KEMA

03-1175

TYPE TEST CERTIFICATE OF COMPLETE TYPE TEST

OBJECT	three-core, XLPE insulated power cable
DESIGNATION	3x240 mm^2 + 3x45,7 mm^2 CU/XLPE/STA/PVC
Rated voltage U_o/U (U_m)	7/11 (12) kV Rated frequency 50 Hz
MANUFACTURER	National Cables Industry P.O. Box 27472, Sharjah, United Arab Emirates
TESTED FOR	National Cables Industry P.O. Box 27472, Sharjah, United Arab Emirates
DATE OF TESTS	14 August up to and including 8 September 2003
TESTED BY	KEMA HIGH-VOLTAGE LABORATORY Utrechtseweg 310 – 6812 AR Arnhem - the Netherlands

The object, constructed in accordance with the description, drawings and photographs incorporated in this Certificate, has been subjected to the series of proving tests in accordance with

IEC 60502-2

This Type Test Certification has been issued by KEMA following exclusively the STL Guides.

The results are shown in the record of Proving Tests and the oscillograms attached hereto. The values obtained and the general performance are considered to comply with the above Standard and to justify the ratings assigned by the manufacturer as listed on page 1.

The Certificate applies only to the object tested. The responsibility for conformity of any object having the same designations with that tested rests with the manufacturer.

This Certificate comprises 39 sheets in total.

KEMA Nederland B.V.

S.A.M. Verhoeven

Arnhem, 12 September 2003

RATINGS ASSIGNED BY THE MANUFACTURER AND PROVED BY TESTS

Rated voltage U_o/U (U_m)	7/11 (12)	kV
Impulse test voltage	95	kV
Rated frequency	50	Hz
Maximum rated conductor temperature for XLPE	90	°C
Rated cross-section	240	mm^2

TEST PROGRAMME

1 Electrical type tests

1.1 Bending test followed by partial discharge test in accordance with IEC 60502-2 clause 18.1.4

1.2 Tan δ measurement in accordance with IEC 60502-2 clause 18.1.5

1.3 Heating cycle test followed by partial discharge test in accordance with IEC 60502-2 clause 18.1.6

1.4 Impulse test followed by a voltage test in accordance with IEC 60502-2 clause 18.1.7 and specification no. ADWEA/11kV/2000 clause 1.1.2

1.5 Voltage test for 4 h in accordance with IEC 60502-2 clause 18.1.8

1.6 Resistivity of semi-conducting screens in accordance with IEC 60502-2 clause 18.1.9

2 Non-electrical type tests

2.1 Measurement of thickness of insulation in accordance with IEC 60502-2 clause 19.1

2.2 Measurement of thickness of non-metallic sheaths in accordance with IEC 60502-2 clause 19.2

2.3 Tests for determining the mechanical properties of insulation before and after ageing in accordance with IEC 60502-2 clause 19.3

2.4 Tests for determining the mechanical properties of non-metallic sheaths before and after ageing in accordance with IEC 60502-2 clause 19.4

2.5 Additional ageing test on pieces of completed cables in accordance with IEC 60502-2 clause 19.5

2.6 Loss of mass test on PVC sheaths of type ST_2 in accordance with IEC 60502-2 clause 19.6

2.7 Pressure test at high temperature on sheaths in accordance with IEC 60502-2 clause 19.7

2.8 Test on PVC sheaths at low temperature in accordance with IEC 60502-2 clause 19.8

2.9 Test for resistance of PVC sheaths to cracking (heat shock test) in accordance with IEC 60502-2 clause 19.9

2.10 Hot set test for XLPE insulation in accordance with IEC 60502-2 clause 19.11

2.11 Water absorption test on insulation in accordance with IEC 60502-2 clause 19.13

2.12 Flame retardance test in accordance with IEC 60502-2 clause 19.14

2.13 Shrinkage test for XLPE insulation in accordance with IEC 60502-2 clause 19.16

2.14 Strippability test for insulation screen in accordance with IEC 60502-2 clause 19.21

3 Verification of cable construction in accordance with IEC 60502-2

MATERIAL DATA

Manufacturer	National Cables Industry, Sharjahi, United Arab Emirates
Type	7/11 kV 3x240 + 3x45,7 mm^2 CU/XLPE/DSTA/PVC
Year of manufacture	2003
Quantity submitted	approx. 45 m
No. of cores	3
Insulation	XLPE
Conductor material	Copper
Conductor cross-section	240 mm^2
Screening material	Copper tape
Sheath material	PVC (ST_2)
Sheath colour	Red
Rated voltage U_0/U (U_m)	7/11 (12) kV
Rated frequency	50 Hz
Standard	IEC 60502-2 (1997)
	Specification no. ADWEA/11kV/2000

The manufacturer has guaranteed that the object submitted for tests has been manufactured in accordance with the drawing as shown in appendix A of this report.
KEMA has verified that these drawings adequately represent the equipment tested.

SUBCONTRACTING

The following tests were subcontracted to KEMA Quality B.V.:

1.6 Resistivity of semi-conducting screens in accordance with IEC 60502-2 clause 18.1.9

2 Non-electrical type test in accordance with IEC 60502-2 clause 19

PERSONS ATTENDING THE TEST

Neither the manufacturer nor the purchaser were represented during the tests.

THE TESTS WERE CARRIED OUT BY

Mr C.H. Beverwijk	KEMA Nederland B.V.
Mr H.J. Arnoldus	KEMA Nederland B.V.

PURPOSE OF THE TESTS

Purpose of the tests was to verify whether the material complies with the specified requirements.

DESCRIPTION AND RESULTS OF THE TESTS

MEASUREMENT UNCERTAINTY

The last page of this report contains a table with measurement uncertainties. Unless otherwise indicated in the report, the measurement uncertainties of the results presented are as indicated in this table.

