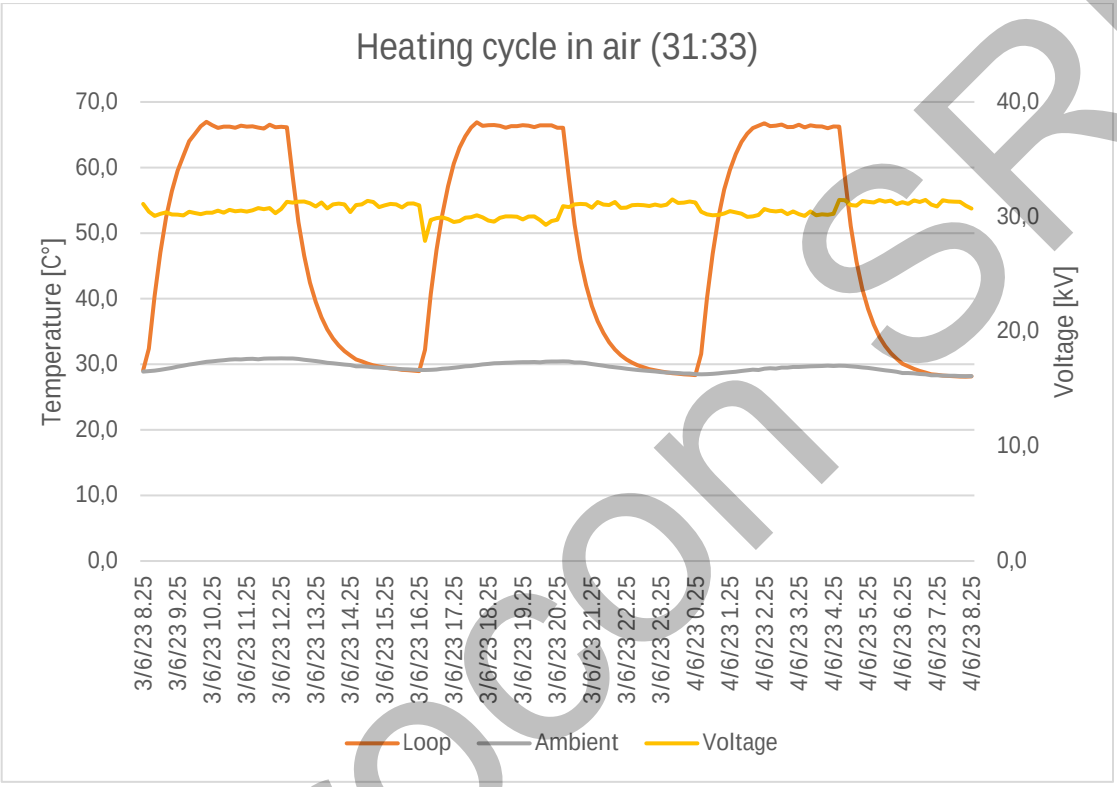


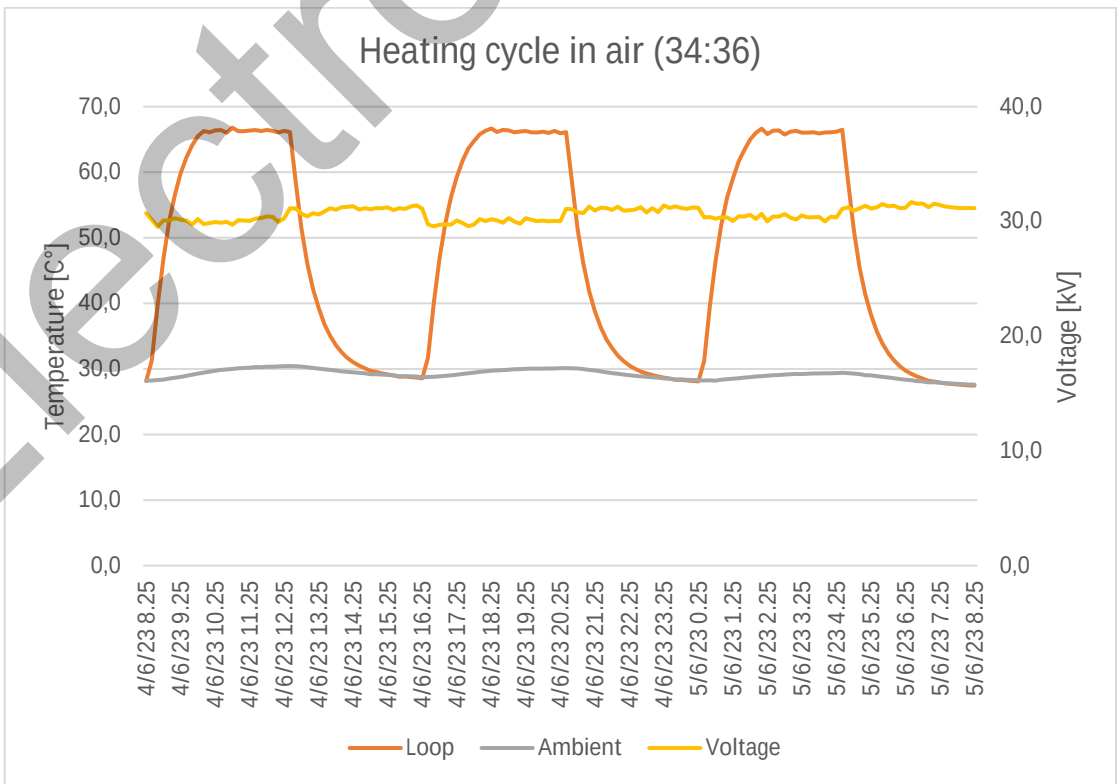


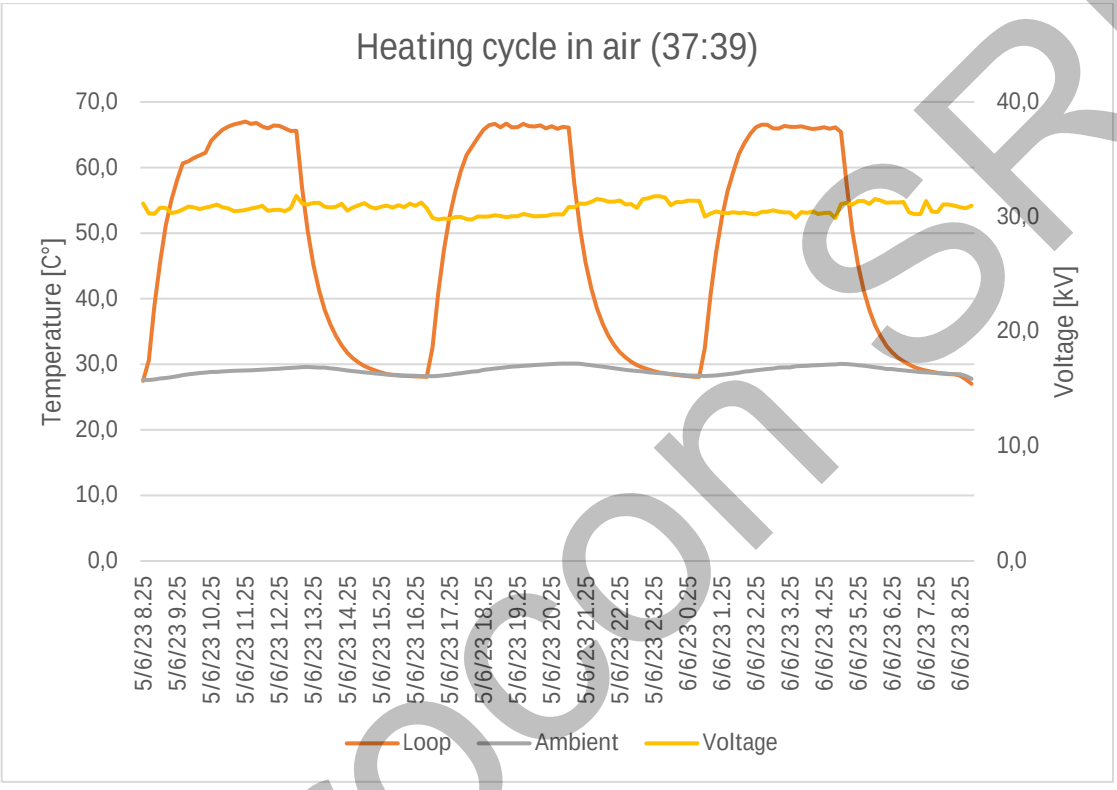


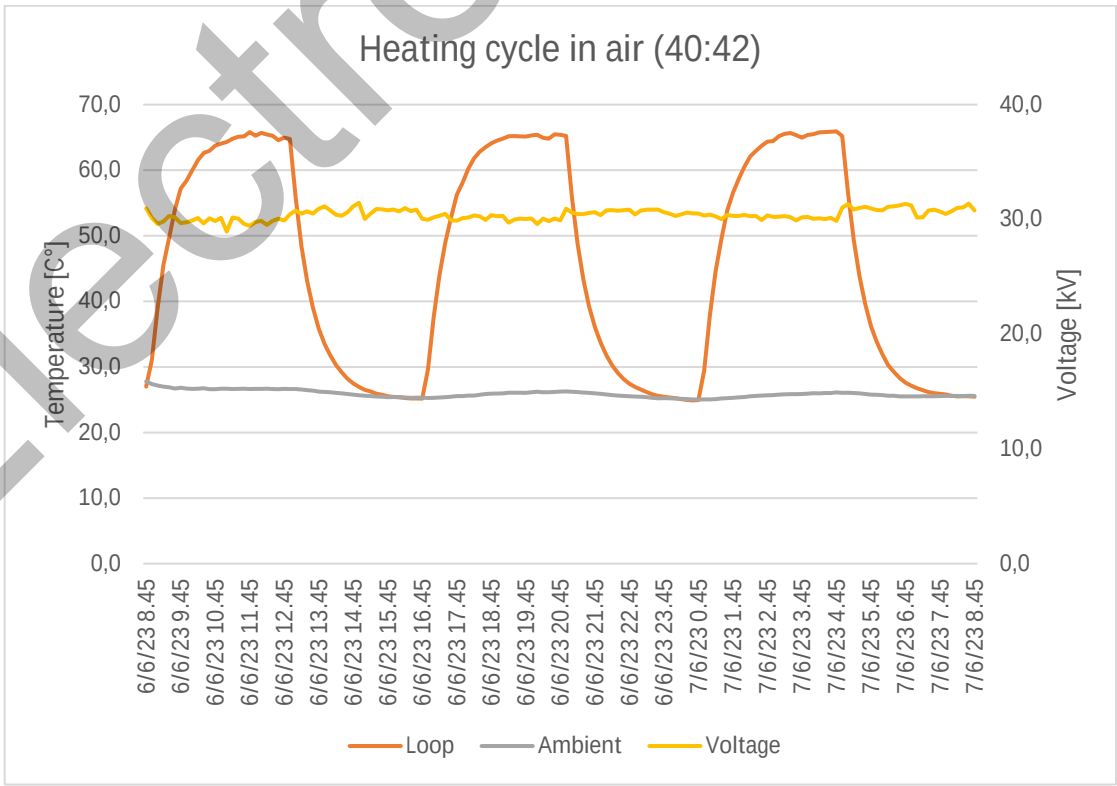


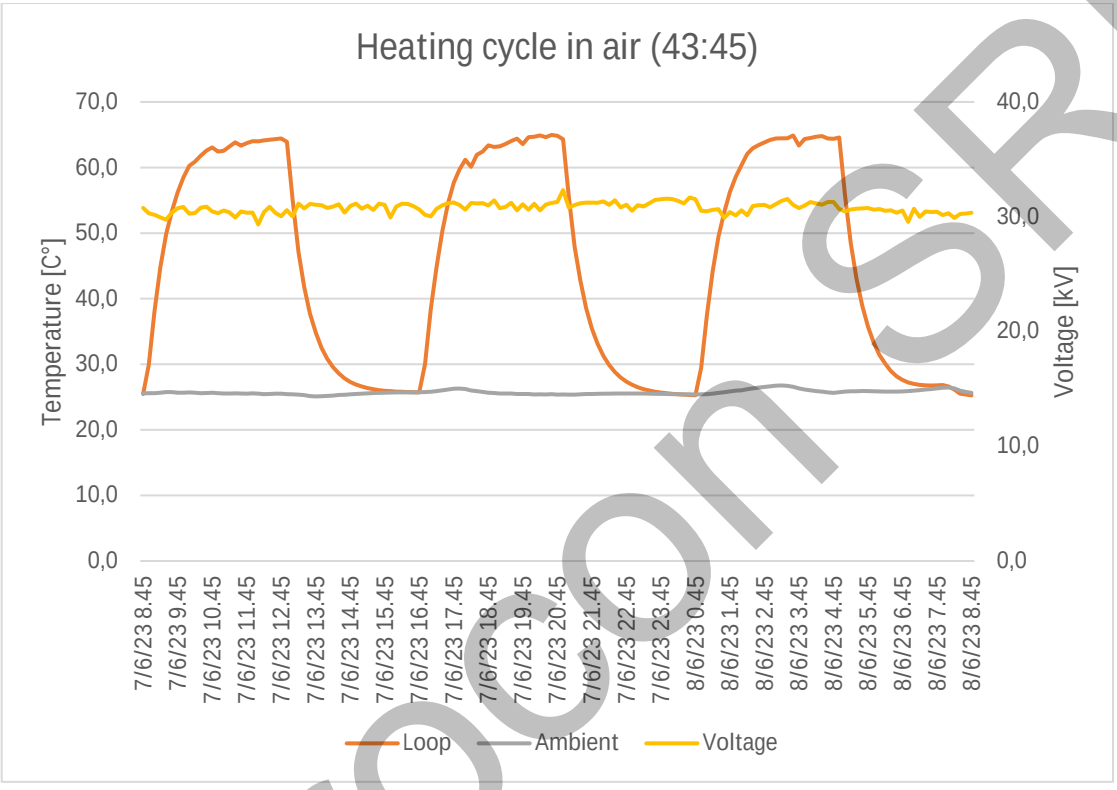


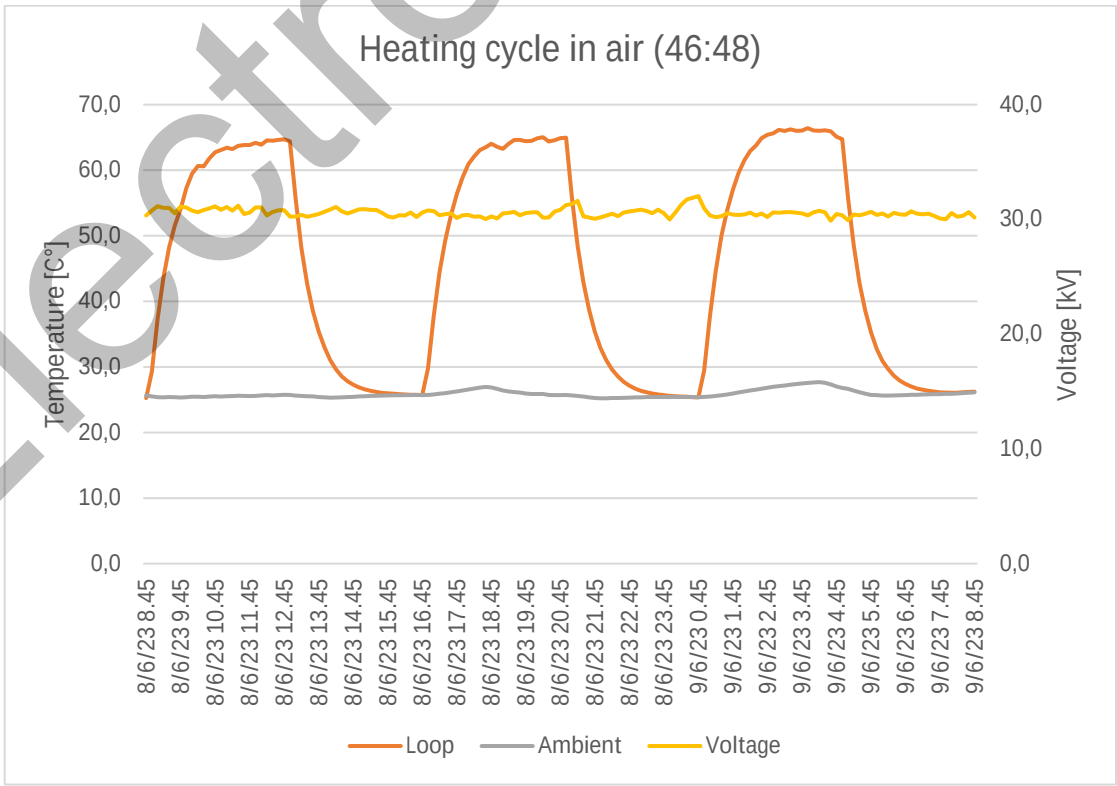


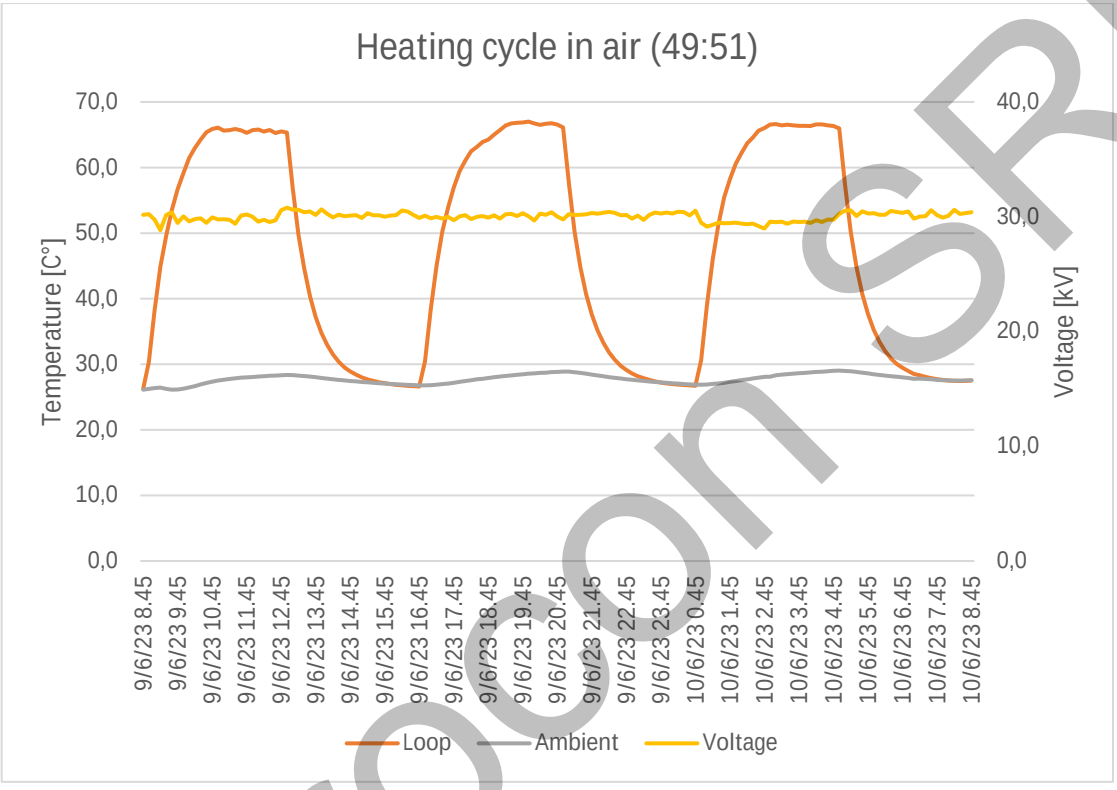


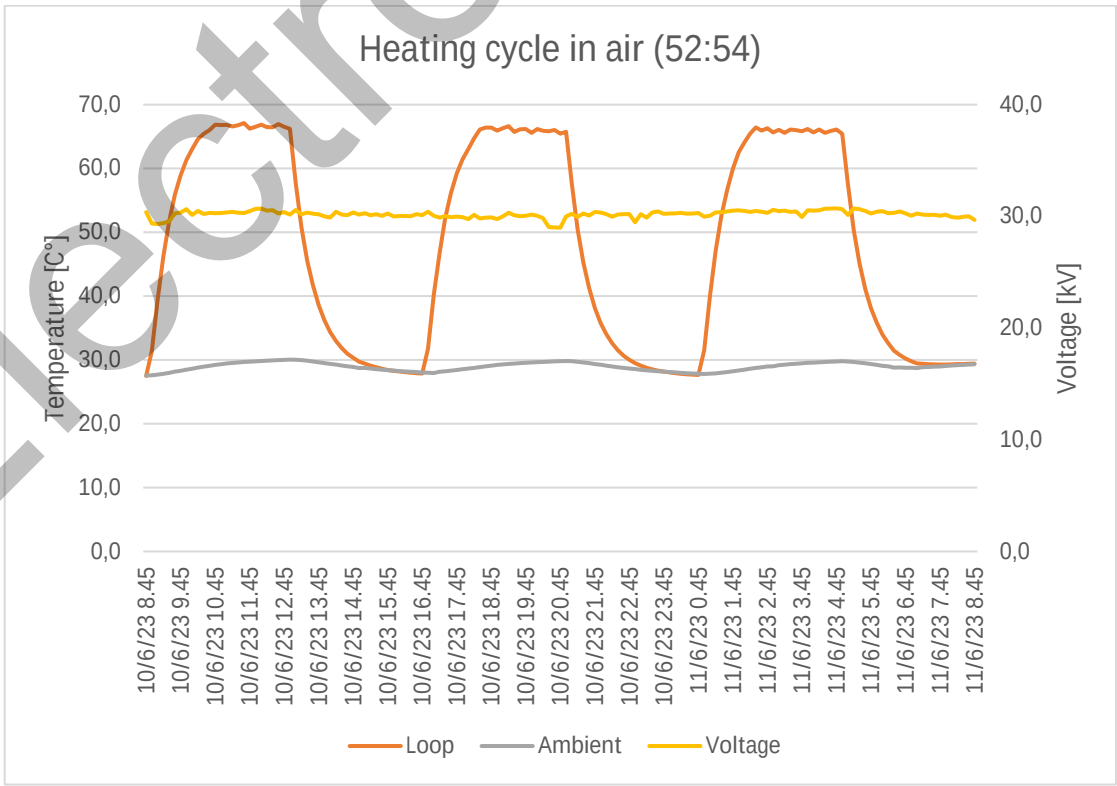


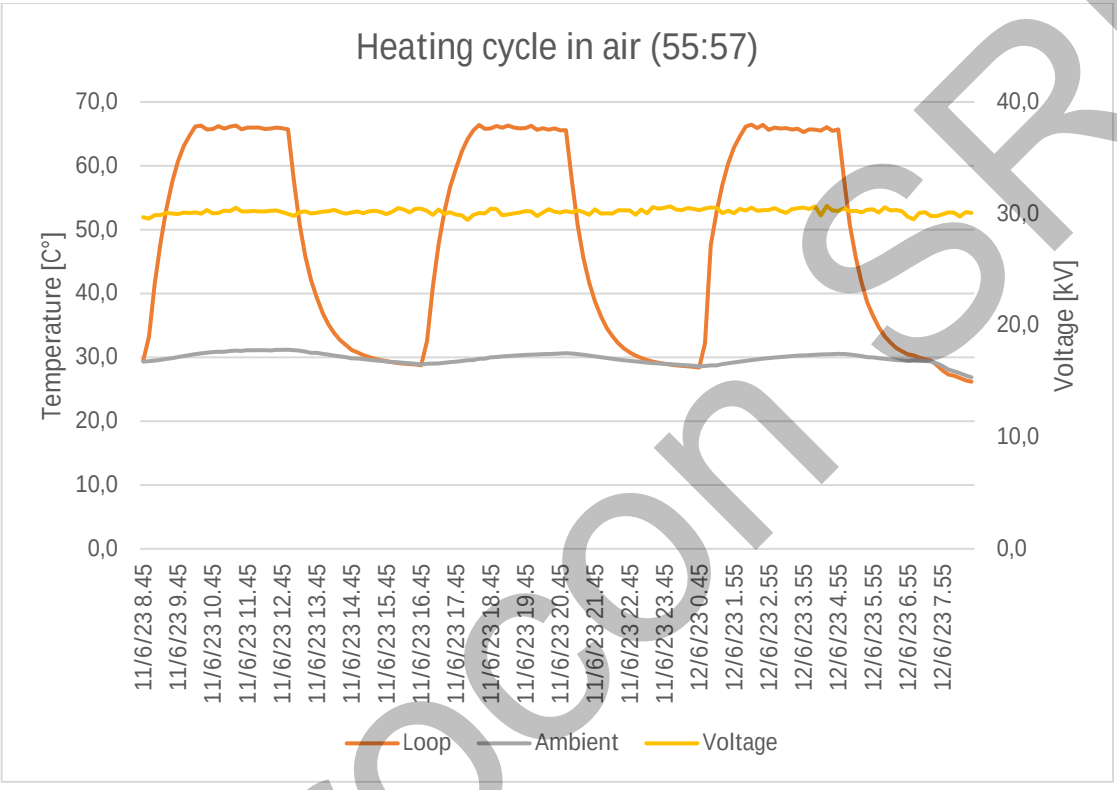


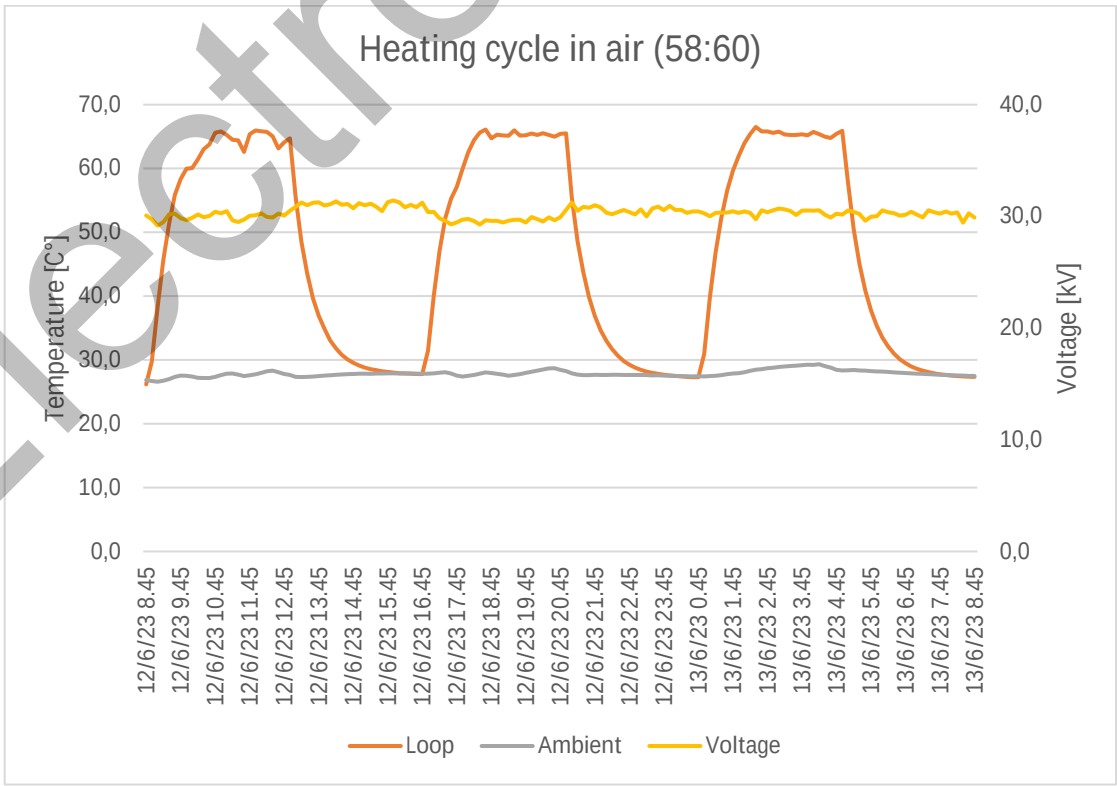


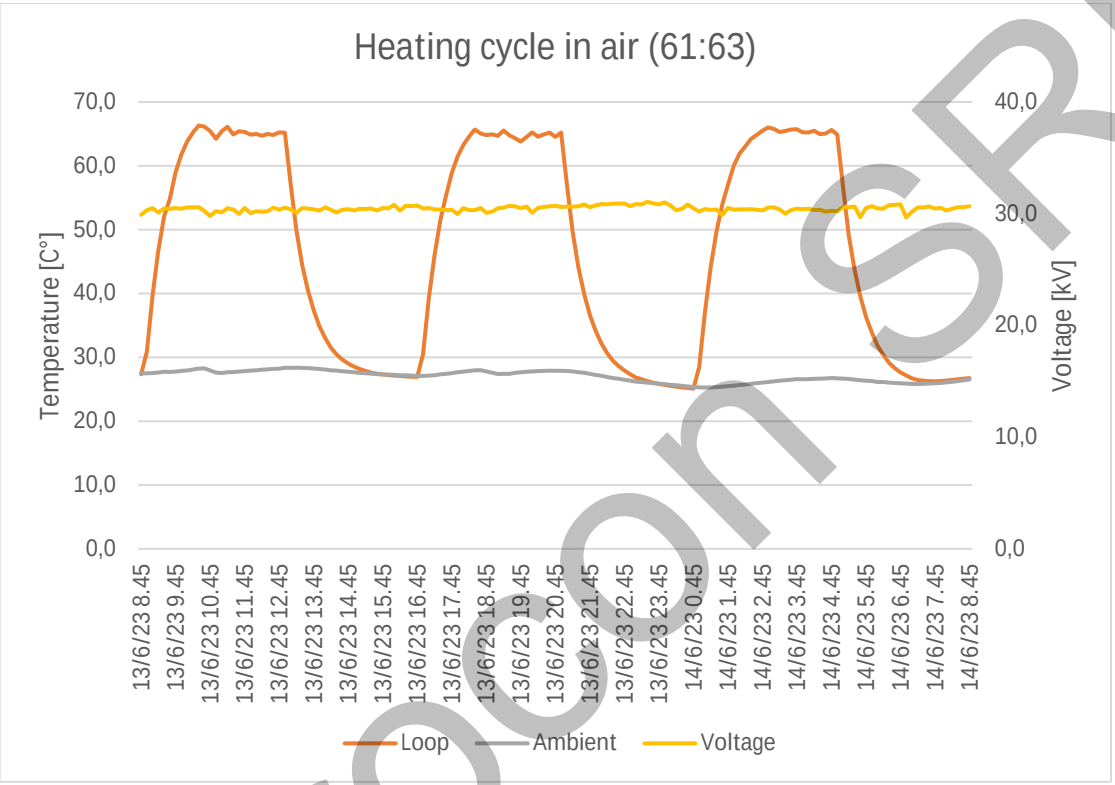








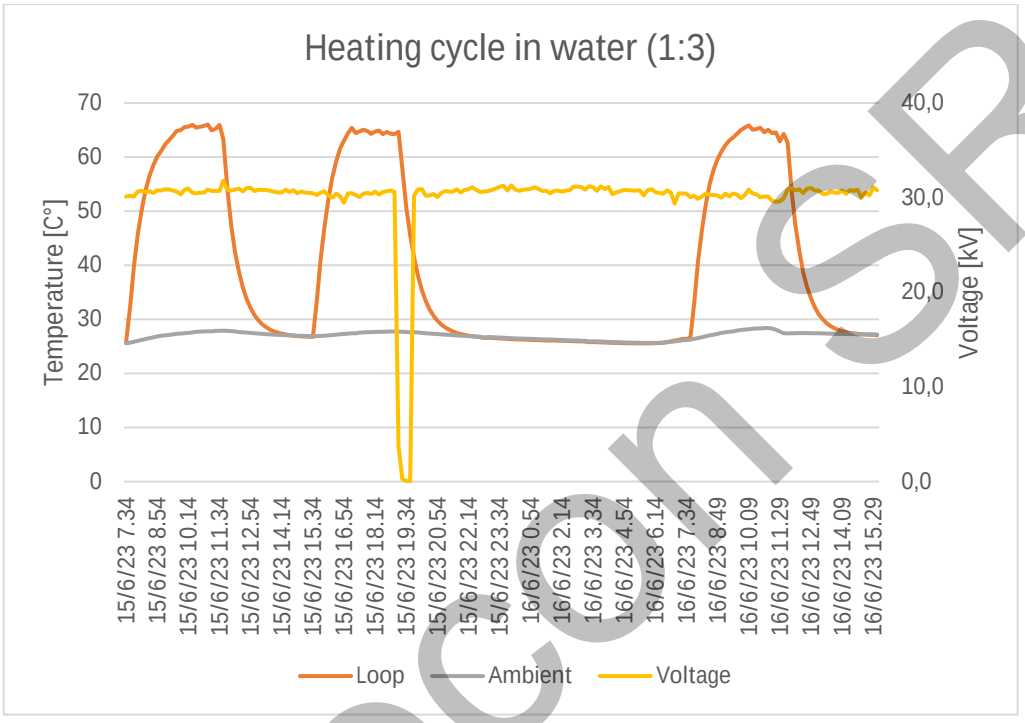




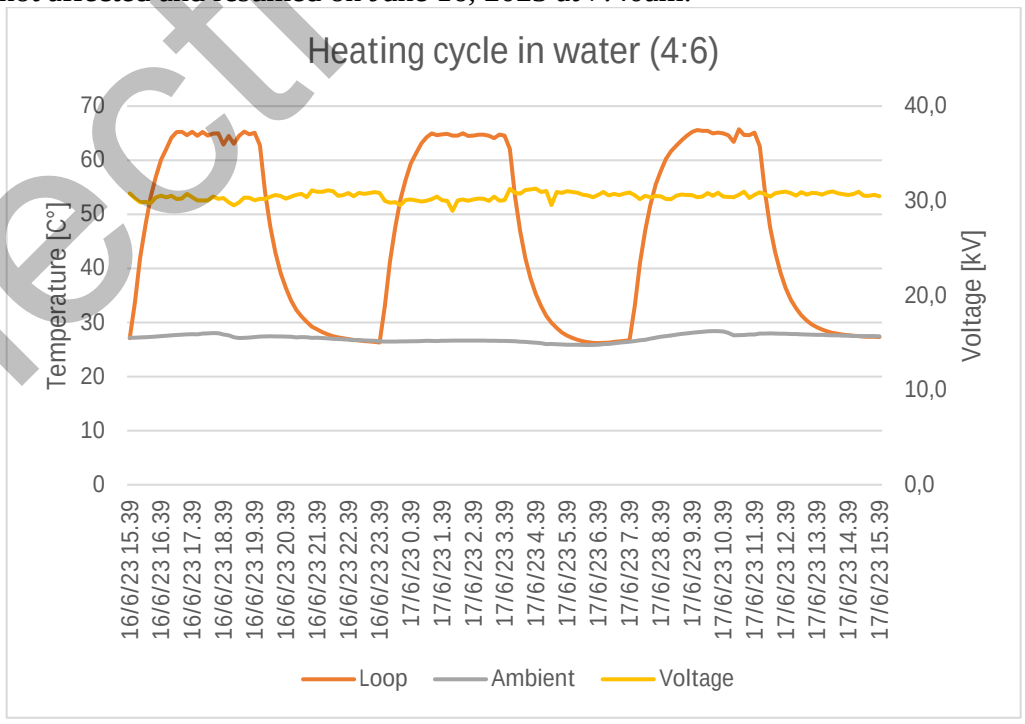
4.3. Heating cycle voltage in water test

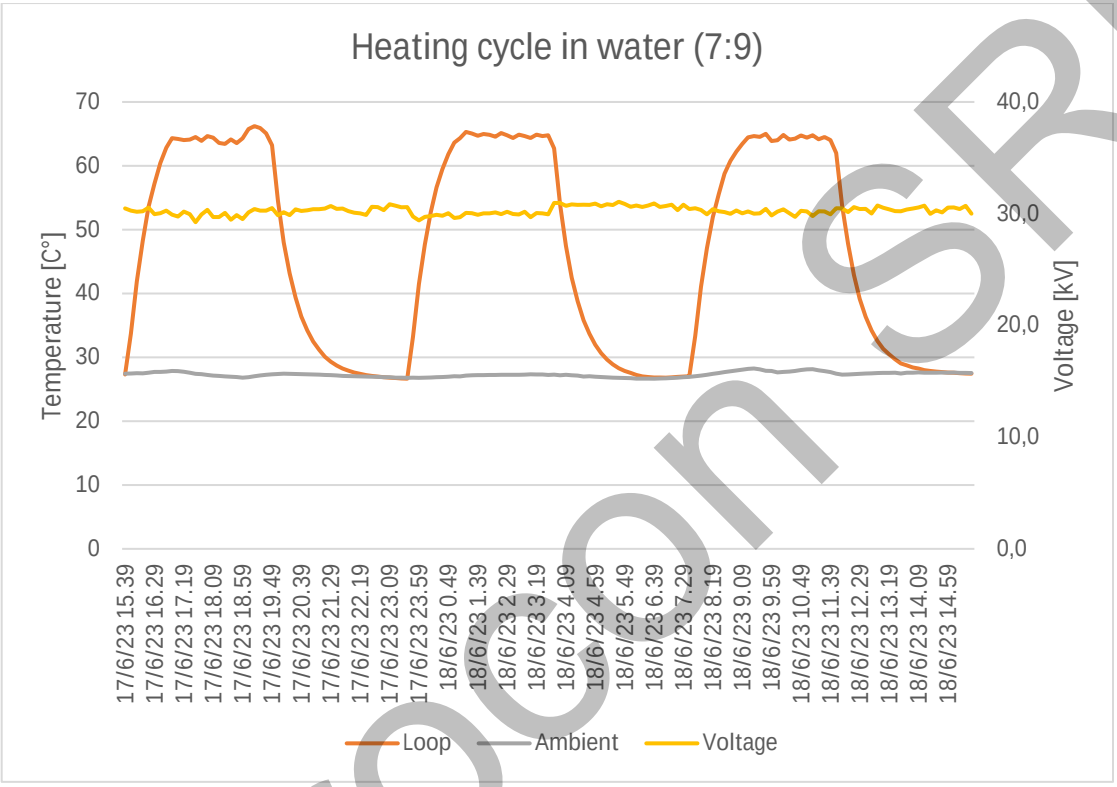
According to CEI EN 61442:2006-06 item 9, we conducted sixty-three heating cycles with the separable connectors in water.
The connectors were installed in a vessel with a water level of 1,00 m above the top surface of all accessories being tested. The water was at ambient temperature.
