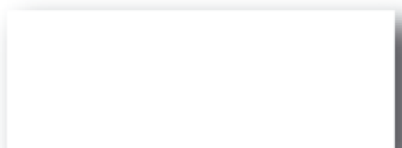


SATS

Certification



Report of Performance No. 06-E08

Type Test of 12 kV Indoor and Outdoor Cable Terminations and Straight Joints

Trondheim, 2006-12-05



SATS Certification: Rolf Hegerberg

Copyright: SATS

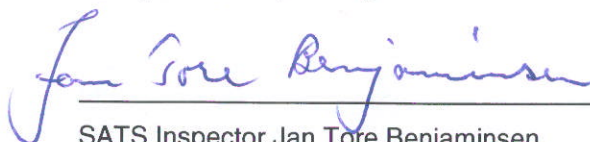
REPORT OF PERFORMANCE No. 06-E08

Client	Elcon Megarad 83030 Arcella (Avellino) - Italia
Test object	Two test lines with indoor termination + straight joint + outdoor termination, installed on a 3x150 mm ² Al, 6/10 (12) kV XLPE-cable of type Axclight-O LT
Designation	Indoor terminations of type Elcoterm TIS-1282/KE FN13074, Outdoor terminations of type Elcoterm TES-1284/KE FN13076 and Straight joints of type Elcoterm GLS-1275/KE FN13078.
Manufacturers	Accessories: Elcon Megarad Cable: Nexans Sweden
Ratings assigned by the manufacturer	$U_m = 12$ kV, $U = 11$ kV and $U_0 = 6.35$ kV
Tests performed	DC voltage dry withstand test AC voltage dry withstand test AC voltage wet withstand test (For outdoor terminations only) Partial Discharge measurement at ambient temperature Impulse voltage withstand test at elevated temperature Load cycling under voltage. For terminations 126 cycles in air. For joints 63 cycles in air and 63 cycles in water. Immersion. 10 cycles in water without voltage (For outdoor terminations only) Partial Discharge measurement at elevated temperature Partial Discharge measurement at ambient temperature Impulse voltage withstand test at ambient temperature AC voltage dry withstand test Thermal short circuit test (conductor) Impulse voltage withstand test at ambient temperature AC voltage dry withstand test Examination
Standards	CENELEC HD 629.1 S2, EN 61442, IEC 60060-1 and IEC 60270
Testing station	SINTEF Energy Research, NO-7465 Trondheim, Norway
Date of tests	2006-08-16 to 2006-10-31
Test results	The accessories fulfilled the requirements of the standards
The documents forming this report	Title page and 15 numbered pages and two appendices

Trondheim 2006-11-22



Acting Laboratory Manager Hallvard Faremo



SATS Inspector Jan Tore Benjaminsen

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PICTURES OF THE TEST SET UP	8
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The tests were witnessed by Mr Horst Förster and Jan Tore Benjaminsen representing SATS Certification, Norway

TEST OBJECT

Two test lines with indoor termination + joint + outdoor termination, installed on a 3x150 mm² Al, 6/10 (12) kV XLPE-cable of type Axclight. The length of the test lines was approximately 6.5 m.

The installation of test objects was performed by the manufacturer.

SUMMARY OF TEST RESULTS

Test No	Description	Test procedure	Acceptance criteria	Test results	Comments
1.1	DC withstand	See page 4	No breakdown or flashover	No breakdown or flashover occurred	
1.2	AC withstand	See page 4	No breakdown or flashover	No breakdown or flashover occurred	
1.3	AC wet withstand	See page 4	No breakdown or flashover	No breakdown or flashover occurred	
1.4	Partial discharge	See page 4	<10 pC at 12.5 kV	Discharge level < 2 pC	
1.5	Impulse voltage at elevated temp.	See page 4	No breakdown or flashover	No breakdown or flashover occurred	Oscillograms on page 34
1.6	Load cycling under voltage	See page 4	No breakdown or flashover	No breakdown or flashover occurred	
1.7	Immersion test	See page 5			
1.8	Partial discharge at elevated temp.	See page 5	<10 pC at 12.5 kV	Discharge level < 2 pC	
1.9	Partial discharge at ambient temp.	See page 5	<10 pC at 12.5 kV	Discharge level < 2 pC	
1.10	Impulse voltage at ambient temp.	See page 5	No breakdown or flashover	No breakdown or flashover occurred	
1.11	AC withstand	See page 5	No breakdown or flashover	No breakdown or flashover occurred	
2.1	Short circuit	See page 5	No visible signs of damage.	No visible signs of damage.	Oscillograms on page 36
2.2	Impulse voltage at ambient temp.	See page 6	No breakdown or flashover	No breakdown or flashover occurred	Oscillograms on page 38
2.3	AC withstand	See page 6	No breakdown or flashover	No breakdown or flashover occurred	
2.4	Visual inspection	See page 6	No sign of deterioration	No visible signs of damage observed	

TEST PROGRAM AND TEST REQUIREMENTS

DC VOLTAGE WITHSTAND TEST

A test voltage of 38 kV negative polarity shall be applied for 15 minutes between the conductor and the earthed cable screen for each of the three phases.

Test requirements: No breakdown or flashover.

AC VOLTAGE WITHSTAND TEST

A test voltage of 28.5 kV shall be applied for 5 minutes between the conductor and the earthed cable screen for each of the three phases.

Test requirements: No breakdown or flashover.

AC VOLTAGE WET WITHSTAND TEST (FOR OUTDOOR TERMINATIONS ONLY)

The test voltage shall be 25.5 kV for 1 minute with the terminations erected in a vertical position and with water spray rate according to IEC Publication 60060-1. The voltage shall be applied between the conductor and the earthed cable screen for each test line.

Test requirements: No breakdown or flashover.

PARTIAL DISCHARGE MEASUREMENT AT AMBIENT TEMPERATURE

The PD measurements shall be performed at a test voltage of 12.5 kV. The voltage shall be applied between the conductor and the earthed cable screen for each of the three phases.

Test requirements: The discharge level shall be less than 10 pC.

IMPULSE VOLTAGE WITHSTAND TEST AT ELEVATED TEMPERATURE

10 positive and 10 negative standard lightning impulses (1,2/50 μ s) with peak values of 95 kV shall be applied between the conductor, heated to 95°C, and the earthed cable screen for each of the three phases.

Test requirements: No breakdown or flashover.

LOAD CYCLING UNDER VOLTAGE

The load cycle test shall comprise 126 heating cycles in air for the terminations, each of 8 h duration, and for the joints 63 cycles in air and 63 cycles in water. Each load cycle consists of 5 h current heating to maximum operating temperature + 5°C, i.e. 95°C. Subsequently, the cable is cooled in ambient atmosphere for 3 hours. The voltage shall be continuously applied during the cycling at a level of 16 kV AC between the conductor and the earthed cable screen for each of the three phases.

Test requirements: No breakdown or flashover during the test period.

LOAD CYCLING IMMERSED IN WATER (FOR OUTDOOR TERMINATIONS ONLY)

Ten load cycles shall be applied at no voltage with the outdoor terminations immersed in water.

PARTIAL DISCHARGE MEASUREMENT AT ELEVATED TEMPERATURE

The PD measurements shall be performed at a test voltage of 12.5 kV. The voltage shall be applied between the conductor, heated to 95°C, and the earthed cable screen for each of the three phases.

Test requirements: The discharge level shall be less than 10 pC.

PARTIAL DISCHARGE MEASUREMENT AT AMBIENT TEMPERATURE

The PD measurements shall be performed at a test voltage of 12.5 kV. The voltage shall be applied between the conductor and the earthed cable screen for each of the three phases.

Test requirements: The discharge level shall be less than 10 pC.

IMPULSE VOLTAGE WITHSTAND TEST AT AMBIENT TEMPERATURE

10 positive and 10 negative standard lightning impulses (1,2/50 µs) with peak values of 95 kV shall be applied between the conductor at ambient temperature and the earthed cable screen for each of the three phases.

Test requirements: No breakdown or flashover.

AC VOLTAGE WITHSTAND TEST

A test voltage of 16 kV shall be applied for 15 minutes between the conductor and the earthed cable screen for each of the three phases.

Test requirements: No breakdown or flashover.

THERMAL SHORT CIRCUIT TEST

A short circuit current of 17,8 kA shall be applied for each of the conductors for 1 sec.

This short circuit test shall be repeated after the conductors have cooled to room temperature.

Test requirements: No visible signs of damage.

IMPULSE VOLTAGE WITHSTAND TEST AT AMBIENT TEMPERATURE

10 positive and 10 negative standard lightning impulses (1,2/50 μ s) with peak values of 95 kV shall be applied between the conductor at ambient temperature and the earthed cable screen for each of the three phases.

Test requirements: No breakdown or flashover.

AC VOLTAGE WITHSTAND TEST

A test voltage of 16 kV shall be applied for 15 minutes between the conductor and the earthed cable screen for each of the three phases.

Test requirements: No breakdown or flashover.

EXAMINATION

Examination of test objects is carried out for information only.

TEST CIRCUITS AND TEST EQUIPMENT

DC VOLTAGE TESTS

The tests were performed with a 100 kV HV-DC generator.

AC VOLTAGE TESTS AND PD MEASUREMENTS

The tests were performed with a 800 kV transformer in SEfAS laboratorium.

The wet test was performed with SEfAS spray apparatus, with a precipitation rate according to IEC Publication 60060-1(1989)

The partial discharge measurements were performed with a PD shunt with a frequency response of 300 kHz. Calibration was performed with a 10 pC calibrator.

IMPULSE VOLTAGE TESTS

The tests were performed with a 2.4 MV impulse generator, where two of the 12 stages were connected. Figure 1 shows the circuit.

The voltage measurements were performed with a 400 kV voltage divider with peak voltmeter and transient recorder connected.

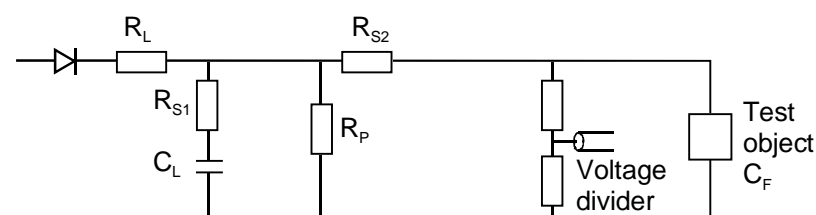


Figure 1: Impulse voltage circuit.

LOAD CYCLING TESTS

The voltage was supplied from a 50 kV, 25 kVA transformer. In order to heat the conductor to 95°C, the test loops were loaded with 350 A per phase. The temperature was calibrated by means of dummy cables with thermocouples in the conductor.

For conductor heating an 11 kVA split core transformer were used.

PICTURES OF THE TEST SET UP

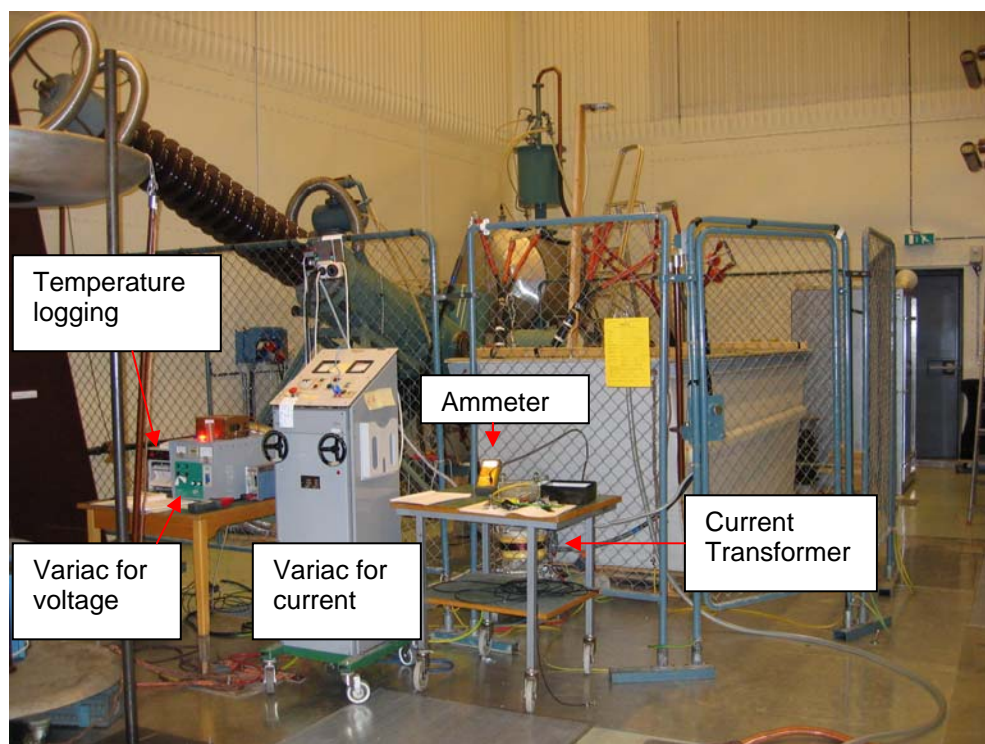


Figure 2: The two test loops installed in the water tank for load cycling.