1 ELECTRICAL TYPE TESTS

1.1 Bending test followed by partial discharge test

1.1.1 BENDING TEST

The test object was subjected to a bending test in accordance with clause 18.1.4 of IEC 60502-2 (1997).
The test object was bent around a test cylinder. The diameter of the cylinder was 2000 mm. The test consisted of three cycles of wind, unwind, reverse winding direction, wind and unwind.
During the test the temperature of the test object was approximately 24 °C.
The results are presented in appendix 1 page 1.

Result

The test was carried out successfully.

1.1.2 MEASUREMENT OF THE PARTIAL DISCHARGES

The test object was subjected to a partial discharge test in accordance with clause 18.1.3 of IEC 60502-2 (1997).
The partial discharges were measured between the conductor and core screen. The measurement was carried out in a balanced circuit. For this purpose a partial discharge-free coupling capacitor was used. Special precautions were taken in order to avoid external discharges of the test object. The partial discharges were detected by means of a wide-band amplifier, a high-pass filter and an oscilloscope. The measuring circuit was calibrated by means of an impulse generator giving a repeating pulse of a known pC-value. The noise level amounted to 1 pC. The voltage was raised up to 13,9 kV, 50 Hz and maintained at this level for

1 minute. Subsequently the voltage was lowered down to 12,1 kV, 50 Hz. At this level the partial discharge level was determined.
The results are presented in appendix 1 page 1.

Result

The test was passed.

1.2 Tan δ measurement

The test object was subjected to a tan δ measurement in accordance with clause 18.1.5 of IEC 60502-2 (1997).
The measurement of the dielectric loss factor was carried out by using a Schering bridge and a loss-free standard capacitor. The measurement was carried out at 5 kV. The loss-factor of the insulation was measured between the conductor and core screen.
During the measurement the temperature of the test object was 95 °C.
The results are presented in appendix 1 page 2.

Result

The test was passed.

1.3 Heating cycle test followed by partial discharge test

1.3.1 HEATING CYCLE TEST

The test object was subjected to a heating cycle voltage test in accordance with clause 18.1.6 of IEC 60502-2 (1997).
One heat cycle consists of applying heating current for 5 hours followed by at least 3 hours of natural cooling. The test object was heated up to a conductor temperature of 96 °C within the first 3 hours of the heating period and was kept steady at 96 °C for 2 hours. This temperature was achieved by inducing current in the cable. In total 20 such heating cycles were carried out.
The results are presented in appendix 1 page 3.

Result

The test was carried out succesfully.

1.3.2 PARTIAL DISCHARGE TEST

After cooling down to ambient temperature, after the last heat cycle, the test object was subjected to a partial discharge test in accordance with clause 18.3 of IEC 60502-2 (1997). The measurements were carried out as mentioned above under item 1.1.2. The measurement was carried out in a balanced circuit. The noise level amounted to 1,5 pC.
The results are presented in appendix 1 page 3.

Result

The test was passed.

1.4 Impulse test followed by a voltage test

1.4.1 IMPULSE TEST

The test object was subjected to an impulse test in accordance with clause 18.1.7 of IEC 60502-2 (1997) and specification no. ADWEA/11kV/2000 clause 1.1.2.
The waveform of the impulse voltage was determined at approximately 50 percent of the specified test value. The recorded front duration and time to half value amounted to 4,18 µs and 48,22 µs respectively. The waveform complied with the specified requirements. The test consisted of 10 positive and 10 negative impulses with crest values of 95 kV. The voltage was applied between the conductor and core screen. The voltage measurement was carried out by means of an RC-voltage divider and a digitizer. During the test the temperature of the test object was 95 °C. In order to achieve this temperature, current was induced in the cable. Two hours after thermal equilibrium was established the impulse test was performed. During the test the atmospheric conditions were not taken into account.
The results are presented in appendix 1 pages 4 up to and including 6.

Result

The test was passed.

1.4.2 VOLTAGE TEST

The test object was subjected to a voltage test in accordance with clause 18.1.7 of IEC 60502-2 (1997).
Upon completion of the impulse test, and cooling down to ambient temperature, the test object was subjected to a voltage test of 24,5 kV, 50 Hz for 15 minutes.
The results are presented in appendix 1 page 4.

Result

The test was passed.

1.5 Voltage test for 4 hours

The test object was subjected to a voltage test for 4 hours in accordance with clause 18.1.8 of IEC 60502-2 (1997).
The test was carried out with a power-frequency voltage of 28 kV, 50 Hz, for 4 hours. The voltage was applied between the conductor and core screen. During the test the temperature of the test object was 20 °C. During the test the atmospheric conditions were not taken into account.
The results are presented in appendix 1 page 7.

Result

The test was passed.

1.6 Resistivity of semi-conducting screens

The measurement of the resistivity of the semi-conducting layers was carried out in accordance with clause 18.1.9 of IEC 60502-2 (1997).
The results are presented in appendix 1 page 8.

Result

The test was passed.

2 NON-ELECTRICAL TYPE TESTS

2.1 Measurement of thickness of insulation

The measurement of thickness of insulation was carried out in accordance with clause 19.1 of IEC 60502-2 (1997).
The results are presented in appendix 2 page 1.

Result

The test was passed.

2.2 Measurement of thickness of non-metalic sheaths

The measurement of thickness of the non-metallic sheaths was carried out in accordance with clause 19.2 of IEC 60502-2 (1997).
The results are presented in appendix 2 page 2.

Result

The test was passed.

2.3 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 19.3 of IEC 60502-2 (1997).
The results are presented in appendix 2 page 3.

Result

The test was passed.

2.4 Tests for determining the mechanical properties of non-metallic sheaths before and after ageing

The mechanical properties of non-metallic sheaths before and after ageing were determined in accordance with clause 19.4 of IEC 60502-2 (1997).
The results are presented in appendix 2 page 4.

Result

The test was passed.

2.5 Additional ageing test on pieces of completed cable

An additional ageing test on pieces of completed cable was carried out in accordance with clause 19.5 of IEC 60502-2 (1997).
The results are presented in appendix 2 page 5.