To heat up the cables, we connected them in series to form a loop. We used a current transformer controlled by a PLC to supply the necessary current.
We applied a voltage of 2,5 U0 (30 kV) between the cable conductor and the screen (which was earthed) using a LV/HV transformer. We maintained this voltage during all heating cycles.
The measurement points and test circuit are the same as those used in the heating cycle voltage in air test. Photo 5 shows the test arrangement.

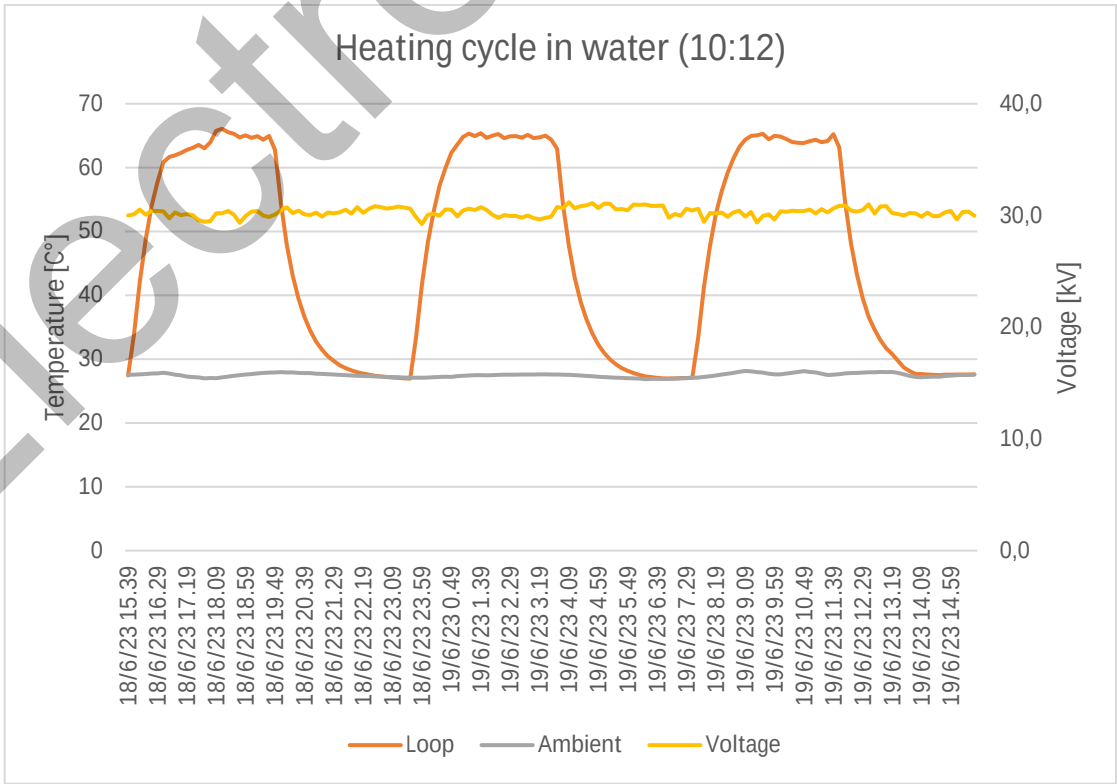
Photo 5 - Test arrangement for heating cycle voltage in water tests

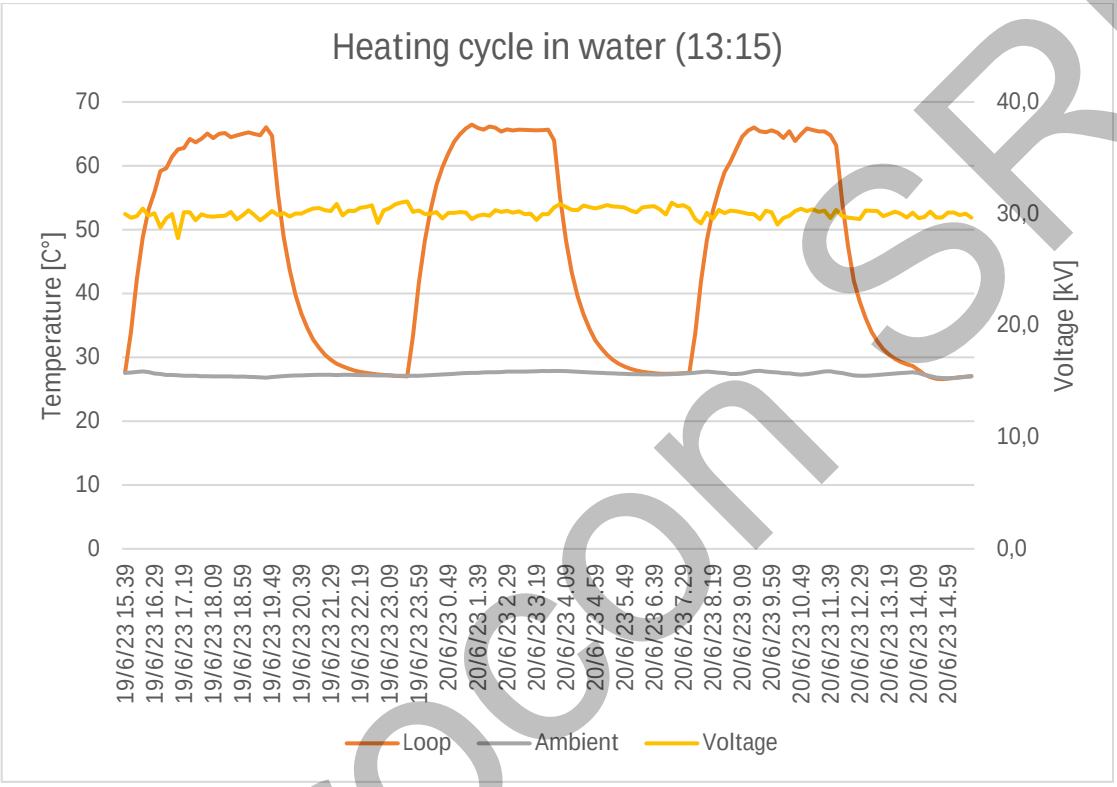


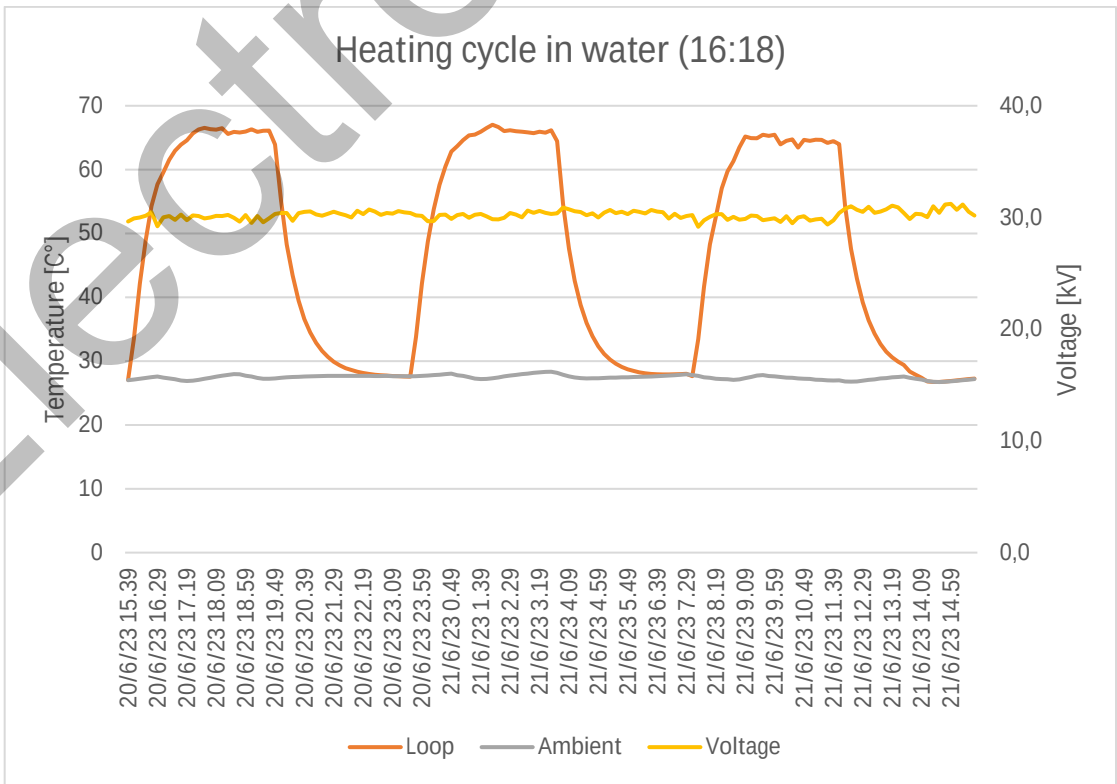
On the night of June 15, 2023, during the cooling period of the 2nd cycle, a fault occurred in the electrical network which caused a voltage interruption on the loops. However, the execution of the cycles was not affected and resumed on June 16, 2023 at 7:40am.