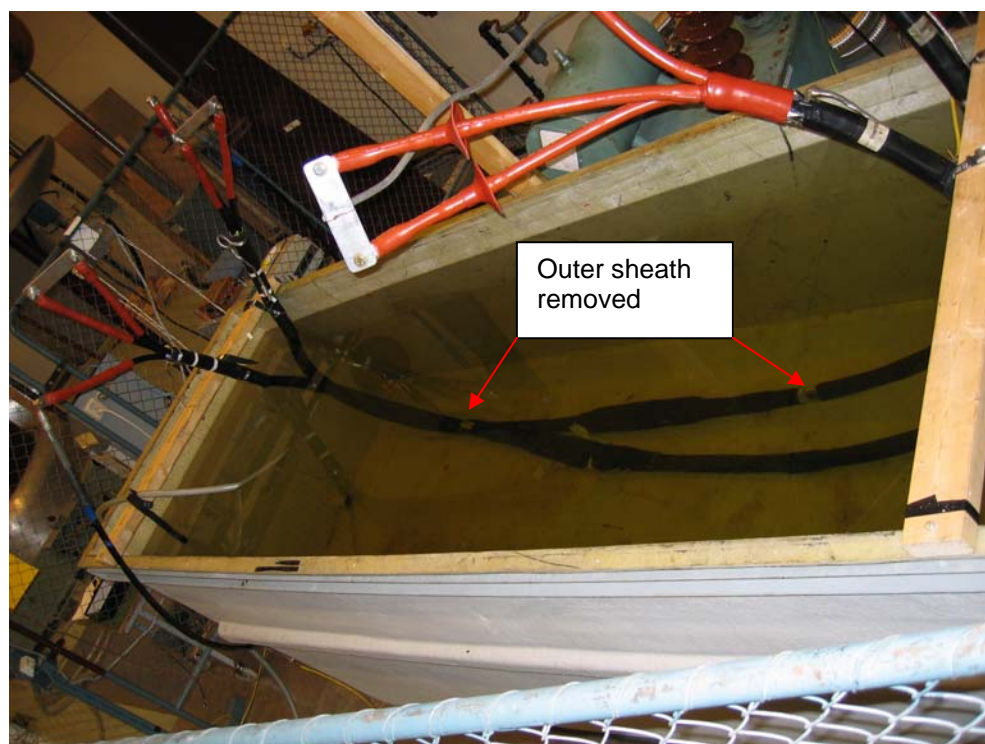


Figure 3: Load cycle of the joints in water.

TEST RESULTS

DC VOLTAGE WITHSTAND TEST

A test voltage of 38 kV negative polarity was applied for 15 minutes between each conductor and the earthed cable screen for each test loop.

Results: No breakdown or flashover occurred.

AC VOLTAGE DRY WITHSTAND TEST

A test voltage of 28.5 kV was applied for 5 minutes between the conductor and the earthed cable screen for each test loop.

Results: No breakdown or flashover occurred.

AC VOLTAGE WET WITHSTAND TEST (FOR OUTDOOR TERMINATIONS ONLY)

A test voltage of 25.5 kV was applied for 1 minute between the conductor and the earthed cable screen for the outdoor terminations of the two test loops. The average precipitation rate was:

- vertical component: 1,4 mm/min
- horizontal component 1,2 mm/min

Results: No breakdown or flashover occurred

PARTIAL DISCHARGE MEASUREMENT AT AMBIENT TEMPERATURE

PD measurements were performed for each test loop after the AC-tests. The measuring voltage was 12.5 kV phase to earth.

Results: The discharge level was < 2 pC (noise level) for both test loops.

IMPULSE VOLTAGE WITHSTAND TEST AT ELEVATED TEMPERATURE

The test loops were heated to 95°C on the conductor and kept at this temperature for 2 h before the impulses were applied.

10 positive and 10 negative impulses with peak values of 95 kV were applied between the conductor and the earthed cable screen for each test loop.

On page 13 is shown examples of oscillograms of the impulses applied.

Results: No breakdown or flashover occurred.

LOAD CYCLING UNDER VOLTAGE

126 heating cycles in air for the terminations and for the joints 63 cycles in air and 63 cycles in water were performed with a voltage of 16 kV applied between the conductor and the earthed cable screen for each test loop during the whole test period.

Results: No breakdown or flashover occurred.

LOAD CYCLING IMMERSSED IN WATER (FOR OUTDOOR TERMINATIONS ONLY)

10 load cycles with the outdoor terminations immersed in water and no voltage applied, were performed.

PARTIAL DISCHARGE MEASUREMENT AT ELEVATED TEMPERATURE

The test loops were heated to 95°C on the conductor and kept at this temperature for 2 h before PD measurements were performed for each test loop. The measuring voltage was 12.5 kV phase to earth.

Results: The discharge level was < 2 pC (noise level) for both test loops.

PARTIAL DISCHARGE MEASUREMENT AT AMBIENT TEMPERATURE

PD measurements were performed for each test loop at ambient temperature. The measuring voltage was 12.5 kV phase to earth.

Results: The discharge level was < 2 pC (noise level) for both test loops.

IMPULSE VOLTAGE WITHSTAND TEST AT AMBIENT TEMPERATURE

10 positive and 10 negative impulses with peak values of 95 kV were applied between the conductor and the earthed cable screen for each test loop.

Results: *No breakdown or flashover occurred.*

AC VOLTAGE DRY WITHSTAND TEST

A test voltage of 16 kV was applied for 15 minutes between the conductor and the earthed cable screen for each test loop.

Results: *No breakdown or flashover occurred.*

THERMAL SHORT CIRCUIT TEST

Test loop 1 (1. shot):

The test loop was subjected to a short circuit current of 12.3 kA for phase 1, 12.0 kA for phase 2 and 12.2 kA for phase 3, all for 2.4 sec for each of the conductors. This is equivalent to 19.1 kA for 1 sec for phase 1, 18.6 kA for 1 sec for phase 2 and 18. kA for 1 sec for phase 3.

Test loop 2 (1. shot):

The test loop was subjected to a short circuit current of 12.4 kA for phase 1, 12.8 kA for phase 2 and 11.6 kA for phase 3, all for 2.25 sec for each of the conductors. This is equivalent to 18.6 kA for 1 sec for phase 1, 19.2 kA for 1 sec for phase 2 and 17.4 kA for 1 sec for phase 3.

The test objects were then allowed to cool to room temperature before the next shot.

Test loop 1 (2. shot):

The test loop was subjected to a short circuit current of 12.7 kA for phase 1, 12.1 kA for phase 2 and 12.5 kA for phase 3, all for 2.25 sec for each of the conductors. This is equivalent to 19.0 kA for 1 sec for phase 1, 18.2 kA for 1 sec for phase 2 and 18.8 kA for 1 sec for phase 3.

Test loop 2 (2. shot):

The test loop was subjected to a short circuit current of 12.4 kA for phase 1, 12.0 kA for phase 2 and 12.3 kA for phase 3, all for 2.2 sec for each of the conductors. This is equivalent to 18.4 kA for 1 sec for phase 1, 17.8 kA for 1 sec for phase 2 and 18.2 kA for 1 sec for phase 3.

On page 14 is shown examples of oscillograms of the applied current.

Results: *No visible signs of damage were observed.*

IMPULSE VOLTAGE WITHSTAND TEST AT AMBIENT TEMPERATURE

10 positive and 10 negative impulses with peak values of 95 kV were applied between the conductor and the earthed cable screen for each test loop.

On page 15 is shown examples of oscillograms of the impulses applied.

Results: No breakdown or flashover occurred.

AC VOLTAGE DRY WITHSTAND TEST

A test voltage of 16 kV was applied for 15 minutes between the conductor and the earthed cable screen for each test loop.

Results: No breakdown or flashover occurred.

EXAMINATION

Examination of the test objects did not reveal any damage.

OSCILLOGRAMS

EXAMPLES OF OSCILLOGRAMS OF THE IMPULSES APPLIED BEFORE LOAD CYCLING

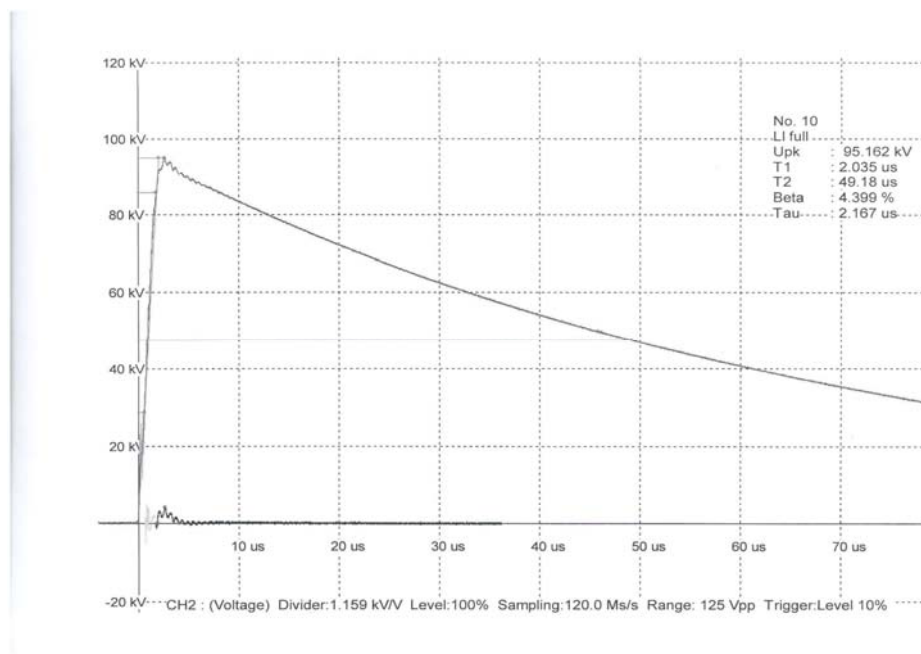


Figure 4: 10th positive impulse applied on test loop 1 and 2.

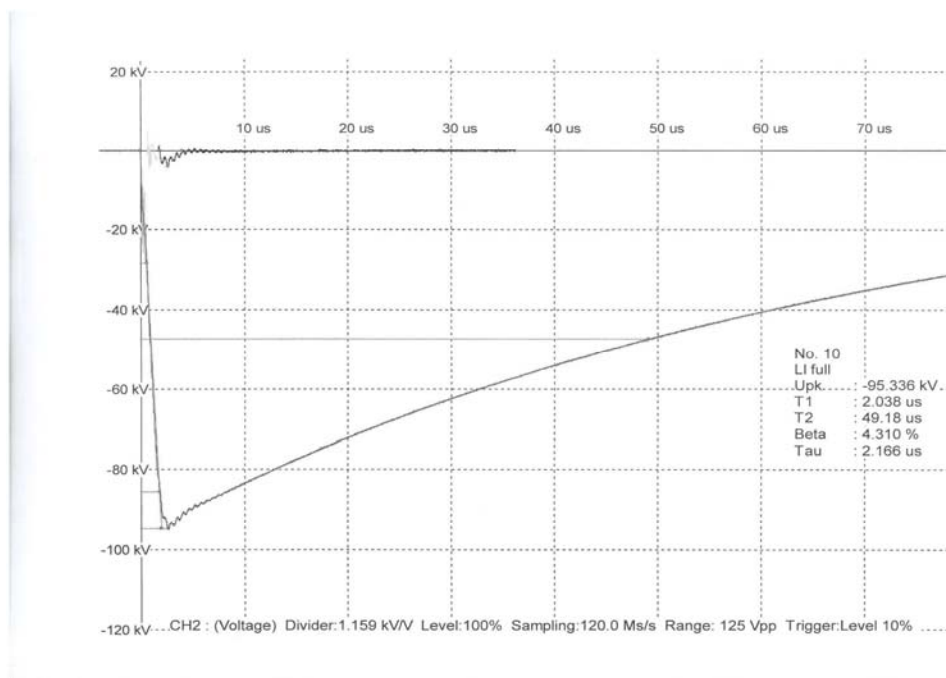


Figure 5: 10th negative impulse for test loop 1 and 2.

EXAMPLES OF OSCILLOGRAMS OF THE APPLIED CURRENT UNDER THERMAL SHORT CIRCUIT TESTS

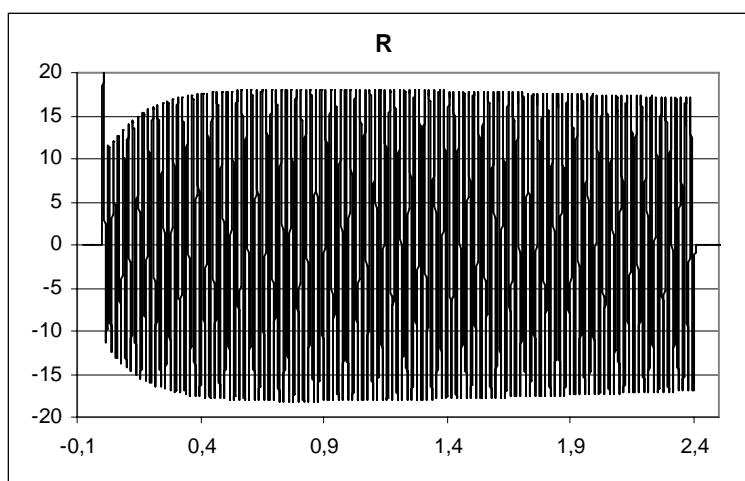


Figure 6: Oscillogram of applied current for test loop 1, phase 1, 1. shot.