Result

The test was passed.

2.6 Loss of mass test on PVC sheaths of type ST_2

A loss of mass test on PVC sheaths of type ST_2 was carried out in accordance with clause 19.6 of IEC 60502-2 (1997).
The results are presented in appendix 2 page 6.

Result

The test was passed.

2.7 Pressure test at high temperature on sheath

A pressure test on the sheath at high temperature on the sheath was carried out in accordance with clause 19.7 of IEC 60502-2 (1997).
The results are presented in appendix 2 page 7.

Result

The test was passed.

2.8 Test on PVC sheaths at low temperature

A test on PVC sheaths at low temperature was carried out in accordance with clause 19.8 of IEC 60502-2 (1997).
The results are presented in appendix 2 page 8.

Result

The test was passed.

2.9 Test for resistance of PVC sheaths to cracking (heat shock test)

A test for resistance of PVC sheaths to cracking (heat shock test) was carried out in accordance with clause 19.9 of IEC 60502-2 (1997).
The results are presented in appendix 2 page 9.

Result

The test was passed.

2.10 Hot set test for XLPE insulation

A hot set test for XLPE insulation was carried out in accordance with clause 19.11 of IEC 60502-2 (1997). The results are presented in appendix 2 page 10.

Result

The test was passed.

2.11 Water absorption test on insulation

A water absorption test on insulation was carried out in accordance with clause 19.13 of IEC 60502-2 (1997).
The results are are presented in appendix 2 page 11.

Result

The test was passed.

2.12 Flame retardance test

A flame retardance test was carried out in accordance with clause 19.14 of IEC 60502-2 (1997).
The results are presented in appendix 2 page 12.

Result

The test was passed.

2.13 Shrinkage test for XLPE insulation

A shrinkage test for the insulation was carried out in accordance with clause 19.16 of IEC 60502-2 (1997).
The results are presented in appendix 2 page 13.

Result

The test was passed.

2.14 Strippability test for insulation screen

A strippability test for insulation screen was carried out in accordance with clause 19.21 of IEC 60502-2 (1997).
The results are presented in appendix 2 page 14.

Result

The test was passed.

3 VERIFICATION OF CABLE CONSTRUCTION IN ACCORDANCE WITH IEC 60502-2

3.1 Check of construction and dimensions

The conductor was checked in accordance with clause 5 of IEC 60502-2 (1997). The remaining cable dimentioned and construction were checked according IEC 60502-2 (1997) and the manufacturer's specifications.
The results obtained are presented in appendix 3 page 1.

Result

The specified requirements were met.

Client National Cables Industry, Sharjah, UAE
Test object cable 7/11 kV 3x240 mm^2
Requirements IEC 60502-2 (1997) clause 18.1.4
Test dates 14 and 20 August 2003

1.1 RESULTS OF THE BENDING TEST

1.1.1 Bending test

Atmospheric conditions
Ambient temperature 24 °C

Test object
Temperature 24 °C

outer diameter of cable D (mm)	diameter of conductor d (mm)	required bending diameter 20(D+d) ± 5% (mm)	hub diameter of drum (mm)	observations
78,0	18,4	1928 ± 96,4	2000	3 cycles (wind / unwind and wind / unwind in opposite direction)

1.1.2 Partial discharge test

Atmospheric conditions
Ambient temperature 20 °C
Humidity 11,5 $g(H_2O)/m^3$
Ambient air pressure 1017 hPa

Test object
Temperature 20 °C
Rated voltage (U_0) 7 kV

Circuit parameters
Power frequency 50 Hz
Bandwidth 16-180 kHz
Coupling capacitor 2600 pF
Calibration 5 pC
Noise level 1 pC
Circuit balanced

phase	voltage (kV)	duration (min)	partial discharge level (pC)	max. allowable pd-level (pC)	inception (kV)	inception (pC)	extinction (kV)	extinction (pC)	result
Red	13,9			-					
	12,1	1	≤ 1	5	-	-	-	-	passed
Yellow	13,9			-					
	12,1	1	≤ 1	5	-	-	-	-	passed
Blue	13,9			-					
	12,1	1	≤ 1	5	-	-	-	-	passed

Client	National Cables Industry, Sharjah, UAE
Test object	cable 7/11 kV 3x240 mm^2
Requirements	IEC 60502-2 (1997) clause 18.1.5
Test dates	21 August 2003

1.2 RESULTS OF THE TAN δ MEASUREMENT

Atmospheric conditions

Ambient temperature	23	°C	Ambient air pressure	1017	hPa
Humidity	11,5	$g(H_2O)/m^3$			

Test object

Length (approx.)	17,8	m	Temperature	95	°C
Rated voltage (U_0)	7	kV			

Circuit parameters

Power frequency	50	Hz
Standard capacitor	99,94	pF

applied voltage (kV)	core capacity* (μF/km)	tan δ (x 10^{-4})	max. allowable value for tan δ (x 10^{-4})	result
5	0,385	1,3	80	passed

* Capacitance per core: for information only

Client	National Cables Industry, Sharjah, UAE
Test object	cable 7/11 kV 3x240 mm^2
Requirements	IEC 60502-2 (1997) clause 18.1.6 and 18.1.3
Test dates	21 up to and including 28 August 2003

1.3 RESULTS OF THE HEATING CYCLE TEST

1.3.1 Heating cycle test

Atmospheric conditions

Ambient temperature (min/max) 20/24 °C

Test object

Temperature ambient/97 °C

no. of heat-cycles	required conductor temperature (°C)	applied heating current (A)	heating		cooling	result
			total heating time (h)	duration of conductor at 96 °C (h)	cooling time (h)	
20	95 ≤ t ≤ 100	720	5	2	3	passed