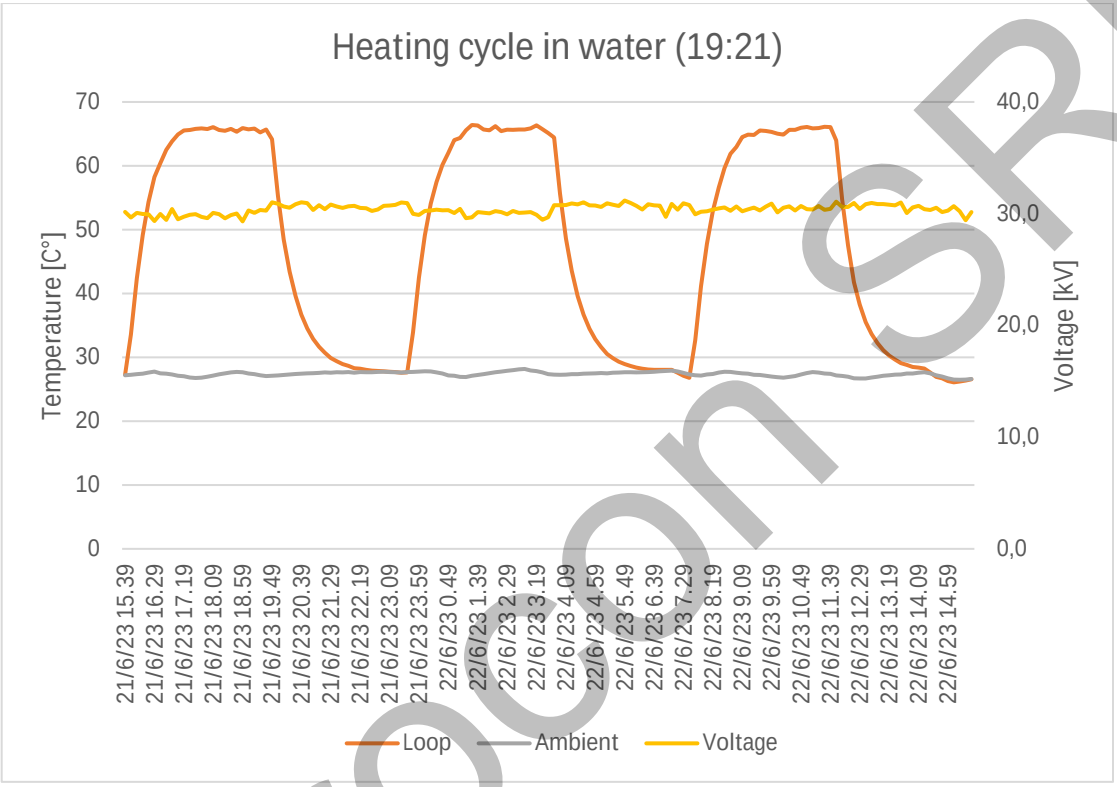


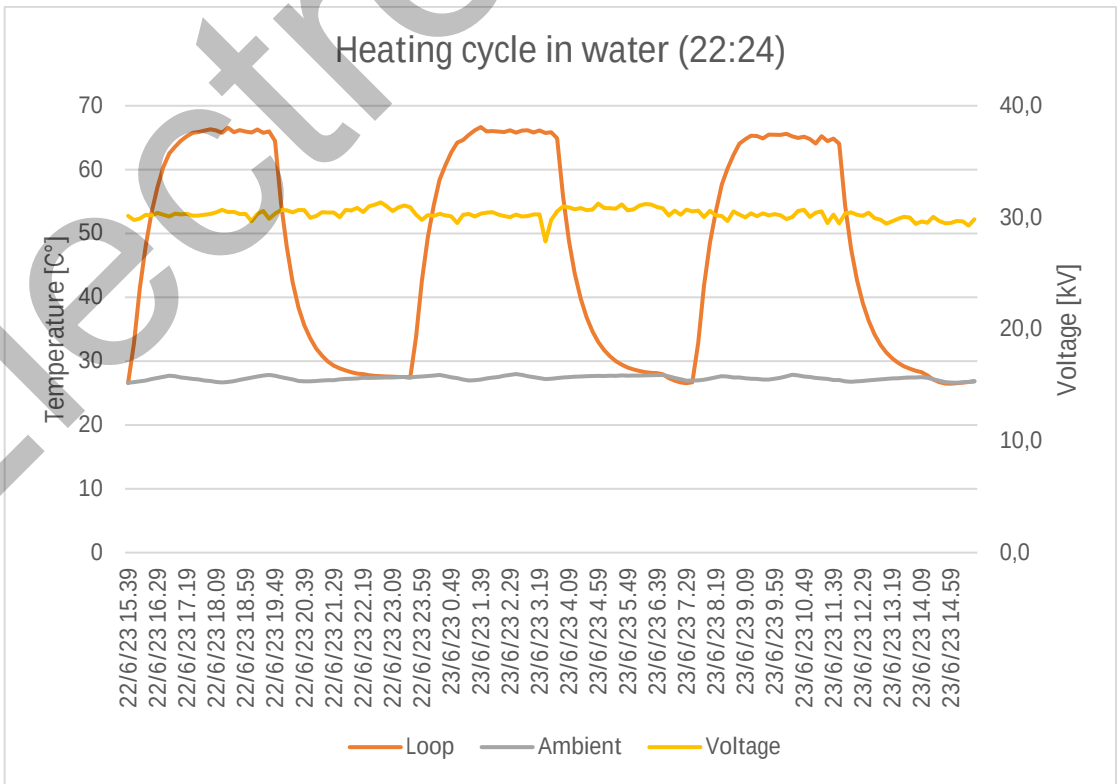


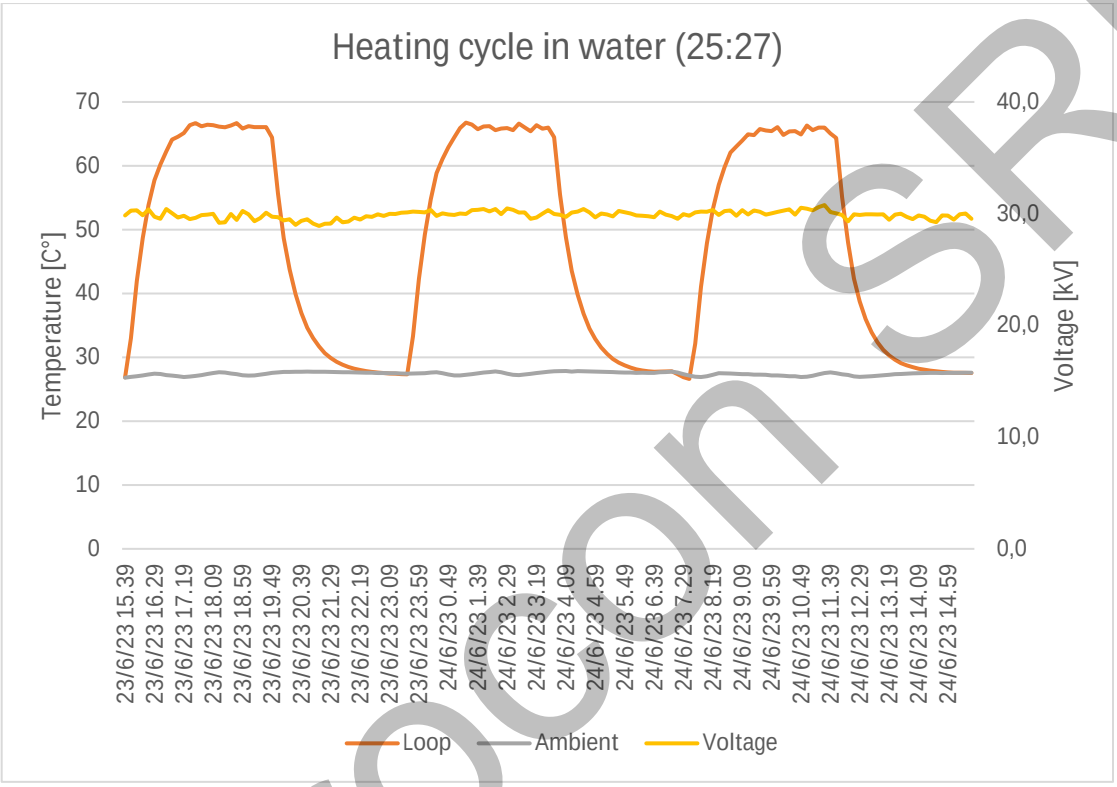


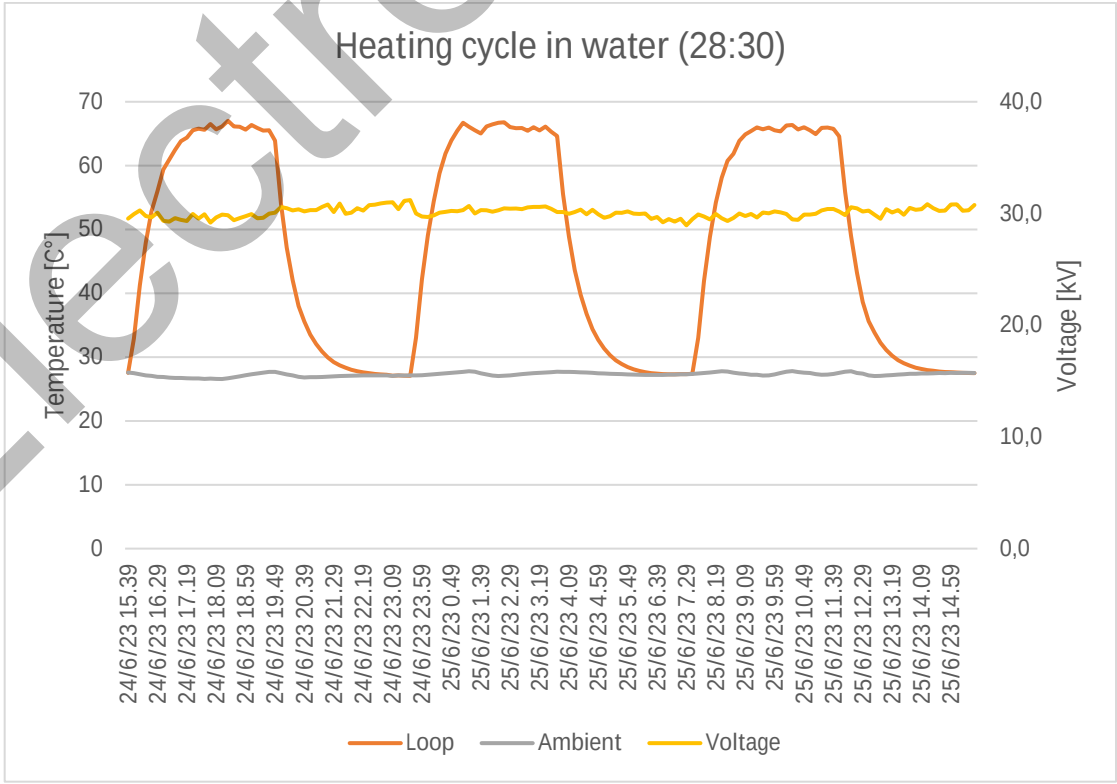


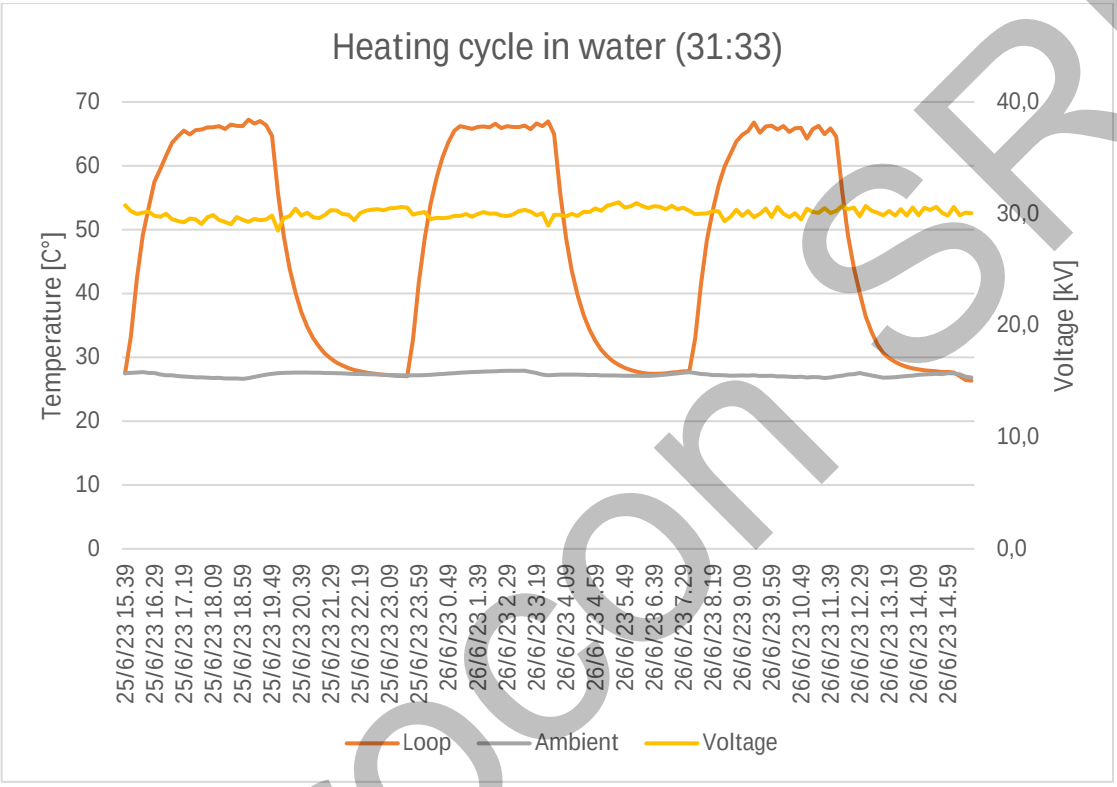


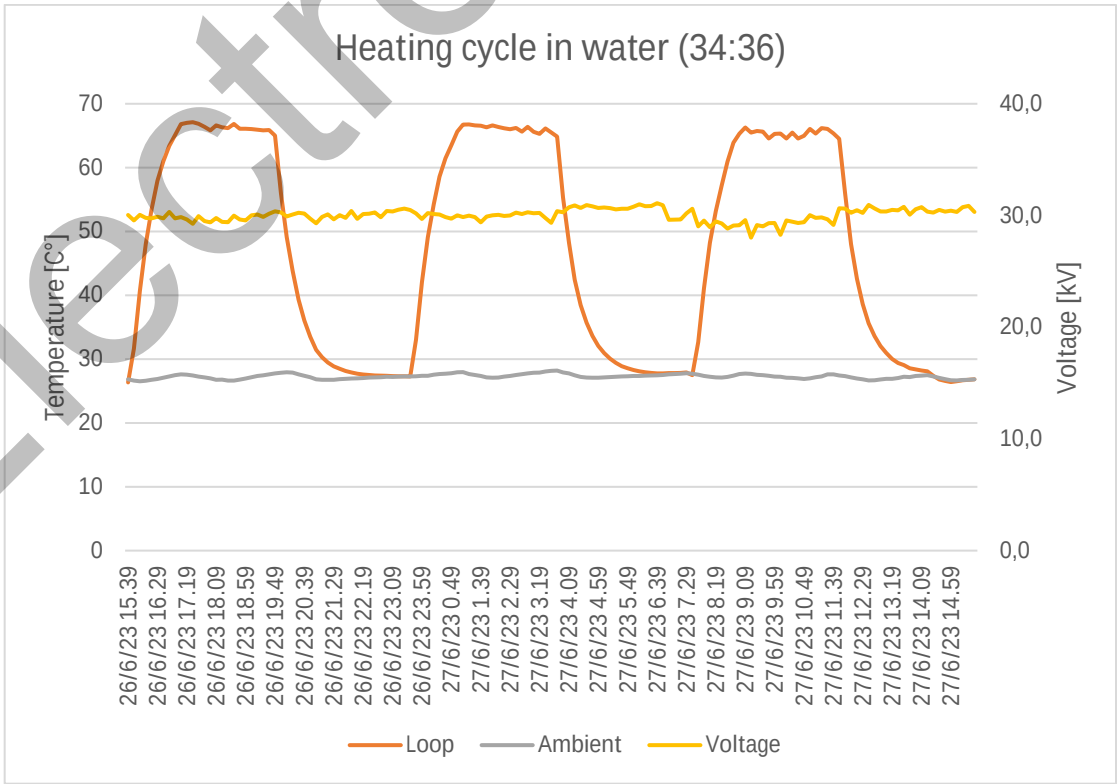


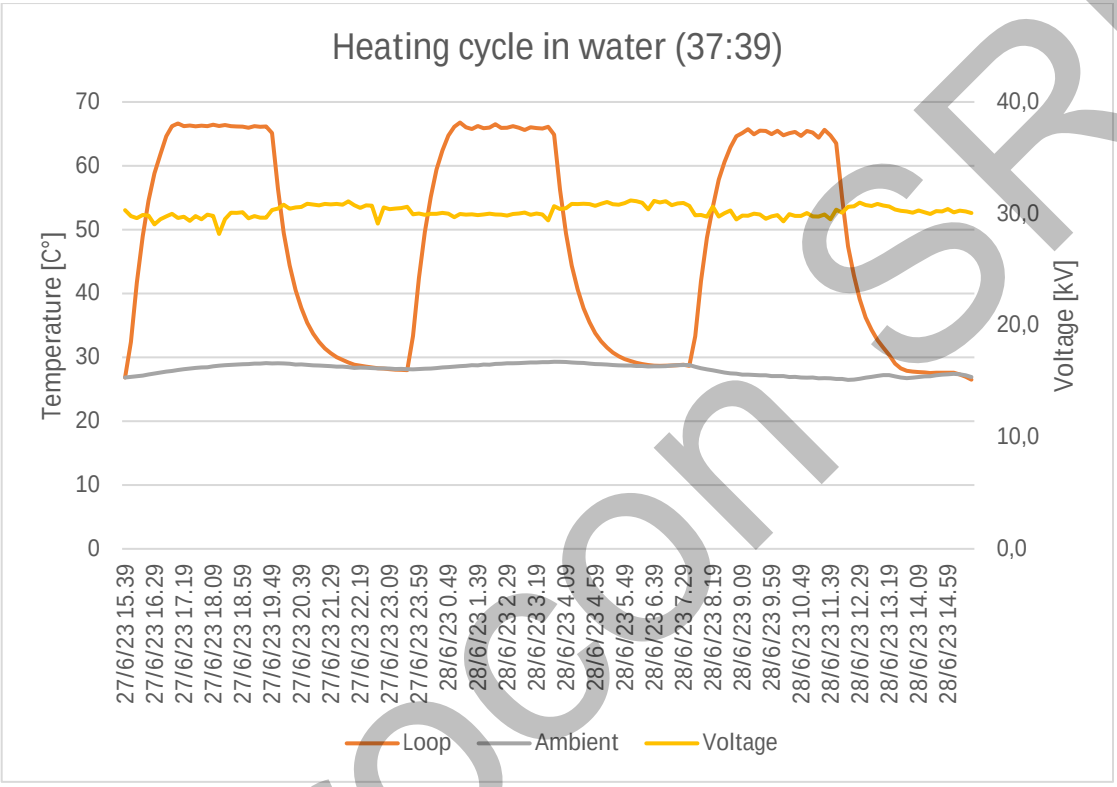


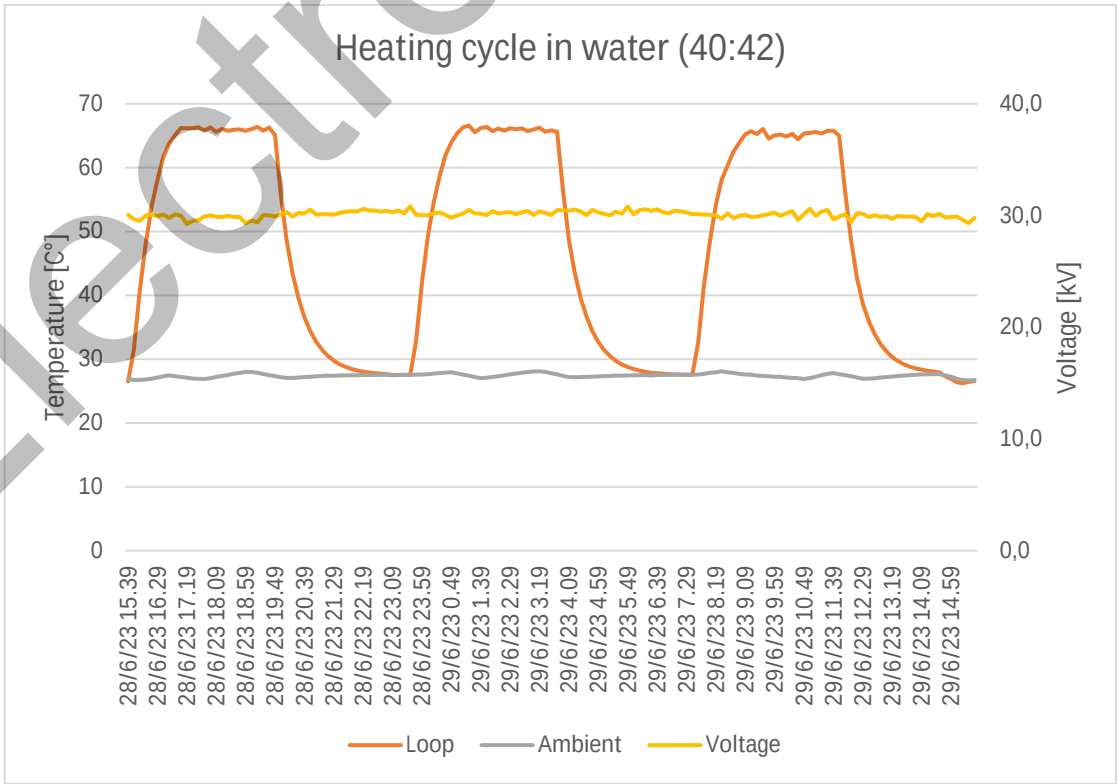


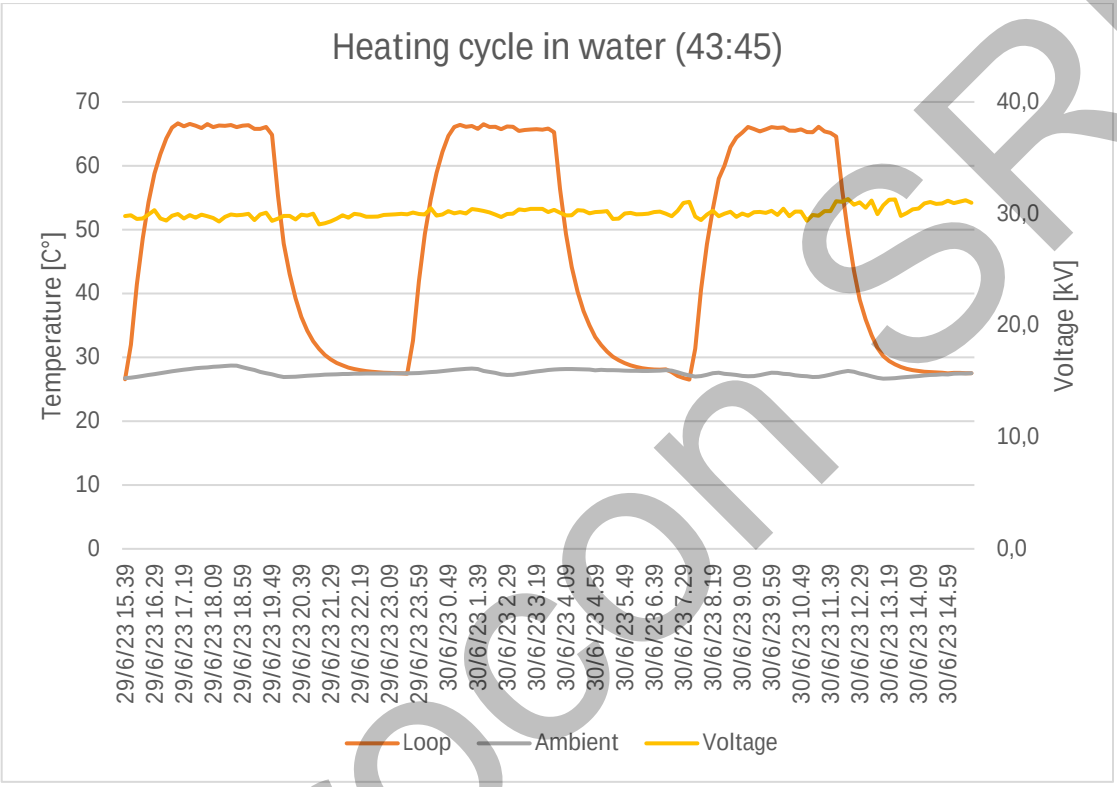


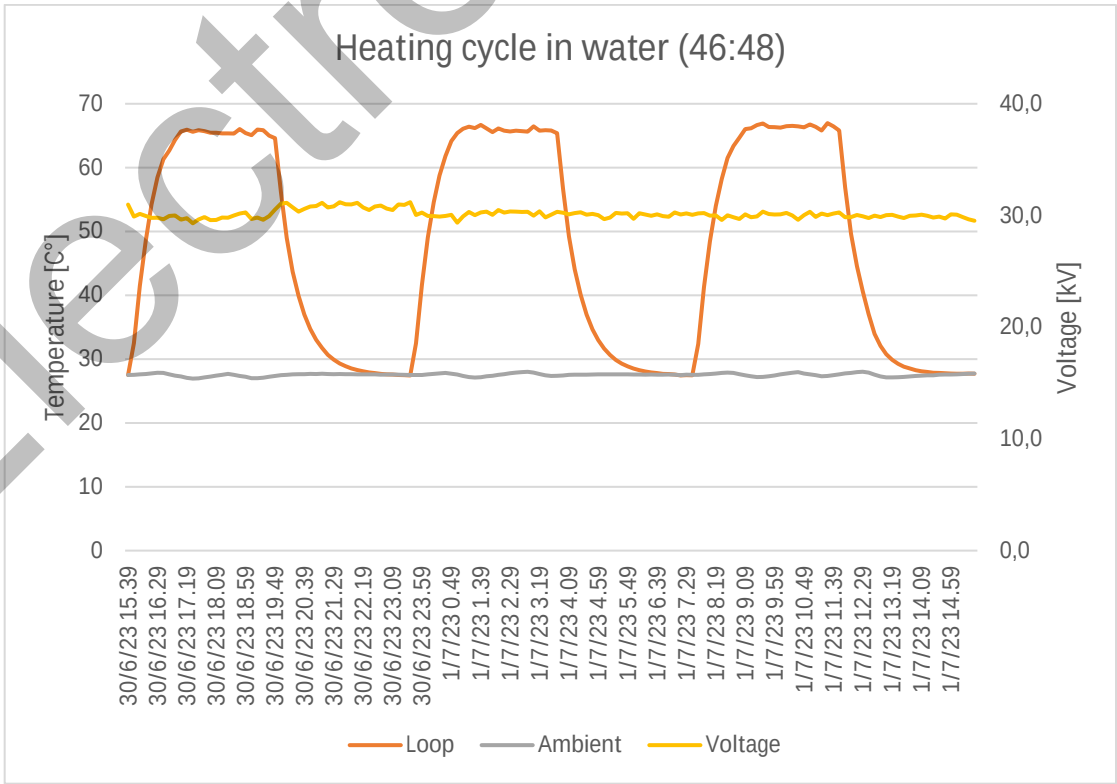


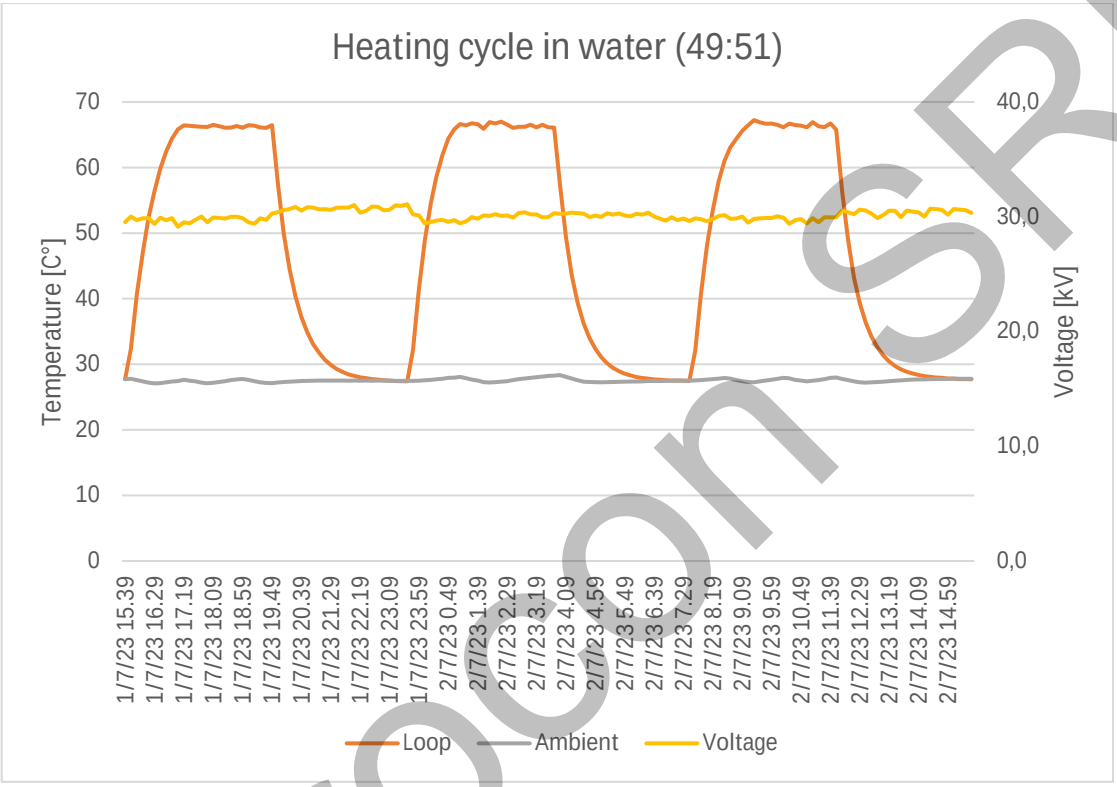


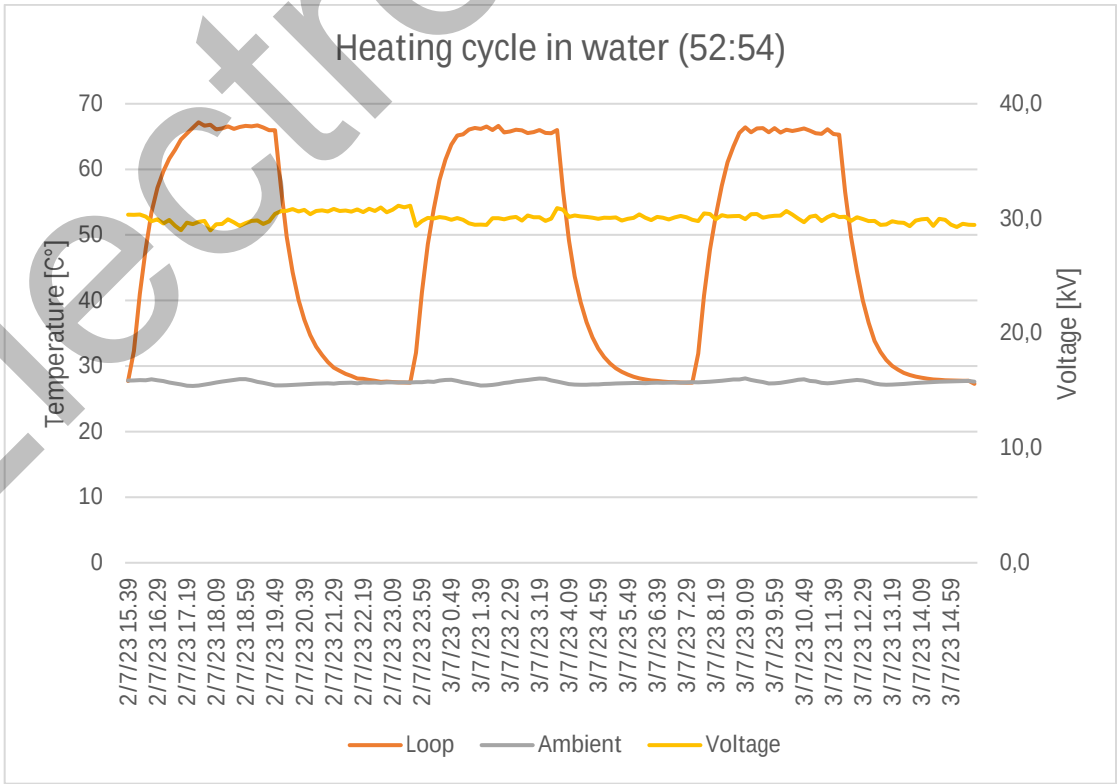


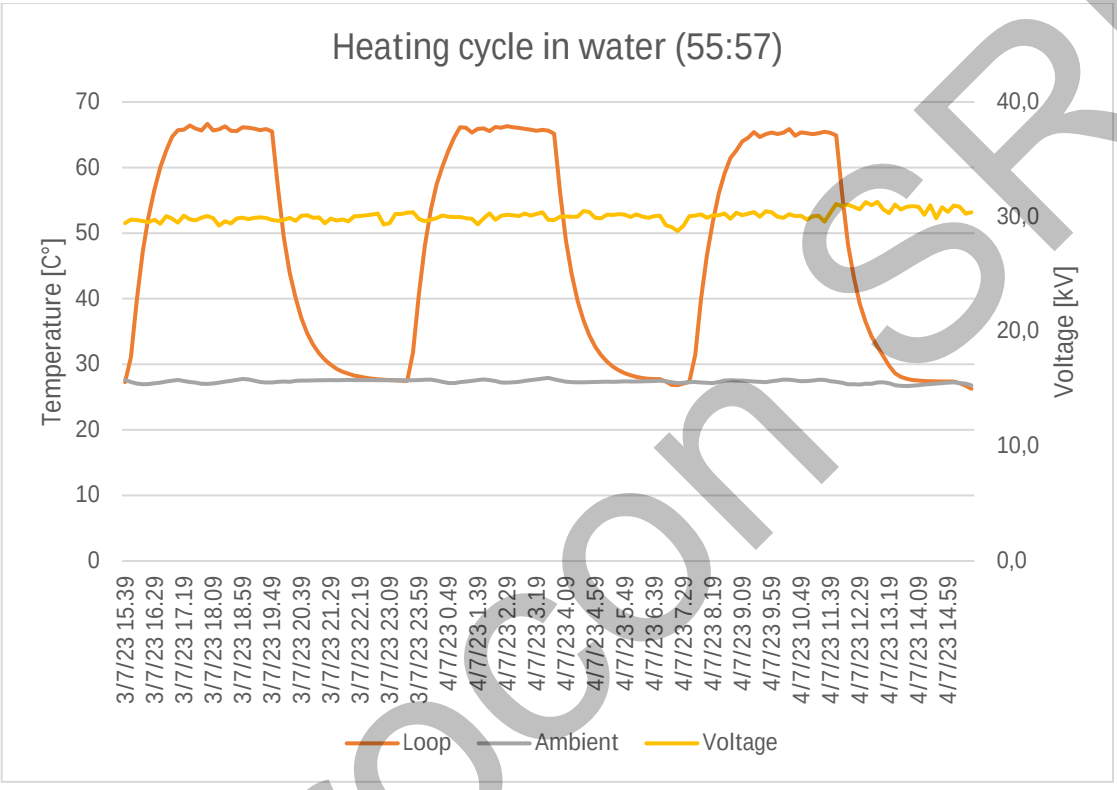


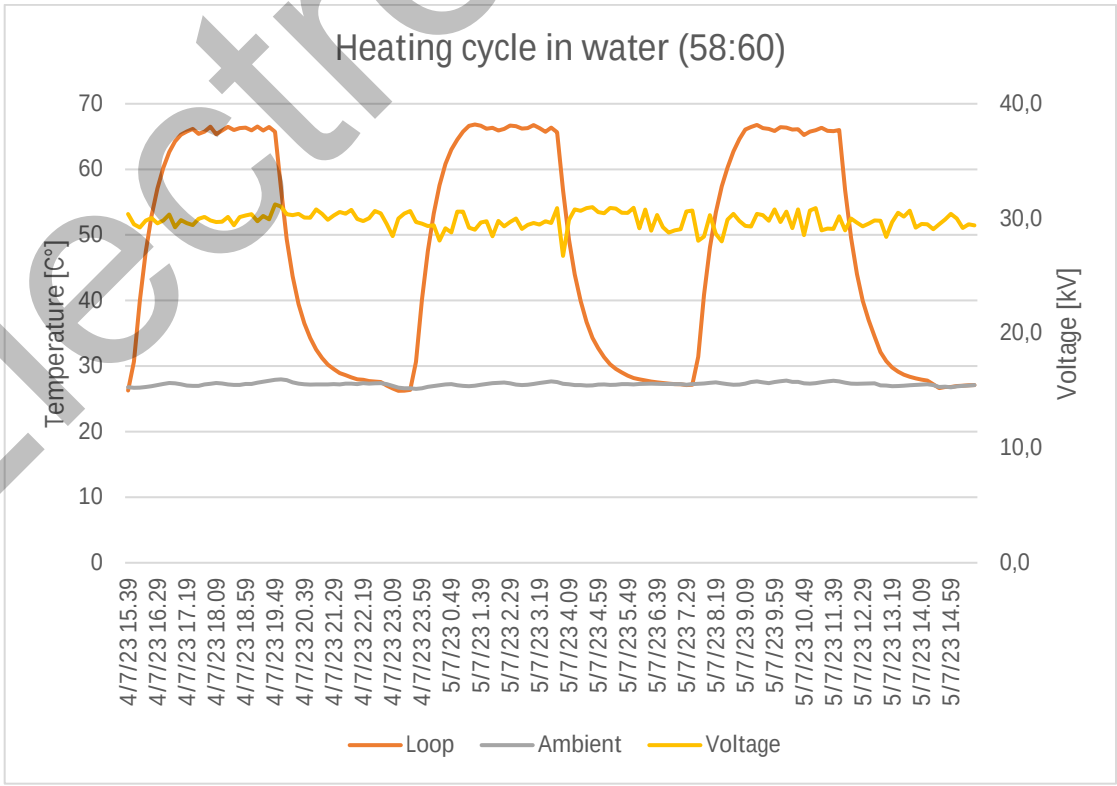


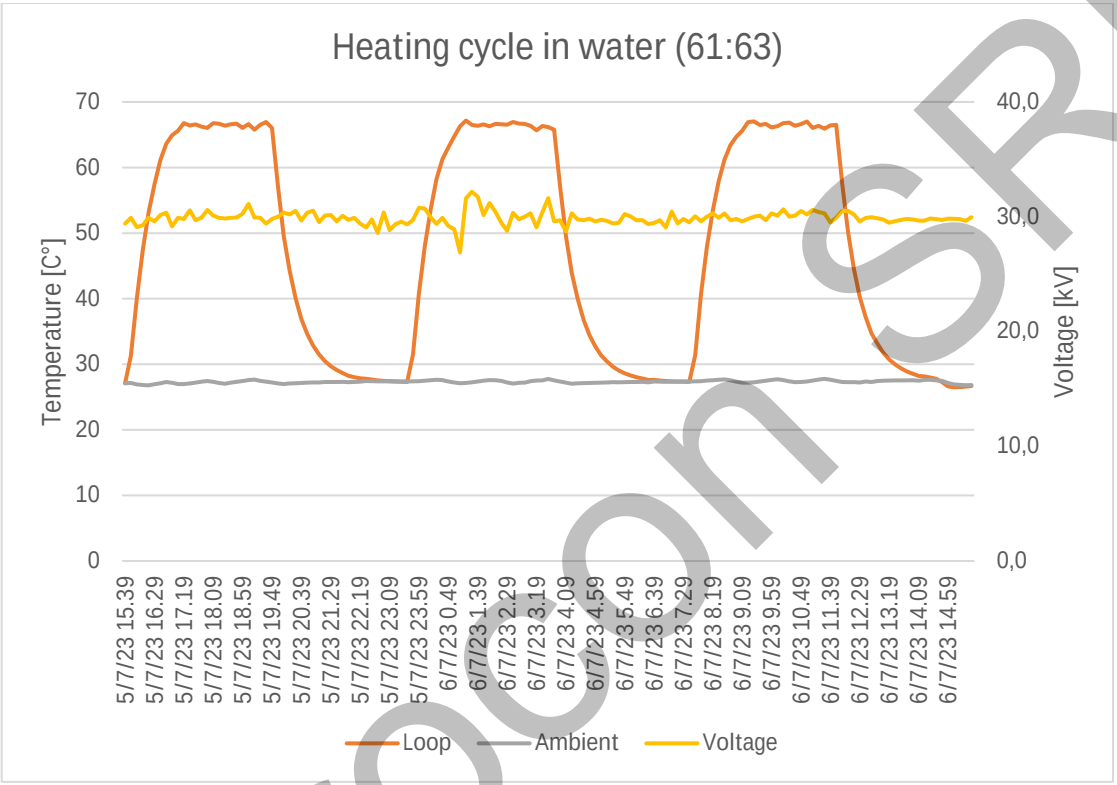












5. DISCONNECTION/CONNECTION

Five operations of disconnection/connection were performed on the separable connector with no visible damage to contact. The photos of different operations are reported below.

Photo 6 – Disconnection/connection operations

6. PARTIAL DISCHARGE AT ELEVATED AND AMBIENT TEMPERATURE

6.1. Partial discharge at elevated temperature

To prepare for the test, the conductors were connected to form a loop and a current was induced to heat up the conductors and separable connectors. The current was adjusted to approximately 720 A to reach a stable temperature on the outer sheath (65 °C), equivalent to a conductor temperature of 5 K to 10 K above the maximum cable conductor temperature (90 °C) in normal operation for extruded insulation cables (with an ambient temperature of 20 °C).
Stabilization was achieved as soon as the temperature remained constant within 2 K for 2 hours.
Measurement points are the same of Table 2 and temperature values on the outer sheath of the loops in the last two hour are detailed in Table 7.
The value of partial discharge at elevated temperature are reported in Table 6.

	N. of thermocouple				
Time	**1 [°C]**	**2 [°C]**	**3 [°C]**	**4 [°C]**	**5 [°C]**
10/07/2023 14.20	67,2	67,3	66,5	67,2	27
10/07/2023 15.20	68	68,1	67,4	68,2	27,5
10/07/2023 16.20	68,1	68,2	67,5	68,1	27,5
ΔT @ 2h	0,9	0,9	1	0,9	-

Table 7 - Value in the last two hour

LOOP SI 01 - 04									
Date [dd/mm/yyyy]	Background noise [pC(S)]								
10/07/2023	3								
Test voltage [kV]	12	18	20	24	30	24	20	18	12
Partial discharge quantity [pC(S)]	3	3	5	8	120	6	5	4	4

Table 8 - Value of partial discharge at elevated temperature

Photo 7 - Test arrangement for partial discharge at elevated temperature

6.2. Partial discharge at ambient temperature

After partial discharge at elevated temperature the separable connectors are disconnected and left to decrease the temperature of conductor at the ambient temperature. Subsequently a partial discharge test was performed at ambient temperature on each loop individually. In photo 8 are shown the test arrangement.