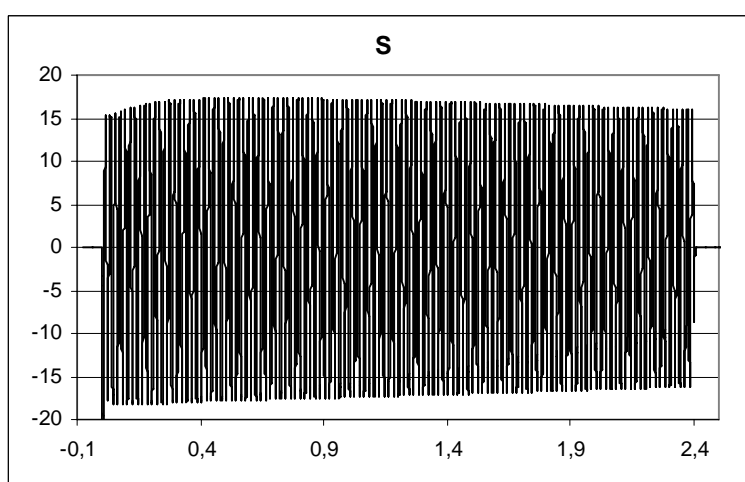


Figure 7: Oscillogram of applied current for test loop 1, phase 2, 1. shot.

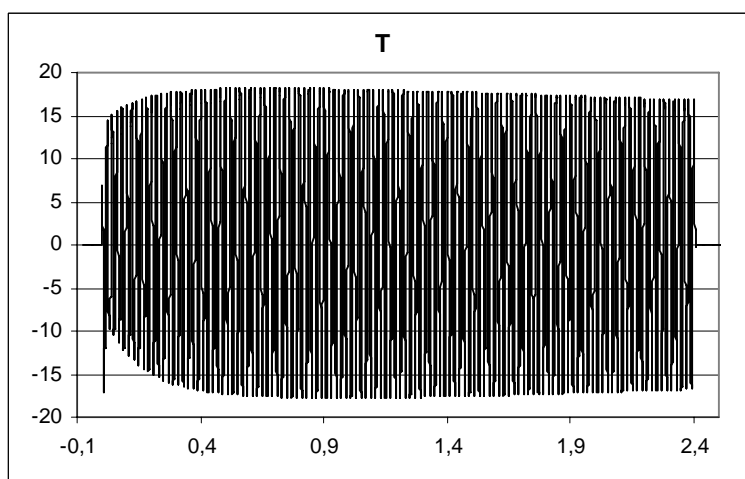


Figure 8: Oscillogram of applied current for test loop 1, phase 3, 1. shot.

EXAMPLES OF OSCILLOGRAMS OF THE IMPULSES APPLIED AFTER THERMAL SHORT CIRCUIT TESTS

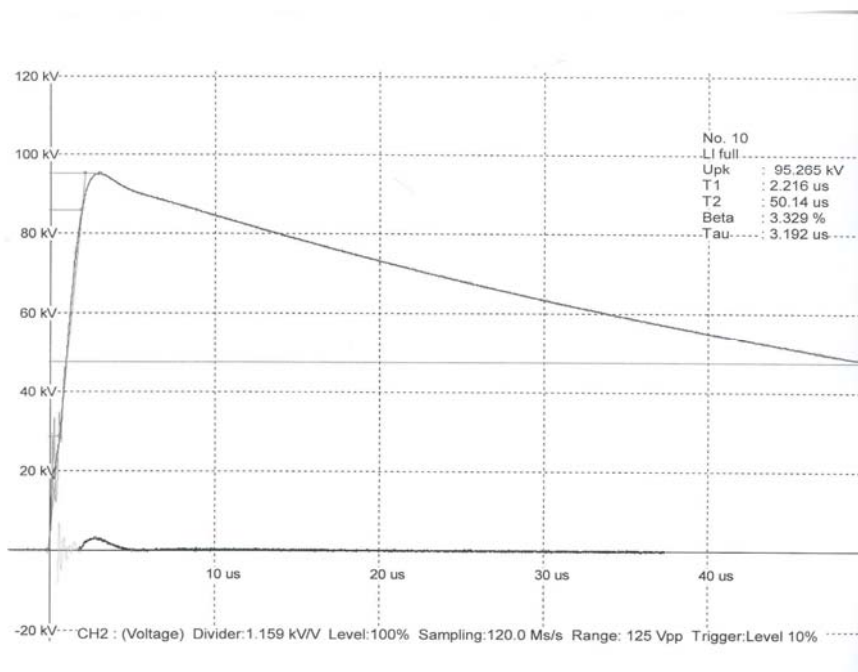


Figure 9: 10th positive impulse applied on test loop 1 and 2.

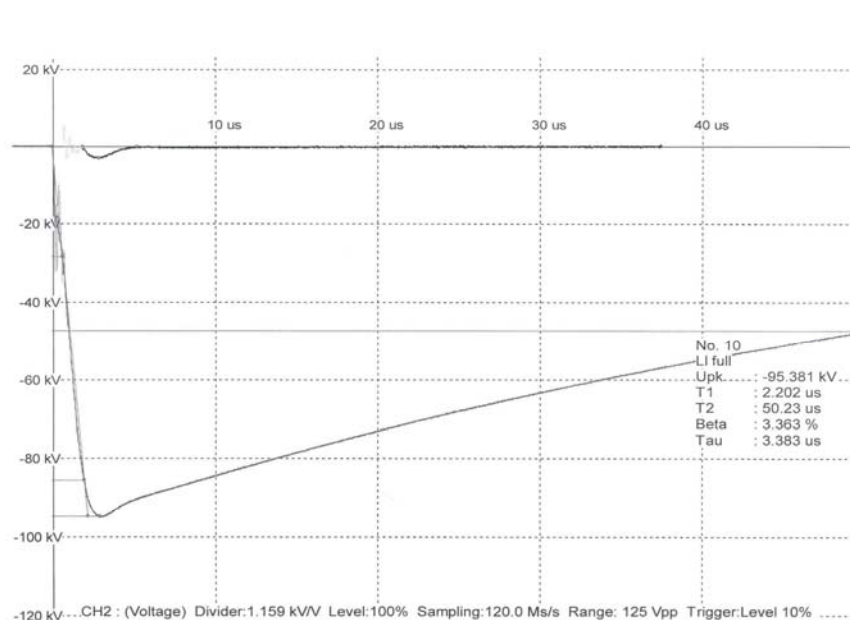


Figure 10: 10th negative impulse for test loop 1 and 2.

APPENDIX 1:
INSTALLATION INSTRUCTIONS


ELCOTERM TIS - 1282/KE

Installation instruction

HEAT SHRINKABLE INDOOR TERMINATION

for
three core
plastic or rubber insulated cable
with copper wire screen

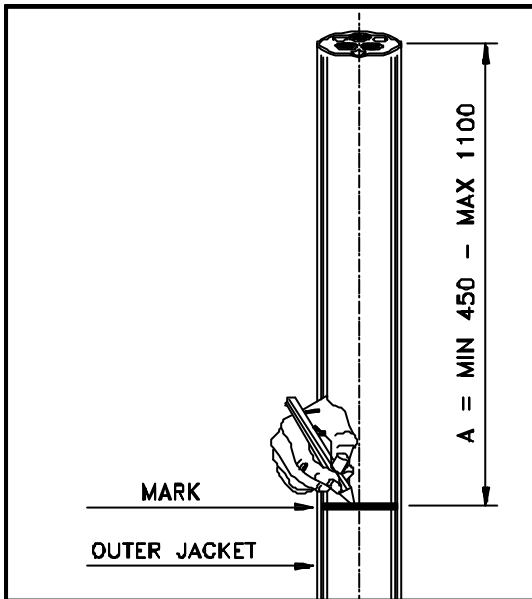
Highest Voltage Um 12 kV

 elcon megarad <small>HEADQUARTER: POMEZIA-ROME-Tel. 06/91802015 Pbx - Fax 06/91251302 Web site: www.elconmegarad.com e-mail: moreinfo@elconmegarad.com FACTORY: ARCELLA (AV) Tel. 0825/607038/9 - Fax 0825/607202</small>	DRAWING N°	Code MP 12970	Dawn	Rev.	Approved
	844/KE-12	Issue	27/01/2006	15/02/2006	
		Signature	C.I.	C.I.	M.M.

GENERAL INFORMATION

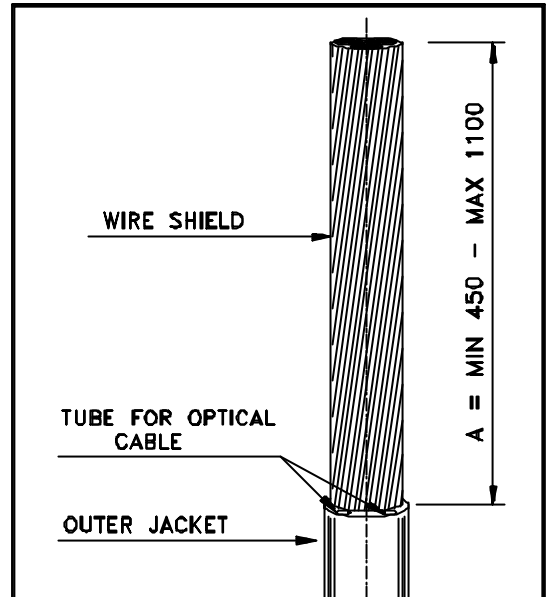
- READ CAREFULLY THE INSTRUCTIONS BEFORE STARTING CABLE PREPARATION.
- CHECK IF ALL THE COMPONENTS LISTED ON THE BILL OF MATERIAL ARE IN THE KIT.
- HEAT SHRINK THE TUBES USING A SOFT FLAME OF A BUTAN OR PROPANE GAS TORCH, STARTING AT THE BOTTOM AND SLOWLY UP TOWARD THE CONDUCTOR, HEATING IT UNIFORMLY ALONG THE CIRCUMFERENCE MOVING IT ALL AROUND. DO NOT INSIST ON THE SAME PARTS, AND STOP WHEN COMPLETELY SHRUNK.

1. CABLE PREPARATION



1.1 Train the cable in final position properly to connect to the electrical system.

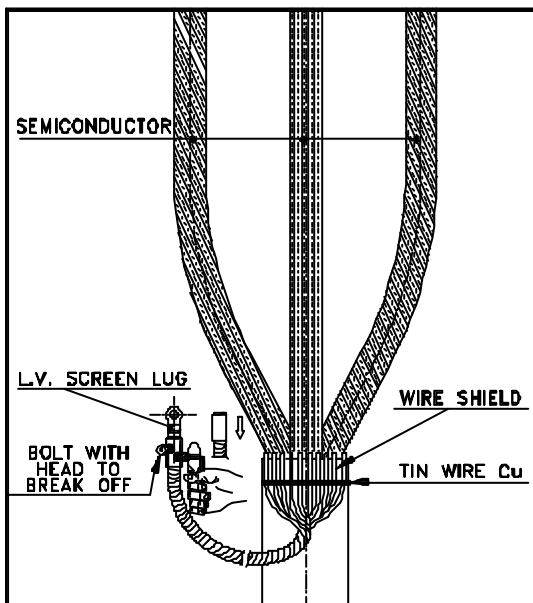
1.2 **Mark** the outer jacket to the dimension of "**A = min 450 mm - max 1100 mm**" starting from the top.



1.3 Cut and remove the **outer jacket** for a dimension of "**A**" mm.

1.4 Remove the tubes for optical cable at the outer jacket cut.

EACH CORE OPERATION

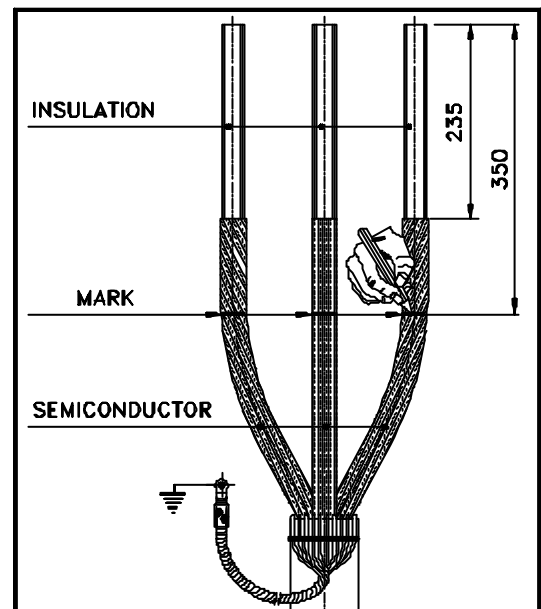


1.5 Don't cut the wires shield, but turn them uniformly on the outer jacket.

1.6 Fix with **tin wire Cu** the wires of metallic shield on the outer jacket.

1.7 Joint and twist the wires of the metallic shield together in order to obtain a strand-shape conductor.

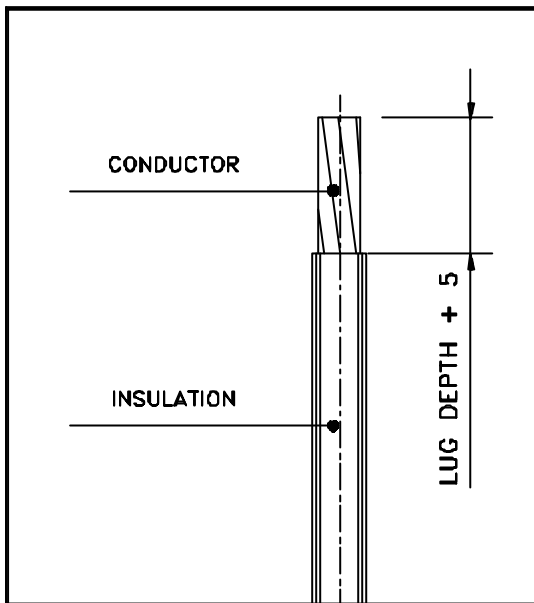
1.8 Apply a suitable **l.v. screen lug with bolts to break off**, orient it correctly, and screw it with a suitable tools.



