TEST REPORT

REPORT No. (295/2014)

- **CLIENT: : ENERGYA POWER CABLES (ELSEWEDY HELAL) .**
- ***Report Date:*** 30 / 12 / 2014
- ***Place:***
  - *Laboratories of Extra High Voltage Research Center.*
  - *Internal code : TO – AC - 14 – 04 – 26 - 01*
- ***Requirements:***
  - Loop type tests according to IEC 60840.
- ***Standard Specification:***
  - ***IEC 60840 "Power cables with extruded insulation and their accessories for rated voltages above 30 kV (Um= 36 kV) up to 150 kV (Um = 170 kV).***
- ***Description of the Specimen :***

- Loop systems, cable and accessories consist of the following:

1- 38/66 kV Power cable with the following specification:

- Manufacturer	:	**ENERGYA POWER CABLES(ELSEWEDY HELAL)EETC.**
- Type	:	38/66 kV/CU/XLPE/LEAD/HDPE /1 x 1200 mm^2
- No. of Phases	:	1
- Insulation	:	XLPE
- Conductor Material	:	Copper + Swelling Powder
- Conductor cross-section	:	1200 mm^2
- Metallic sheath Material	:	Lead
- Over sheath Material	:	HDPE (ST_7)
- Sheath Color	:	Black
- Water Penetration Design	:	A barriers are included which prevents longitudinal water penetration (water blocking tape): Along the outer surface of the conductor, The gap between the outer surface of the insulation screen and the metallic screen .

2- ***One 38/66 kV Porcelain outdoor cable termination with the following specifications:***

- Manufacturer : EL SEWEDY SEDCO.
- Type : SEPT 1-72
- Creepage distance : 2970 mm.
- Arc distance : 930 mm.
- No. of sheds : 13 large and 12 small.
- Greatest diameter : 325 mm.
- Termination housing material: Porcelain.
- Filling compound : Silicon oil.
- Base and top : Aluminum.
- Stress control material : EPDM.
- Gaskets : O-ring

3- ***One 38/ 66 kV straight cable joint with the following specifications:***

- Manufacturer : EL SEWEDY SEDCO.
- Type : 69TCJ.
- Description of joint : Premolded joint.
- Method of ground : Lead cover .
- Type of overall casing : Heat shrink tube.
- Connector type : Compression.
- Type of insulation : EPDM

4- ***One 66 kV Premolded outdoor cable termination with the following specifications:***

- Manufacturer : EL SEWEDY SEDCO.
- Type : 69 TCT
- Creepage distance : 2640 mm.
- Arc distance : 1105 mm.
- No. of sheds : 8 large and 7 small
- Greatest diameter : 325 mm.
- Termination housing material: Premolded.
- Modular material : EPDM.
- Stress control material : EPDM.

M. Rabo

- ***Description of the Equipment:***
  - High voltage reactor – 400 kV – 5000 kVA – 50 Hz – Type: (RSK) – Serial No. 204322/99.
  - PD detector – Type: (TE57).
  - Tan δ measurement devise – Type: 254/321/02 Serial No. 144281.
  - Standard capacitor – Type: NK400 Serial No. 434321.
  - Impulse voltage generator 800 kV – 40 kJ – Type IP40/ 800 m
  - Air oven up to 300 °C – Type: BINDER - Serial No. 02-32772.
  - Universal testing machine 100 kN - Model APEX-T5000 Serial No. 2095.

- ***Test Samples:***

  - Test samples were chosen under the responsibility of the client.

- ***Tests:***

  1. Electrical Type Tests

  1.1 Check of insulation thickness of cable for electrical type tests
  1.2 Bending test on the cable followed by installation of accessories and partial discharge test at ambient temperature.
  1.3 *Tan δ* measurement.
  1.4 Heating cycle voltage test.
  1.5 Partial discharge test:
  - At ambient temperature.
  - At high temperature

  1.6 Lightning impulse voltage test followed by a power frequency voltage test.
  1.7 Tests of outer protection for buried joint.
  1.8 Resistivity of semi-conducting screens.
  1.9 Examination of the test assembly.

  2. Non-Electrical Type Tests:

  2.1 Check of cable construction.
  2.2 Tests for determining the mechanical properties of insulation before and after ageing
  2.3 Tests for determining the mechanical properties of non-metallic sheaths before and after ageing
  2.4 Ageing tests on pieces of complete cable to check compatibility of materials
  2.5 Hot set test for XLPE insulation.
  2.6 Shrinkage test for XLPE insulation.
  2.7 Water penetration test.
  2.8 Measurement of Carbon Black Content

- ***Test Method and Results:***

1- Electrical Type Tests:

1.1 Check on insulation thickness before electrical type tests:

- Prior to the electrical type tests the insulation thickness was measured in accordance with clause 11.3.1 of IEC 60840.

- The measured value of the insulation thickness is shown in the following table:

Average thickness (mm)	Specified thickness (mm)	Requirement
17.231	17	The average thickness of the insulation doesn't exceed the specified value by more than 5%

1.2 Bending test on the cable followed by partial discharge test:

1.2.1 *Bending test*:

- The test cable was subjected to a bending test at ambient temperature in accordance with clause 12.3.4 of IEC 60840. The test cable was bent around a test cylinder. The diameter of the cylinder was 2.8 m. The test consisted of three cycles. The test object was bent for one complete turn. It was then unwound. The process repeated, except that the bending of the sample was in the reverse direction..

Outer diameter of cable D (mm)	Diameter of conductor d (mm)	Requirement of bending diameter < 25(D+d)+5% (mm)	Hub diameter of drum (mm)
98	43.6	< 3717	2800

1.2.2 Partial discharge test:

- After bending test the terminations were installed on the cable and the test assembly was subjected to a partial discharge test at ambient temperature in accordance with clause 12.4.4 of IEC 60840. The test voltage was raised gradually to and held at 1.75 U_o for 10 s and then slowly reduced to 1.5 U_o.
- The measured value of the partial discharge level is shown in the following table

Applied voltage (kV)	Duration (S)	Max. PD level (PC)	PD level (PC)
66.5	10	--	--
57	--	≤ 5	1.8

- *The test results met the requirements.*

1.3 Tan δ measurement:

- Another sample test cable was subjected to a tanδ measurement in accordance with clause 12.4.5 of IEC 60840. The test assembly was heated by passing a current through the conductor until it reached a steady temperature, which was 97 °C. The tan δ was measured at a power frequency voltage of U_o at the temperature specified above.

- The measured value of the partial discharge level is shown in the following table

Applied voltage (kV)	Maximum allowable value for *tan δ* (x 10^{-4})	*tan δ* (x 10^{-4}) [Measured value]
38	10	4

- *The test results met the requirements.*

1.4 Heating Cycle Voltage Test:

- The test assembly was subjected to a heating cycle voltage test in accordance with clause 12.4.6 of IEC 60840. The test assembly was heated by passing a current through the conductor until it reached a steady temperature, which was 97 °C. The heating was applied for 8 h. The conductor temperature was maintained within the stated temperature limits for 2 h of each heating period. This was followed by 16 h of natural cooling. The cycle of heating and cooling was carried out 20 times. During the whole of the test period a voltage of $2U_o$ was applied to the test object.
- The result of the heating cycle voltage test is shown in the following table.

No. of heating cycles	Required conductor temperature (°C)	Heating		Cooling time (h)	Applied voltage continuously (kV)
		Total heating time (h)	Duration of heating at 97 °C (h)		
20	95 ≤ t ≤ 100	8	2	16	76

- *The test results met the requirements.*

1.5 Partial discharge test:

1.5.1 At ambient temperature:

- After the last heat cycle, partial discharge was measured for the test assembly at ambient temperature in accordance with clause 12.4.6 of IEC 60840. The measurement was carried out as mentioned above under item 1.2.2. The measured value of the partial discharge level is shown in the following table.