LOOP SI 01									
Date [dd/mm/yyyy]	Background noise [pC(S)]								
10/07/2023	3								
Test voltage [kV]	12	18	20	24	30	24	20	18	12
Partial discharge quantity [pC(S)]	3	3	5	7	100	9	5	4	3

LOOP SI 02									
Date [dd/mm/yyyy]	Background noise [pC(S)]								
10/07/2023	2								
Test voltage [kV]	12	18	20	24	30	24	20	18	12
Partial discharge quantity [pC(S)]	2	2	2	4	8	3	2	2	2

LOOP SI 03									
Date [dd/mm/yyyy]	Background noise [pC(S)]								
10/07/2023	3								
Test voltage [kV]	12	18	20	24	30	24	20	18	12
Partial discharge quantity [pC(S)]	3	3	4	6	60	7	4	3	3

LOOP SI 04									
Date [dd/mm/yyyy]	Background noise [pC(S)]								
10/07/2023	4								
Test voltage [kV]	12	18	20	24	30	24	20	18	12
Partial discharge quantity [pC(S)]	4	4	4	4	5	4	4	4	4

Photo 8 - Test arrangement of partial discharge at ambient temperature

7. IMPULSE VOLTAGE TEST AT AMBIENT TEMPERATURE

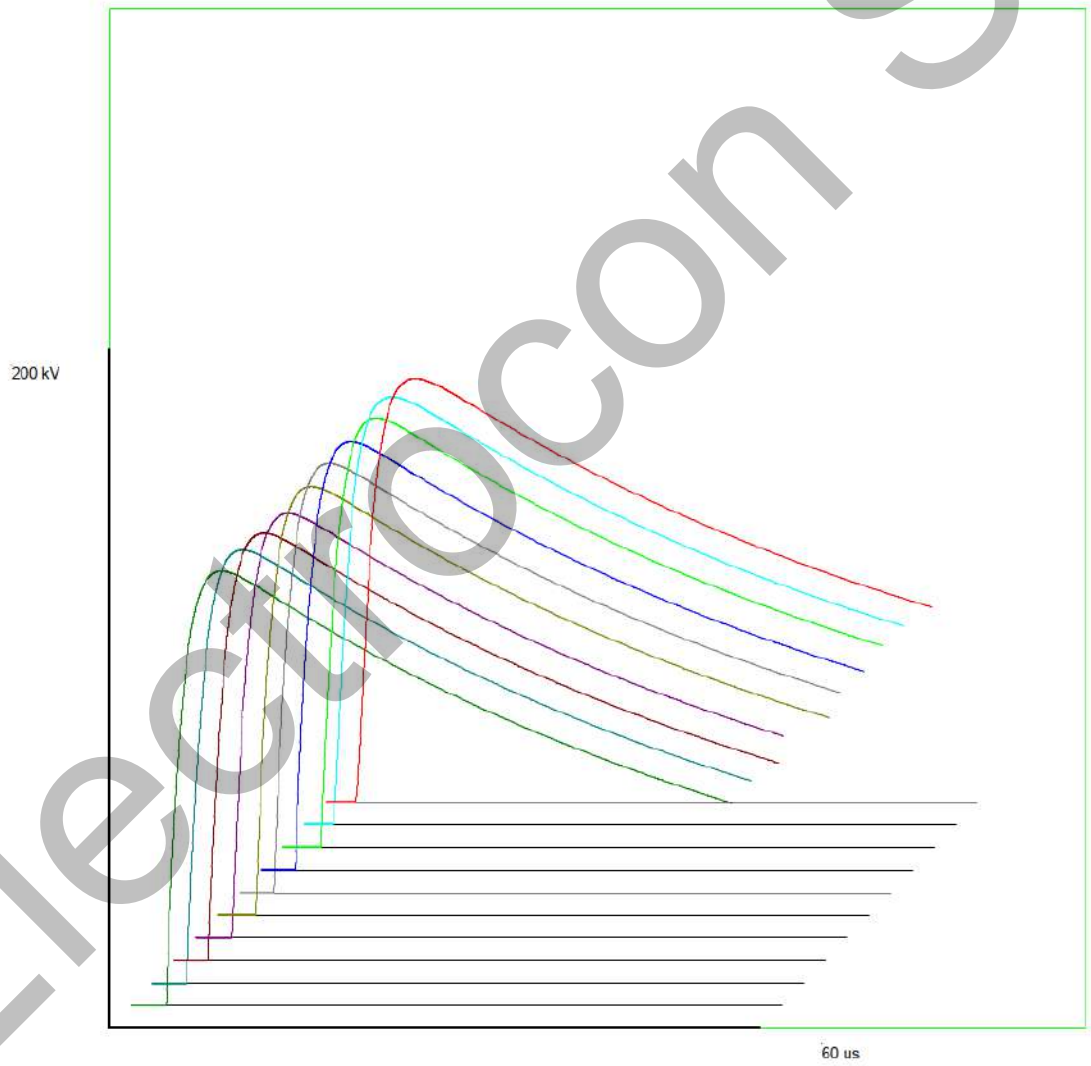
After partial discharge, all loops 01-02-03-04 underwent an impulse voltage test, consisting of 10 negative and 10 positive impulses at a peak voltage of 125 kV.
Test circuit is the same of the impulse voltage test performed before the heating cycle voltage test (Figure 2) and was arranged as shown in photo 9.
Oscillograms of the test are provided on the following pages.

Photo 9 - Test arrangement for impulse voltage test at ambient temperature

7.1. Oscillograms

11/07/2023 15:34:25 - Converter: TEKTRONIX,TDS3012C - Channel: 1
Optimized Impulses - Scale Factor = 6097

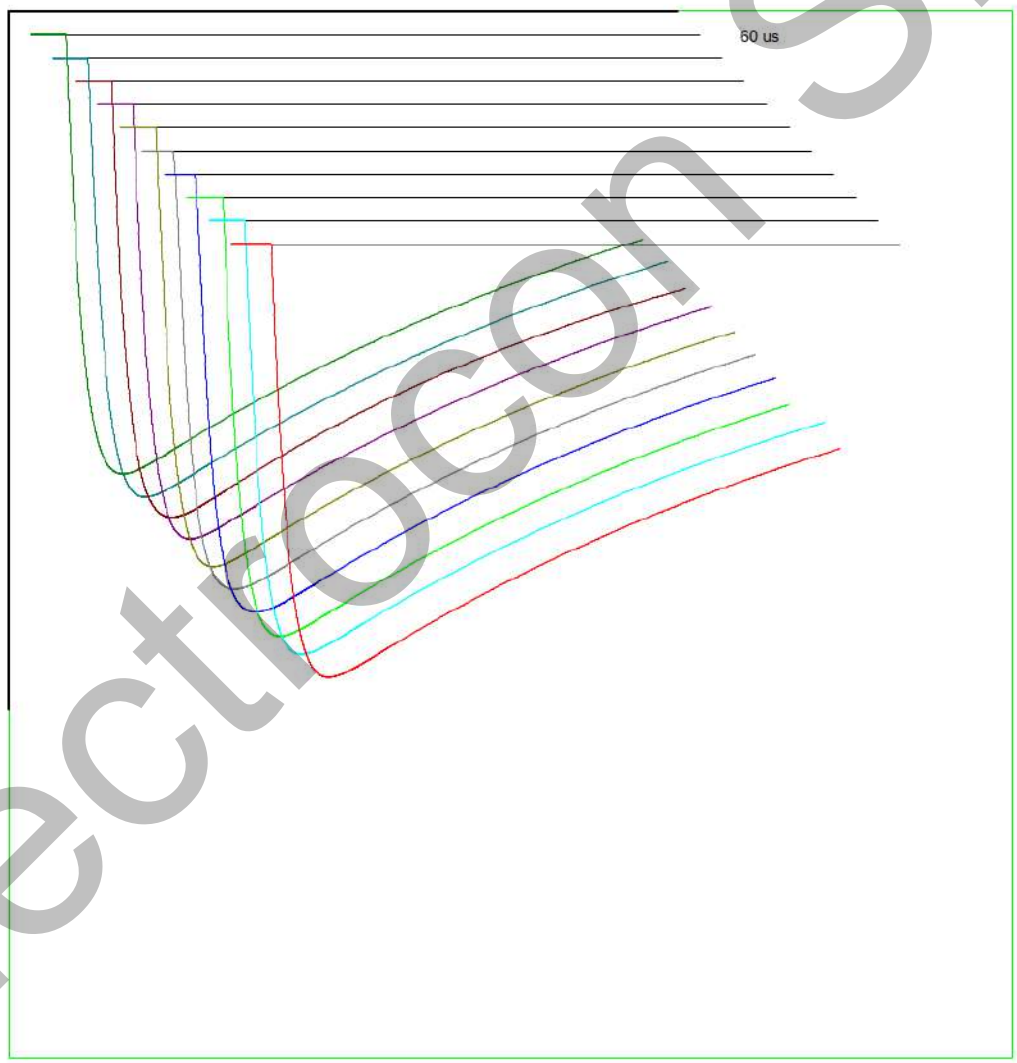
	Mean Value	Dev Std Abs	Dev Std %	
t1 [0.84-1.56] (us)	3,51	4,35E-02	1,24E+00	[10]
t2 [40-60] (us)	48,486	3,40E-02	7,01E-02	[10]
Vp (kV)	126,14	1,02E+00	8,05E-01	[10]



n.	Vp (kV)
1)	127,98
2)	127,47
3)	125,75
4)	124,89
5)	126,17
6)	126,30
7)	125,95
8)	126,35
9)	125,88
10)	124,64

11/07/2023 15:14:10 - Converter: TEKTRONIX,TDS3012C - Channel: 1
Optimized Impulses - Scale Factor = 6097

	Mean Value	Dev Std Abs	Dev Std %	
t1 [0.84-1.56] (us)	3,52	5,15E-02	1,46E+00	[10]
t2 [40-60] (us)	48,216	2,22E-01	4,60E-01	[10]
Vp (kV)	-125,26	6,86E-01	5,48E-01	[10]



n.	Vp (kV)
1)	-125,93
2)	-125,89
3)	-125,00
4)	-124,56
5)	-125,84
6)	-125,65
7)	-125,55
8)	-125,72
9)	-124,27
10)	-124,22

8. DRY AC VOLTAGE TEST

All loops (01-02-03-04) were together submitted to a dry AC voltage test at 4,5 U_0 (54 kV) with positive result (no puncture neither surface discharges occurred during the test). The test circuit was the same of dry AC voltage test (Figure 1) and was arranged as shown in Photo 10 .