1.3.2 Partial discharge test

Atmospheric conditions

Ambient temperature 21 °C
Humidity 10 g(H_2O)/m^3
Ambient air pressure 1004 hPa

Test object

Temperature 30 °C
Rated voltage (U_0) 7 kV

Circuit parameters

Power frequency 50 Hz
Bandwidth 16-180 kHz
Coupling capacitor 2600 pF
Calibration 5 pC
Noise level 1,5 pC
Circuit balanced

phase	voltage (kV)	duration (min)	partial discharge level (pC)	max. allowable pd-level (pC)	inception (kV)	inception (pC)	extinction (kV)	extinction (pC)	result
Red	13,9 12,1	1	≤ 1,5	- 5	-	-	-	-	passed
Yellow	13,9 12,1	1	≤ 1,5	- 5	-	-	-	-	passed
Blue	13,9 12,1	1	≤ 1,5	- 5	-	-	-	-	passed

Client: National Cables Industry, Sharjah, UAE
Test object: cable 7/11 kV 3x240 mm^2
Requirements: IEC 60502-2 (1997) clause 18.1.7 and ADWEA/11kV/2000 clause 1.1.2
Test dates: 29 August and 1 September 2003

1.4 RESULTS OF THE IMPULSE TEST FOLLOWED BY A VOLTAGE TEST

1.4.1 Impulse test

Atmospheric conditions

Ambient temperature	19	°C	Ambient air pressure	997	hPa
Humidity	12	$g(H_2O)/m^3$			

Test object

Temperature	96	°C

voltage and polarity (kV)	description	oscillogram		result
		appendix 1 page	fig. no.	
+ 47,7	waveshape: 4,18/48,22 µs	5	1	
+ 62,1	1 impulse at 65% of the test voltage		2	
+ 77,2	1 impulse at 80% of the test voltage		2	
+ 95,0	5 impulses at 100 % of the test voltage		3	
+ 95,0	5 impulses at 100 % of the test voltage		4	
- 47,7	waveshape: 4,20/48,61 µs	6	5	
- 61,9	1 impulse at 65% of the test voltage		6	
- 77,1	1 impulse at 80% of the test voltage		6	
- 95,0	5 impulses at 100 % of the test voltage		7	
- 95,0	5 impulses at 100 % of the test voltage		8	passed

1.4.2 Voltage test

Atmospheric conditions

Ambient temperature	20	°C	Ambient air pressure	1015	hPa
Humidity	12	$g(H_2O)/m^3$			

Test object

Temperature	20	°C

applied voltage (kV)	frequency (Hz)	duration (min)	observations	result
24,5	50	15	no breakdown	passed