Applied voltage (kV)	Duration (S)	Max. PD level (PC)	PD level (PC)
66.5	10	--	--
57	--	≤ 5	1.9

- *The test results met the requirements.*

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1.5.2 *At high temperature:*

- After test assembly was subjected to a partial discharge test at ambient temperature, partial discharge was measured for the test assembly at the conductor temperature 97°C in accordance with clause 12.4.6 of IEC 60840. The measurement was carried out as mentioned above under item 2.2.
- The measured value of the partial discharge level is shown in the following table:

Applied voltage (kV)	Duration (S)	Max. PD level (PC)	PD level (PC)
66.5	10	--	--
57	--	≤ 5	1.8

- *The test results met the requirements.*

1.6 *Lightning impulse voltage test followed by a power frequency voltage test:*

1.6.1 *Lightning impulse voltage test:*

- The test assembly was subjected to a lightning impulse voltage withstand test in accordance with clauses 12.4.7 of IEC 60840. The test was performed on the test assembly at a conductor temperature of 97 °C. The cable withstood 10 positive and 10 negative voltage impulses with crest value of 325 kV without failure.
- The results were illustrated by the Figures in pages No. (13 : 16) of this report.
- *The test results met the requirements.*

1.6.2 *Power frequency voltage test:*

- After the impulse voltage test, the test assembly was subjected to power frequency voltage test of $2.5U_o$ for 15 min. in accordance with clause 12.4.7 of IEC 60840.
- The result of the power frequency voltage test is shown in the following table

Applied voltage (kV)	Frequency (Hz)	Duration (min)	Observations
95	50	15	No breakdown

- *The test results met the requirements.*

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1.7 Tests of outer protection for buried joints

- After completion the above tests the isolated joint that still on the cable was immersed in water to a depth of 1m at the highest point of the outer protection in accordance with clause G.3 (Annex G) of IEC 60840. The total of 7 heating/cooling cycles was applied by raising the water temperature to 77°C and maintained at this temperature for 5 hours and then permitted to cool to 10 °C above the ambient temperature. The result of the test is shown in the following table :

Water immersion and heat cycling		
No. of heating cycles	**Required water temperature (°C)**	**Duration of heating at 77 °C (h)**
20	$70 \leq t \leq 75$	5

- After completion the heating cycles and with the joint still immersed in the water, the following tests were carried out:

a- DC voltage test:

- The test voltage of 25 kV d.c. was applied for 5 min. in accordance with Annex G of IEC 60840 between the metallic sheath (Lead) of the power cable, at either end of the accessory and also between the metallic sheath and the earthed exterior of the joint outer protection (the water). The result of the test is shown in the following table:

d. c voltage test		
Applied voltage (kV)	**Duration (min)**	**Observations**
25	1	No breakdown

- *The test results met the requirements.*

b- Impulse voltage test

- After completion the DC voltage test the isolated joint that still on the cable was immersed in water, the joint withstood 10 positive and 10 negative voltage impulses with crest value of 60 kV between the metallic sheath and the earthed exterior of the joint outer protection (the water) without failure.
- The results were illustrated by the Figures in pages No. (16 :19) of this report.
- *The test results met the requirements.*

1.8 Resistivity of semi-conducting screens:

- The measurement of the resistivity of the semi-conducting screens was carried out in accordance with clause 11.3.9 of IEC 60840. The resistivity of extruded semi-conducting screens applied over the conductor and over the insulation was determined by measurements on test pieces taken from the core of a sample of cable as manufactured and a sample of cable which has been subjected to the ageing treatment to test the compatibility of component materials specified in IEC 60840. The measurements were made at a temperature of 90 °C.

- The resistivity of the semi-conducting screens are shown in the following table:

Item	Unit	Requirement	Measured / Determined
Conductor screen			
- without ageing	Ωm	≤ 1000	25.4
- after ageing	Ωm	≤ 1000	12.4
Insulation screen			
- without ageing	Ωm	≤ 500	16.4
- after ageing	Ωm	≤ 500	9.1

- ***The test results met the requirements.***

1.9 Examination of the test assembly.

- The examination of the terminations was carried out after completion of the electrical type test mentioned above in accordance with clause 12.3.2 of IEC 60840.

- The terminations were revealing no signs of degradation, leakage, corrosion or harmful shrinkage.

- ***The test results met the requirements.***

2- Non-Electrical Type Tests:

2.1. Check of Cable Construction:

- The examination of the conductor and measurements of insulation and sheath thickness was carried out in accordance with clause 12.5.1 of IEC 60840. The results are shown in the following table:

No.	Items	Unit	requirement	Measured Values
1	Cable Marking			1 x 1200 mm² 38/66 kV – CU/XLPE/LEAD/HD PE EETC 2014
2	Color of the outer sheath		Black	Black
3	Conductor: - Material - Diameter (Av.) - Number of wires	 mm No.	 ≥ 43.6	 Copper 43.6 61
4	Extruded Inner semi-conducting material - thickness (Av.)	mm	---	1.53
5	XLPE Insulation - minimum thickness - $(t_{max} - t_{min}) / t_{max}$	mm	≥ 15.3 ≤ 0.15	17.53 0.062
6	Extruded Outer semi-conducting material - thickness (Av.)		---	1.29
7	Diameter over insulation	mm	---	
8	Semi-conductive water blocking tape - Thickness (Av.)	mm		0.54
9	Metallic sheath - material - minimum thickness	 mm	 ≥ 2.085	 Lead 2. 632
10	Oversheath - material - diameter (Av.) - minimum thickness.	 mm mm	 ≥ 2.875	 High Density Poly Ethylene (HDPE) - ST_7 98 3.69
11	Semi – conductive layer graghite powder	mm	---	0.05

- ***The test results met the requirements.***

2.2. ***Tests for determining the mechanical properties of insulation before and after ageing:***

- The mechanical properties of insulation before and after ageing were determined in accordance with clause 12.5.2 of IEC 60840.
- The results of the mechanical properties of insulation before and after ageing are.

- shown in the following table:

Item	Unit	Requirement	Measured/ Determined
Without ageing			
-Min. tensile strength	N/mm^2	12.5	23.34
-Min. elongation at break	%	200	401.2
after ageing in air oven			
-Min. tensile strength	N/mm^2	---	19.65
-Max. variation with samples without ageing	%	± 25	15.80
-Min. elongation at break	%	---	452.1
-Max. variation with samples without ageing	%	± 25	-12.68

- ***The test results met the requirements.***

2.3. *Tests for determining the mechanical properties of non-metallic sheaths before and after ageing:*

- The mechanical properties of the outer sheath before and after ageing were determined in accordance with clause 12.5.3 of IEC 60840.
- The results of the mechanical properties of non-metallic sheaths before and after ageing are shown in the following table:

Item	Unit	Requirement	Measured / determined
Without ageing			
-Min. tensile strength	N/mm^2	12.5	25.31
-Min. elongation at break	%	300	436
after ageing			
-Min. elongation at break	%	300	380

- ***The test results met the requirements.***

2.4. *Ageing Tests on Pieces of Completed Cable to Check Compatibility of Materials:*

- Ageing tests on pieces of completed cable were carried out in accordance with clause 12.5.4 of IEC 60840.
- The results of the mechanical properties of completed cable are shown in the following table:

Item	Unit	Requirement	Measured /determined
Insulation			
-Min. tensile strength	N/mm^2	----	19.96
-Max. variation with samples without ageing	%	± 25	14.48
-Min. elongation at break	%	----	354.1
-Max. variation with samples without ageing	%	± 25	11.73
Sheath			
- Min. elongation at break	%	300	456

- ***The test results met the requirements.***

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2.5. Hot set test for XLPE insulation:

- A hot set test for the XLPE insulation was carried out in accordance with clause 12.5.10 of IEC 60840.
- The results of the hot set test for the XLPE insulation are shown in the following table:

Item	Unit	Requirement	Measured
-elongation under load -permanent elongation	% %	≤ 175 ≤ 15	125 8.2

- *The test results met the requirements.*

2.6. Shrinkage test for XLPE insulation

- A shrinkage test for XLPE insulation was carried out in accordance with clause 12.5.16 of IEC 60840.
- The result of the shrinkage test for XLPE insulation is shown in the following table.

Distance L (mm)	Air oven temp. (°C)	Duration (hour)	Max. shrinkage (%)	Shrinkage measurement (%)
200	130	6	4	1.25

- *The test results met the requirements.*

2.7. *Water penetration test :*

- ***The test has been carried out a new sample have the same dimensions with marking (Energya Power Cables)***
- The water penetration test was carried out in accordance with clause 12.5.14 of IEC 60840. In total 6m cable was used for this test. The cable was tested for longitudinal water tightness along the conductor, the outer surface of the conductor, and the gap between the outer surface of the insulation screen and the metallic screen.

No. of heating cycles	Required conductor temp. (°C)	Heating		Cooling time (h)
		Total heating time (h)	Duration at 98 °C (h)	
10	95 ≤ t ≤ 100	8	2	16

- After completion of the 10 heating cycles no water emerged from the ends of the cable
- ***The test results met the requirements.***

2.8. *Measurement of Carbon Black Content :*

- Measurement of carbon black content for HDPE was carried out in accordance with clause (12.5.12) of IEC (60840).
- The test results are shown in the following table :