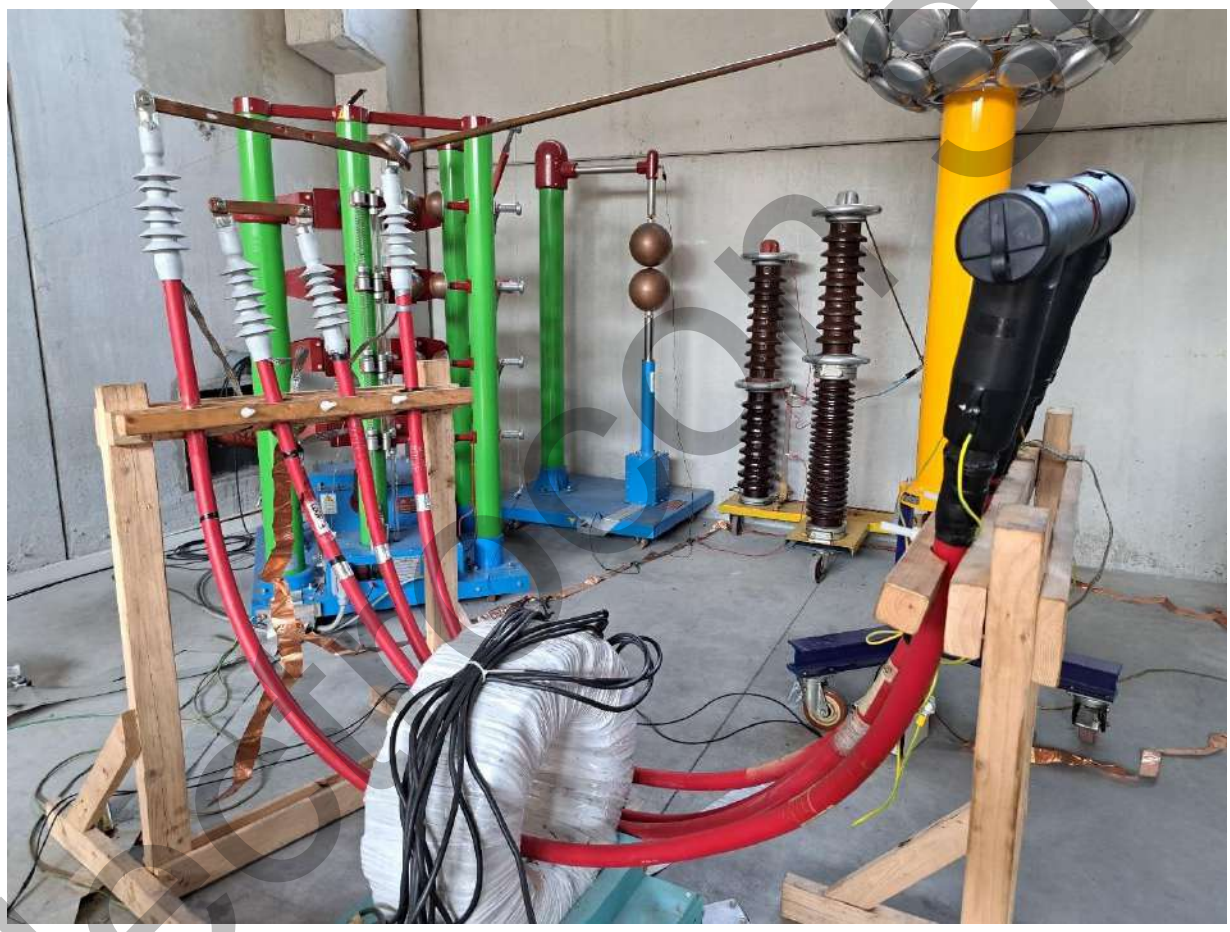


Photo 10 - Test arrangement for dry AC voltage test

9. PARTIAL DISCHARGE AT AMBIENT TEMPERATURE

According to HD 629-1 table 12 sequence D1, partial discharge at ambient temperature were performed on each loop individually. The test arrangement is the same of photo 8. Below the result of partial discharge test are reported.

LOOP SI 01									
Date [dd/mm/yyyy]	Background noise [pC(S)]								
13/07/2023	4								
Test voltage [kV]	12	18	20	24	30	24	20	18	12
Partial discharge quantity [pC(S)]	4	4	7	9	155	8	6	4	4

LOOP SI 02									
Date [dd/mm/yyyy]	Background noise [pC(S)]								
11/07/2023	2								
Test voltage [kV]	12	18	20	24	30	24	20	18	12
Partial discharge quantity [pC(S)]	2	2	3	5	10	4	3	2	2

LOOP SI 03									
Date [dd/mm/yyyy]	Background noise [pC(S)]								
12/07/2023	3								
Test voltage [kV]	12	18	20	24	30	24	20	18	12
Partial discharge quantity [pC(S)]	3	4	4	7	70	7	5	4	4

LOOP SI 04									
Date [dd/mm/yyyy]	Background noise [pC(S)]								
13/07/2023	4								
Test voltage [kV]	12	18	20	24	30	24	20	18	12
Partial discharge quantity [pC(S)]	4	4	4	4	6	4	4	3	3

10. VISUAL EXAMINATION

Accessory was dismantled by the manufacturer and the different components of the accessory was examined to identify any abnormalities. The result of examination is the following:

- Presence of water or moisture not detected;
- Presence of corrosion on connection not detected;
- Electrical degradation in primary insulation of accessory and cable not detected;
- Crack, split, leakage of insulation material not detected;
- Change in dimensions not detected.

The photos of visual inspection are reported below.

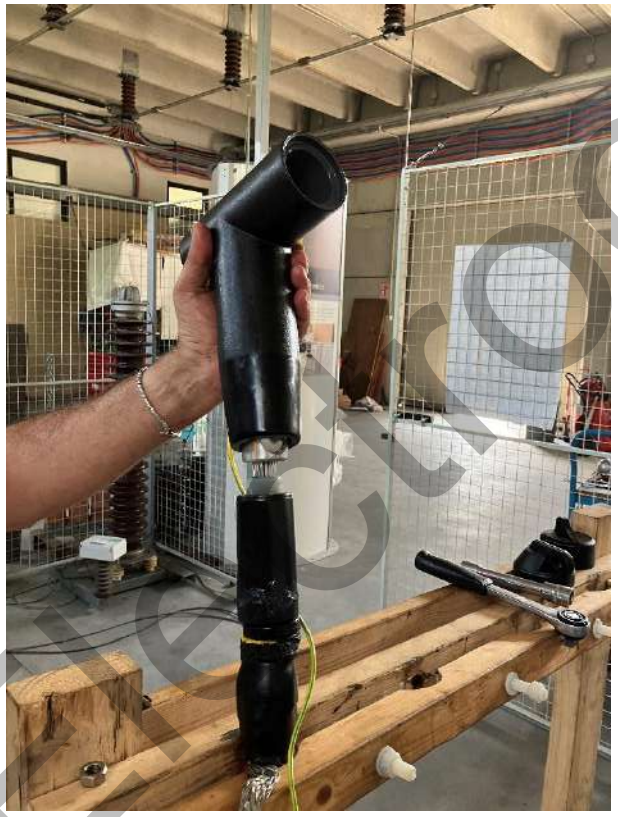


Photo 11 - Body removal

Photo 12 – Connector

Photo 13 – Connector

Photo 14 - Adapter

Photo 15 - Insulation material

Photo 16 - Insulation material

Photo 17 – Adapter

Photo 18 - Body

11. LIST OF INSTRUMENTS USED

Test performed	Quantity	Measure chain tag	Uncertainty
Dry AC voltage test	Voltage	PT 865+MU116	2,5 %
Partial discharge test	Partial discharge quantity	CA 018 / AN 04	0,1 pC / 2 pC
Impulse voltage test	Voltage	CM 878	3,0 %
Heating cycle voltage test	Voltage	TV 855+MU857	2,5 %
	Temperature	TE 003AT	2,0 °C
	Current	TA 018 + MU 116	2,0%

Decision rule: if in the present Test Report a declaration of conformity/non conformity to any test requirements would be stated, the declaration itself would be issued according to values measured during the test, not considering the above mentioned uncertainty of the measure.

END OF THE REPORT

ELCONEXT

Istruzioni di Montaggio

TERMINALE UNIPOLARE DI TIPO SCONNETTIBILE A CONO ESTERNO A "T" ASIMMETRICO "INTERFACCIA C" - 630 A con tappo isolante e capocorda con viti a rottura

per cavo M.T. con isolante estruso schermato con fili di rame o tubo di alluminio

Tensione massima di esercizio: Umax 24 kV

ELCON MEGARAD S.p.A.
SEDE E STABILIMENTO: ARCELLA (AV) ITALY
Tel. +39 0825/6077 – Fax +39 0825/607782
Sito Web: www.elconmegarad.com e-mail: elcon@elconmegarad.com

DISEGNO N°	Codice MP22253	Disegnato	Revisione	Approvato
1008OM K1-W-A	Data di emissione	30/12/2022 Ed. 1 Rev. 0	02/05/2023 Ed. 1 Rev. 1	
	Autore	LR.	ER.	M.R./ G.D.S.

INFORMAZIONI GENERALI

* **L'installazione di questo prodotto deve essere eseguito solo da personale qualificato all'utilizzo di apparecchiature elettriche di alta tensione.**
* **Leggere attentamente le istruzioni di montaggio prima di dare inizio alle operazioni di preparazione del cavo.**
* **Controllare che il corredo contenga tutti i componenti elencati nella distinta.**
* **La temperatura durante il montaggio deve essere compresa tra 0 ° C e 40 ° C nel caso in cui la temperatura non rispetta l'intervallo sopra indicato, il kit deve essere posto in un ambiente condizionato, ad esempio nella cabina di un automezzo nella quale deve essere garantita una temperatura adeguata.**

NOTE PER L'APPLICAZIONE DEI BODY AUTORETRAIBILI

* Prima di infilare il body sul cavo verificare la corretta posizione del tratto di spirale svolto secondo le indicazioni che verranno fornite più avanti.
* Svolgere le spirali tirandole e ruotandole secondo il senso indicato, non invertire mai il senso di rotazione.
* Prestare attenzione affinché il tratto di spirale svolto non vada a stringere sul cavo stesso.

ATTREZZATURA OCCORRENTE

* Utensili per taglio guaina esterna e schermo tubo Al nei cavi in XLPE o HPTE - unificazione ENEL tab. EA 0443 o EA 0531;
* spella semiconduttore per cavo isolato in HEPR - unificazione ENEL tab. EA 0093;
* spella semiconduttore per cavo isolato in XLPE o HPTE - unificazione ENEL tab. EA 0094;
* spella cavi per l'isolante di cavi per media tensione - unificazione ENEL tab. EA 0104;
* utensile per l'applicazione delle fascette metalliche a nastro - unificazione ENEL tab. EA 0402;
* attrezzo di supporto per l'installazione del capocorda - unificazione ENEL tab. EA 0536;
* chiave dinamometrica con bussola lunga e prolunga con [chiave da 19/21/22/24];
* pressa oleodinamica 45 kN - unificazione ENEL tab. EA 0392;

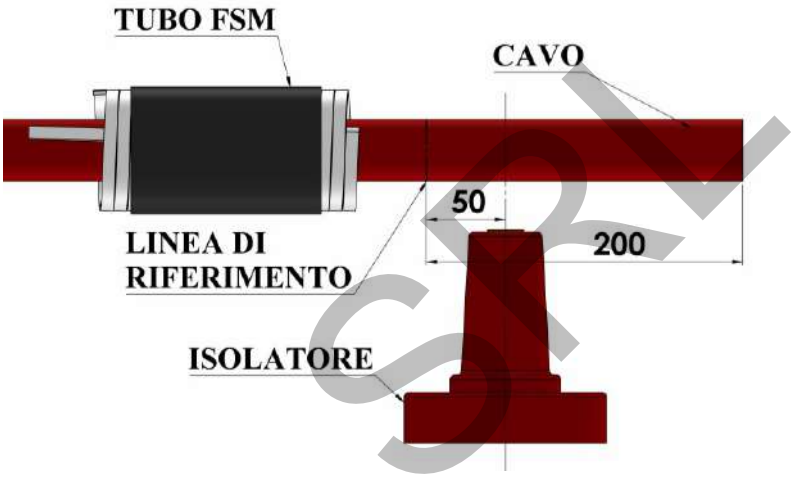
I codici QR inseriti nelle pagine seguenti si collegano ai video contenuti nella piattaforma WEB e che rappresentano le fasi principali di montaggio così come descritto nelle istruzioni di montaggio.

Dopo aver ultimato l'installazione, raccogliere tutti i materiali di risulta e depositarli nei sacchetti che prima contenevano i componenti del kit e smaltirli secondo le norme vigenti.

ATTENZIONE: TUTTE LE APPARECCHIATURE **NON DEVONO ESSERE ENERGIZZATE** DURANTE L'INSTALLAZIONE O MANUTENZIONE.

1. PREPARAZIONE DEL CAVO SCHERMATO CON FILI DI RAME

1.1 Pulire la guaina esterna del cavo per almeno **0,5 m** mediante apposito solvente. Disporre il cavo nella sua posizione finale.
Fare attenzione affinché il cavo sia abbastanza lungo da permettere il movimento dello sconnettibile le azioni di connessione e sconnessione dall'isolatore.



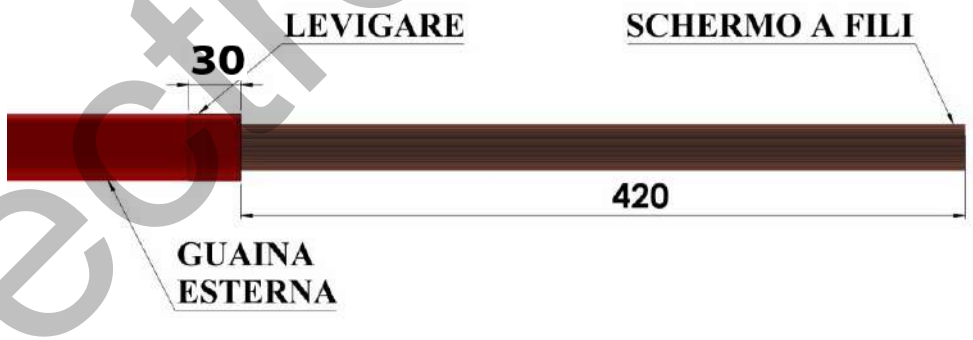
1.2 Infilare sul cavo il **tubo autoretraibile FSM** con la parte di spirale svolta rivolto verso la parte opposta della testa del cavo.

1.3 Segnare sulla guaina esterna una linea di riferimento alla distanza di **50 mm** dalla linea di mezzeria della presa a cono esterno (isolatore).

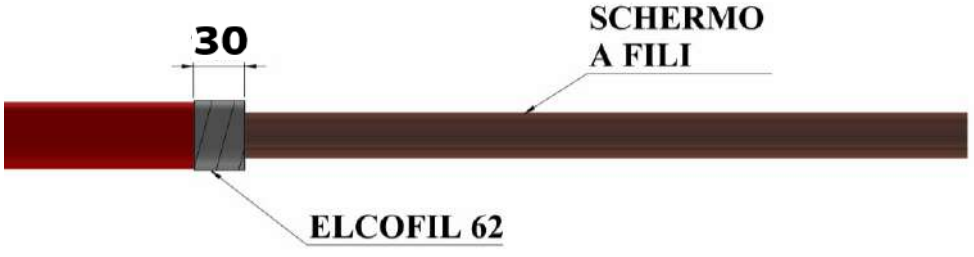
Note: Si consiglia di tagliare il cavo con un seghetto per evitare di farlo ovalizzare e quindi non permettere un corretto utilizzo dell'attrezzo spella-semiconduttore.

1.4 Tagliare il cavo alla distanza di **200 mm** dal segno effettuato, verso la estremità del cavo, eliminando la parte eccedente.

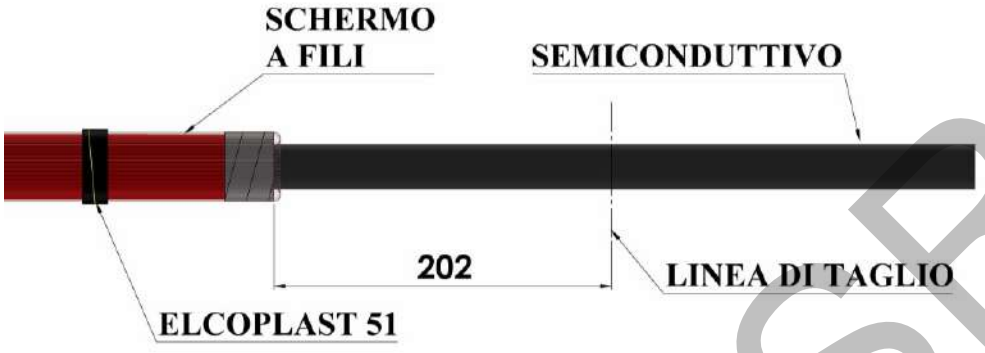
1.5 Asportare, utilizzando l'apposito attrezzo raffigurato (unificazione ENEL tab. EA 0531) la guaina esterna dalla testa del cavo per una lunghezza pari a **420 mm**.
Levigare con la tela abrasiva acclusa a corredo la guaina esterna per un tratto di **30 mm**.



1.6 Applicare sulla parte levigata della guaina esterna **(30 mm),** una nastratura con sormonto del 50%, di nastro di sigillatura **ELCOFIL 62**.



1.7 Rimuovere eventuali nastri metallici di contenimento. Non tagliare i fili dello schermo ma piegarli completamente all'indietro sulla guaina esterna fissandoli alla distanza di **100 mm** dal taglio guaina con alcuni giri di nastro **PVC ELCOPLAST 51**.
Asportare un tratto di cavo in modo da lasciarne esposto un tratto di **202 mm** dal bordo guaina esterna.



1.8 Asportare il semiconduttore in modo da lasciarne esposto un tratto di **44 mm** a partire dal taglio della guaina esterna del cavo. Tale operazione va fatta mediante i seguenti attrezzi conformi secondo unificazione ENEL.

- Per cavi isolati in HEPR (gomma etilen-propilenica qualità G7) utilizzare l'attrezzo raffigurato, unificazione ENEL tab. EA 0093.

- Per cavi isolati in XLPE (polietilene reticolato) utilizzare l'attrezzo raffigurato, unificazione ENEL tab. EA 0094.

1.9 Asportare l'isolante dall'estremità del cavo per una lunghezza pari alla **profondità capocorda + 5 mm**, in modo da esporre il conduttore prestando attenzione a non inciderlo. Effettuare un lieve smusso sull'estremità dell'isolante del cavo. Eliminare dal conduttore eventuali bave o punte ed applicare provvisoriamente sull'estremità qualche passata di nastro **PVC ELCOPLAST 51**.

- L'operazione di asportazione dell'isolante va effettuata utilizzando l'attrezzo raffigurato, unificazione ENEL tab. EA 0104.

1.10 Asportare eventuali tracce di semiconduttore o irregolarità levigando l'isolante del cavo con la **tela abrasiva** acclusa a corredo. Tale operazione deve essere effettuata fino a rendere l'isolante liscio ed esente da difetti causati dall'attrezzo. Pulire l'isolante del cavo mediante la **salvietta detergente** fornita a corredo, procedendo dal conduttore verso il semiconduttore, per evitare di trascinare particelle semiconduttive sull'isolante, se necessario pulire anche il semiconduttore prestando attenzione a non toccare l'isolante pulito in precedenza.

ATTENZIONE: continuare le operazioni, solo dopo che ogni traccia di solvente adoperato per la pulizia dell'isolante primario sia evaporato!

NOTA IMPORTANTE
PRIMA DI CONTINUARE LE OPERAZIONI DI INSTALLAZIONE, VERIFICARE LE DIMENSIONI DI PREPARAZIONE CAVO UTILIZZANDO LA DIMA DI CONTROLLO FORNITA NEL KIT.

- **Se le dimensioni sono corrette, continuare l'installazione secondo le istruzioni che seguono, in caso contrario apportare le opportune correzioni.**

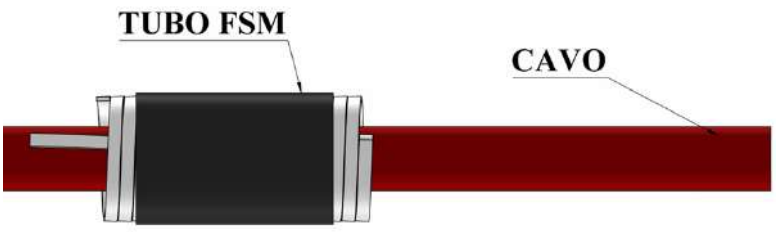
1.11 Applicare una nastratura, con sormonto del 50% di **ELCOFIL 62**, sul bordo della guaina esterna per una lunghezza di **35 mm**.

1.12 Applicare la **FASCETTA DI POSIZIONAMENTO** sullo strato semiconduttivo in corrispondenza della fine della nastratura di **ELCOFIL 62**, come mostrato nella figura seguente.

2. PREPARAZIONE DEL CAVO SCHERMATO CON TUBO DI ALLUMINIIO

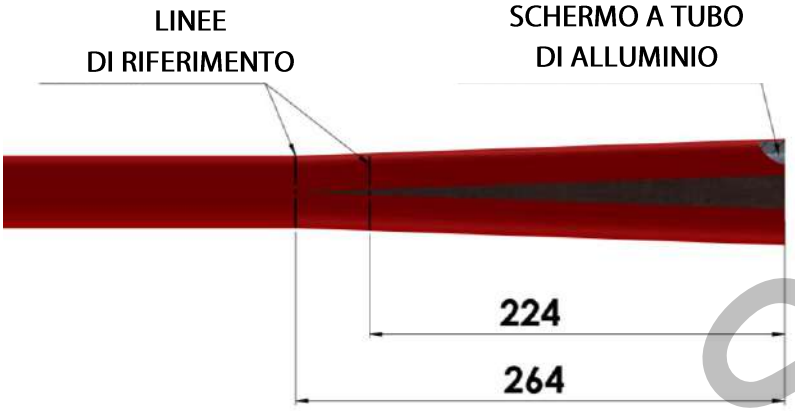
2.1 Pulire la guaina esterna del cavo per almeno **0,5 m** mediante apposito solvente. Disporre il cavo nella sua posizione finale.
Fare attenzione affinché il cavo sia abbastanza lungo da permettere il movimento dello sconnettibile le azioni di connessione e sconnessione dall'isolatore.

2.2 Infilare sul cavo il tubo **auto retraibile FSM** con la parte di spirale svolta rivolta verso la parte opposta della testa del cavo.



2.3 Fare due segni di riferimento sulla guaina esterna del cavo come segue:
1° linea di riferimento relativa al taglio della guaina esterna, ad una distanza di **224 mm** dall'estremità del cavo.
2° linea di riferimento relativa al posizionamento della piastra di terra, ad una distanza di **264 mm** dall'estremità del cavo.

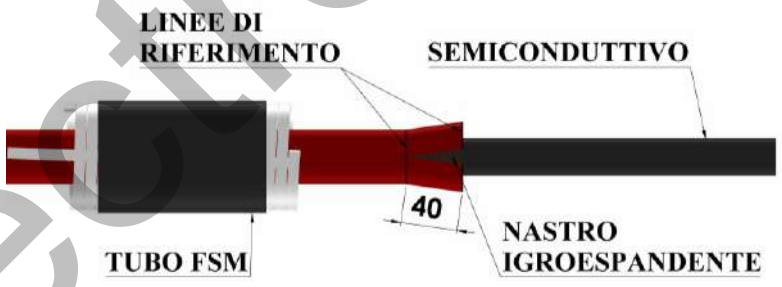
2.4 Utilizzando l'apposito attrezzo raffigurato (unificazione ENEL tab. EA 0443 o EA 0531), effettuare sulla guaina esterna/schermo Al tre tagli longitudinali a 120° per la lunghezza pari a **264 mm** dall'estremità del cavo.