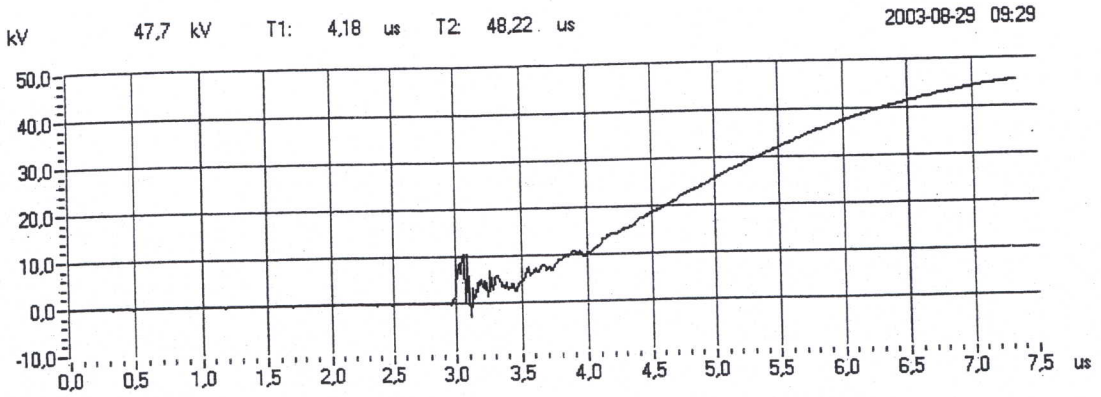


Fig. 1: Waveshape +50% of testvoltage

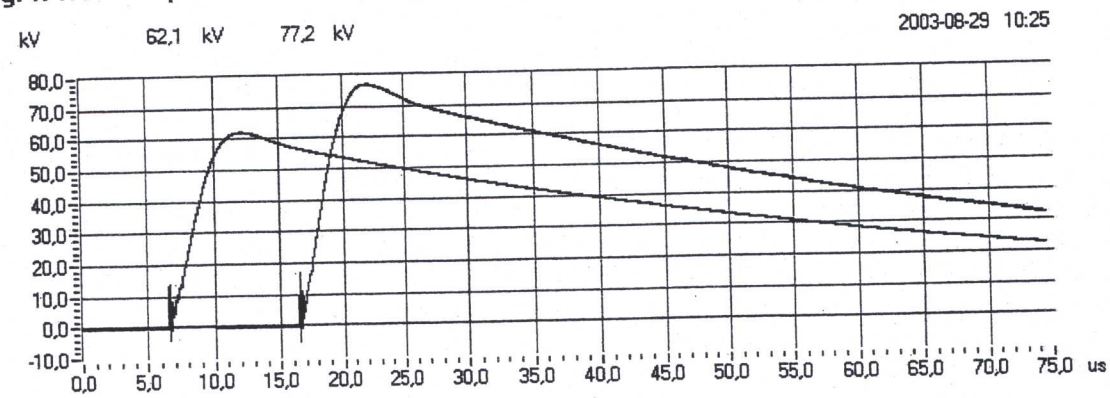


Fig. 2: +65%, +80% of testvoltage

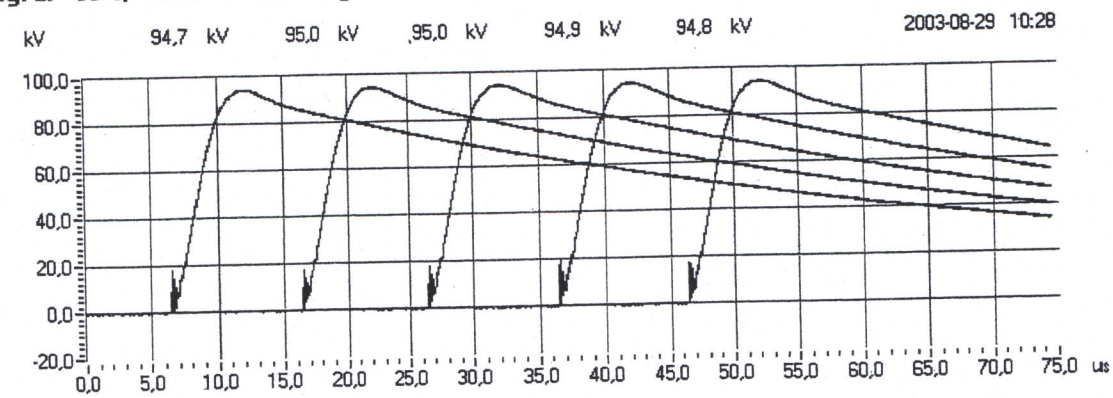


Fig. 3: +100% of testvoltage

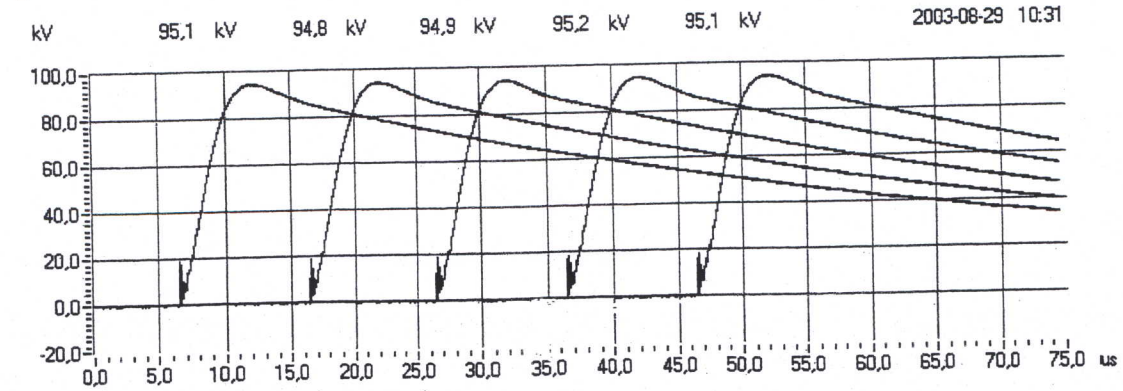


Fig. 4: +100% of testvoltage

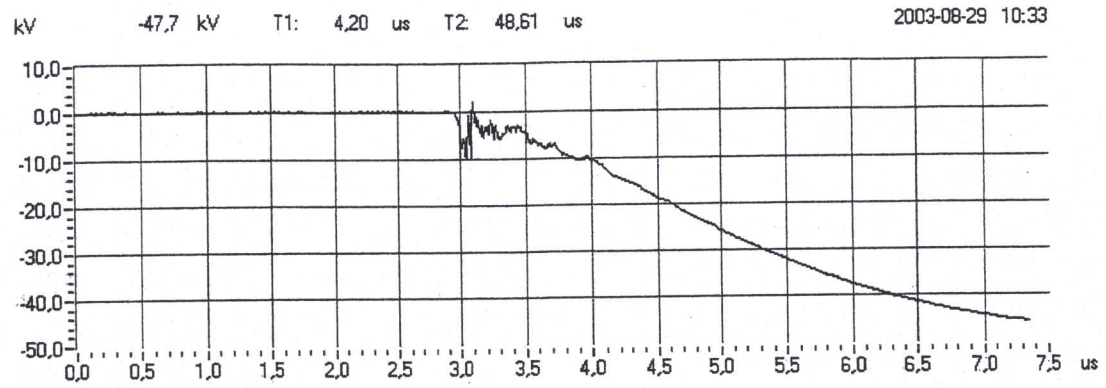


Fig. 5: Waveshape -50% of testvoltage

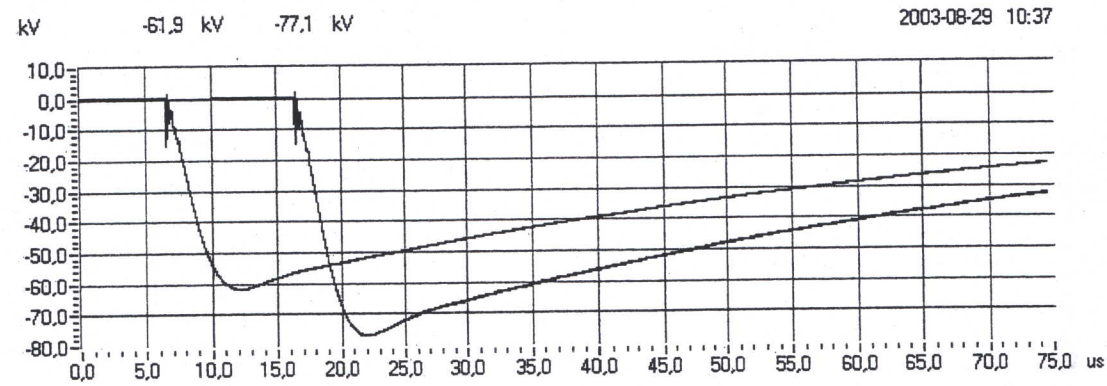


Fig. 6: -65%, -80% of testvoltage

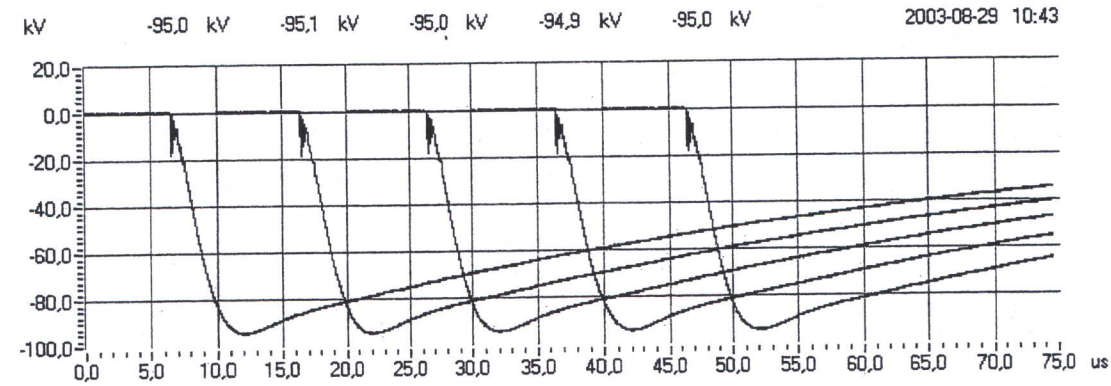


Fig. 7: -100% of testvoltage

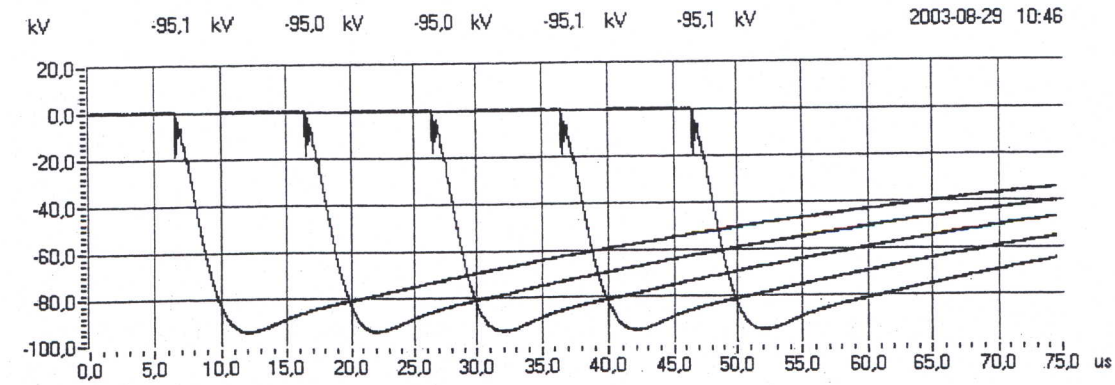


Fig. 8: -100% of testvoltage

Client	National Cables Industry, Sharjah, UAE
Test object	cable 7/11 kV 3x240 mm^2
Requirements	IEC 60502-2 (1997) clause 18.1.8
Test dates	1 September 2003

1.5 RESULTS OF THE VOLTAGE TEST FOR 4 H

Atmospheric conditions

Ambient temperature	20	°C	Ambient air pressure	1015	hPa
Humidity	12	$g(H_2O)/m^3$			

Test object

Temperature	20	°C

applied voltage (kV)	frequency (Hz)	duration (h)	observations	result
28	50	4	no breakdown	passed

Client: National Cables Industry, Sharjah, UAE
Test object: cable 7/11 kV 3x240 mm^2
Requirements: IEC 60502-2 (1997) clause 18.1.9
Test dates: 15 August until 8 September 2003

1.6 RESULTS OF THE MEASUREMENT OF THE RESISTIVITY OF SEMI-CONDUCTING SCREENS

item	unit	requirement	measured/determined			result
			Red	Yellow	Blue	
conductor screen						
- without ageing	Ωm	≤ 1000	5,8	5,8	5,4	passed
- after ageing	Ωm	≤ 1000	1,3	2,4	1,8	passed
insulation screen						
- without ageing	Ωm	≤ 500	5,2	5,2	5,4	passed
- after ageing	Ωm	≤ 500	0,7	0,7	0,6	passed