1.9 Remove the **cable semiconductor** (if necessary use appropriate tool) for the dimension of **235 mm** from top of the cable. Pay attention do not nick the insulation.

1.10 **Mark** the semiconductor (**without damaging it**) for a dimension of **350 mm** from the top.

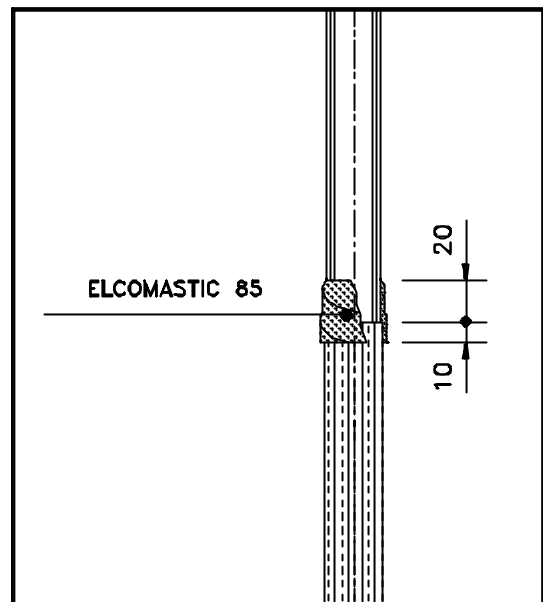
2. STRESS CONTROL OPERATION



1.11 Remove the **insulation** leaving exposed the conductor for **lug depth + 5 mm**. Clean up the exposed conductor.

1.12 If necessary, smooth the insulation surface, to be sure that all semiconductor traces are removed, using the supplied **abrasive cloth** without touching the semiconductor layer.

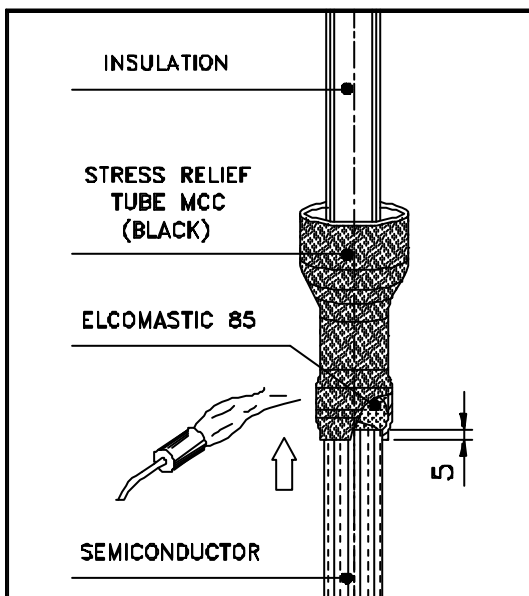
1.13 Clean the cable insulation by the **cleaning tissue**, starting from the top end toward the semiconductor, if necessary clean also the cable semiconductor without touching the primary insulation previously cleaned.



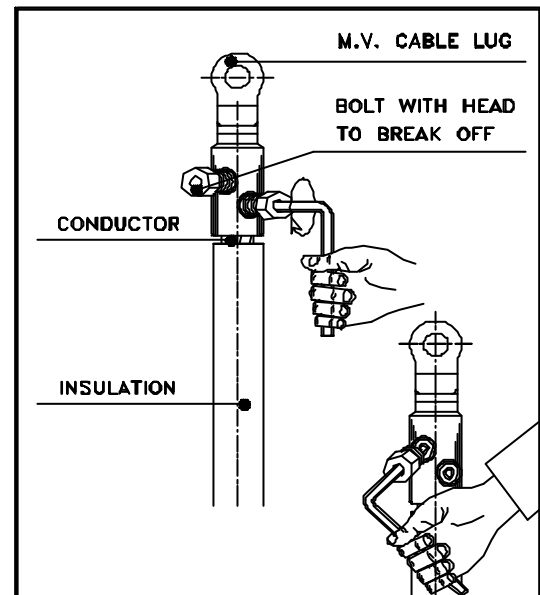
Note: the **ELCOMASTIC 85** tape must be applied **stretching up to reduce the original width to the half, at least**.

2.1 Wrap two halflapped layers of **ELCOMASTIC 85**, overlapping for **20 mm** the insulation and for **10 mm** the semiconductor.

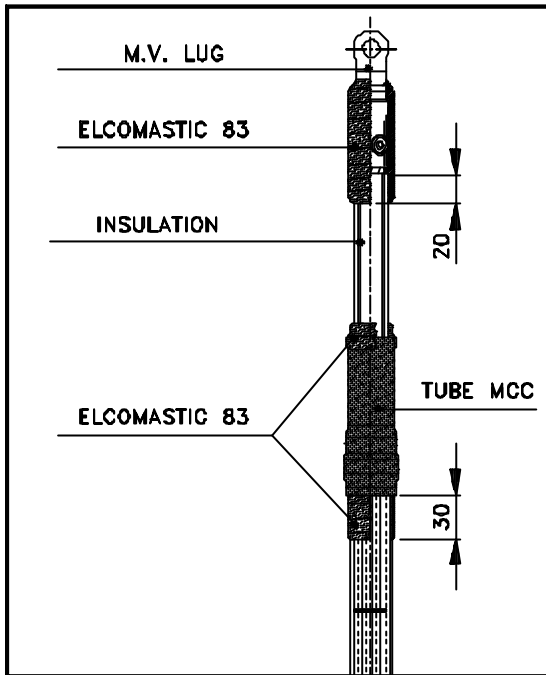
3. M.V. LUG APPLICATION, SEALING AND TERMINATION INSTALLATION



2.2 Place the **stress relief tube MCC** (black) on to the semiconductor at **5 mm** from ELCOMASTIC 85 end. Heat shrink the tube.



3.1 Apply a suitable **M.V. cable lug** (the figure shown the lug with bolts to break off), orient it correctly, and screw it with a suitable tools, remove sharp or point of a crimping product and, at last fill up by a mastic eventual hole.

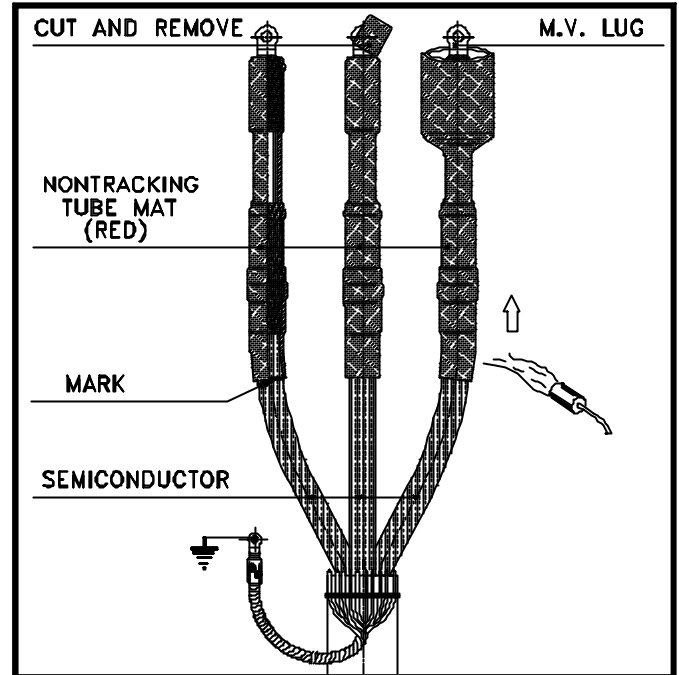


Note: the ELCOMASTIC 83 tape must be applied stretching up to reduce the original width to the half, at least.

3.2 Apply the **ELCOMASTIC 83** on the exposed conductor, between insulation and the lug, overlapping the insulation for **20 mm** and the cylindrical part of the lug by two layers.

3.3 Apply the **ELCOMASTIC 83** around the top edge of stress relief tube MCC, in order to fill up and smooth off the gap between the tube and the insulation.

3.4 Wrap two half-lapped layers of **ELCOMASTIC 83**, proceed from the bottom of MCC tube overlapping the exposed semiconductor for **30 mm**.



3.5 Slide on to each core the **nontracking tube MAT (red)**. Positioning the bottom edge of the tube on the mark previously made on the semiconductor layer. Heat shrink them. Cut and remove the possible surplus part of tube.

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

3.7 The termination is ready to be energized.



ELCOTERM TIS - 1282/KE

Bill of material

Code	FN 13074
Section	3 x 95 ÷ 240 mm² Cu/Al
Highest Voltage Um	12 kV
Rated Voltage Uo/U	6,35/11 kV
Description	Heat shrinkable indoor termination for three core plastic or rubber insulated cable with copper wire screen.

ITEM	Q.TY'	DESCRIPTION MATERIAL
1	3	M.V. cable lug with bolts to break off 95 ÷ 240 mm ²
2	3	Stress control tube MCC 17/47 length = 90 mm
3	3	Nontracking tube MAT 20/45 length = 370 mm
4	3	Stress control tape ELCOMASTIC 85 length = 0,3 m
5	3	Sealing mastic ELCOMASTIC 83 length = 1,5 m
6	1	P.V.C. tape ELCOPLAST 51
7	1	Polyten bag containing:
8	1	<i>l.v. screen lug with bolts to break off</i>
9	2	<i>Peeling rope 1,5 m</i>
10	3	<i>Abrasive cloth 30 x 300 mm</i>
11	9	<i>Cleaning tissue - bag</i>
12	1	<i>Tin wire Cu 1 m</i>
13	1	<i>Sealing mastic grey, filling the screw holes</i>
14	1	Glove P.E. - pair
15	1	Box carton - packaging
16	1	Label - packaging
17	1	Drawing N° 844/KE-12 with installation instruction

Date	20/04/06
Signature	M.M./C.I.


ELCOTERM TES - 1284/KE

Installation instruction

HEAT SHRINKABLE OUTDOOR TERMINATION

for
three core
plastic or rubber insulated cable
with copper wire screen

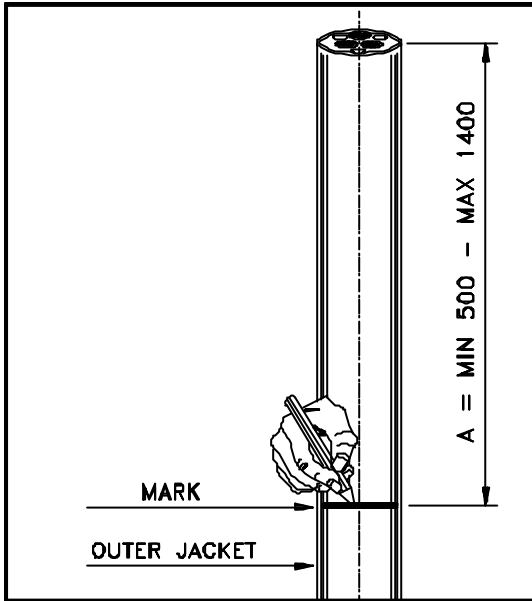
Highest Voltage Um 12 kV

 elcon megarad <small><u>HEADQUARTER:</u> POMEZIA-ROME-Tel. 06/91802015 Pbx - Fax 06/91251302 Web site: www.elconmegarad.com e-mail: moreinfo@elconmegarad.com <u>FACTORY:</u> ARCELLA (AV) Tel. 0825/607038/9 - Fax 0825/607202</small>	DRAWING N°	Code MP 12971	Dawn	Rev.	Approved
	846/KE-12	Issue	27/10/2006	15/02/2006	
		Signature	C.I.	C.I.	M.M.

GENERAL INFORMATION

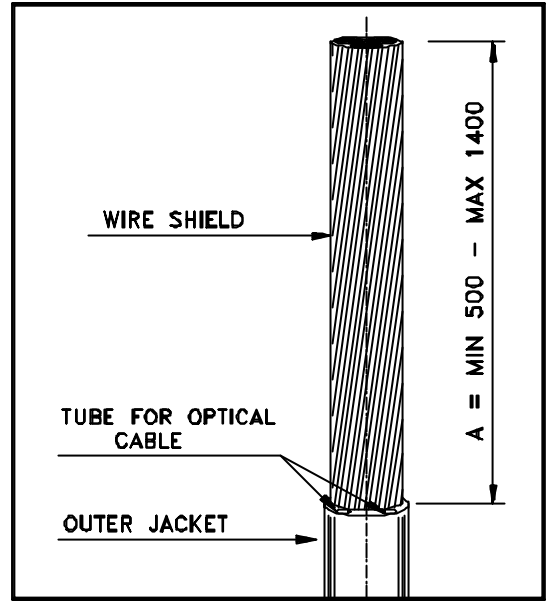
- READ CAREFULLY THE INSTRUCTIONS BEFORE STARTING CABLE PREPARATION.
- CHECK IF ALL THE COMPONENTS LISTED ON THE BILL OF MATERIAL ARE IN THE KIT.
- HEAT SHRINK THE TUBES USING A SOFT FLAME OF A BUTAN OR PROPANE GAS TORCH, STARTING AT THE BOTTOM AND SLOWLY UP TOWARD THE CONDUCTOR, HEATING IT UNIFORMLY ALONG THE CIRCUMFERENCE MOVING IT ALL AROUND. DO NOT INSIST ON THE SAME PARTS, AND STOP WHEN COMPLETELY SHRUNK.