Premold Joint Type: 69 TCJ For 1200mm² Power Cable, ELSEWEDY SEDCO

Polarity: (+ve) TO-AC-14-04-26-01

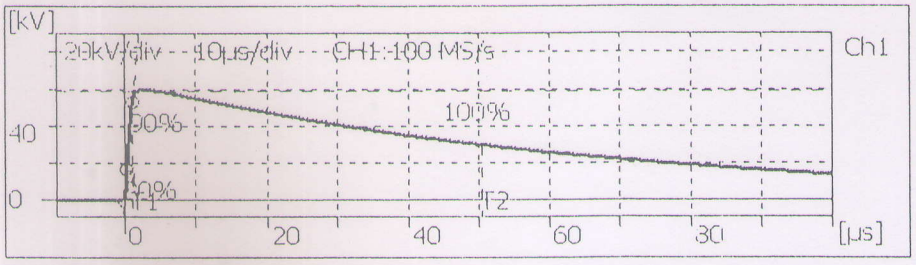

Fig. 6

Ch1: 1
Up = 60.184 kV
T1 = 1.3081 µs
T2 = 50.439 µs

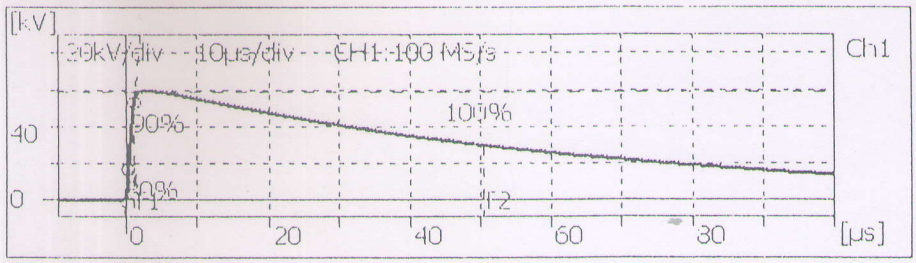

Fig. 7

Ch1: 1
Up = 60.217 kV
T1 = 1.3076 µs
T2 = 50.452 µs

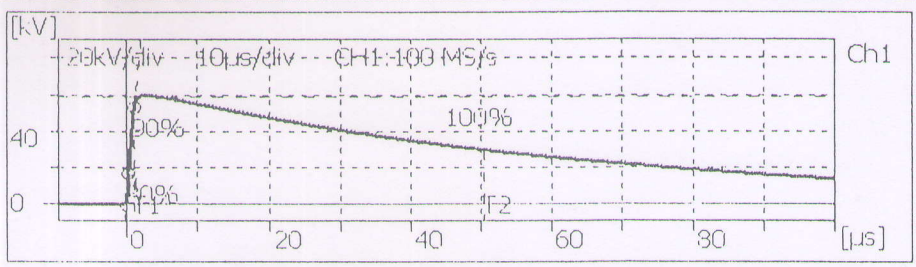

Fig. 8

Ch1: 1
Up = 60.194 kV
T1 = 1.3012 µs
T2 = 50.461 µs

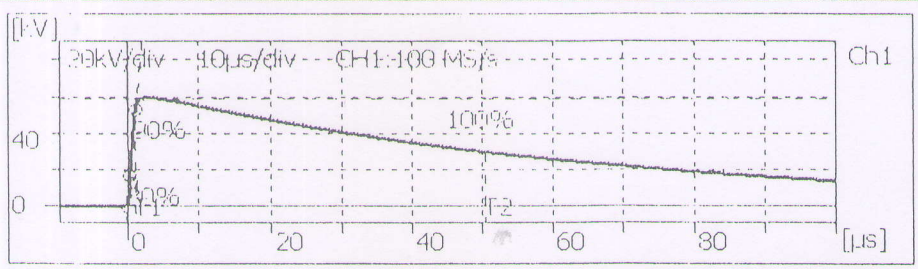

Fig. 9

Ch1: 1
Up = 60.114 kV
T1 = 1.3006 µs
T2 = 50.579 µs

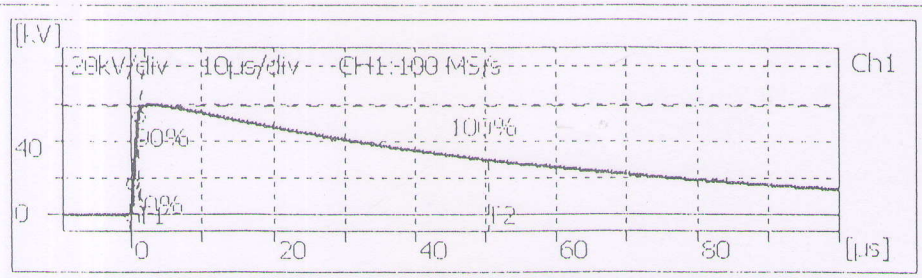

Fig. 10

Ch1: 1
Up = 60.228 kV
T1 = 1.3060 µs
T2 = 50.480 µs

Item	Requirement	Measured
Carbon black content	2.5 + 0.5	2.15

- *The test results met the requirements.*

▪ Conclusion :

- ***The loop system, 38/66 kV Power cable - CU/XLPE/CW/LEAD/HDPE /1× 1200 mm² manufactured by Energya Power Cables (El Sewedy Helal) ., 66 kV Porcelain outdoor cable termination manufactured by EL SEWEDY SEDCO , , 66 kV straight & isolated cable joint manufactured EL SEWEDY SEDCO ,and 66 kV Premolded outdoor cable termination manufactured EL SEWEDY SEDCO fulfilled the requirements of tests mentioned in this report according to IEC 60840(2011).***

- ***Notes:***
  - **Tests were carried out on the above specimens only without any responsibility concerning other untested specimens.**
  - **The tests were carried out without any obligation on Egyptian Electricity Holding Company.**
  - **This test report shall not be reproduced except in full, without written approval of EHVRC.**