2.5 Divaricare opportunamente le tre parti della guaina esterna/schermo Al e verificare che la **piastra di terra** entri completamente senza particolare sforzo.

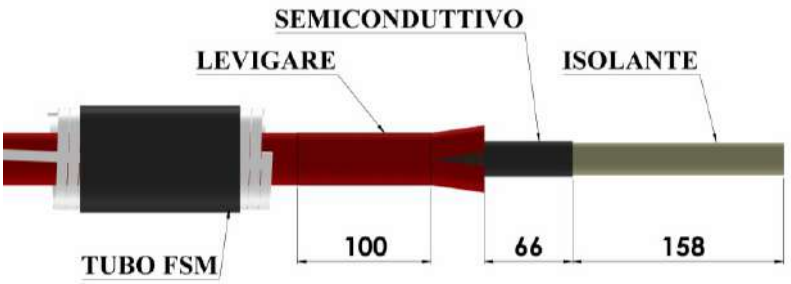
2.6 Rimuovere temporaneamente la piastra di terra dall'area di lavoro e rimuovere la guaina esterna protettiva tagliandola in prossimità della **1° linea di riferimento** con le forbici da elettricista.

2.7 Rimuovere la **nastro igro-espandente** fino al bordo del taglio della guaina esterna.



2.8 Levigare la guaina esterna del cavo con la tela abrasiva inclusa nel kit per una distanza di **100 mm**.

2.9 Rimuovere il semiconduttore, utilizzando l'attrezzo raffigurato (unificazione ENEL tab. EA 0094), in modo da lasciare scoperto un tratto di **66 mm** a partire dal taglio guaina.

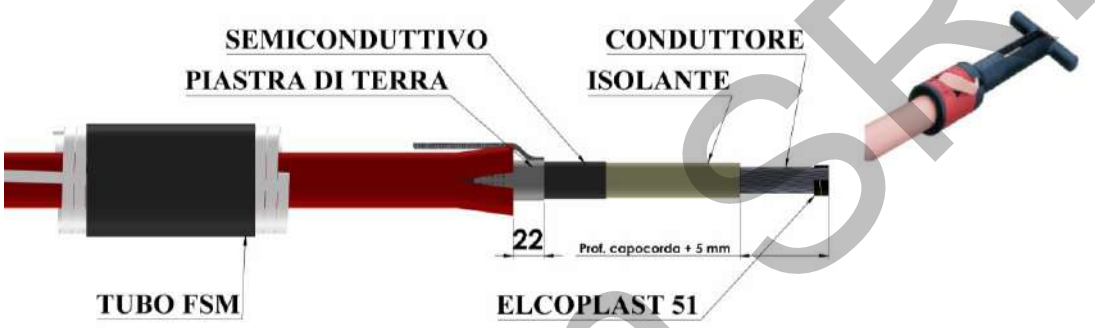


2.10 Inserire la **piastra di terra** tra la guaina igro-espandente e lo schermo in alluminio lasciando una zona di circa **22 mm** a vista.

2.11 Asportare l'isolante dall'estremità del cavo per una lunghezza pari alla **profondità capocorda + 5 mm**, in modo da esporre il conduttore prestando attenzione a non inciderlo. Effettuare un lieve smusso sull'estremità dell'isolante del cavo. Eliminare dal conduttore eventuali bave o punte ed applicare provvisoriamente sull'estremità qualche passata di nastro **PVC ELCOPLAST 51.**

2.12 Asportare eventuali tracce di semiconduttore o irregolarità levigando l'isolante del cavo con la **tela abrasiva** acclusa a corredo. Tale operazione deve essere effettuata fino a rendere l'isolante liscio ed esente da difetti causati dall'attrezzo. Pulire l'isolante del cavo mediante la **salvietta detergente** fornita a corredo, procedendo dal conduttore verso il semiconduttore, per evitare di trascinare particelle semiconduttive sull'isolante, se necessario pulire anche il semiconduttore prestando attenzione a non toccare l'isolante pulito in precedenza.

ATTENZIONE: <u>continuare le operazioni, solo dopo che ogni traccia di solvente adoperato per la pulizia dell'isolante primario sia evaporato!</u>

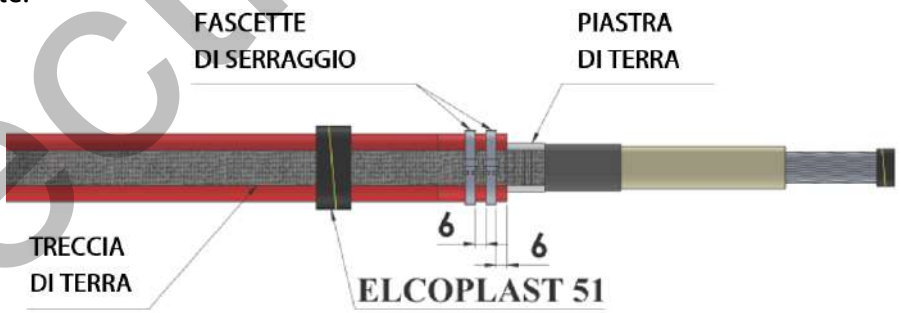


NOTA IMPORTANTE
PRIMA DI CONTINUARE LE OPERAZIONI DI INSTALLAZIONE, VERIFICARE LE DIMENSIONI DI PREPARAZIONE CAVO UTILIZZANDO LA DIMA DI CONTROLLO FORNITA NEL KIT.

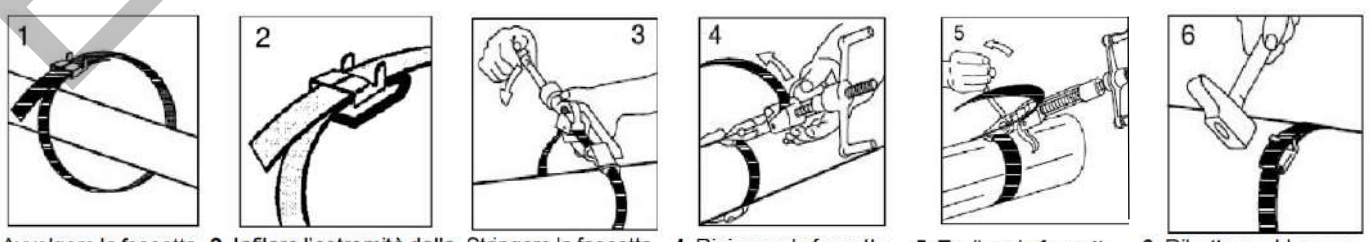
- **Se le dimensioni sono corrette, continuare l'installazione secondo le istruzioni che seguono, in caso contrario apportare le opportune correzioni.**

2.13 Fissare la treccia di terra al cavo con alcune passate di **ELCOPLAST 51**. Ribattere la guaina esterna / schermo Al sulla piastra di terra, in modo da ottenere un primo provvisorio compattamento, quindi applicare a circa **6 mm** dal bordo guaina esterna, la prima fascetta di serraggio avvolgendola intorno al cavo. Stringere a fondo la fascetta utilizzando l'utensile di serraggio (unificazione ENEL tab. EA 0402) raffigurato in figura e seguendo le relative istruzioni di utilizzo. **Tale operazione è fondamentale in quanto è l'unico contatto elettrico fra gli schermi e pertanto percorso dalle correnti di guasto oltre che dalle correnti parassite.**

2.14 Applicare la seconda fascetta di serraggio a circa **6 mm** dalla prima ed eseguire le stesse operazioni sopra descritte.

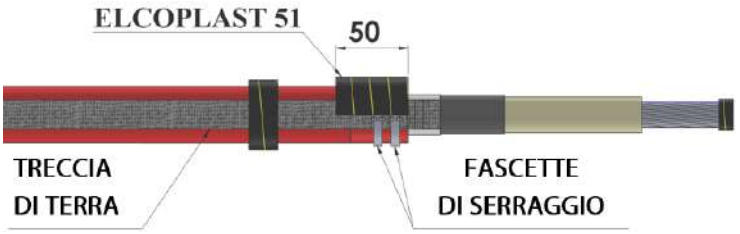


-- ISTRUZIONI PER L'APPLICAZIONE DELLE FASCETTE DI SERRAGGIO

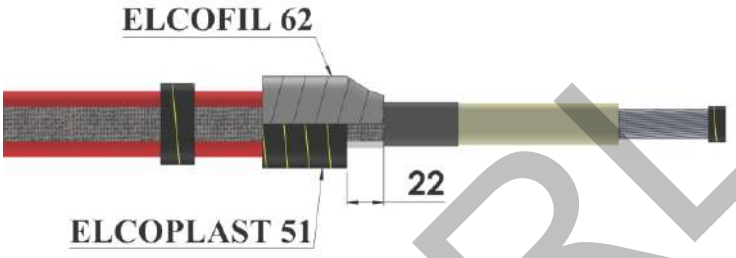


1. Avvolgere la fascetta sul cavo. 2. Infilare l'estremità della fascetta nella graffetta. Stringere la fascetta. 4. Ripiegare la fascetta. 5. Tagliare la fascetta. 6. Ribattere e bloccare la fascetta.

2.15 Coprire le fascette di serraggio e il taglio guaina con una nastratura di nastro in pvc **ELCOPLAST 51** per una lunghezza di **50 mm** dal taglio guaina.



2.16 Applicare una nastratura di **ELCOFIL 62** fino a ricoprire completamente la nastratura di ELCOPLAST 51 e la piastra di terra.



2.17 Applicare la **fascetta di posizionamento** sullo strato semiconduttivo all'estremità della nastratura **ELCOFIL 62**, come mostrato in figura.

3. INSTALLAZIONE DELL'ADATTATORE – OPERAZIONI COMUNI -

Verificare il diametro sull'isolante del cavo per poi selezionare l'adattatore giusto da applicare. Il range di applicabilità è indicato sia sull'etichetta della confezione che contiene l'adattatore che sulla distinta componente allegata a queste istruzioni di montaggio.
Nel caso in cui il diametro sull'isolante permette l'utilizzo di entrambi gli adattatori è sempre preferibile utilizzare quello con diametro minore.

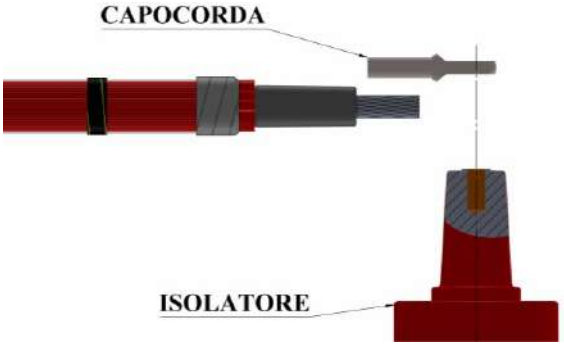
3.1 Indossare i guanti inclusi nel kit e lubrificare l'isolante, il semiconduttore e la parte interna dell'adattatore mediante l'**ELCOIL 21**.

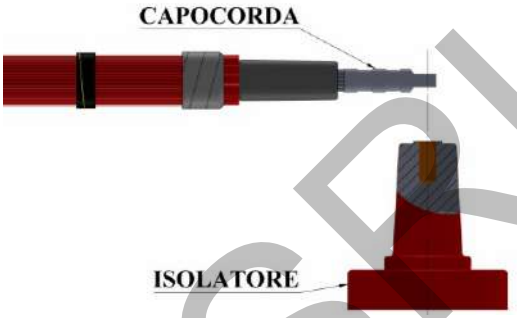
3.2 Inserire l'**ADATTATORE (CONICO)** sul cavo in modo da far andare in battuta la parte più larga sulla fascetta di posizionamento. Pulire il lubrificante in eccesso.
Rimuovere il nastro PVC ELCOPLAST 51dalla punta del conduttore.

4. INSTALLAZIONE DEL CAPOCORDA – OPERAZIONI COMUNI -

4.1 CAPOCORDA A CRIMPATURA

- Posizionare il capocorda sopra al conduttore, verificare che il suo foro sia in corrispondenza del foro dell'isolatore.
- Assicurarsi che la parte piana del capocorda sia parallela alla faccia di accoppiamento dell'isolatore. Crimpare il capocorda con l'apposito attrezzo.
- Rimuovere il grasso in eccesso e eventuali bave risultanti dalla crimpatura. Infine pulire adattatore e capicorda con le salviette incluse nel kit.





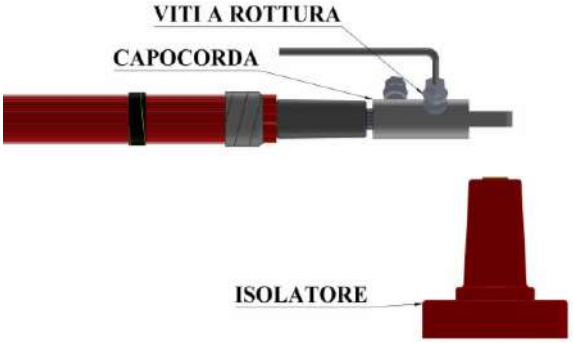
4.2 CAPOCORDA CON VITI A ROTTURA

Per l'installazione del capocorda utilizzare il dispositivo di tenuta (tab. unificazione ENEL – EA 0536) raffigurato, per sostenere correttamente il capocorda durante il serraggio delle viti.

- Posizionare il capocorda sopra al conduttore, verificare che il suo foro sia in corrispondenza del foro dell'isolatore.
- Assicurarsi che la parte piana del capocorda sia parallela alla faccia di accoppiamento dell'isolatore.

4.2.1 Installare il capocorda seguendo le istruzioni del costruttore.

4.2.2 Rimuovere il grasso in eccesso e eventuali punte dalle viti.



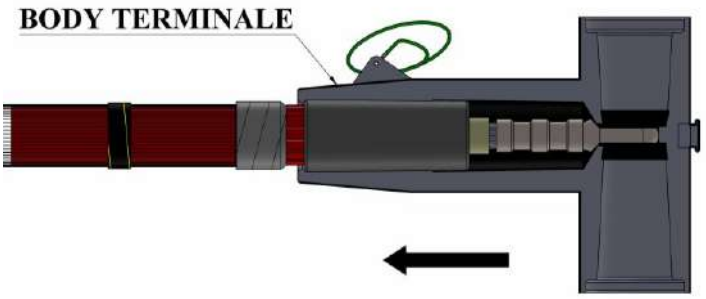
5. INSTALLAZIONE DEL BODY - OPERAZIONI COMUNI -

5.1 Pulire la superficie esterna dell'adattatore usando le salviette incluse nel kit.

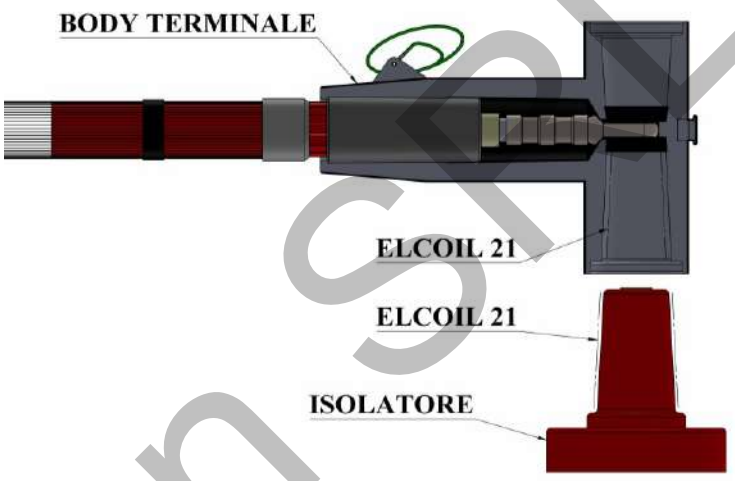
5.2 Indossare i guanti inclusi nel kit e lubrificare la parte interna del body applicando l'**ELCOIL 21**.

5.3 Inserire il **BODY** sull'adattatore in modo da far andare in battuta il capocorda nella sua sede nel body.

5.4 Rimuovere eventuali eccessi di lubrificante.

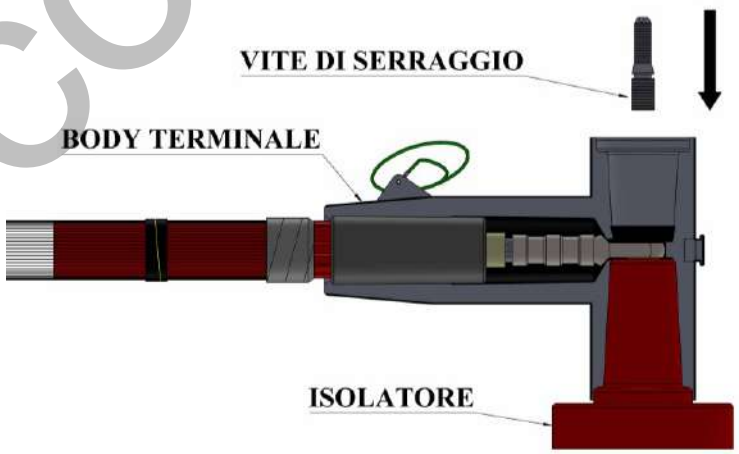


5.5 Pulire il body e l'isolatore e lubrificare la superficie esterna dell'isolatore e quella interna del body con l'**ELCOIL 21**.

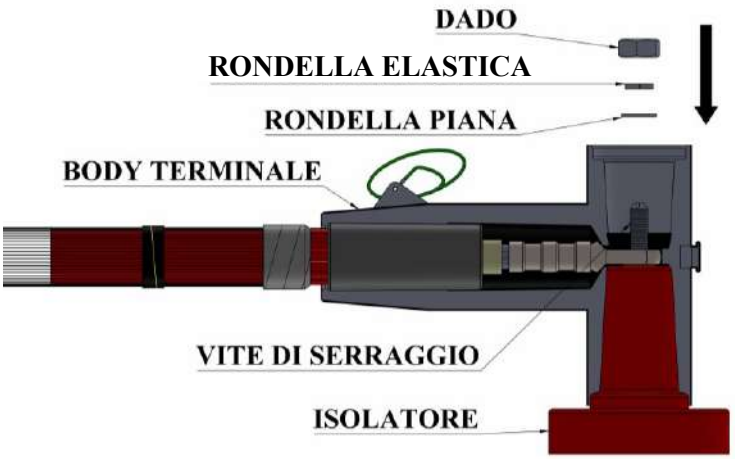


5.6 Avvitare la **VITE DI SERRAGGIO** nella parte filettata dell'isolatore mediante apposito attrezzo.

5.7 Inserire il body terminale sull'isolatore.



5.8 Inserire la **RONDELLA PIANA**, la **RONDELLA ELASTICA** e il **DADO**. Serrare il dado usando una chiave dinamometrica con bussola lunga e applicando una coppia massima di **30 Nm**.

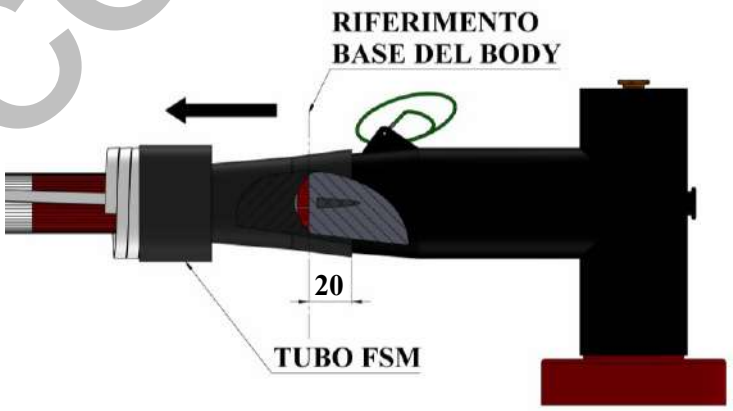


5.9 Pulire e lubrificare la superficie esterna del **TAPPO ISOLANTE (CREK)** e la superficie interna di accoppiamento del body con **ELCOIL 21**.

5.10 Inserire il tappo isolante all'interno della sede del body e serrarlo agendo sulla **PRESA CAPACITIVA** usando una chiave dinamometrica e applicando una coppia massima di **30 Nm**.

5.11 Tenendo la spirale in trazione posizionare il **TUBO FSM** sul body terminale in modo da sormontarlo per circa **20 mm**.

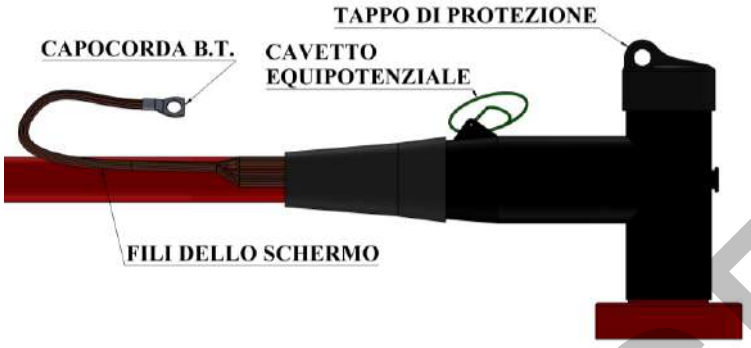
5.12 Tenendo fermo il **TUBO FSM** nella posizione prescritta, svolgere un tratto di spirale tirandola e ruotandolo secondo il senso indicato, in modo che l'estremità del tubo collassi sul **BODY TERMINALE**, apportare eventuale correzione di posizione e continuare con l'applicazione del tubo.
Prestare attenzione durante lo svolgimento della spirale affinché il tratto svolto non vada ad avvolgersi intorno al cavo.



5.13 Spingere il **tappo di protezione TGS** sulla vite presente sul tappo isolante (CREK) esercitando una lieve forza.

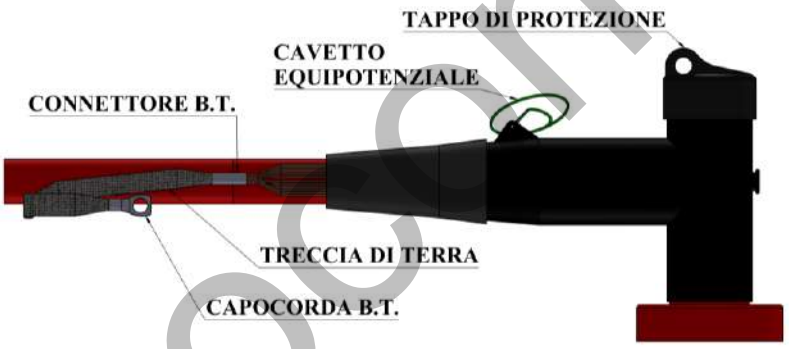
CAVO SCHERMATO CON FILI DI RAME

5.14 Riunire i fili dello schermo a forma di conduttore rotondo compatto, attestare le estremità e verificare se la distanza per il collegamento sul punto di messa a terra è sufficiente quindi se risulta sufficiente, applicare il capocorda b.t. incluso nel kit utilizzando la pressa oleodinamica (45 kN) e apposite matrici e punzoni.



5.15 Nel caso in cui la distanza per il collegamento della messa a terra non è sufficiente, utilizzare la treccia di terra saldata sulla piastra di terra, e dopo averla tagliata opportunamente vicino la saldatura sulla piastra di terra, connetterla mediante il connettore b.t. incluso nel kit allo schermo a fili del cavo vedi utilizzando la pressa oleodinamica (45 kN) e apposite matrici e punzoni.

5.16 Applicare all' estremità della treccia di terra il capocorda di b.t. incluso nel kit utilizzando la pressa oleodinamica (45 kN) e apposite matrici e punzoni.



CAVO SCHERMATO CON TUBO Al

5.17 Applicare all' estremità della treccia di terra il capocorda di b.t. incluso nel kit utilizzando la pressa oleodinamica (45 kN) e apposite matrici e punzoni.

- OPERAZIONI COMUNI -

5.18 Collegare a terra il capocorda di terra e il cavetto equipotenziale.

5.19 Fissare sulla guaina esterna mediante la fascetta in PVC, la **TARGHETTA IDENTIFICAZIONE FASE**.

5.20 Applicare nelle immediate vicinanze dell'accessorio **L' ETICHETTA DI IDENTIFICAZIONE DEL MONTATORE**.

- **L'installazione è completa.**

LABORATORIO
SVEPPI

Via A. Volta, 34/A
30037 Scorzè (VE)
tel. 041/8945092

VEIKI - VNL

VILLAMOS NAGYLABORATÓRIUMOK Kft.
ELECTRIC LARGE LABORATORIES Ltd.

VEIKI-VNL ELECTRIC LARGE LABORATORIES LTD.