1. CABLE PREPARATION



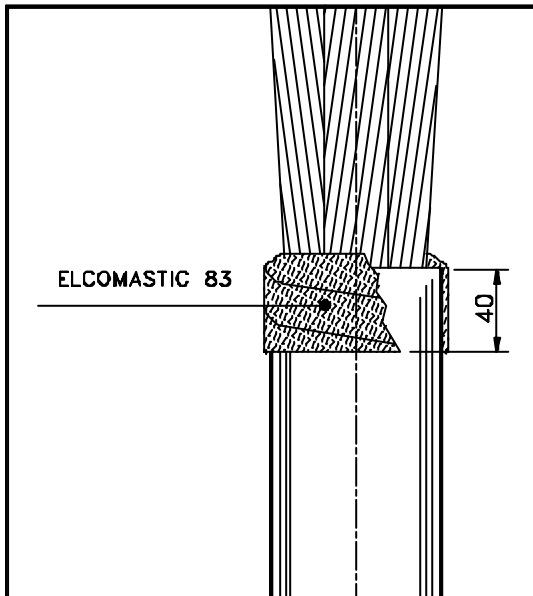
1.1 Train the cable in final position properly to connect to the electrical system.

1.2 Mark the outer jacket to the dimension of "A = min 500 mm - max 1400 mm" starting from the top.



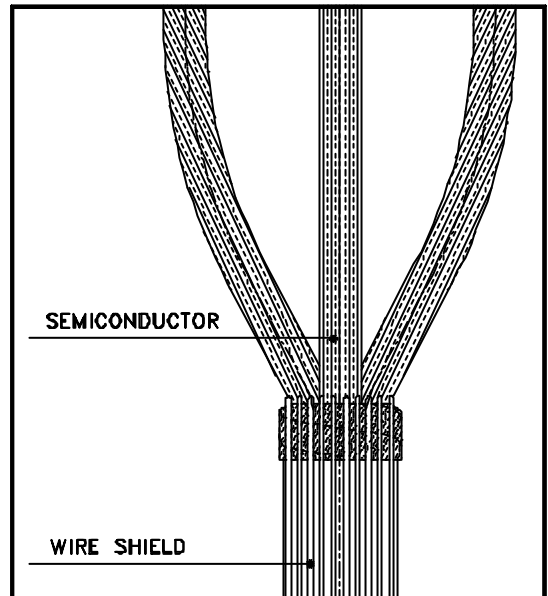
1.3 Cut and remove the **outer jacket** for a dimension of "A" mm.

1.4 Remove the tubes for optical cable at the outer jacket cut.

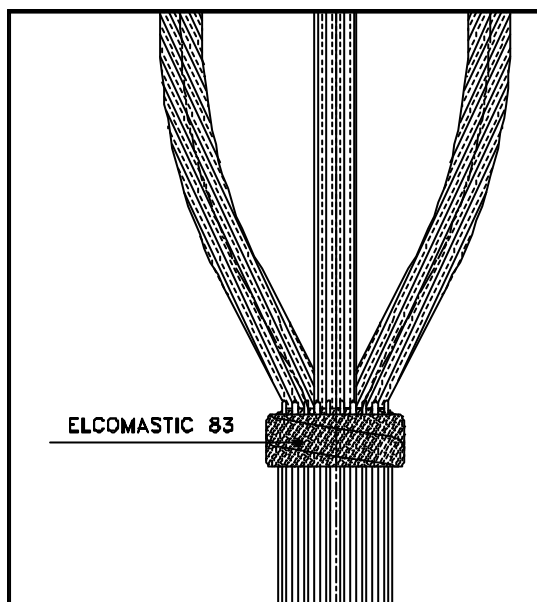


Note: the ELCOMASTIC 83 tape must be applied stretching up to reduce the original width to the half, at least.

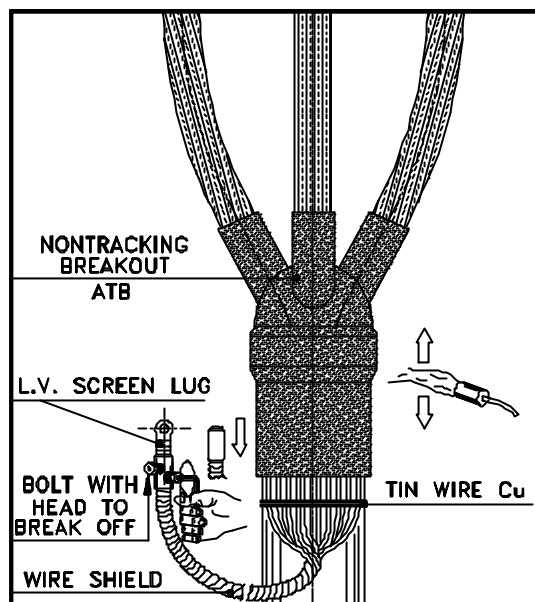
1.5 Apply two half lapped layer of ELCOMASTIC 83 tape on the outer jacket edge for 40 mm.



1.6 Don't cut the wires shield, but turn them uniformly on the outer jacket.



1.7 Cover with two halflapped layer of **ELCOMASTIC 83** tape the same tape previously applied on the outer jacket in such a way to fix also the wire shield.



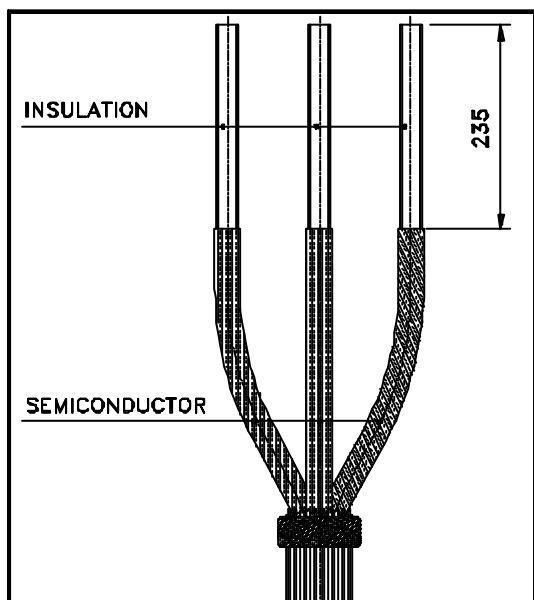
1.8 Slide on the **nontracking breakout ATB** over the cores. Push the breakout as far as possible down in to the trifurcation cable. Heat shrink the **nontracking breakout ATB**, starting from the middle toward the edge.

1.9 Fix with **tin wire Cu** the wires shield on the outer jacket at breakout end.

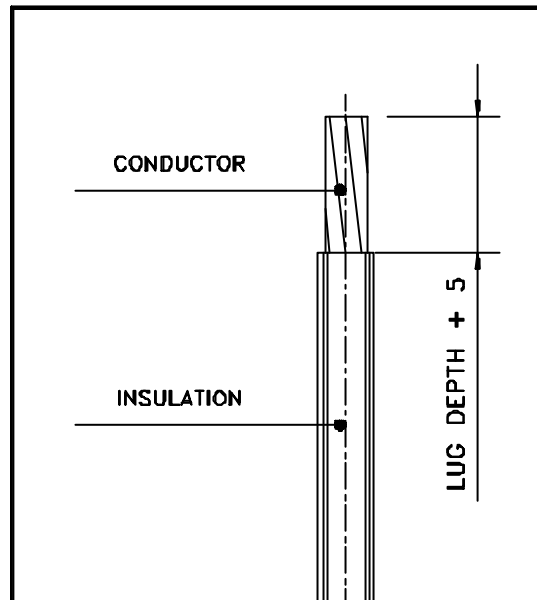
1.10 Joint and twist the wires of the metallic shield together in order to obtain a strand-shape conductor.

1.11 Apply a suitable **l.v. lug with bolts to break off**, orient it correctly, and screw it with a suitable tools.

EACH CORE OPERATION



1.12 Remove the **cable semiconductor** (if necessary use appropriate tool) for the dimension of **235 mm** from top of the cable. Pay attention do not nick the insulation.

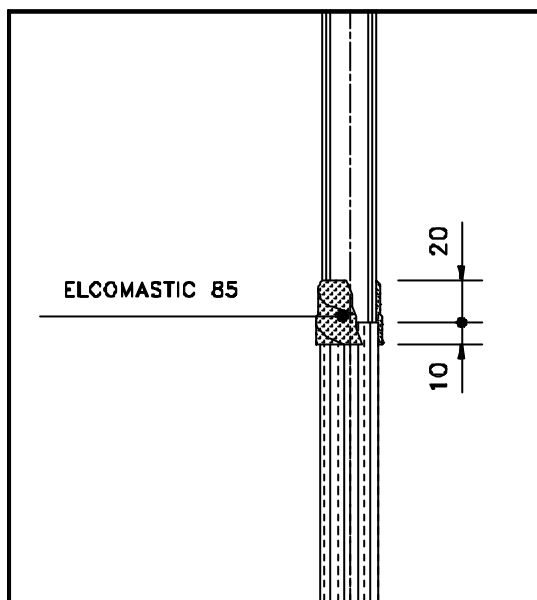


1.13 Remove the **insulation** leaving exposed the conductor for **lug depth + 5 mm**. Clean up the exposed conductor.

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

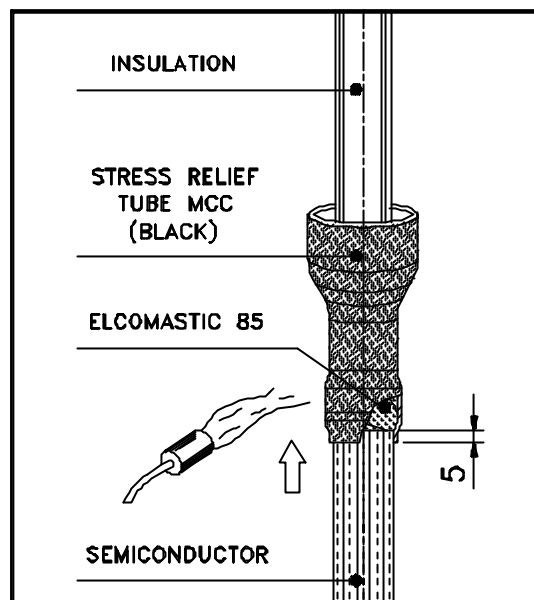
1.15 Clean the cable insulation by the cleaning tissue, starting from the top end toward the semiconductor, if necessary clean also the cable semiconductor without touching the primary insulation previously cleaned.

2. STRESS CONTROL OPERATION



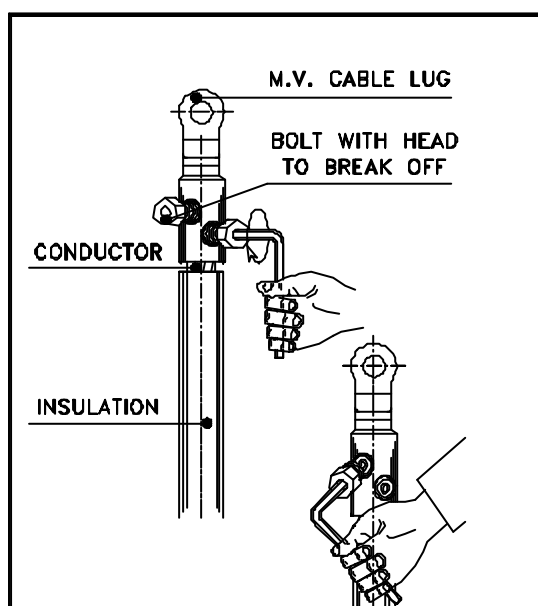
Note: the ELCOMASTIC 85 tape must be applied stretching up to reduce the original width to the half, at least.

2.1 Wrap two halflapped layers of **ELCOMASTIC 85**, overlapping for **20 mm** the insulation and for **10 mm** the semiconductor.

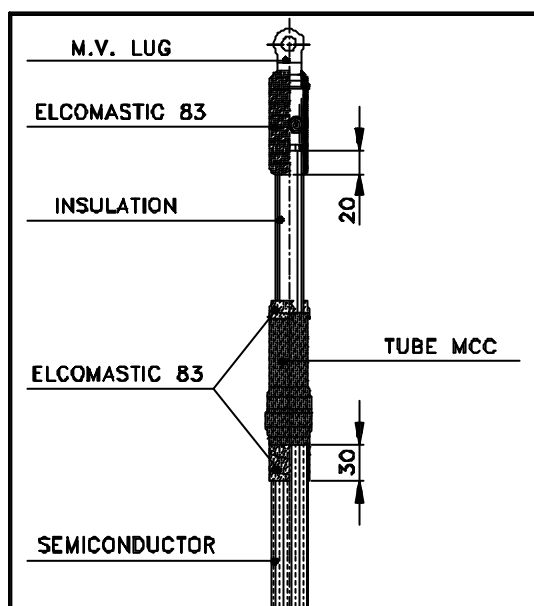


2.2 Place the **stress relief tube MCC (black)** on to the semiconductor at **20 mm** from ELCOMASTIC 85 end. Heat shrink the tube.

3. M.V. LUG APPLICATION, SEALING AND TERMINATION INSTALLATION



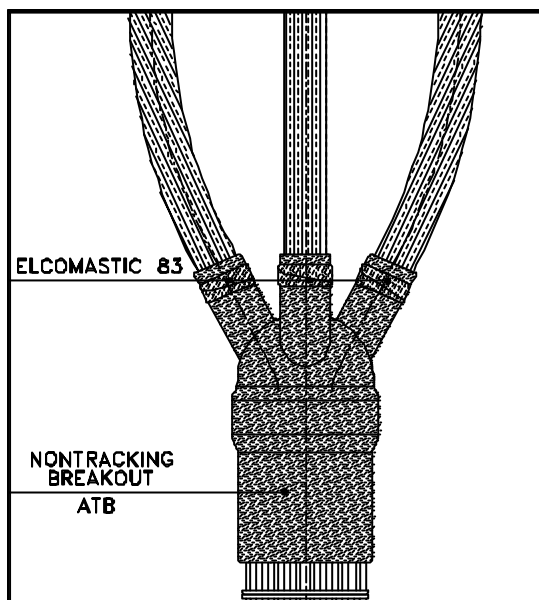
3.1 Apply a suitable **M.V. cable lug** (the figure shown the lug with bolts to break off), orient it correctly, and screw it with a suitable tools, remove sharp or point of a crimping product and, at last fill up by a mastic eventual hole.