▪ ***TEST ENGINEERS:***

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M. Abd Elaal
22/1/2015

SECTOR HEAD

22.1.2015

Azza

38/66 KV Power Cable CU/XLPE/LEAD/HDPE, 1200mm², Energya Cables

Polarity: (+ve) TO-AC-14-04-26-01

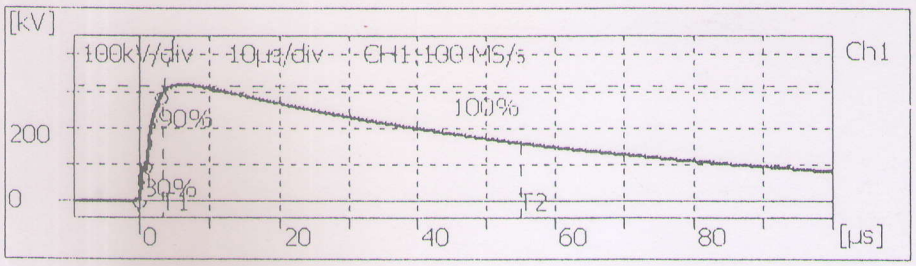

Fig. 1

Ch1: 1
Up = 321.63 kV
T1 = 3.5960 µs
T2 = 55.072 µs

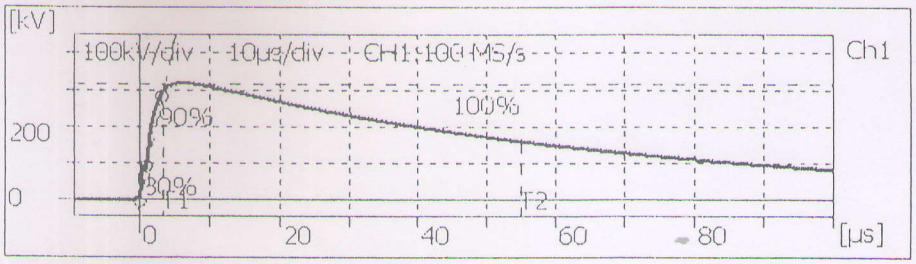

Fig. 2

Ch1: 1
Up = 321.72 kV
T1 = 3.6071 µs
T2 = 54.990 µs

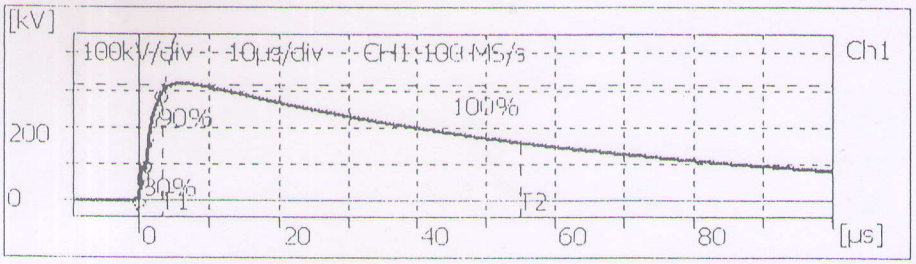

Fig. 3

Ch1: 1
Up = 321.86 kV
T1 = 3.6088 µs
T2 = 55.010 µs

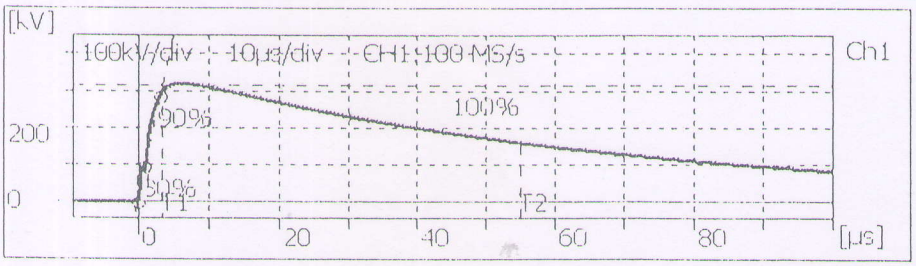

Fig. 4

Ch1: 1
Up = 321.76 kV
T1 = 3.5985 µs
T2 = 55.043 µs

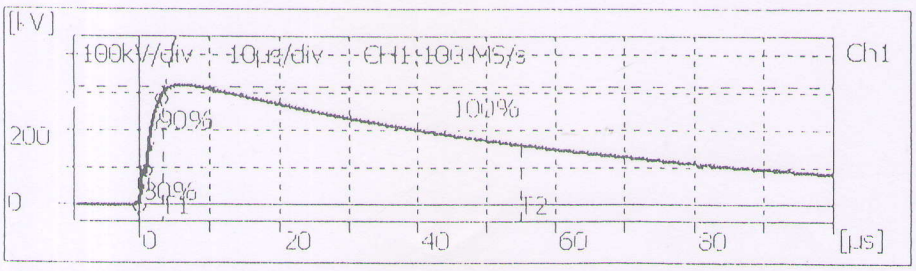

Fig. 5

Ch1: 1
Up = 321.80 kV
T1 = 3.6052 µs
T2 = 55.035 µs

Premold Joint Type: 69 TCJ For 1200mm² Power Cable, ELSEWEDY SEDCO

Polarity: (-ve) TO-AC-14-04-26-01

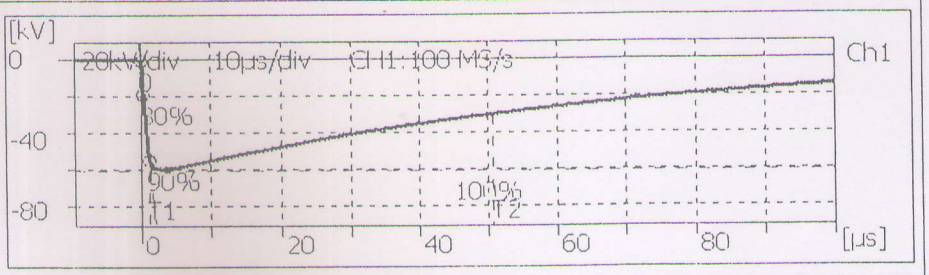

Fig. 1

Ch1: 1
Up = -59.658 kV
T1 = 1.3255 µs
T2 = 50.601 µs

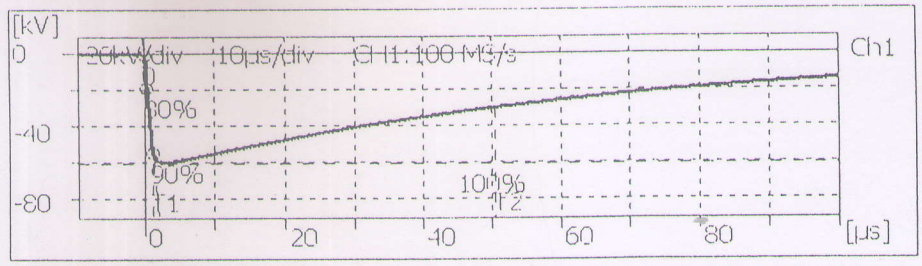

Fig. 2

Ch1: 1
Up = -59.724 kV
T1 = 1.3012 µs
T2 = 50.525 µs

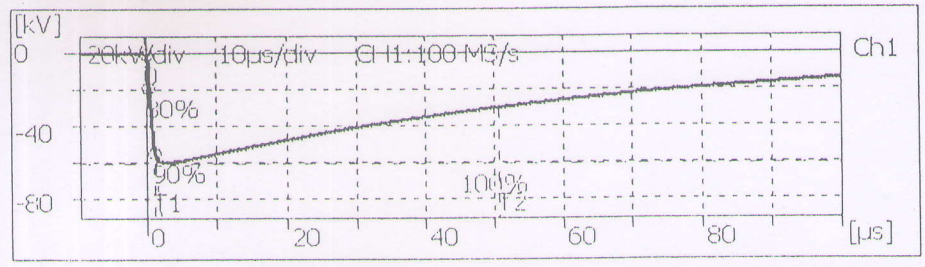

Fig. 3

Ch1: 1
Up = -59.724 kV
T1 = 1.3001 µs
T2 = 50.597 µs

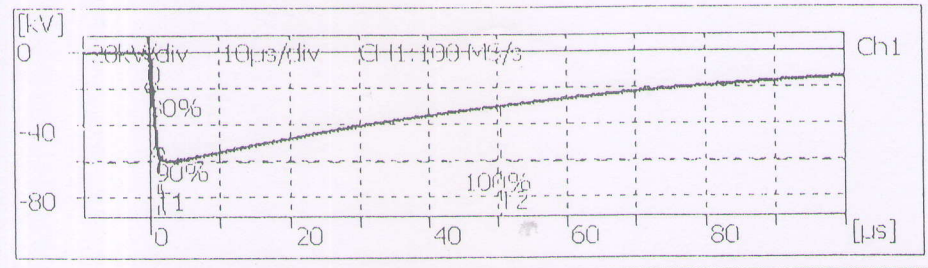

Fig. 4

Ch1: 1
Up = -59.742 kV
T1 = 1.3005 µs
T2 = 50.572 µs

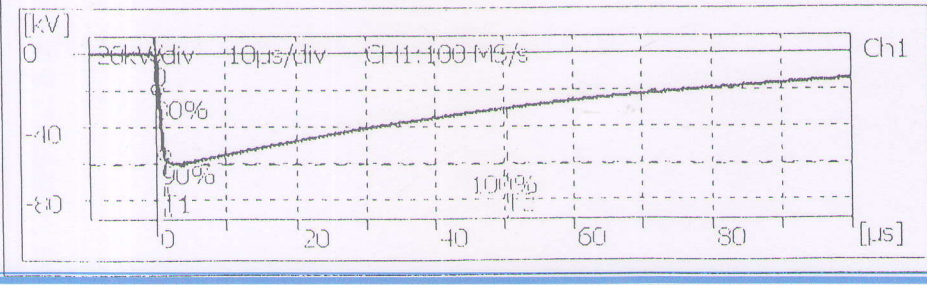

Fig. 5

Ch1: 1
Up = -59.793 kV
T1 = 1.2983 µs
T2 = 50.473 µs

38/66 KV Power Cable CU/XLPE/LEAD/HDPE, 1200mm², Energya Cables

Polarity: (+ve)

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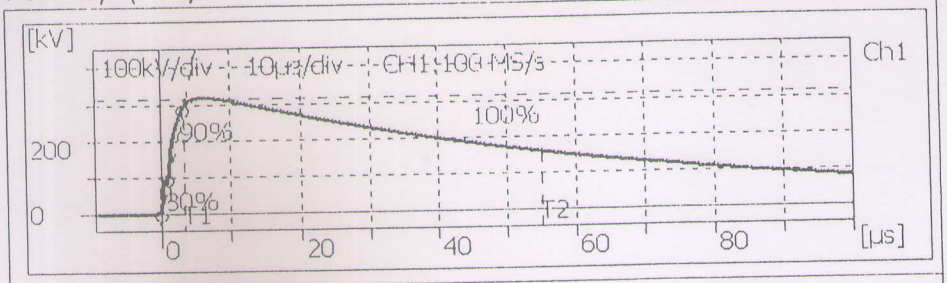