Client: National Cables Industry, Sharjah, UAE
Test object: cable 7/11 kV 3x240 mm^2
Requirements: IEC 60502-2 (1997) clause 19.1
Test dates: 15 August until 8 September 2003

2.1 RESULTS OF THE MEASUREMENT OF THICKNESS OF INSULATION

item	unit	requirement	measured/determined			result
			Red	Yellow	Blue	
- average	mm	3,4	3,5	3,4	3,5	passed
- minimum	mm	≥ 3,0	3,5	3,4	3,5	passed

Client National Cables Industry, Sharjah, UAE
Test object cable 7/11 kV 3x240 mm^2
Requirements IEC 60502-2 (1997) clause 19.2
Test dates 15 August until 8 September 2003

2.2.1 RESULTS OF THE MEASUREMENT OF THICKNESS OF INNER SHEATH

item	unit	requirement	measured/determined	result
- average	mm	1,8	1,9	passed
- minimum	mm	≥ 1,2	1,5	passed

2.2.2 RESULTS OF THE MEASUREMENT OF THICKNESS OF OUTER SHEATH

item	unit	requirement	measured/determined	result
- average	mm	3,4	4,4	passed
- minimum	mm	≥ 2,5	3,9	passed

Client: National Cables Industry, Sharjah, UAE
Test object: cable 7/11 kV 3x240 mm^2
Requirements: IEC 60502-2 (1997) clause 19.3
Test dates: 15 August until 8 September 2003

2.3 RESULTS OF THE TESTS FOR DETERMINING OF THE MECHANICAL PROPERTIES OF INSULATION BEFORE AND AFTER AGEING

item	unit	requirement	measured/determined			result
			Red	Yellow	Blue	
without ageing						
- tensile strength	N/mm²	≥ 12,5	26,4	29,0	29,0	passed
- elongation	%	≥ 200	563	584	544	passed
after ageing						
- tensile strength	N/mm²	-	27,9	30,0	27,6	
variation with samples without ageing	%	± 25 max.	6	4	-5	passed
- elongation	%	-	539	604	572	
variation with samples without ageing	%	± 25 max.	-4	3	5	passed