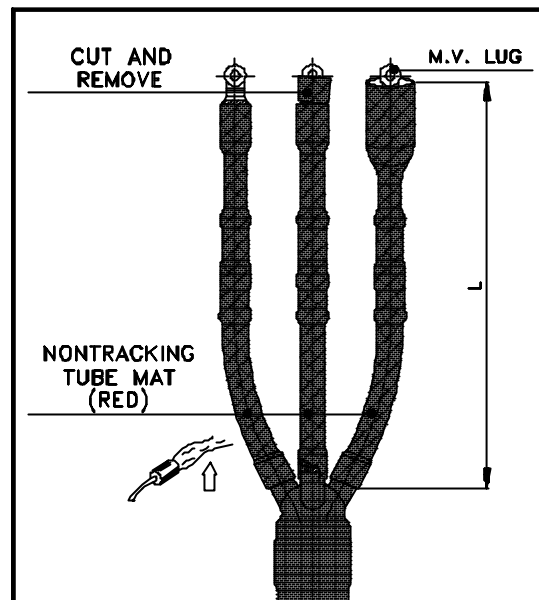
3.2 Apply the **ELCOMASTIC 83** on the exposed conductor, between insulation and the lug, overlapping the insulation for **20 mm** and the cylindrical part of the lug by two layers.

3.3 Apply the **ELCOMASTIC 83** around the top edge of stress relief tube MCC, in order to fill up and smooth off the gap between the tube and the insulation.

3.4 Wrap two halflapped layers of **ELCOMASTIC 83**, proceed from the bottom of MCC tube overlapping the exposed semiconductor for **30mm**.



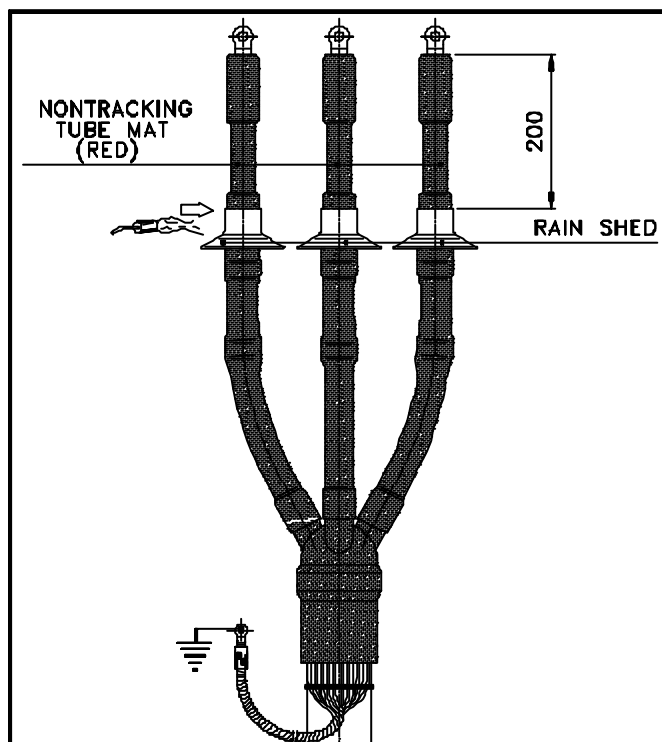
3.5 Wrap one layer of **ELCOMASTIC 83** on the nontracking breakout fingers.



3.6 Cut the **nontracking tube MAT** (red) for the length necessary according the dimension " L ".

3.7 Slide on to each core the **nontracking tube MAT**. Overlap as far as possible the breakout fingers. Heat shrink them. Cut and remove the possible surplus part of tube.

4. RAIN SHED APPLICATION



4.1 **Apply the rain shed just after the heat shrinking of the MAT tube** locating the upper rain shed edge at **200 mm** from the top of nontracking tube edge and heat shrink around the circumference orienting the heat only on the neck of the rain shed.

4.2 Connect the medium voltage lug to the electrical sistem and the low voltage lug to the ground station.

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



ELCOTERM TES - 1284/KE**Bill of material**

Code	FN 13076
Section	3 x 95 ÷ 240 mm² Cu/Al
Highest Voltage Um	12 kV
Rated Voltage Uo/U	6,35/11 kV
Description	Heat shrinkable outdoor termination for three core plastic or rubber insulated cable with copper wire screen.

ITEM	Q.TY'	DESCRIPTION MATERIAL
1	3	M.V. cable lug with bolts to break off 95 ÷ 240 mm ²
2	3	Stress control tube MCC 17/47 length = 90 mm
3	3	Nontracking tube MAT 20/45 length = 1,4 m
4	1	Nontracking breakout ATB 110/50
5	3	Rain shed ICT2
6	3	Stress control tape ELCOMASTIC 85 length = 0,3 m
7	4	Sealing mastic ELCOMASTIC 83 length = 1,5 m
8	1	P.V.C. tape ELCOPLAST 51
9	1	Polyten bag containing:
10	1	<i>l.v. screen lug with bolts to break off</i>
11	2	<i>Peeling rope 1,5 m</i>
12	3	<i>Abrasive cloth 30 x 300 mm</i>
13	9	<i>Cleaning tissue - bag</i>
14	1	<i>Tin wire Cu 1 m</i>
15	1	<i>Sealing mastic grey, filling the screw holes</i>
16	1	Glove P.E. - pair
17	1	Box carton - packaging
18	1	Label - packaging
19	1	Drawing N°846/KE-12 with installation instruction

Date	20/04/06
Signature	M.M./C.I.

ELCOTERM GLS - 1275/KE


Installation instruction

HEAT SHRINKABLE

STRAIGHT JOINT

for
three core
plastic or rubber insulated cable
with copper wire screen

Highest Voltage Um 12 kV

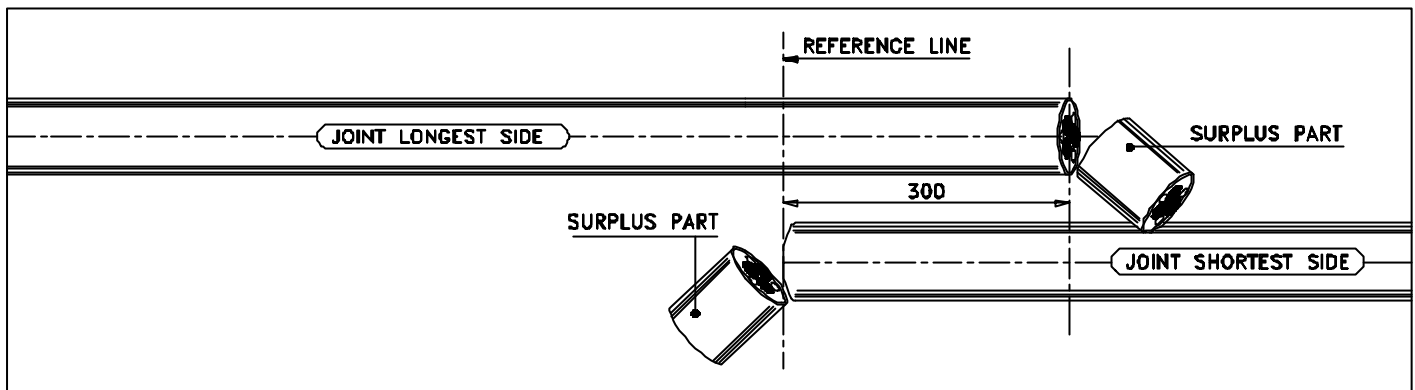
 <p>elcon megarad</p> <p><u>HEADQUARTER:</u> POMEZIA-ROME-Tel. 06/91802015 Pbx - Fax 06/91251302 Web site: www.elconmegarad.com e-mail: moreinfo@elconmegarad.com</p> <p><u>FACTORY:</u> ARCELLA (AV) Tel. 0825/607038/9 - Fax 0825/607202</p>	DRAWING N°	Code MP 12981	Drawed	Rev.	Approved
	834/KE-12	Issue	25/01/06		
		Signature	N.R.		M.M.

GENERAL INFORMATION

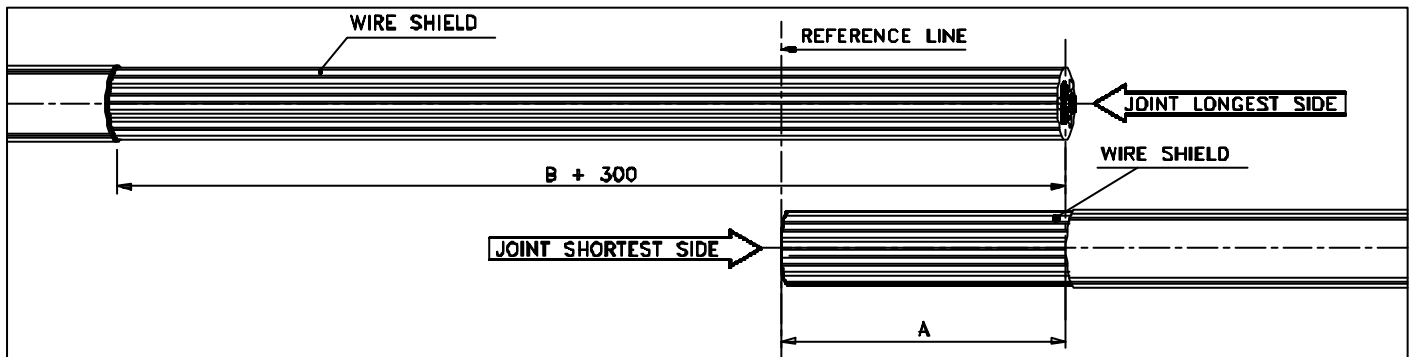
- READ CAREFULLY THE INSTRUCTIONS BEFORE STARTING CABLE PREPARATION.
- CHECK IF ALL THE COMPONENTS LISTED ON THE BILL OF MATERIAL ARE IN THE KIT.
- HEAT SHRINK THE TUBES USING A SOFT FLAME OF A BUTAN OR PROPANE GAS TORCH, STARTING FROM THE CENTER AND SLOWLY UP TOWARD THE END, HEATING IT UNIFORMLY ALONG THE CIRCUMFERENCE MOVING IT ALL AROUND. DO NOT INSIST ON THE SAME PARTS, AND STOP WHEN COMPLETELY SHRUNK.

1. CABLES PREPARATION

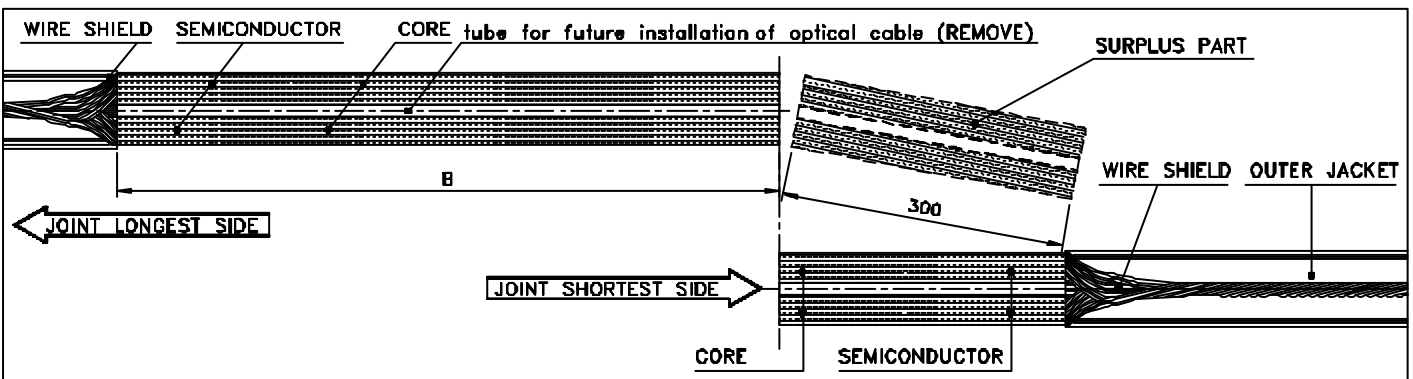
- 1.1 Train the cables to overlap both ends for **1 m** at least; mark on to the cables a reference line in a center of joint. Cut only one cable on the reference line, and the other cable (longest side) at **300 mm** toward the end from the reference line so to remove the surplus part.



- 1.2 Cut and remove the **outer jacket** and possible inner jacket according to the dimension "**A**" (*shown on the bill of material enclosed*) from the shortest cable side and for the dimension "**B**" (*shown on the bill of material enclosed*) + **300 mm** from the longest cable side.
- 1.3 Clean up the outer jacket with a suitable solvent for **1,5 m** at least to avoid dirtiness is transferred to the internal surface of the heat shrinkable tube.