No. 4648 /VNL

Test Report

Type tests of cable accessories for rated voltage of 6.35/11 (12) kV

28th February 2007

MSZ EN 17025 NAT VIZSGÁLÓ NAT-1-1251/2004

MSZ EN ISO 9001 MSZT CERT 503/0243

IQNet

STL participant

The accreditation of VEIKI-VNL Ltd.
refers to the test activities registered by HAB (Hungarian Accreditation Board) under No.: NAT-1-1251/2004

H-1158 Budapest, Vasgolyó u. 2-4.
E-mail: vnl@vnl.hu
Phone:+36.1.417 3157, Fax:+36.1.417 3163
www.vnl.hu

Subject:	Type tests of cable accessories for rated voltage of 6.35/11 (12) kV
Kind of the test:	Type test
Client:	Elcon Megarad S.p.A. Z.I. Via Nazionale, 110 83030 Arcella (Avellino) ITALY
Reference and date of the order:	-, 28.03.2006.
Our reference number:	V-213/2006
Place and date of the test:	VEIKI-VNL Electric Large Laboratories Ltd. H-1158 Budapest, Vasgolyó u. 2-4. 08.07.2006 – 20.12.2006.
Present at the test in charge of the purchaser:	

Details of the tested object:

Manufacturer:	Elcon Megarad S.p.A.
Designation:	Cable accessories for three core belted paper insulated cable
Types:	
Indoor termination:	ELCOTERM TIC 1256/E
Outdoor termination:	ELCOTERM TEC 1256/E
Straight joint 1 (standard):	ELCOTERM GLC 1263/EZ
Straight joint 2 (filler):	ELCOTERM GLC 1255/E
Rated voltage U_0/U (U_m):	6.35/11 (12) kV
Designation:	Transition joint from three single core XLPE insulated cables to three core belted paper insulated cable
Type:	ELCOTERM GLM 1266/EN
Rated voltage U_0/U (U_m):	6.35/11 (12) kV

The cables which were used to the tests:

Type:	ASB 3x120 mm²
Designation:	belted paper insulated cable with Al-conductors, lead sheath and steel tape armour
Maximum conductor temperature in normal operation:	65°C
Nominal cross-sectional area of conductor:	120 mm^2
Rated voltage:	6/10 (12) kV
Type:	AHXAMK-W 3x1x120Al+35Cu mm²
Designation:	XLPE insulated cable with aluminium conductors, aluminium tape shield and separate copper earth conductor
Nominal cross-sectional area of conductor:	120 mm^2
Material of wires:	Al
Nominal cross-sectional area of separate earth conductor:	35 mm^2
Rated voltage:	12/20 (24) kV

Number of the manufacturer's drawings and documents for the identification of the test objects:

Title:	Code:
Indoor termination U_0/U (U_m) = 6.35/11 (12) kV 120-240 mm^2:	ELCOTERM TIC 1256/E
Outdoor termination U_0/U (U_m) = 6.35/11 (12) kV 120-240 mm^2::	ELCOTERM TEC 1256/E
Straight joint U_0/U (U_m) = 6.35/11 (12) kV 120-240 mm^2:	ELCOTERM GLC 1263/EZ
Straight filler joint U_0/U (U_m) = 6.35/11 (12) kV 120-240 mm^2:	ELCOTERM GLC 1255/E
Transition joint U_0/U (U_m) = 6.35/11 (12) kV 120-240 mm^2:	ELCOTERM GLM 1266/EN

Bills of materials, Installation instructions – *These documents are not attached*

The test was carried out in accordance with the following standards:

HD 629.2 S2:2006 Test requirements on accessories for use on power cables of rated voltage from 3.6/6 (7.2) kV up to 20.8/36 (42) kV
Part 2: Cables with impregnated paper insulation

EN 61442:2005 Test methods for accessories for power cables with rated voltages from 6 kV (U_m=7.2 kV) up to 36 kV (U_m=42 kV) (IEC 61442:2005, modified)

Summary of the test results:

Type tests were performed on cable accessories for rated voltage of 6.35/11 (12) kV according to the HD 629.2 S2:2006 standard.
The following tests were performed on the samples:

	Test	Test clause of EN 61442	Test sequence of HD 629.2 S2		
			Terminations		Joints
			Indoor	Outdoor	
1.	D.C. voltage dry withstand (15 min, $6U_0$)	5	A1,A2	A1,A2	I.B1, B2
2.	A.C. voltage dry withstand (5 min, $4.5U_0$)	4	A1,A2	A1,A2	I.B1, B2
3.	A.C. voltage wet withstand (1 min, $4U_0$)	4	-	A1	-
4.	Impulse voltage at elevated temperature	6	A1	A1	I.B1
5.	Electric heat cycling in air (126 cycles, $1.5U_0$)	9	A1	A1	-
5a.	*Electric heat cycling in air (63 cycles, $1.5U_0$)*	*9*	-	-	I.B1
5b.	*Electric heat cycling in water (63 cycles, $1.5U_0$)*	*9*	-	-	I.B1
6.	Immersion (10 cycles)	9.4	-	A1	-
7.	A.C. voltage dry withstand (4 h, $3U_0$)	4	A1	A1	I.B1
8.	Impulse voltage at ambient temperature	6	A1	A1	I.B1
9.	A.C. voltage dry withstand (15 min, $2.5U_0$)	4	A1	A1	I.B1
10.	Thermal short circuit (screen)	10	A2	A2	B2
11.	Thermal short circuit (conductor)	11	A2	A2	B2
12.	Impulse voltage at ambient temperature	6	A2	A2	B2
13.	A.C. voltage dry withstand (15 min, $2.5U_0$)	4	A2	A2	B2
14.	Humidity (300 h, $1.25U_0$)	13	A3	-	-
15.	Salt fog (1000 h, $1.25U_0$)	13	-	A3	-
16.	Examination	-	A1-A3	A1-A3	I.B1, B2

All of the tested cable accessories met the type test requirements of the referred standard.

Budapest, 28th February 2007

VEIKI-VNL Villamos Nagylaboratóriumok Korlátolt Felelősségű Társaság 1158 Budapest, Vasúlyó u. 2-4.

/Csaba Homok/
Responsible for the work

/Ildikó Fogarasi/
Supervised by

/Dr. László Varga /
Managing director

Numbered sheets:	10	Tables:	-	Oscillograms:	2
Diagrams:	3	Photos:	9	Drawings:	5

1. Description of the tests

Type tests were performed on cable accessories for rated voltage of 6.35/11 (12) kV according to the HD 629.2 S2:2006 standard.
The following test lines were prepared for the tests:

Line 1:
indoor termination + 12 kV belted cable + transition joint + 24 kV plastic cable + transition joint + 12 kV belted cable + outdoor termination

Line 2:
indoor termination + 12 kV belted cable + straight joint 1+ 12 kV belted cable + straight joint 1+ 12 kV belted cable + outdoor termination

Line 3:
indoor termination + 12 kV belted cable + straight joint 2+ 12 kV belted cable + straight joint 2+ 12 kV belted cable + outdoor termination

Line 4:
indoor termination + 12 kV belted cable + outdoor termination

The following tests were performed on the samples:

	Test	Test clause of EN 61442	Test sequence of HD 629.2 S2		
			Terminations		Joints
			Indoor	Outdoor	
1.	D.C. voltage dry withstand (15 min, $6U_0$)	5	A1,A2	A1,A2	I.B1, B2
2.	A.C. voltage dry withstand (5 min, $4.5U_0$)	4	A1,A2	A1,A2	I.B1, B2
3.	A.C. voltage wet withstand (1 min, $4U_0$)	4	-	A1	-
4.	Impulse voltage at elevated temperature	6	A1	A1	I.B1
5.	Electric heat cycling in air (126 cycles, $1.5U_0$)	9	A1	A1	-
5a.	*Electric heat cycling in air (63 cycles, $1.5U_0$)*	*9*	-	-	I.B1
5b.	*Electric heat cycling in water (63 cycles, $1.5U_0$)*	*9*	-	-	I.B1
6.	Immersion (10 cycles)	9.4	-	A1	-
7.	A.C. voltage dry withstand (4 h, $3U_0$)	4	A1	A1	I.B1
8.	Impulse voltage at ambient temperature	6	A1	A1	I.B1
9.	A.C. voltage dry withstand (15 min, $2.5U_0$)	4	A1	A1	I.B1
10.	Thermal short circuit (screen)	10	A2	A2	B2
11.	Thermal short circuit (conductor)	11	A2	A2	B2
12.	Impulse voltage at ambient temperature	6	A2	A2	B2
13.	A.C. voltage dry withstand (15 min, $2.5U_0$)	4	A2	A2	B2
14.	Humidity (300 h, $1.25U_0$)	13	A3	-	-
15.	Salt fog (1000 h, $1.25U_0$)	13	-	A3	-
16.	Examination	-	A1-A3	A1-A3	I.B1, B2

1.1 DC voltage test

The DC voltage test was carried out according to the Clause 5 of the EN 61442 standard. This test was carried out on all accessories at ambient temperature (Photo 1). A DC voltage of negative polarity was applied for 15 minutes to the samples between conductor and screen. The test voltage was $6U_0$=38 kV. No breakdown or flashover on the insulation shall occur.

1.2 AC voltage test

The AC voltage test was carried out according to the Sub-Clause 4.1 of the EN 61442 standard. This test was carried out on all accessories at ambient temperature (Photo 1). A power frequency voltage was applied for 5 minutes to the samples between conductor and screen. The test voltage was $4.5U_0$=28.5 kV. No breakdown or flashover on the insulation shall occur.

1.3 AC voltage test

The AC voltage test was carried out according to the Sub-Clause 4.2 of the EN 61442 standard. This test was carried out on outdoor terminations of the Line 1 and Line 2 at ambient temperature (Photo 1). A power frequency voltage was applied for 1 minute to the samples between conductor and screen. The test voltage was $4U_0$=25.5 kV. No breakdown or flashover on the insulation shall occur.
The terminations were pre wetted for 15 minutes before the wet test. The form of the artificial rain was drop. During the test the terminations were continuously wetted.
Characterisation of the artificial rain:

- Vertical and horizontal component of the rain 1-1.2 mm/min
- Specific resistance of water 9800 Ωcm
- Direction of the rain to the terminations 45°

1.4 Impulse voltage test

The impulse voltage test was carried out according to the Clause 6 of the EN 61442 standard. This test was carried out on all accessories at elevated temperature.
This test was performed on the samples at a conductor temperature between 65°C-70°C (0 K to 5 K above the maximum conductor temperature in normal operation).
The cable accessories shall withstand 10 impulses of 95 kV_{peak} on each polarity without breakdown.
Characteristics of the impulses:

- front time: 3.22 – 3.31 µs
- time to half value: 50.2 – 52.1 µs
- peak value: 94.22 – 95.87 kV

1.5 Heating cycles voltage test

A preliminary calibration on the test cable was performed to determine the actual conductor temperature during the test according to the Annex A of the EN 61442 standard. The Method 2 was used described in A.3.2 of the EN 61442 standard.
The heating cycles voltage test was carried out according to the Clause 9 of the EN 61442 standard. This test was carried out on all accessories. The test lines were heated with a current, which flowed the conductor. The cables were heated until the conductor reached the steady temperature between 65°C-70°C (0 K to 5 K above the maximum conductor temperature in normal operation). The temperatures of cables were measured with thermocouples, which were built up in the screen of the cables. The test lines were energized with a test voltage of $1.5U_0$=9.5 kV. The duration of heating cycles was 8 hours. The heating and the maintained periods were 4h20m, than these were followed by 3h40m of natural cooling in air. This cycle was carried out 126 times. After the 63rd cycle the joints were tested under water with height of 1 m above the top surface of all joints. The test arrangement is shown on Photo 2.

1.6 Immersion test for outdoor terminations

The immersion test was carried out according to the Sub-Clause 9.4 of the EN 61442 standard. This test was carried out on two samples of outdoor termination. The outdoor terminations of the Line 1 and Line 2 were immersed upside down in water with height of water 0.03 m above every part of the termination (Photo 3). 10 cycles described in 1.5 was performed on the Lines without test voltage.

1.7 AC voltage test

The AC voltage test was carried out according to the Sub-Clause 4.1 of the EN 61442 standard. This test was carried out on all accessories at ambient temperature (Photo 1). A power frequency voltage was applied for 4 hours to the samples between conductor and screen. The test voltage was $3U_0$=19 kV. No breakdown or flashover on the insulation shall occur.

1.8 Impulse voltage test

The impulse voltage test was carried out according to the Clause 6 of the EN 61442 standard. This test was carried out on all accessories at ambient temperature (Photo 1).
The cable accessories shall withstand 10 impulses of 95 kV_{peak} on each polarity without breakdown.
Characteristics of the impulses:

- front time: 1.13 – 1.24 µs
- time to half value: 49.2 – 52.2 µs
- peak value: 93.78 – 94.97 kV

1.9 AC voltage test

The AC voltage test was carried out according to the Sub-Clause 4.1 of the EN 61442 standard. This test was carried out on all accessories at ambient temperature (Photo 1). A power frequency voltage was applied for 15 minutes to the samples between conductor and screen. The test voltage was $2.5U_0$=16 kV. No breakdown or flashover on the insulation shall occur.

1.10 Thermal short-circuit test (screen)

The thermal short-circuit test on screen was carried out according to the Clause 10 of the EN 61442 standard. This test was carried out on all accessories. The cables were heated and stabilized for 2 hours between 65°C-70°C (0 K to 5 K above the maximum conductor temperature in normal operation) before carrying out the short-circuit test. Two short-circuits were applied to the screen. Between the two short-circuits the cable screen cooled to a temperature less than 10 K above its temperature prior to the first short-circuit. The test arrangement is shown on Photo 8.
The test currents and duration were as the following:

	Test current [kA]	Duration [s]
Line 1	2.72	1
Line 2	2.75	1
Line 3	10.28	1

1.11 Thermal short-circuit test (conductor)

The thermal short-circuit test on conductor was carried out according to the Clause 11 of the EN 61442 standard. This test was carried out on all accessories in three-phase a.c test circuit. Two short-circuits were applied to the conductor. Between the two short-circuits the cable screen cooled to a temperature less than 10 K above its temperature prior to the first short-circuit. The test arrangement is shown on Photo 9.

The test currents and duration were as the following:

	Test current 1 [kA]	Test current 2 [kA]	Test current 3 [kA]	Duration [s]
Line 1	14.11	14.25	13.91	0.747
Line 2	13.90	14.11	13.83	0.747
Line 3	14.39	14.43	14.22	0.750

1.12 Impulse voltage test

The impulse voltage test was carried out according to the Clause 6 of the EN 61442 standard. This test was carried out on all accessories at ambient temperature (Photo 1).
The cable accessories shall withstand 10 impulses of 95 kV_{peak} on each polarity without breakdown.
Characteristics of the impulses:

- front time: 1.33 – 1.60 µs
- time to half value: 56.6 – 58.5 µs
- peak value: 94.18 – 95.75 kV

1.13 AC voltage test

The AC voltage test was carried out according to the Sub-Clause 4.1 of the EN 61442 standard. This test was carried out on all accessories at ambient temperature (Photo 1). A power frequency voltage was applied for 15 minutes to the samples between conductor and screen. The test voltage was $2.5U_0$=16 kV. No breakdown or flashover on the insulation shall occur.

1.14 Humidity test

The humidity test was carried out according to the Clause 13 of the EN 61442 standard. This test was carried out on indoor termination of test Line 4 at ambient temperature in three-phase a.c test circuit for 300 hours. The test voltage was $1.25U_0$=8 kV. The spray water conductivity was 70 mS/m with a rate of 0.4 l/h/m^3 volume.
The tested indoor termination is shown on Photo 4.

1.15 Salt fog test

The salt fog test was carried out according to the Clause 13 of the EN 61442 standard. This test was carried out on outdoor termination of test Line 4 at ambient temperature in three-phase a.c test circuit for 1000 hours. The test voltage was $1.25U_0$=8 kV. The spray water conductivity was 1600 mS/m with a rate of 0.4 l/h/m^3 volume.
The tested outdoor termination is shown on Photo 6.

1.16 Examination

After the tests the cable accessories were examined for information only about:

- any cracking in the filling components;
- and/or corrosion, tracking, erosion which would, in time, lead to failure;
- and/or leakage of any insulating material;
- moisture path.

2. Results of the tests

2.1 DC voltage test

During the DC voltage test described in 1.1 no breakdown of the insulation occurred.

2.2 AC voltage test

During the AC voltage test described in 1.2 no breakdown of the insulation occurred.

2.3 AC voltage test

During the AC voltage test described in 1.3 no breakdown of the insulation occurred.

2.4 Impulse voltage test

The cable accessories withstood 10 impulses of 95 kV_{peak} on each polarity without breakdown. The typical oscillograms of the test from each polarity are included in the test report.

2.5 Heating cycles voltage test

The preliminary calibration on the test cable can be seen on the Diagrams 1-2.
During the heating cycles voltage test described in 1.5 no breakdown of the insulation occurred. The heating cycles No's: 1-6 can be seen on Diagram 3.

2.6 Immersion test for outdoor terminations

The immersion test described in 1.6 was performed on the outdoor terminations of the Line 1 and Line 2.

2.7 AC voltage test

During the AC voltage test described in 1.7 no breakdown of the insulation occurred.

2.8 Impulse voltage test

The cable accessories withstood 10 impulses of 95 kV_{peak} on each polarity without breakdown. The typical oscillograms of the test from each polarity are included in the test report.

2.9 AC voltage test

During the AC voltage test described in 1.9 no breakdown of the insulation occurred.

According to the test results described in 2.1-2.9 the indoor and the outdoor terminations, both of straight and transition joints met the type test requirements of the referred standard according to test sequence A1 and I.B1.

2.10 Thermal short-circuit test (screen)

The thermal short circuit test on screen described in 1.10 was performed on the test Lines 1-3.

2.11 Thermal short-circuit test (conductor)

The thermal short circuit test on conductor described in 1.11 was performed on the test Lines 1-3.

2.12 Impulse voltage test

The cable accessories withstood 10 impulses of 95 kV_{peak} on each polarity without breakdown. The typical oscillograms of the test from each polarity are included in the test report.

2.13 AC voltage test

During the AC voltage test described in 1.13 no breakdown of the insulation occurred.

According to the test results described in 2.1-2.2 and 2.10-2.13 the indoor and the outdoor terminations, both of straight and transition joints met the type test requirements of the referred standard according to test sequence A2 and B2.

2.14 Humidity test

During the humidity test described in 1.14 neither breakdown nor flashover, no trip and no substantial damage of the insulation occurred, therefore the indoor termination met the type test requirements of the referred standard according to test sequence A3.

2.15 Salt fog test

During the salt fog test described in 1.15 neither breakdown nor flashover, no trip and no substantial damage of the insulation occurred, therefore the outdoor termination met the type test requirements of the referred standard according to test sequence A3.

2.16 Examination

After the tests the cable accessories were examined and it could established, that there were not any:

- cracking in the filling components;
- corrosion, tracking, erosion which would, in time, lead to failure;
- leakage of any insulating material;
- moisture path.

3. Uncertainty of the measurement

Uncertainty of the d.c. voltage measurement:	±1 %
Uncertainty of the conductivity of water:	±1 %
Uncertainty of the temperature measurement:	±1 °C
Uncertainty of the current measurement:	±0.5 %
Uncertainty of the impulse voltage measurement:	±0.5 %
Uncertainty of the power frequency measurement:	±1 %

The uncertainty values given in this report are the standard deviation values multiplied by k=2. Measurement uncertainties were estimated according to the method described in the EAL-R2 document.

Preliminary calibration on the test cable to determine the actual conductor temperature during the heating cycles voltage test
Time-Temperature diagram

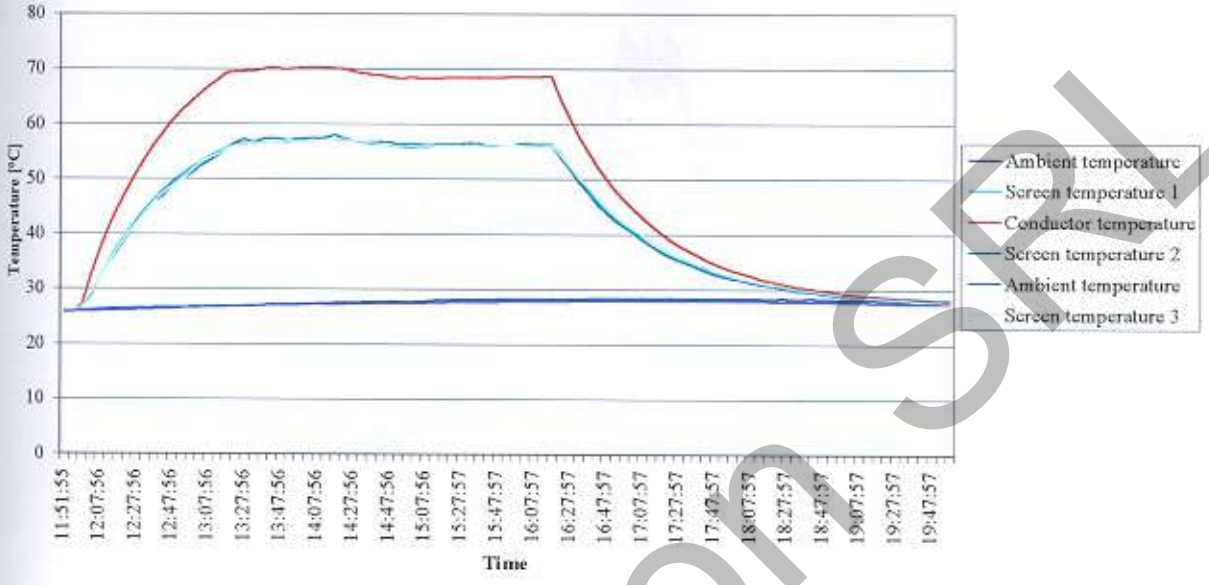


Diagram 1
Time-Temperature diagram of the preliminary calibration

Preliminary calibration on the test cable to determine the actual conductor temperature during the heating cycles voltage test
Time-Current diagram