Client: National Cables Industry, Sharjah, UAE
Test object: cable 7/11 kV 3x240 mm^2
Requirements: IEC 60502-2 (1997) clause 19.4
Test dates: 15 August until 8 September 2003

2.4 RESULTS OF THE TESTS FOR DETERMINING OF THE MECHANICAL PROPERTIES OF NON-METALLIC SHEATHS BEFORE AND AFTER AGEING

Inner sheath

item	unit	requirement	measured/determined	result
without ageing				
- tensile strength	N/mm²	≥ 12,5	20	passed
- elongation	%	≥ 150	292	passed
after ageing				
- tensile strength	N/mm²	≥ 12,5	19,3	passed
variation with samples without ageing	%	± 25 max.	-3	passed
- elongation	%	≥ 150	274	passed
variation with samples without ageing	%	± 25 max.	-6	passed

Outer sheath

item	unit	requirement	measured/determined	result
without ageing				
- tensile strength	N/mm²	≥ 12,5	19,5	passed
- elongation	%	≥ 150	314	passed
after ageing				
- tensile strength	N/mm²	≥ 12,5	19,6	passed
variation with samples without ageing	%	± 25 max.	1	passed
- elongation	%	≥ 150	316	passed
variation with samples without ageing	%	± 25 max.	1	passed

Client: National Cables Industry, Sharjah, UAE
Test object: cable 7/11 kV 3x240 mm^2
Requirements: IEC 60502-2 (1997) clause 19.5
Test dates: 15 August until 8 September 2003

2.5 RESULTS OF THE ADDITIONAL AGEING TESTS ON PIECES OF COMPLETED CABLES

item	unit	requirement	measured/determined			result
insulation			Red	Yellow	Blue	
- tensile strength	N/mm^2	-	26,0	28,0	25,0	
variation with samples without ageing	%	± 25 max.	0	-3	-14	passed
- elongation	%	-	373	574	566	
variation with samples without ageing	%	± 25 max.	2	-2	4	passed
inner sheath						
- tensile strength	N/mm^2	-		20,5		
variation with samples without ageing	%	± 25 max.		2		passed
- elongation	%	-		300		
variation with samples without ageing	%	± 25 max.		3		passed
outer sheath						
- tensile strength	N/mm^2	-		19,1		
variation with samples without ageing	%	± 25 max.		-2		passed
- elongation	%	-		327		
variation with samples without ageing	%	± 25 max.		4		passed

Client: National Cables Industry, Sharjah, UAE
Test object: cable 7/11 kV 3x240 mm^2
Requirements: IEC 60502-2 (1997) clause 19.6
Test dates: 15 August until 8 September 2003

2.6.1 RESULTS OF MASS TEST ON PVC INNER SHEATH OF TYPE ST_2

item	unit	requirement	measured	result
loss of mass	mg/cm^2	≤ 1,5	0,6	passed

2.6.2 RESULTS OF MASS TEST ON PVC OUTER SHEATH OF TYPE ST_2

item	unit	requirement	measured	result
loss of mass	mg/cm^2	≤ 1,5	0,3	passed

Client: National Cables Industry, Sharjah, UAE
Test object: cable 7/11 kV 3x240 mm^2
Requirements: IEC 60502-2 (1997) clause 19.7
Test dates: 15 August until 8 September 2003

2.7.1 RESULTS OF THE PRESSURE TEST AT HIGH TEMPERATURE ON INNER SHEATH

item	unit	requirement	measured	result
depth of indentation	%	≤ 50	20	passe

2.7.2 RESULTS OF THE PRESSURE TEST AT HIGH TEMPERATURE ON OUTER SHEATH

item	unit	requirement	measured	result
depth of indentation	%	≤ 50	18	passe

Client National Cables Industry, Sharjah, UAE
Test object cable 7/11 kV 3x240 mm^2
Requirements IEC 60502-2 (1997) clause 19.8
Test dates 15 August until 8 September 2003

2.8.1 RESULTS OF THE TESTS ON PVC INNER SHEATH AT LOW TEMPERATURE

item	unit	requirement	measured	result
elongation	%	≥ 20	120	passed
cold impact test	-	no cracks	no cracks	passed

2.8.2 RESULTS OF THE TESTS ON PVC OUTER SHEATH AT LOW TEMPERATURE

item	unit	requirement	measured	result
elongation	%	≥ 20	135	passed
cold impact test	-	no cracks	no cracks	passed

Client National Cables Industry, Sharjah, UAE
Test object cable 7/11 kV 3x240 mm^2
Requirements IEC 60502-2 (1997) clause 19.9
Test dates 15 August until 8 September 2003

2.9.1 RESULT OF THE TEST FOR RESISTANCE OF PVC INNER SHEATH TO CRACKING (HEAT SHOCK TEST)

item	unit	requirement	measured	result
soundness	-	no cracks	no cracks	passed

2.9.2 RESULT OF THE TEST FOR RESISTANCE OF PVC OUTER SHEATH TO CRACKING (HEAT SHOCK TEST)

item	unit	requirement	measured	result
soundness	-	no cracks	no cracks	passed

Client: National Cables Industry, Sharjah, UAE
Test object: cable 7/11 kV 3x240 mm^2
Requirements: IEC 60502-2 (1997) clause 19.11
Test dates: August unti 8 September 2003

2.10 RESULTS OF THE HOT SET TEST FOR XLPE INSULATION

item	unit	requirement	measured			result
			Red	Yellow	Blue	
elongation under load	%	≤ 175	125	170	90	passed
permanent elongation	%	≤ 15	1	2	1	passed