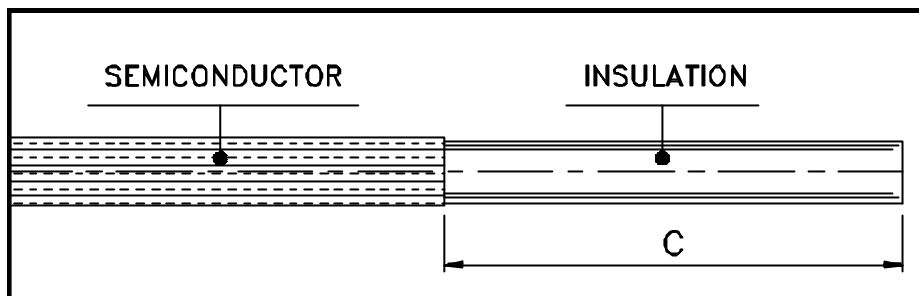
- 1.4 Don't cut the wire shield but turn them downwards the outer jacket. Fix them on the outer jacket by some layer of **ELCOPLAST 51**.
- 1.5 Cut and remove only from the longest cable side the cores end for **300 mm**.
- 1.6 Remove the optical tube and spread the cores.



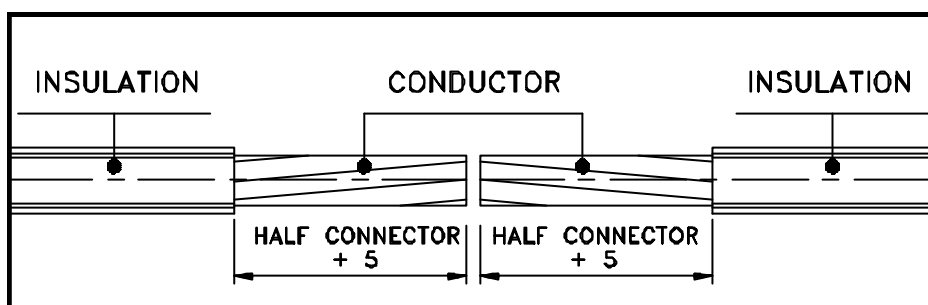
2. CORES PREPARATION

--- Each core operation ---

- 2.1 Remove the cable semiconductor (if necessary use appropriate tool), for the dimension " C " (*shown on the bill of material enclosed*) from the edge.

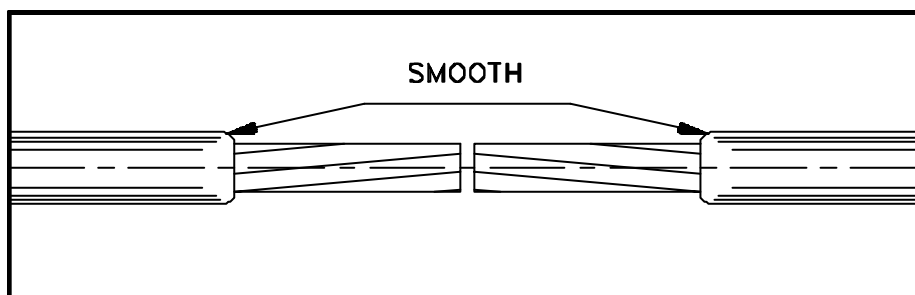


- 2.2 Remove the cable primary insulation from the top of a cable for **HALF CONNECTOR DEPTH + 5mm**. Take care to do not nick the conductor.



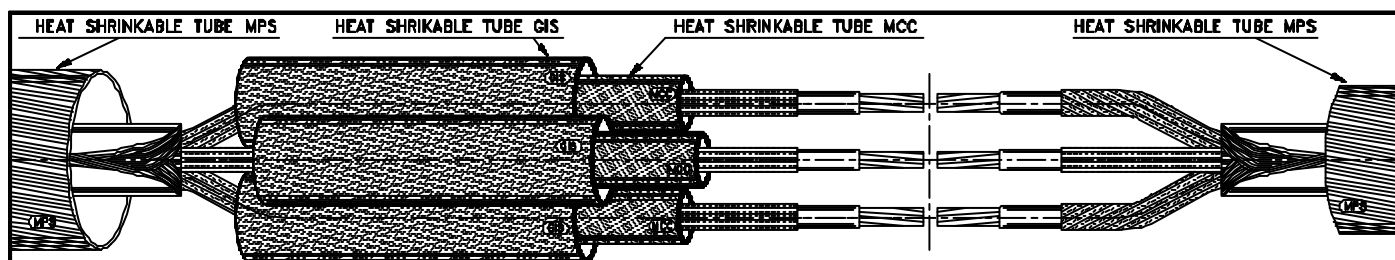
- 2.3 If necessary smooth the insulation surfaces, to be sure that all semiconducting traces are removed, using the supplied abrasive cloth without touching the cable semiconductor. Smooth the insulating cutting edge.

- 2.4 Clean up the exposed conductors and apply on the edge some laps of **ELCOPLAST 51**.



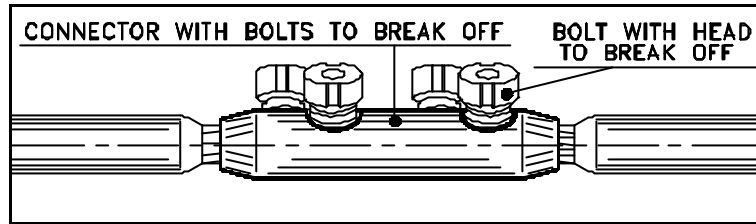
- 2.5 **WARNING:** Slip on the outer jacket, the **two sealing MPS** shrinkable tubes.

- 2.6 **WARNING:** Slip on each phase (joint longest side) **n.1 insulating and semiconductive GIS** tube and **n.1 stress control MCC** tube. Protect them opportunely from dirtiness.

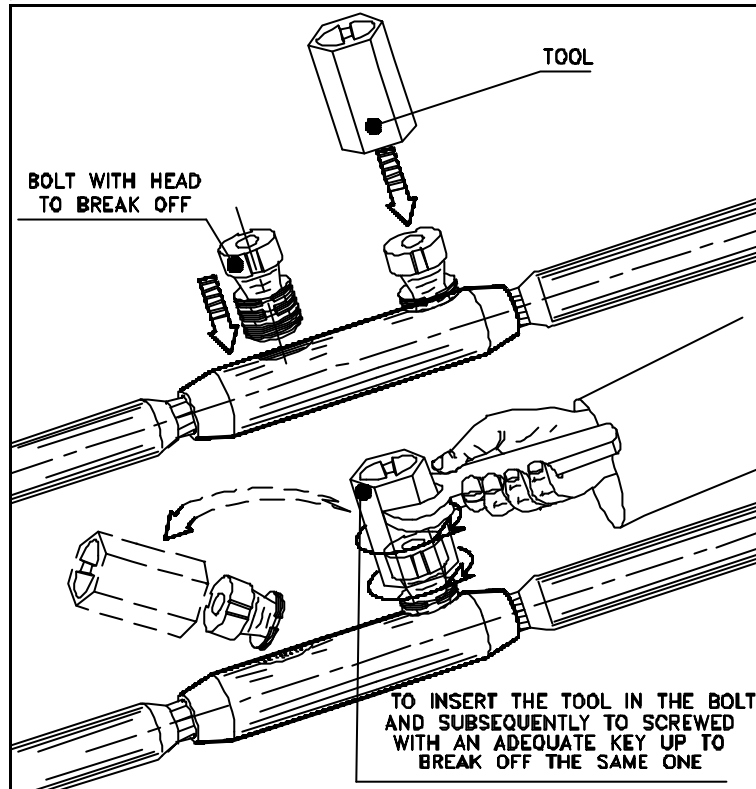


--- Follow the instructions for each core at a time ---

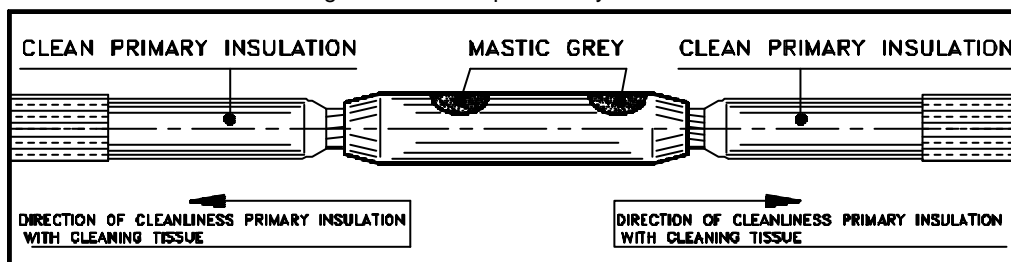
- 2.7 Remove the P.V.C. tape on the conductors, connect the conductors using a suitable **M.V. CONNECTOR**. (The figure shown the connector with bolts to break off).



- 2.8 After to have screwed the four bolts on the connector to insert the tool in the bolt (one to the time) and subsequently screwed with an adequate key up to break off the some one.

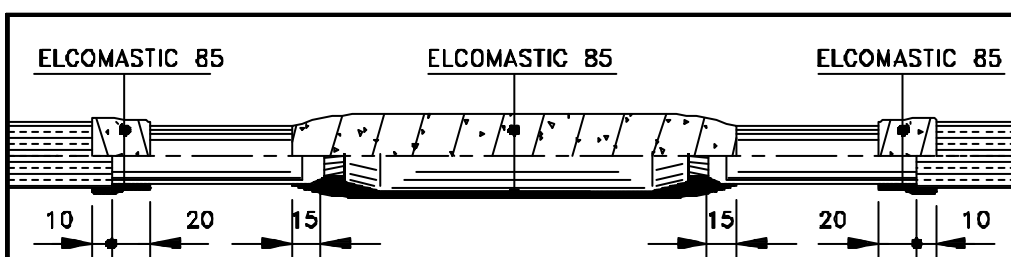


- 2.9 Cover the holes on the connector with filling mastic grey.
- 2.10 Clean the cable insulation by the cleaning tissue, starting from the top end toward the semiconductor, if necessary clean also the cable semiconductor without touching the insulation previously cleaned.



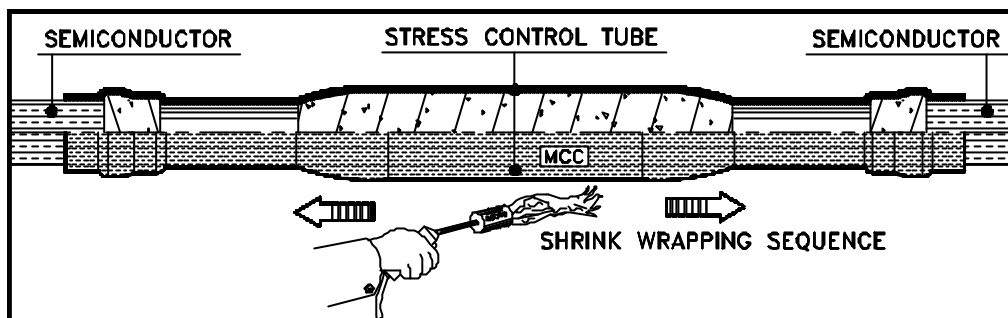
NOTE: the **ELCOMASTIC 85** tape must be applied stretching up to reduce the original width to the half, about.

- 2.11 Apply at least two half lapped layers of **ELCOMASTIC 85** tape, on the connector area, filling uniformly the area between connector ends and primary insulation, wich has to be overlapped for about **15mm**. Any way, after wrapping, the final diameter in the connector area should be slightly greater than one of cable insulation.
- 2.12 Apply two half lapped layers of **ELCOMASTIC 85**, on the cable semiconductor edges overlapping it for **10 mm** and the insulation for **20 mm**.

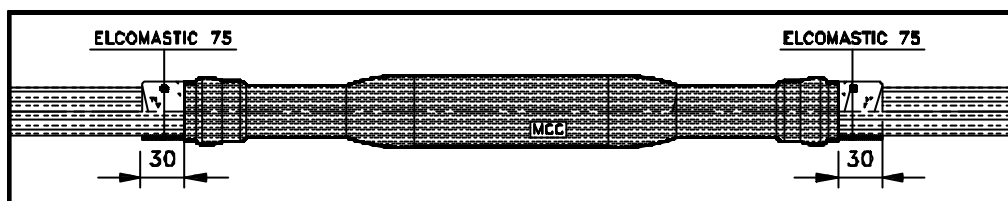


- 2.13 Slide the **stress control tube MCC** (black colour) on the joint in such a way as to overlap fairly the cable semiconductor on both sides. Heat shrink the tube starting from the center toward the ends. Pay attention to avoid heat shrink the other tubes on the side of the cores.

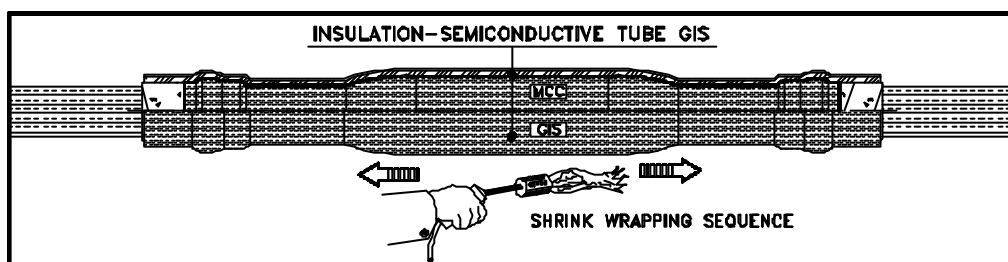
WARNING: the **stress control tube MCC** have to be cleaned by appropriate solvent after the heat shrinking.



- 2.14 Apply two half lapped layer of **ELCOMASTIC75**, starting from **MCC** tube edges overlapping for **30 mm** the cable semiconductor on both sides.