Fig. 6

Ch1: 1
Up = 321.86 kV
T1 = 3.6046 µs
T2 = 55.066 µs

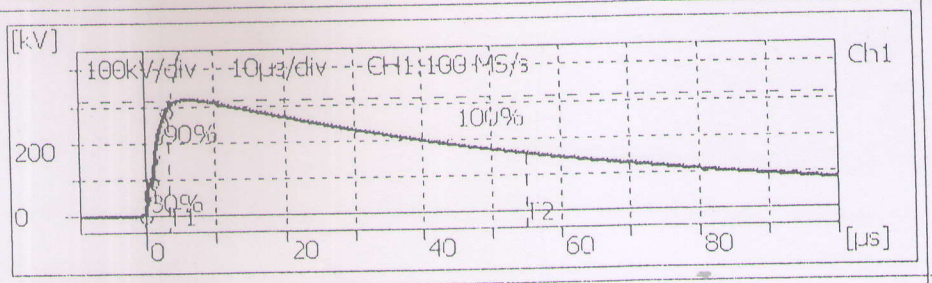


Fig. 7

Ch1: 1
Up = 321.93 kV
T1 = 3.6149 µs
T2 = 55.045 µs

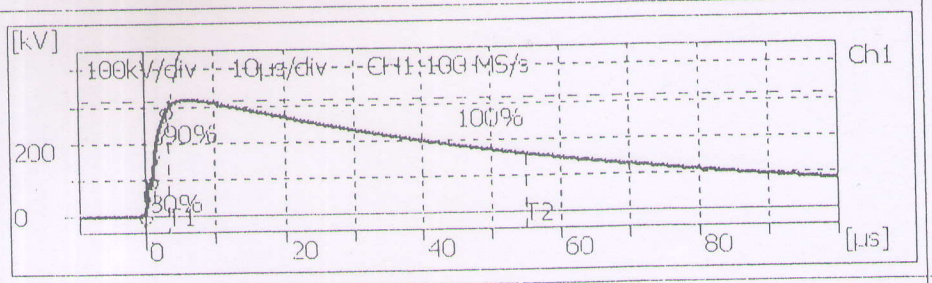


Fig. 8

Ch1: 1
Up = 321.92 kV
T1 = 3.6132 µs
T2 = 55.072 µs

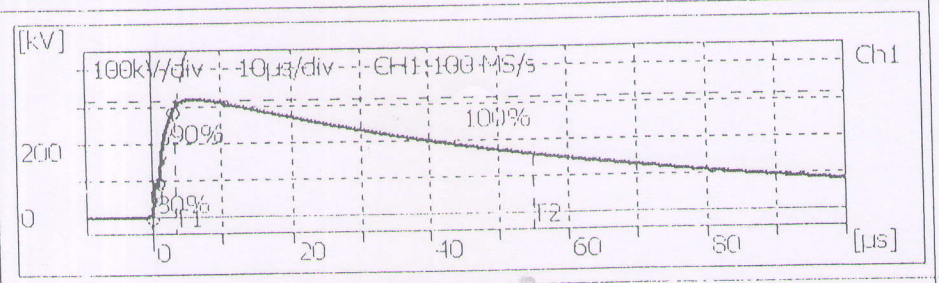


Fig. 9

Ch1: 1
Up = 321.94 kV
T1 = 3.6150 µs
T2 = 55.081 µs

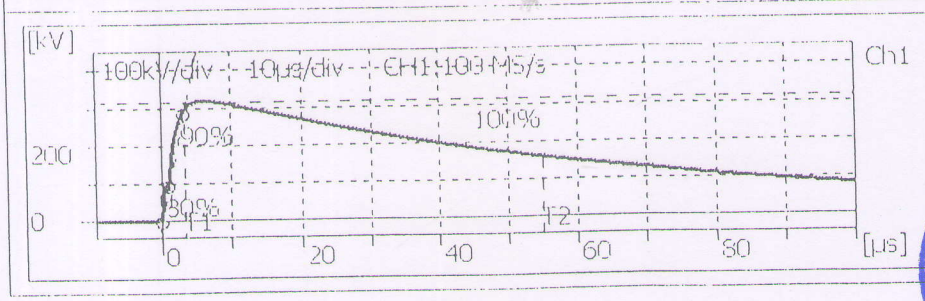


Fig. 10

Ch1: 1
Up = 321.72 kV
T1 = 3.6083 µs
T2 = 55.090 µs

38/66 KV Power Cable CU/XLPE/LEAD/HDPE, 1200mm², Energya Cables
Polarity: (-ve)

TO-AC-14-04-26-01

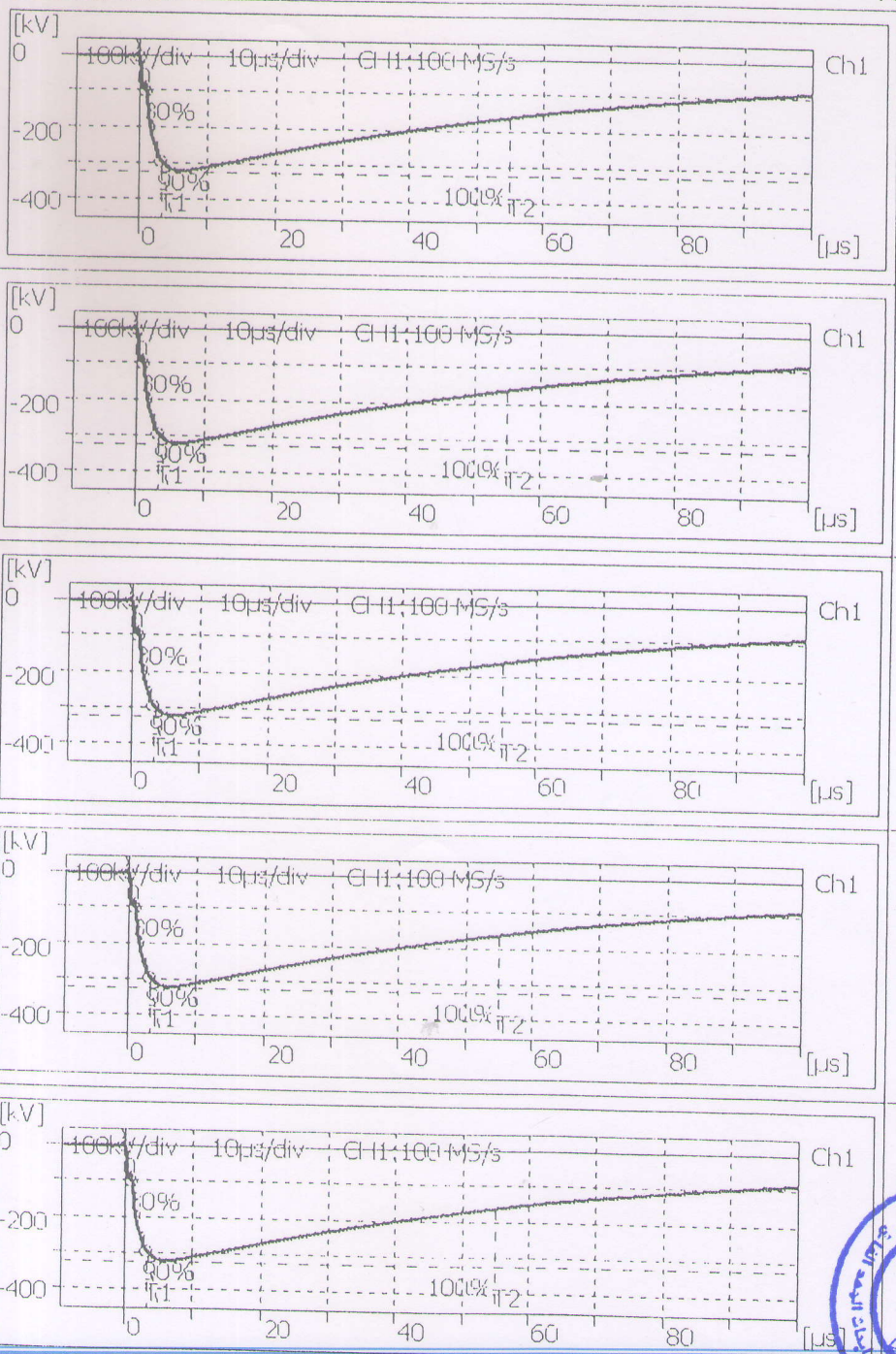


Fig. 1	Ch1: 1 Up = -321.88 kV T1 = 3.5995 µs T2 = 55.065 µs
Fig. 2	Ch1: 1 Up = -321.89 kV T1 = 3.5968 µs T2 = 55.072 µs
Fig. 3	Ch1: 1 Up = -321.93 kV T1 = 3.6006 µs T2 = 55.069 µs
Fig. 4	Ch1: 1 Up = -321.86 kV T1 = 3.5952 µs T2 = 55.122 µs
Fig. 5	Ch1: 1 Up = -321.90 kV T1 = 3.6004 µs T2 = 55.108 µs

Premold Joint Type: 69 TCJ For 1200mm² Power Cable, ELSEWEDY SEDCO
Polarity: (-ve)