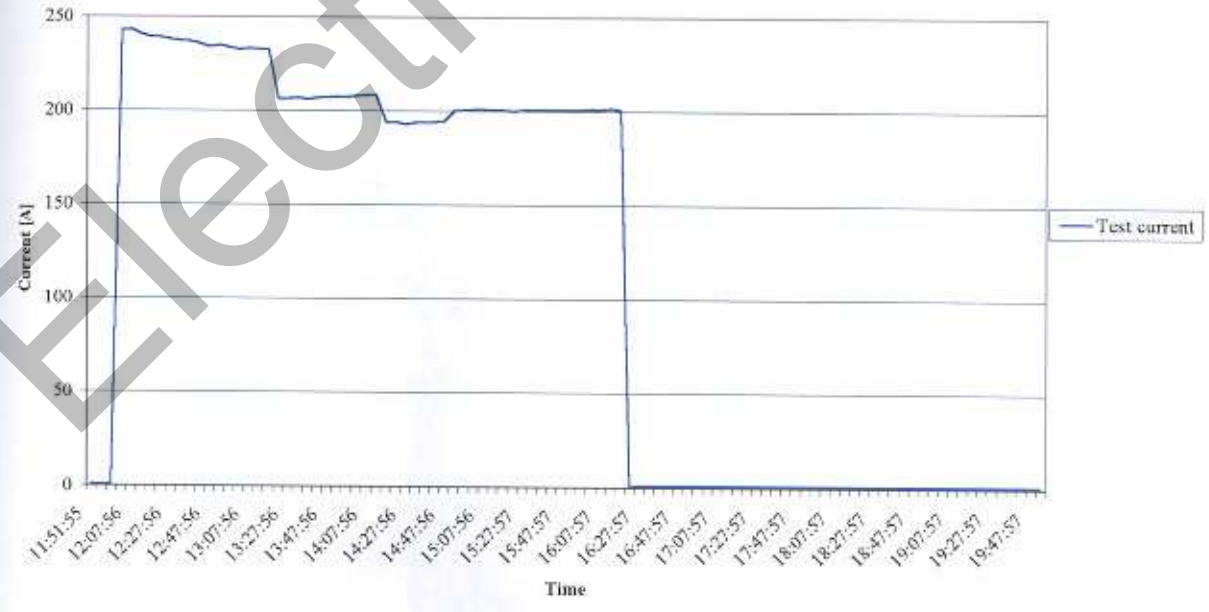


Diagram 2
Time-Current diagram of the preliminary calibration

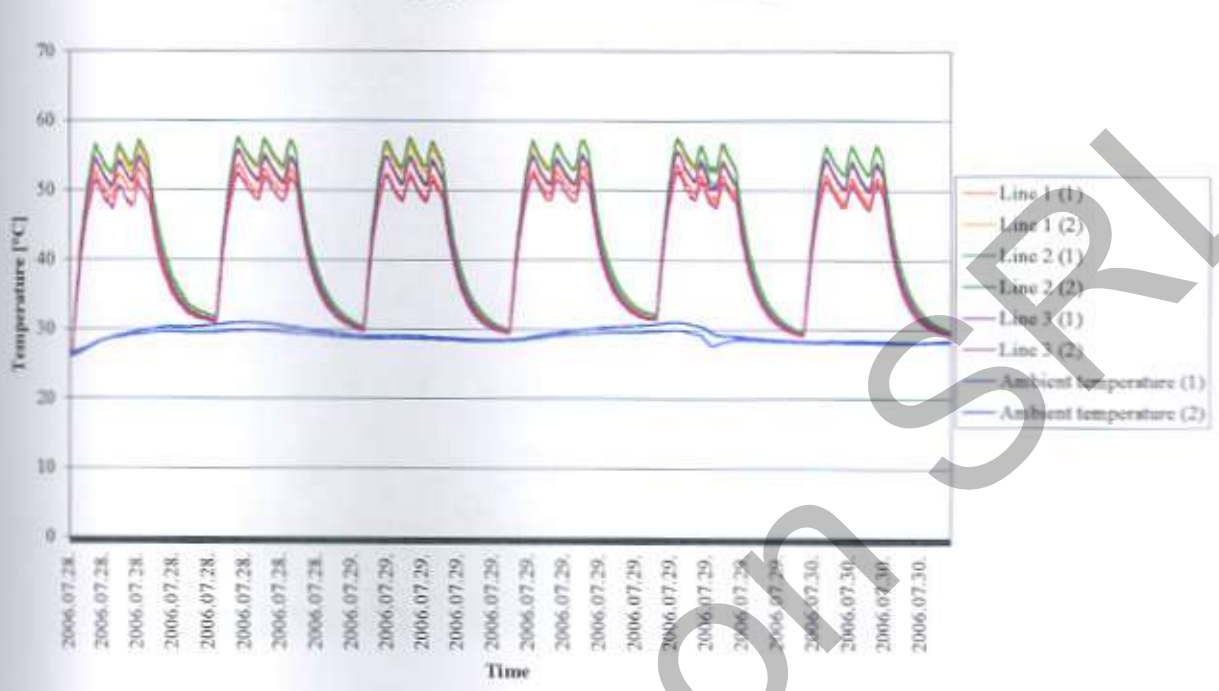


Diagram 3
Time-Temperature diagram of the heating cycle test

Photo 1
Test arrangement of impulse voltage, AC voltage and DC voltage tests

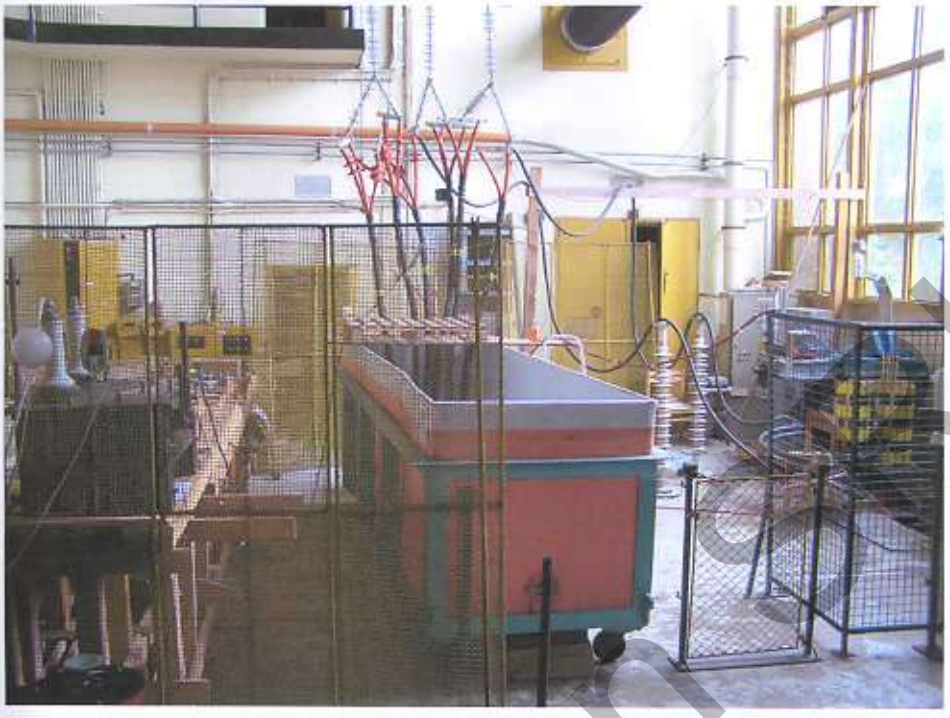


Photo 2
Test arrangement of heating cycle test

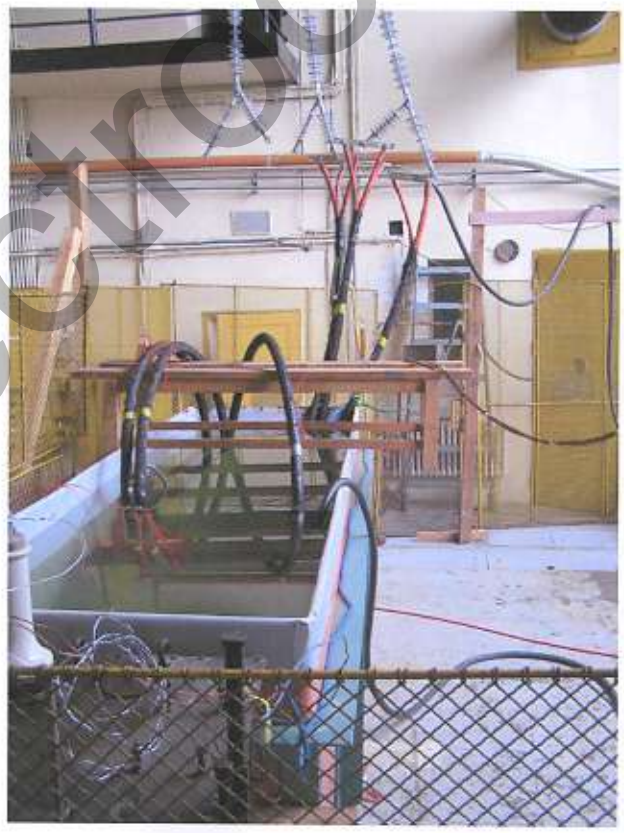


Photo 3
Test arrangement of immersion test

Photo 4
The indoor termination before the humidity test

Photo 5
The indoor termination after the humidity test

Photo 6
The outdoor termination before the salt fog test

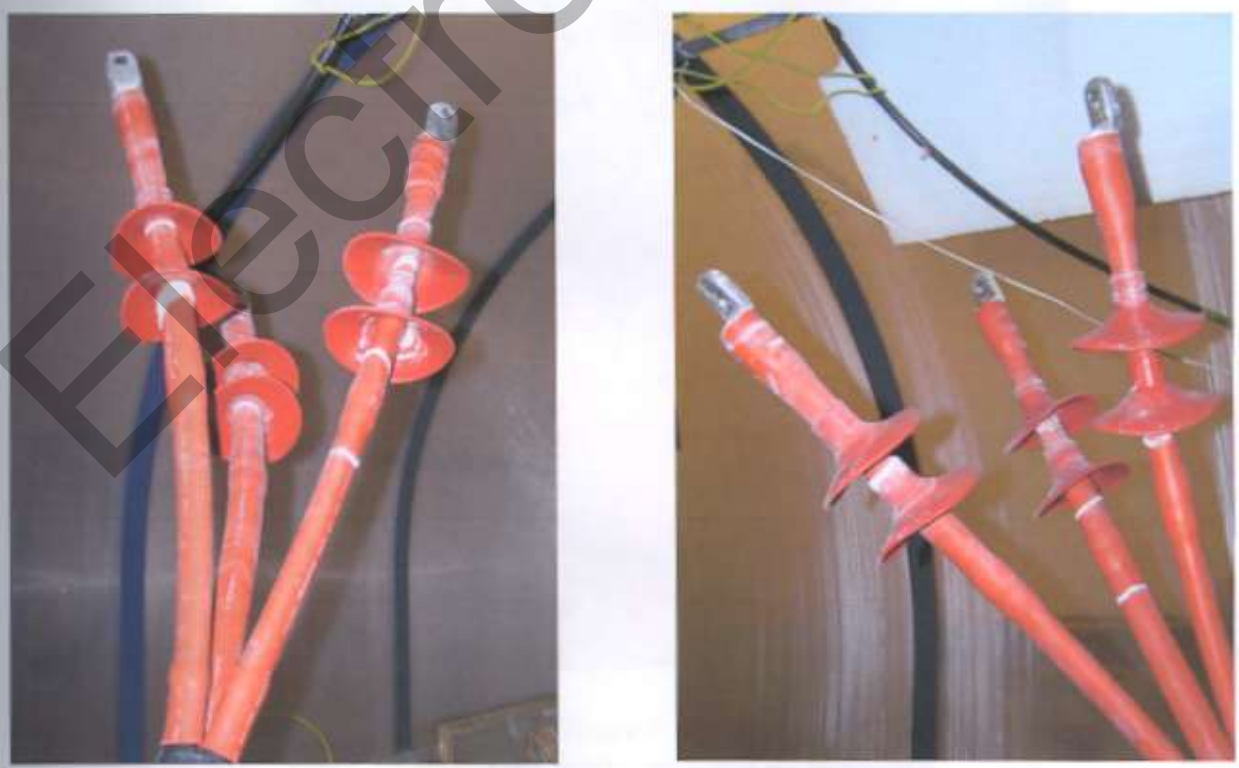
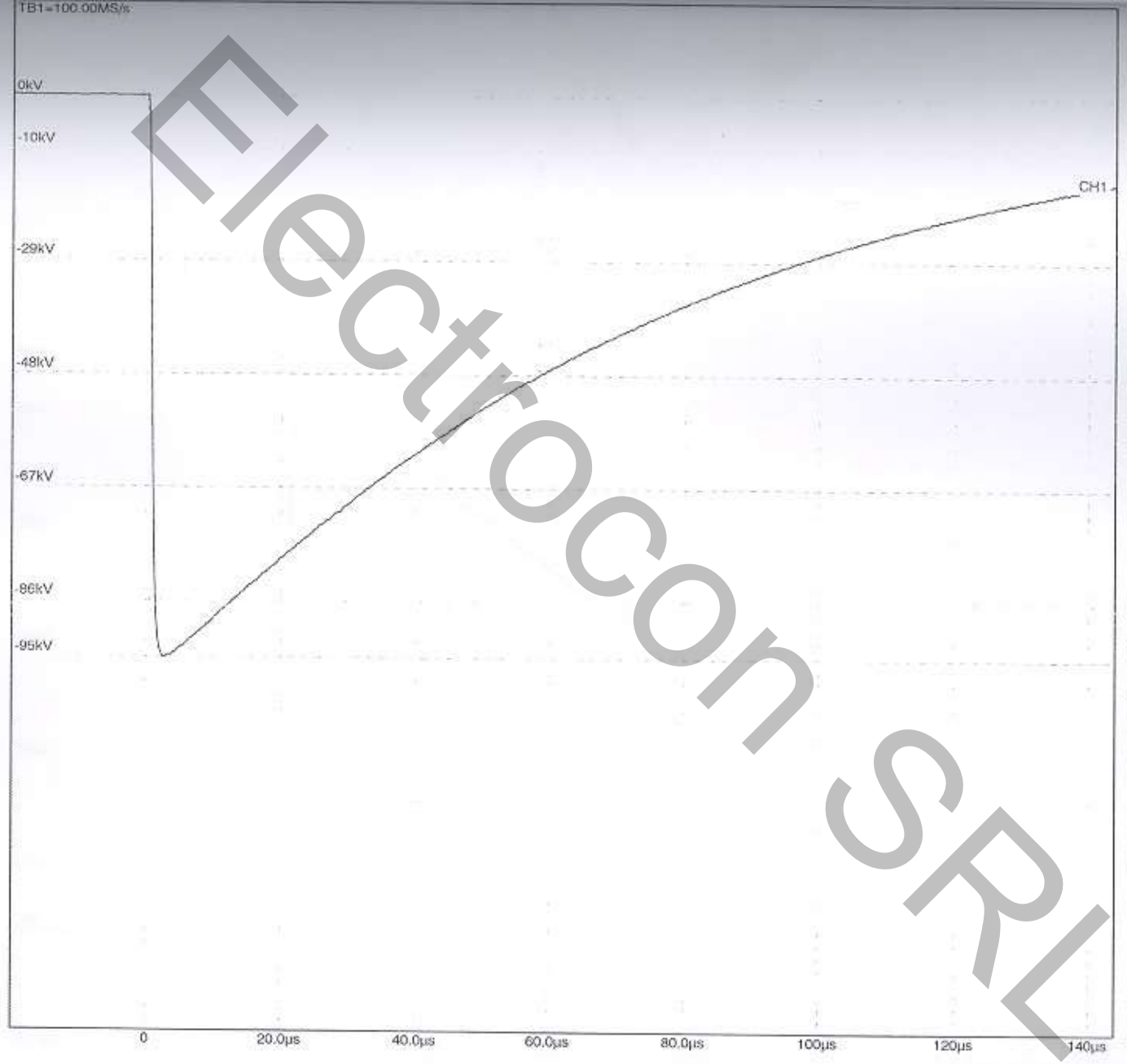


Photo 7
The outdoor termination after the salt fog test

Photo 8
Test arrangement of short-circuit test on screen

Photo 9
Test arrangement of short-circuit test on conductor



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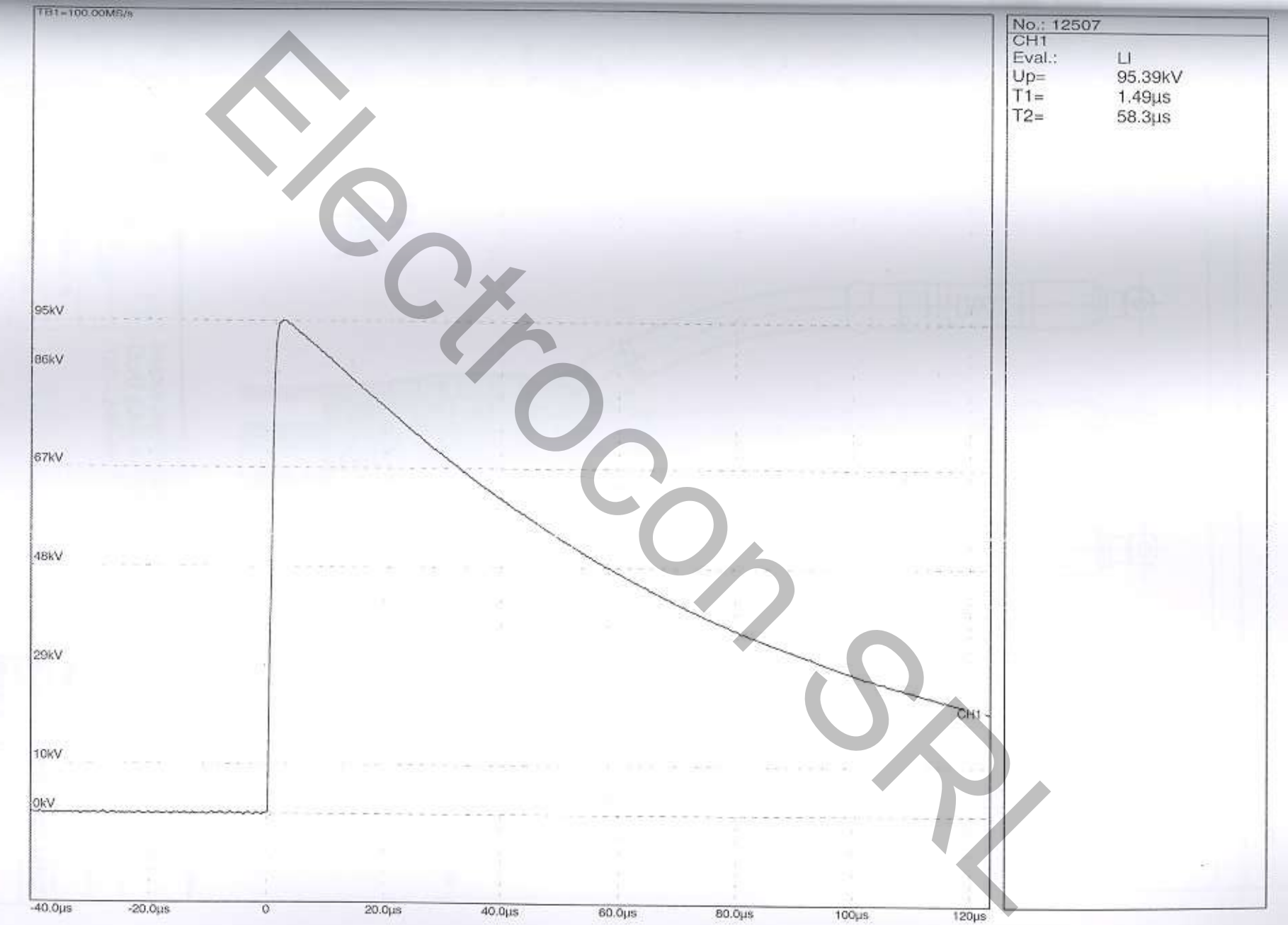
T1=	1.51µs
T2=	58.5µs



#	Revision	Date
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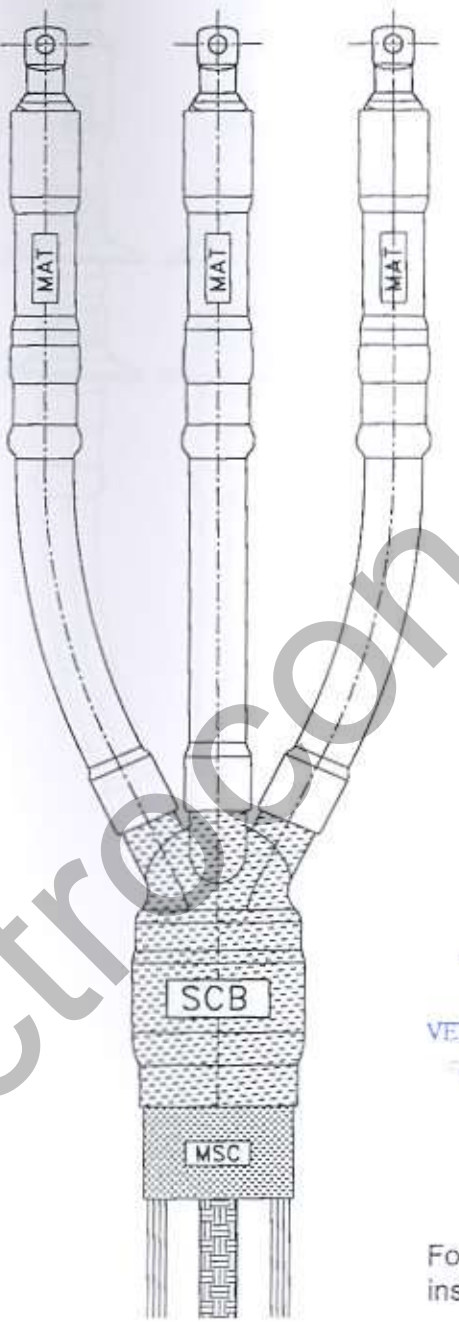
C		



elcon megarad S.p.A.
UFFICIO TECNICO

4648/VNL
Kovacs Gabor
VEIKI-VNL Villamos Nagylaboratóriumok
Korlátolt Felelősségű Társaság
1158 Budapest, Vasgolyó u. 2-4
28.02.2007.

For three core belted paper insulated cables

Model:
Drawing:

elcon megarad

Scale: 1 : 1
Date: 31.1.2007
By N.Rainone
Chk: M.Monte
Ctrl:

Indoor termination
Uo/U (Um) = 6.35/11 (12) kV
120 - 240 mm²

Replaces
Replaced:
Drw N°:
Ref:
Code: ELCOTERM TIC 1256/E
Sheet N°: 1/1

#	Revision	Date
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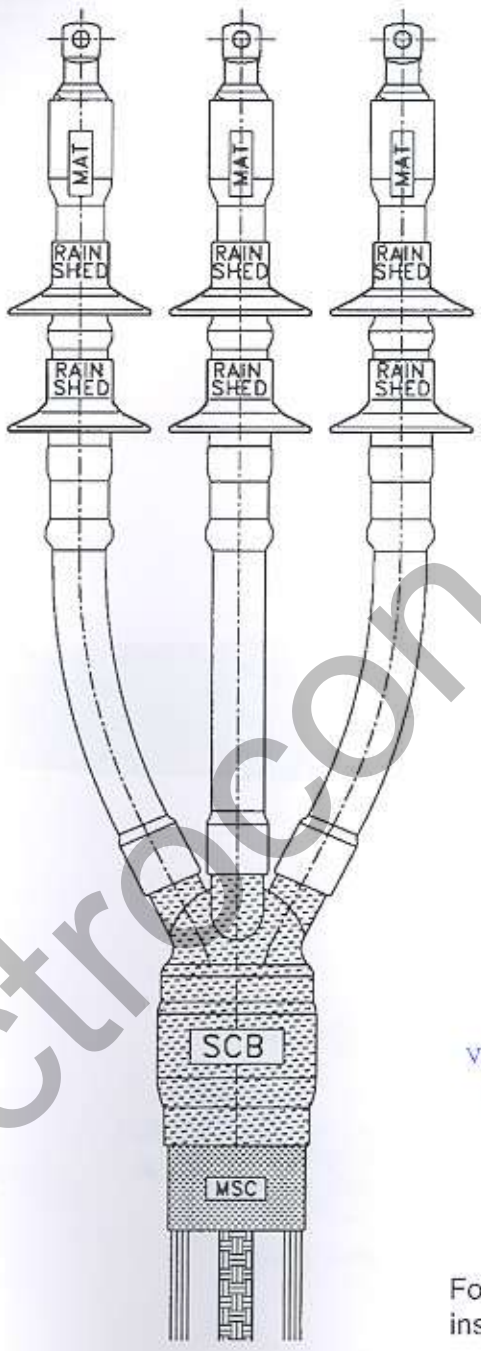
B		
C		



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Korlátolt Felelősségű Társaság
1158 Budapest, Vasgolyó u. 2-4.

28.02.2007.

elcon megarad A.p.r.
UFFICIO TECNICO

For three core belted paper insulated cables

Model: / Drawing:	elcon megarad		Outdoor termination Uo/U (Um) = 6.35/11 (12) kV 120 - 240 mm²	Replaces
	Scale:	Date: 31.1.2007		Replaced:
	1 : 1	By: N.Rainone		Drw N°:
		Chk: M.Monte		Ref:
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				Sheet N°: 1/1

#	Revision	Date
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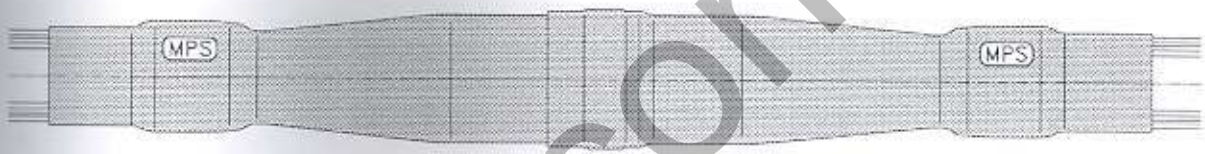
B		
C		



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1158 Budapest, Vasgolyó u. 2-4.

28.02.2007.

elcon megarad S.p.A.
UFFICIO TECNICO

For three core belted paper insulated cables

elcon megarad		Straight joint Uo/U (Um) = 6.35/11 (12) kV 120 ÷ 240 mm²	Replaces
Scale:	Date: 31.1.2007		Replaced:
1 : 1	By: N.Rainone		Drw N°:
	Chk: M.Monte		Ref:
	Ctrl:		Code:ELCOTERM GLC 1263/EZ
Model:			Sheet N°: 1/1
Drawing:			

#	Revision	Date
A		
B		
C		

4648/VUL

Zavada Csaba

VEIKI-VNI. Villamos Nagylaboratóriumok
Korlátolt Felelősségű Társaság
1158 Budapest, Vasgolyó u. 2-4.
I.

28.02.2007.

elcon megarad S.p.A.
UFFICIO TECNICO

For three core belted paper insulated cables

elcon megarad		Straight filler joint Uo/U (Um) = 6.35/11 (12) kV 120 ÷ 240 mm²	Replaces
Scale:	Date: 31.1.2007		Replaced:
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	Chk: M.Monte		Ref:
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Model:			Sheet N°: 1/1
Drawing:			

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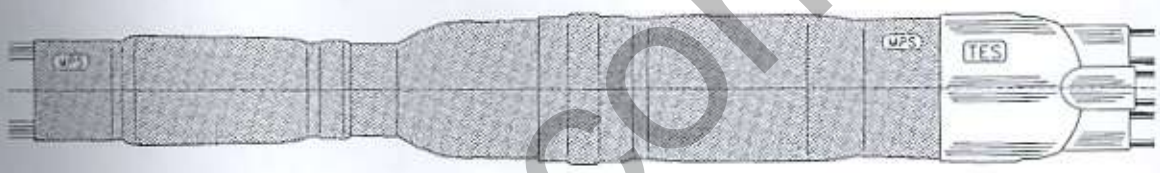
B		
C		



H648/VNL

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Korlátolt Felelősségű Társaság
1158 Budapest, Vasgolyó u. 2-4.

28.02.2007.

elcon megarad S.p.A.
UFFICIO TECNICO

For three core belted paper insulated cables
to three single core XLPE insulated cable

Model:	elcon megarad		Transition joint Uo/U (Um) = 6.35/11 (12) kV 120 - 240 mm²	Replaces
Drawing:	Scale: 1 : 1	Date: 31.1.2007		Replaced:
		By: N.Rainone		Drw N°:
		Chk: M.Monte		Ref:
		Ctrl:		Code: ELCOTERM GLM 1266/EN
				Sheet N°: 1/1