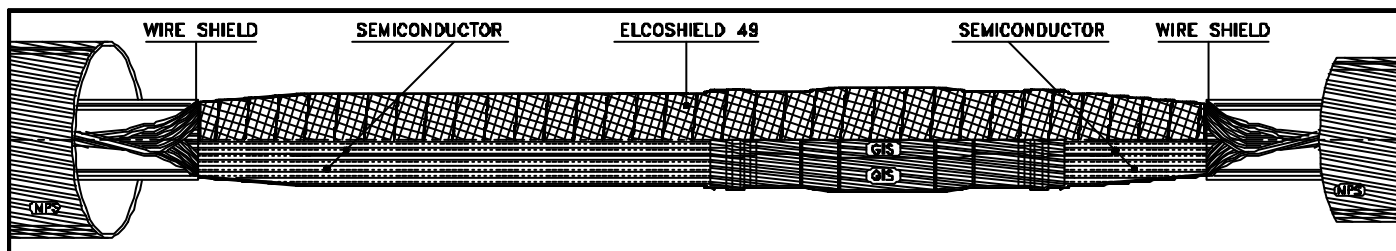


- 2.15 Position the shrinkable **insulating and semiconductive tube GIS** (red/black colour), on the joint in such away to center it on the previously applied tube, heat shrink it as above.

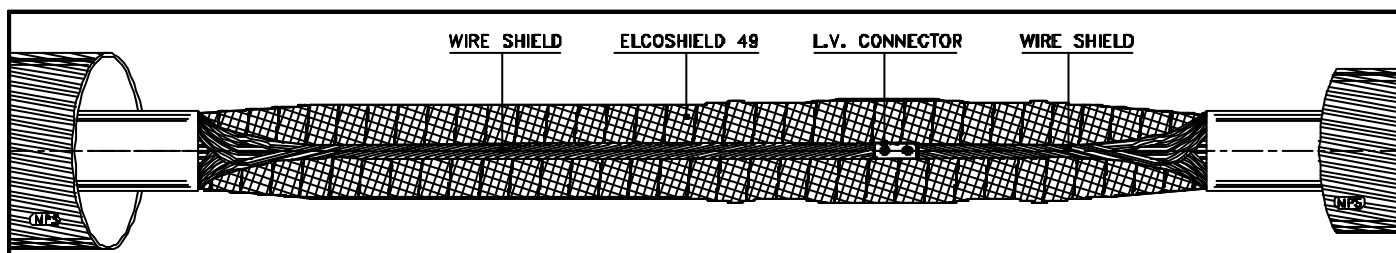


3. SHIELDING OPERATION

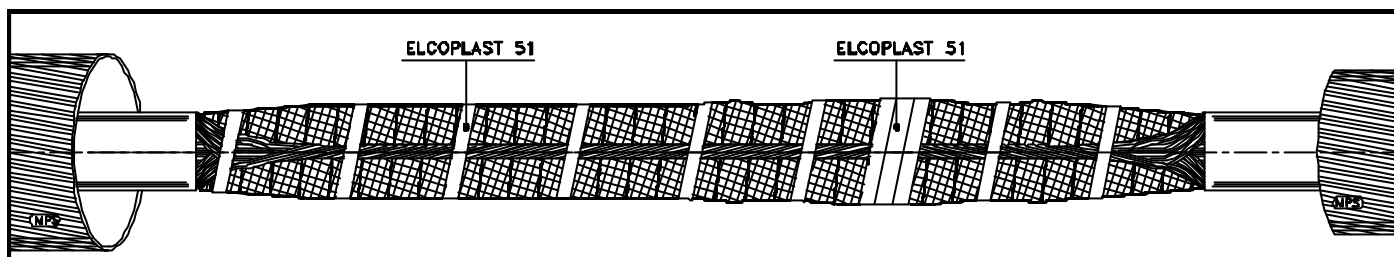
- 3.1 Compact the cores and wrap the **ELCOSHIELD 49** tinned copper tape around the three cores, start up to overlap the exposed semiconductor, wrap the cores with an overlap 20 % until overlap the exposed semiconductor at opposite side. Fix the extremity, at the end of the taping, by a knot obtained by the same tape.



- 3.2 Turn the wire shield on to the joint, joint and twist the wires together in order to obtain a strand shape conductor. After having removed the exceeding length, connect the conductors by a **L.v.connector** contained in the kit, out of central area of joint.

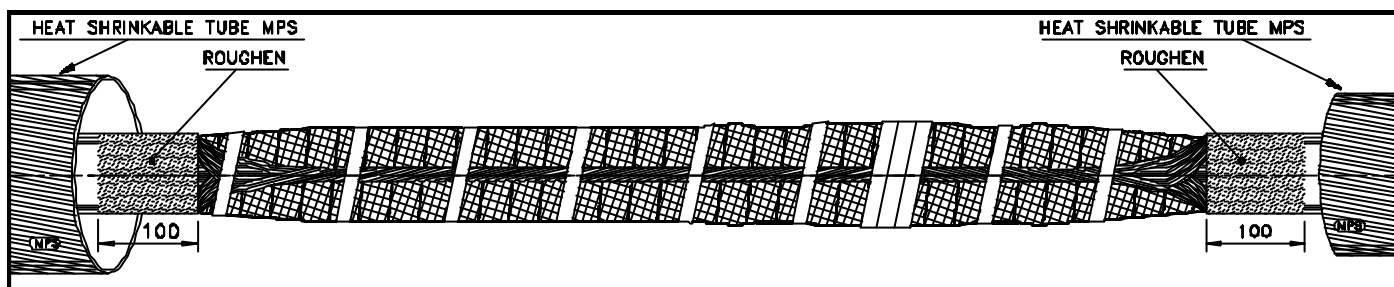


- 3.3 Fix the l.v. connector and the tapping of the ELCOSHIELD 49 to the joint by some layers of **ELCOPLAST 51**.



4. OUTER JACKET BUILD UP OPERATION.

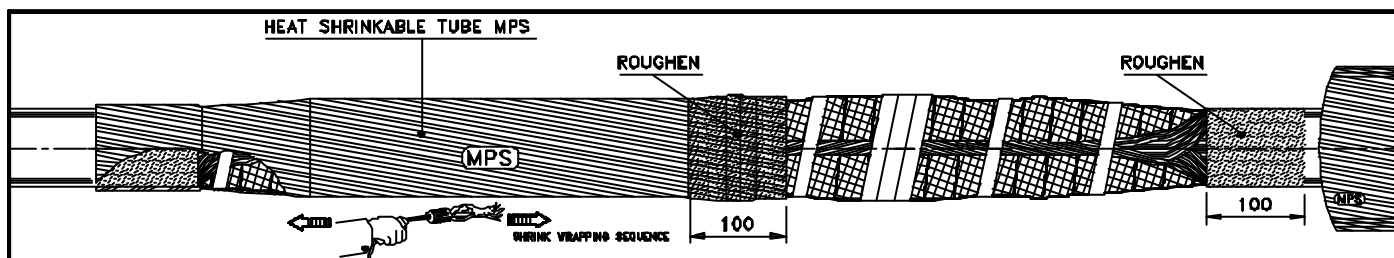
- 4.1 Roughen with abrasive cloth the outer jacket for **100 mm**, on both edges.



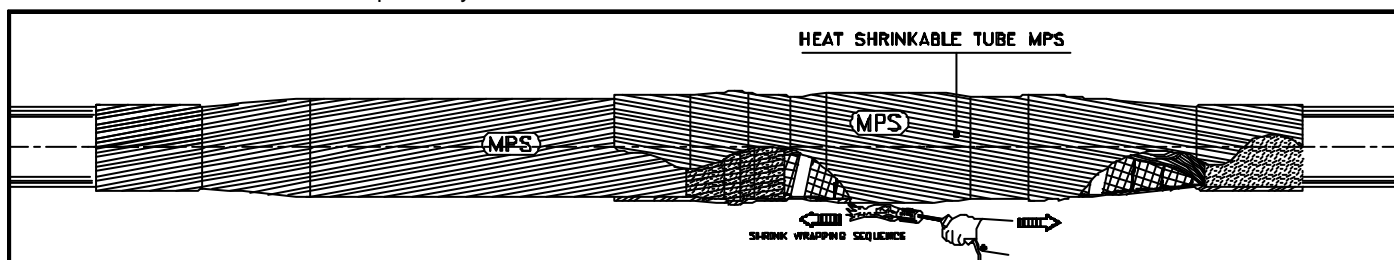
- 4.2 Slide on the joint one of the **sealing MPS** tubes overlapping the roughen on the outer jacket for **100 mm**.

- 4.3 Heat shrink the tube, as before mentioned, until it perfectly stick to the cable. The adhesive that will come out from the ends of tube shows that the heat shrinking has been sufficient.

- 4.4 Roughen the tube edge in a middle point of the joint for **100 mm** at least.



- 4.5 Slide on the second **sealing MPS** tube to overlap for **100 mm**, the outer jacket edge, and the **MPS** tube previously applied. Heat shrink the tube until it perfectly stick to the cable.



- 4.6 The joint is ready to be energized.



DIMENSION FOR CABLE PREPARATION (mm)			MAXIMUM DIMENSIONS OF CONNECTORS (mm)	
OUTER JACKET REMOVAL		SEMICONDUCTOR REMOVAL	LENGTH	DIAMETER
A	B	C		
350	750	150	130	33

ELCOTERM GLS - 1275/KE

Bill of material

Code	FN 13078
Section	3 x 95 ÷ 240 mm² Cu/Al
Highest Voltage Um	12 kV
Rated Voltage U0/U	6,35/11 kV
Description	Heat shrinkable straight joint for three core plastic or rubber insulated cable with copper wire screen.

ITEM	Q.TY'	DESCRIPTION MATERIAL
1	3	M.V. cable connector with bolts to break off 95 ÷ 240 mm ²
2	3	Stress control tube MCC 17/47 length = 380 mm
3	3	Insulating and semiconductive tube GIS 20/66 length = 420 mm
4	1	Sealing tube MPS 130/36 length = 750 mm
5	1	Sealing tube MPS 140/42 length = 750 mm
6	3	Stress control tape ELCOMASTIC 85 length = 2 m
7	3	Sealing mastic ELCOMASTIC 75 length = 0,6 m
8	1	P.V.C. tape ELCOPLAST 51 25 mm x 20 m
9	3	Tinned copper tape ELCOSHIELD 49 60 mm x 3 m
10	1	Polyten bag containing:
11	3	<i>Peeling rope 1,5 m</i>
12	3	<i>Abrasive cloth 30 x 300 mm</i>
13	9	<i>Cleaning tissue - bag</i>
14	1	<i>I.v. connector with bolts to break off (SJ 1.47)</i>
15	3	<i>Sealing mastic grey, filling the screw holes</i>
16	1	Glove disposable - pair
17	1	Box carton - packaging
18	1	Label - packaging
19	1	Drawing N°834/KE-12 with installation instruction

Date 20/04/06
Signature M.M./G.D.

APPENDIX 2:
TEST EQUIPMENT

For DC testing:

HVDC generator:	Registration no.: B02- 0444
HV probe	Registration no.: I06 - 0345

For current and voltage cycling:

Test transformer :	Registration no.: B1- 698
Variac:	Registration no.: B1- 555
Split core transformer:	Registration no.: B1- 587
Variac:	Registration no.: B1- 205
Clamp on measuring current transformer:	Registration no.: I04- 0254
Voltmeter:	Registration no.: S03-224
Amperemeter:	Registration no.: D1-443

For Partial Discharge Measurements and AC testing:

Power Supply:	Registration no.: N07-0067
PD preamplifier:	Registration no.: N07-0102
PD RLC shunt:	Registration no.: I06-0397
PD calibrator:	Registration no.: H2-090
PD reg. oscilloscope:	Registration no.: G4-048
Coupling capacitor:	Registration no.: K03-0142, 0148, 0153
High voltage transformer:	Registration no.: B01-0591
Control desk:	Registration no.: B01-0591-02
Voltmeter:	Registration no.: C6-036

For impulse testing:

Control desk:	Registration no.: B3-026
Oscilloscope:	Registration no.: G05-0205
Impulse peak voltmeter:	Registration no.: C6-30
Impulse generator:	Registration no.:
Resistive voltage divider:	Registration no.: I6-16

For Thermal short circuit testing

Rogowski coils:	Registration no.: I04-0256, 0257, 0258
Fiber transmitters:	Registration no.: P08-0036, 0038, 0037
Fiber receivers:	Registration no.: P08-0040, 0041, 0042
Transient recorder:	Registration no.: G5-079
Personal computer:	Registration no.: P07-443
Current transformer:	T8, 11kV/115V, 3MVA cont.

SATS Certification issues four kinds of documents:

1. Type Test Certificate

A type test certificate contains a record of a series of type tests strictly in accordance with one or more IEC standards or Regional or National Standards aligned with IEC. The tested equipment has fulfilled the requirements of the standard(s) and therefore the relevant ratings assigned by the manufacturer are justified

2. Certificate of Type Conformity

A certificate of type conformity granted by SATS Certification attests, with adequate confidence, that the product identified exhaustively and physically available at the time of certification, confirms to IEC, ANSI/IEEE and/or other regional or national standards.

3. Report of Type Test Conformity

A report of type test conformity attests, with adequate confidence, that the applicant's product identified in it and physically available at the time of certification, confirms to the specifications and/or other documents referred to in the report.

4. Report of Performance

A report of performance contains a record of one or more tests which have been carried out according to the client's instructions. The test(s) may be in accordance with a recognized standard. The results do not necessarily verify the ratings assigned by the manufacturer.

SATS Certification

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