TO-AC-14-04-26-01

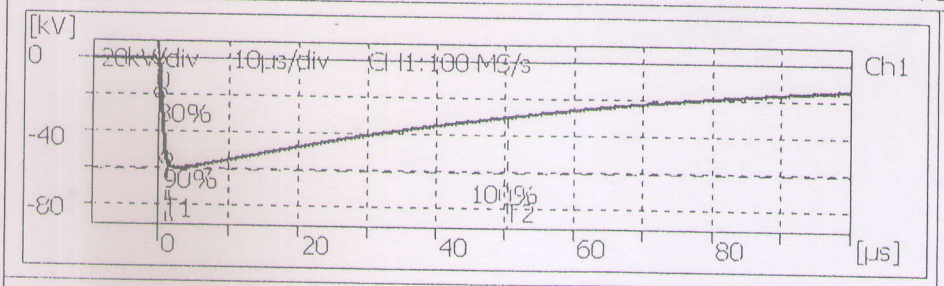


Fig. 6

Ch1: 1
Up = -59.785 kV
T1 = 1.2985 µs
T2 = 50.498 µs

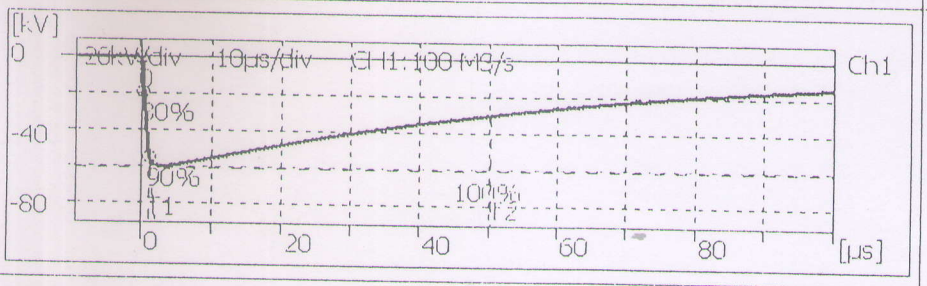


Fig. 7

Ch1: 1
Up = -59.802 kV
T1 = 1.2972 µs
T2 = 50.476 µs

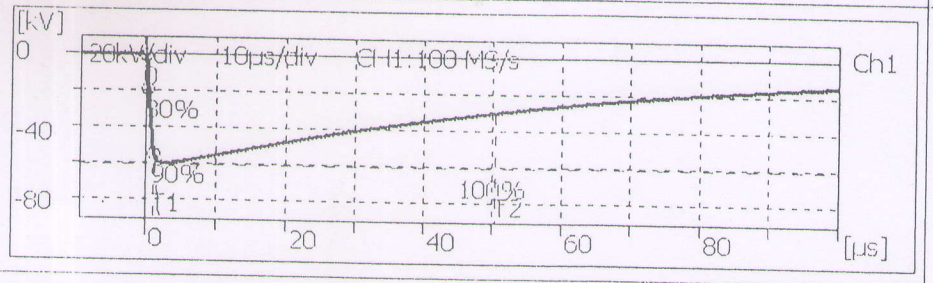


Fig. 8

Ch1: 1
Up = -59.810 kV
T1 = 1.2997 µs
T2 = 50.456 µs

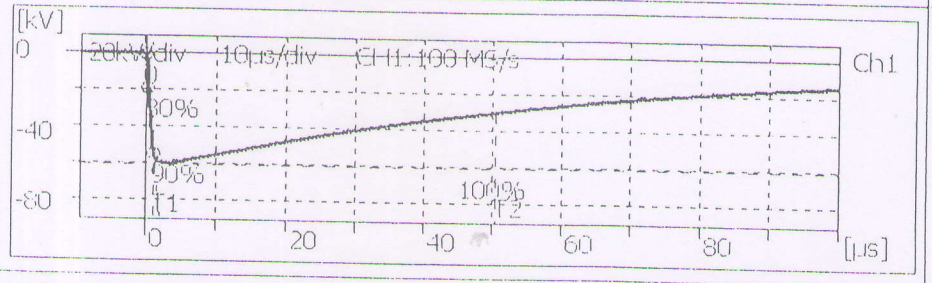


Fig. 9

Ch1: 1
Up = -59.774 kV
T1 = 1.2973 µs
T2 = 50.520 µs

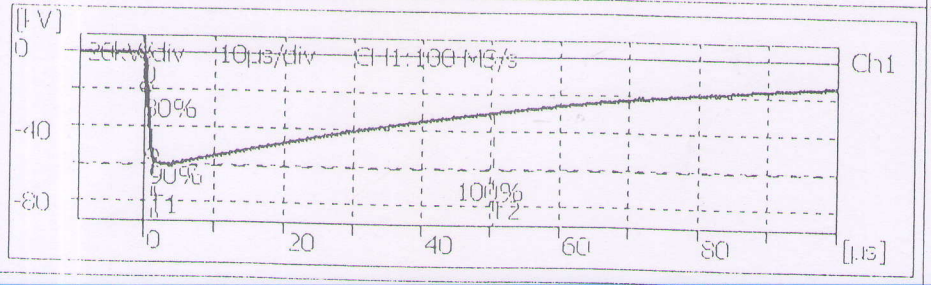


Fig. 10

Ch1: 1
Up = -59.761 kV
T1 = 1.2959 µs
T2 = 50.500 µs

38/66 KV Power Cable CU/XLPE/LEAD/HDPE, 1200mm², Energya Cables

Polarity: (-ve) TO-AC-14-04-26-01

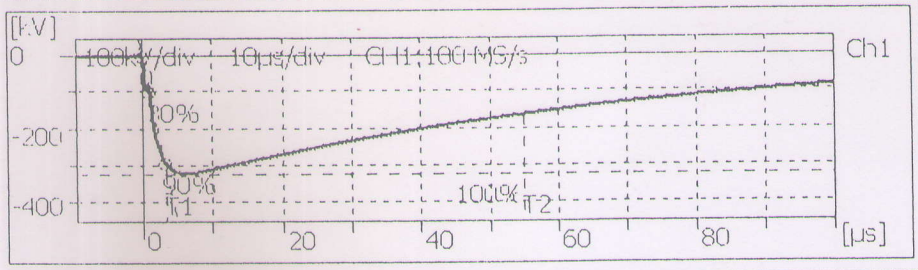


Fig. 6

Ch1: 1
Up = -321.95 kV
T1 = 3.5974 µs
T2 = 55.113 µs

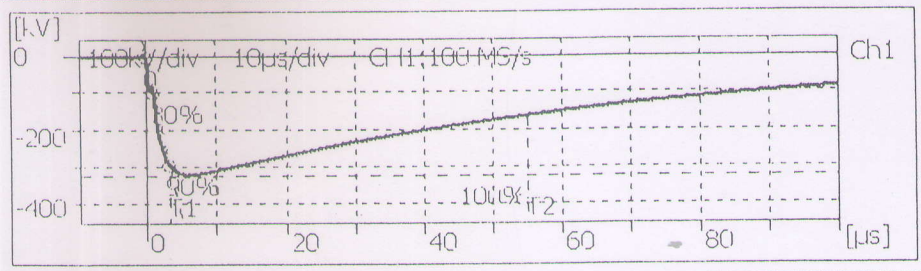


Fig. 7

Ch1: 1
Up = -321.96 kV
T1 = 3.6046 µs
T2 = 55.092 µs

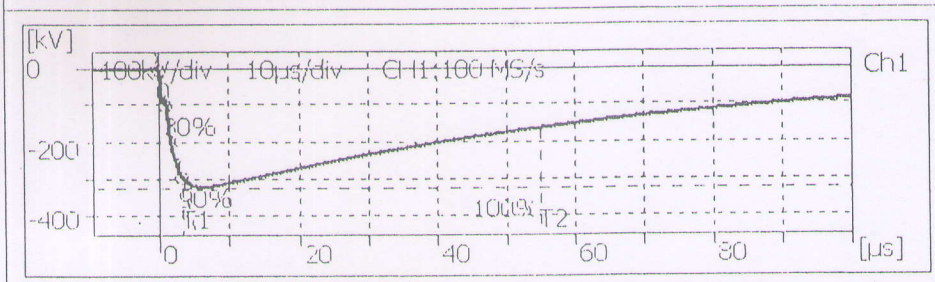


Fig. 8

Ch1: 1
Up = -321.94 kV
T1 = 3.6037 µs
T2 = 55.099 µs

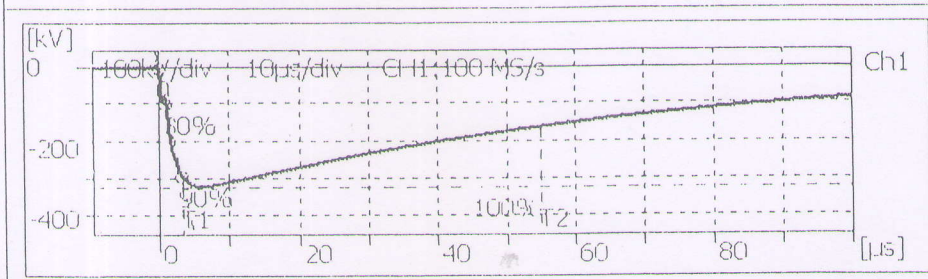


Fig. 9

Ch1: 1
Up = -321.83 kV
T1 = 3.5958 µs
T2 = 55.170 µs

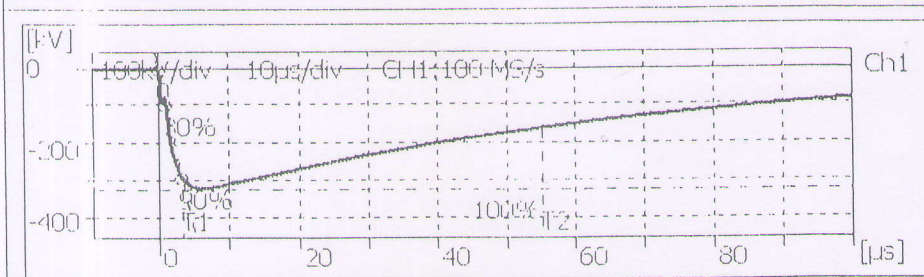


Fig. 10

Ch1: 1
Up = -321.83 kV
T1 = 3.5998 µs
T2 = 55.184 µs

Premold Joint Type: 69 TCJ For 1200mm² Power Cable, ELSEWEDY SEDCO

TO-AC-14-04-26-01

Polarity: (+ve)

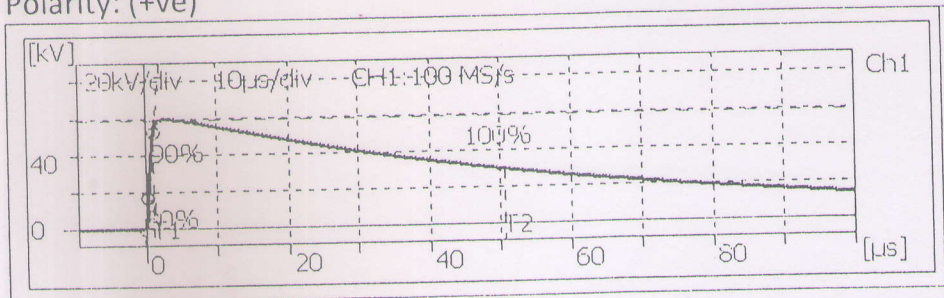


Fig. 1

Ch1: 1
Up = 59.962 kV
T1 = 1.3045 µs
T2 = 50.678 µs

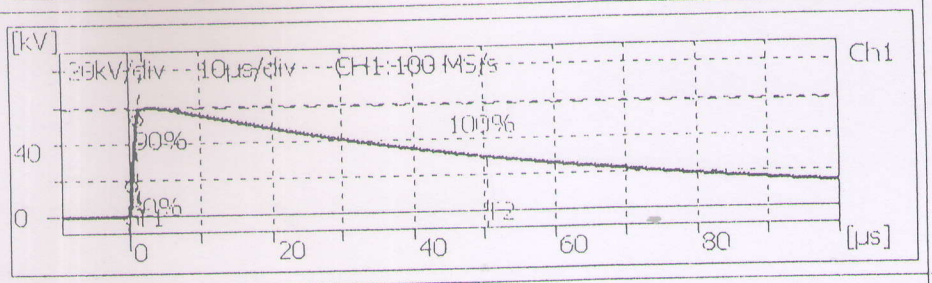


Fig. 2

Ch1: 1
Up = 60.195 kV
T1 = 1.3080 µs
T2 = 50.458 µs

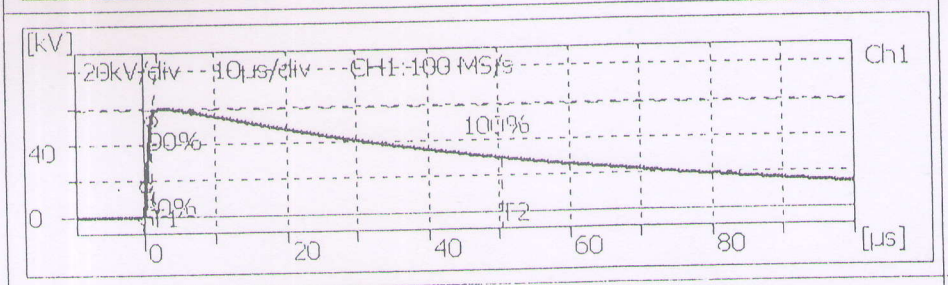


Fig. 3

Ch1: 1
Up = 60.115 kV
T1 = 1.3010 µs
T2 = 50.531 µs

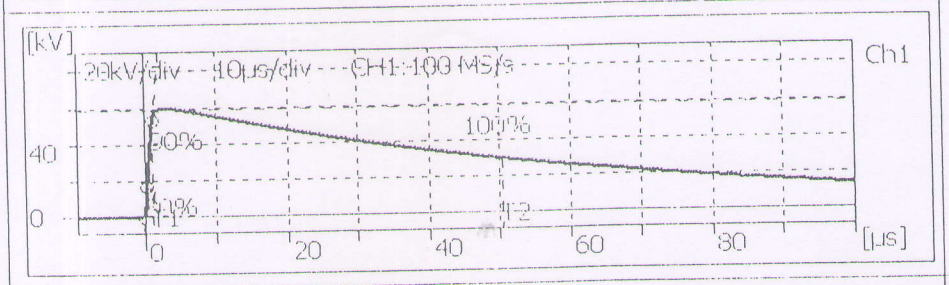


Fig. 4

Ch1: 1
Up = 60.210 kV
T1 = 1.3073 µs
T2 = 50.428 µs

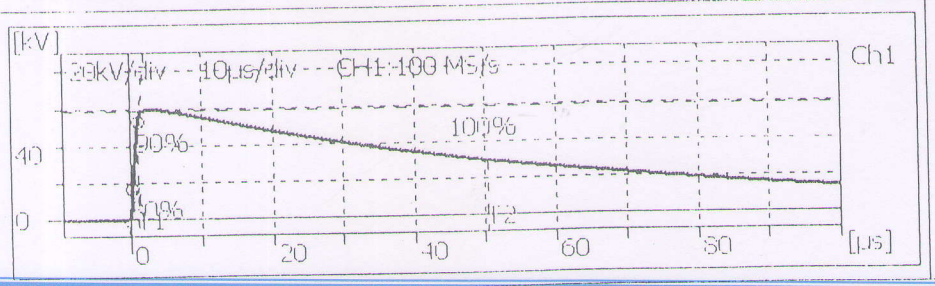


Fig. 5

Ch1: 1
Up = 60.186 kV
T1 = 1.3022 µs
T2 = 50.459 µs

energya
POWER CABLES
A Company of Energya Cables
elsewedy HELAL
17-02-2014

Energya power Cables
انيرجيا لكابلات الطاقة
ELSEWEDY HELAL

١٠٢
١٨/ ١٤١٢ هـ

السيدة المهندسة / مديرة مركز أبحاث الجهد الفائق

تحية طيبة وبعد ....

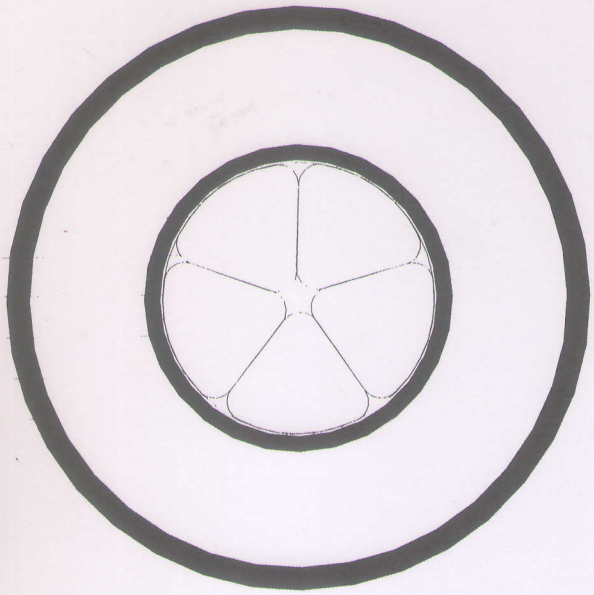
نرجوا من سيادتكم الموافقة على إجراء أختبار النوع لكابل ١ X ١٢٠٠ مم^2 ٦٦ كف ذو موصل نحاس وعزل XLPE ومزود بطبقة رصاص وغلاف HDPE حسب المواصفات المرفقة ونحن على إستعداد لتحمل كافة تكاليف الإختبار لذا يرجى من سيادتكم تحديد ميعاد الإختبار وطول الكابل المناسب للاختبار .

ملحوظة :- سيتم إختبار الكابل بنهايتان ووصلة

مركز أبحاث الجهد الفائق
مرفق فني رقم ٥٥٥ / ١٤١٨

ولسيادتكم جزيل الشكر ووافر الاحترام.....

CONSTRUCTION DATA
1X1200 mm^2 XLPE, CU. 66kv

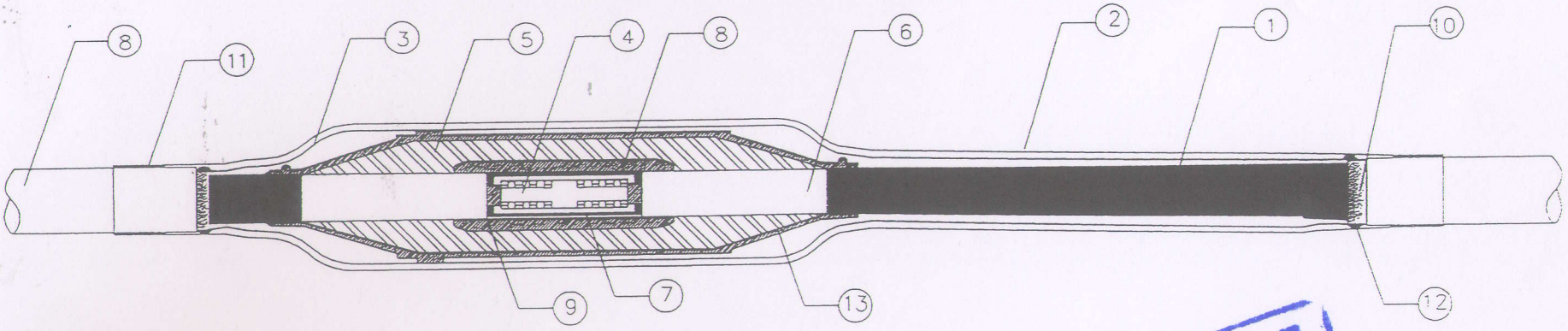


Size :	**1 x 1200** *mm^2*	*Type :*	**Cu/XLPE/LEAD/HDPE**
Voltage:	**38 / 66** *kV*	*Standard:*	**IEC 60502, 60811, 60840**
Code :	**P-MT31-X9-01-PH**		***Enrgya Power CABLES***

Sr.	*Description*	*Thickness mm*	*Diameter mm*
1.	**Copper** *Conductor* + ***Swelling Powder***		**43.6 (Approx.)**
2.	Non-Conductive Water Blocking Tape		
3.	Semi-Conductive Water Blocking Tape/ 30% O.L	**0.2**	**44.4**
4.	**Inner Semi-Conductive**	**1.53**	
5.	**XLPE** *Insulation*	**17.53**	
6.	**Outer Semi-Conductive**	**1.29**	
7.	Semi-Conductive Water Blocking Tape/30% O.L	**0.54**	
8.	**Lead Alloy** Sheath	**2.632**	
9.	**HDPE** Sheath	**3.69**	
10.	Semi-Conductive Layer – Graghite powder	**0.05**	**Approx. 98**

Not to Scale

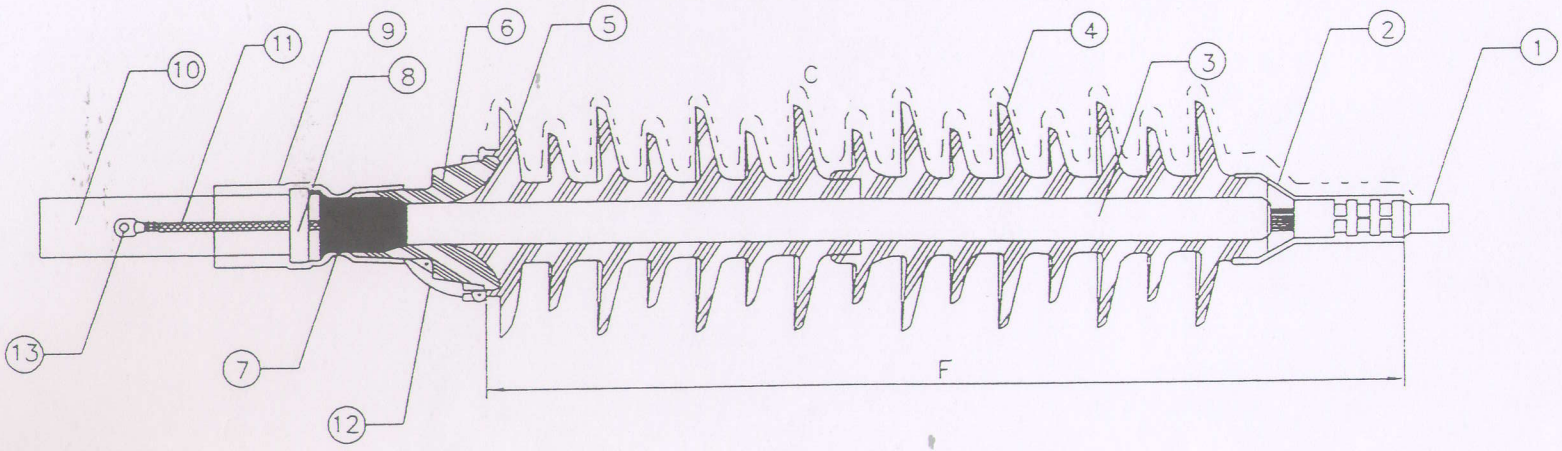
مرفق أبحاث المجد الفائق
مرفق رقم / ٥١٢
للتقرير الفني رقم



1– Cable outer semi conductive
2– Heat shrink tubing
3– Lead cover
4– Crimping connector
5– Housing insulation
6– Cable insulation
7– Heat sink
8– Cable outer jacket
9– Semi conductive insert
10– Lead sheath
11– Mastic tape
12– Plumbing
13– Housing outer semi conductive

* Test rating according to IEC 60840 .
* Joint applicable for C.S.A up to 1200mm2 and diameter over insulation up to 82mm.

Date 9/4/2014			All dimensions are in millimeters	
Drawn by A.Abdelrahman	Checked by A.Refai	Approved by A.Refai	66KV cable accessories	Scale NTS
ELSEWEDY S E D C O Subsidiary of Elsewedy Electric			Premold joint	Edition 1
			69 TCJ	Sheet 1 / 1



1– Cable lug.

2– Lug sealing.

3– Cable insulation.

4– Premolded module.

5– Termination base.

6– Stress control part.

7– Cable outer semi conductive.

8– Mastic tape.

9– Heat shrink tube

10– Cable outer jacket

11– Copper braid

12– Grounding wire.

13– Earthing lug

– Test rating according to IEC 60840

– Termination applicable for C.S.A up to 1200mm2 and diameter over insulation up to 82mm

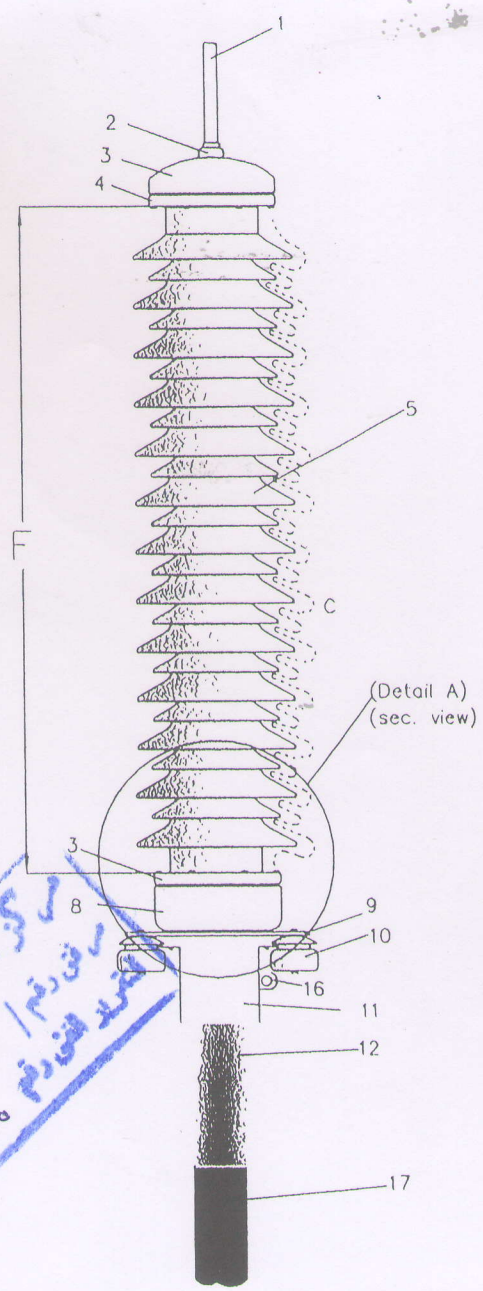
– Min. Creepage distance (C) =2640 mm

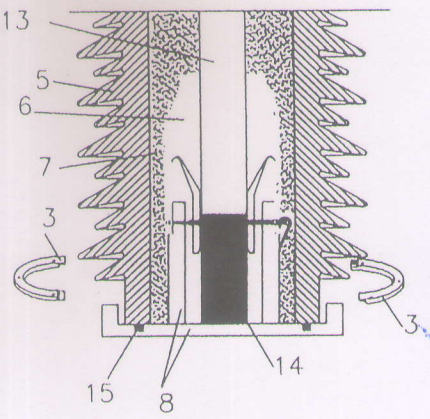
– Flash over distance (F) =1105 mm

Date 9/4/2014			All dimensions are in mm.	
Drawn by A.Abdelrahman	Checked by A.Refai	Approved by A.Refai	66KV cable accessories	Scale NTS
ELSEWEDY SEDCO Subsidiary of Elsewedy Electric			Premolded termination	Edition 1
			69 TCT	Sheet 1/1

Legend:

1- Compression Top bolt lug
2- Lug sealing
3- AL cap
4- AL half rings
5- Porcelain insulator
6- EPDM stress cone
7- Silicon oil
8- Aluminum base
9- Metallic base
10- post insulator (optional)
11- Cu earthing tube
12- Heat shrink tube
13- Cable insulation
14- Cable semi conductor layer
15- Gasket
16- Earthing point
17- Cable outer jacket





Detail A

* For outdoor termination Arcing horn and corona ring can be supplied upon request
* Test rating according to IEC 60840.
* Termination applicable for C.S.A up to 1200mm2 and diameter over insulation up to 82mm
* Min. Creepage distance (C) =2970 mm
* Flash over distance (F) =930 mm

Date 30/3/2014			All dimension in mm	
drawn by A.Abdelrahman	checked by A.Refai	approved by A.Refai	66KV cable accessories	Scale NTS
ELSEWEDY S E D C O Subsidiary of Elsewedy Electric			Porcelain termination	Edition 1
			SEPT1- 72	Sheet 1