Client: National Cables Industry, Sharjah, UAE
Test object: cable 7/11 kV 3x240 mm^2
Requirements: IEC 60502-2 (1997) clause 19.13
Test dates: 15 August until 8 September 2003

2.11 RESULTS OF THE WATER ABSORPTION TEST ON INSULATION

item	unit	requirement	measured			result
			Red	Yellow	Blue	
variation of mass	mg/cm2	≤ 1	0,01	0,01	0,03	passed

Client: National Cables Industry, Sharjah, UAE
Test object: cable 7/11 kV 3x240 mm^2
Requirements: IEC 60502-2 (1997) clause 19.14
Test dates: 15 August until 8 September 2003

2.12 RESULTS OF THE FLAME RETARDANCE TEST

item	unit	requirement	measured	result
length free charring	mm	> 50	> 50	passed
downward limit charred surface	mm	< 540	< 540	passed

Client: National Cables Industry, Sharjah, UAE
Test object: cable 7/11 kV 3x240 mm^2
Requirements: IEC 60502-2 (1997) clause 19.16
Test dates: 15 August until 8 September 2003

2.13 RESULTS OF THE SHRINKAGE TEST FOR XLPE INSULATION

item	unit	requirement	measured			result
			Red	Yellow	Blue	
shrinkage	%	≤ 4	1	1	1	passed

Client National Cables Industry, Sharjah, UAE
Test object cable 7/11 kV 3x240 mm^2
Requirements IEC 60502-2 (1997) clause 19.21
Test dates 15 August until 8 September 2003

2.14 RESULTS OF THE STRIPPABILITY TEST

item	unit	requirement	measured			result
			Red	Yellow	Blue	
before ageing	N	$4 \leq F \leq 45$	15,11,13	19,14,15	18,18,19	passed
after ageing	N	$4 \leq F \leq 45$	11,10,12	10,14,16	11,12,12	passed

Client: National Cables Industry, Sharjah, UAE
Test object: cable 7/11 kV 3x240 mm^2
Requirements: IEC 60502-2 (1997) clause 5-14
Test dates: 15 August until 8 September 2003

3.1 RESULTS OF THE VERIFICATION OF CABLE CONSTRUCTION

See also manufacturer's drawing in appendix A.

item	required/specified	measured/determined	result
Conductor (IEC 60228 Class 2) Material: stranded copper wires (circular compacted)	see results of non-electrical type tests above	see results of non-electrical type tests above	
- resistance at 20 °C (Ω/km)	≤ 0,0754 / -	0,0729 0,0730 0,0734	passed
- no. of wires	≥ 34 / -	61 61 61	passed
- diameter max (mm)	≤ 20,6 / 18,4	18,6 18,6 18,6	passed
Screening conductor screening	yes / yes	present, extruded semi-conductive compound, bonded	passed
- thickness, minimum (mm)	- / 0,7	-	
insulation screening non-metallic part	yes / yes	present, extruded semi-conductive compound, strippable	passed
- thickness, minimum (mm)	- / 0,7	-	
metallic part	yes / yes	present, plain annealed copper tape	passed
- thickness, nominal (mm)	- / 0,075	-	
Insulation Material: extruded XLPE	see result of non-electrical type tests above	see results of non-electrical type tests above	
Ground conductor Material: stranded copper wires - no. of wires	- / -	19 19 19	
Filler	yes /yes	present, synthetic fibre	passed

Client: National Cables Industry, Sharjah, UAE
Test object: cable 7/11 kV 3x240 mm^2
Requirements: IEC 60502-2 (1997) clause 5-14
Test dates: 15 August until 8 September 2003

3.1 RESULTS OF THE VERIFICATION OF CABLE CONSTRUCTION (continued)

item	required/specified	measured/determined	result
Inner sheath Material: PVC ST_2	see results of non-electrical type tests above	see results of non-electrical type tests above	
Armour wire	yes / yes	present, galvanized steel tape	passed
Outer sheath Material: PVC ST_2	see results of non-electrical type tests above	see results of non-electrical type tests above	
Marking of the cable	- / -	ELECTRIC CABLE 11000 VOLTS 3x240 + 3x45,7 mm^2 CU/XLPE/DSTA/PVC IEC 60502 NATIONAL CABLES UAE 2003	
Colour of the outer sheath	- / -	red	
Outer diameter of the cable average (mm)	- / 78	78,4	
Outer diameter of the core average (mm)	- / 29,5	28,8	

The measurement uncertainties in the results presented are as specified below unless otherwise indicated

measurement	**measurement uncertainty**
dielectric tests and impulse current tests	peak value: ≤ 3% time parameters: ≤ 10%
capacitance measurement tan δ measurement	0,3% ± 0,5% ± $5,10^{-5}$
partial discharge measurement	< 10 pC : 2 pC 10 - 100 pC : 5 pC > 100 pC : 20 %
measurement of impedance a.c.-resistance measurement	≤ 1%
measurement of losses	≤ 1%
measurement of insulation resistance	≤ 10%
measurement of dc resistance	1 μΩ- 5 μΩ: 1% 5 μΩ- 10 μΩ: 0,5% 10 μΩ- 200 μΩ: 0,2%
radio interference test	2 dB
calibration of current transformers	2,2 x 10^{-4} Ii/Iu and 290 μrad
calibration of voltage transformers	1,6 x 10^{-4} Ui/Uu en 510 μrad
measurement of conductivity	5%
measurement of temperature	-50 °C- -40 °C: 3 K -40 °C- 125 °C: 2 K 125 °C- 150 °C: 3 K
tensile test	1%
sound level measurement	type 1 meter as per IEC 60651 and ANSI S1.4.1971
measurement of voltage ratio	0,1%

Appendix A

Drawings of

National Cables Industry, Sharjah, UAE

No. of pages: 2

drawing no.	date	title
-	2003-09-05	7/11(12) kV 3x240 +3x45,7 mm^2 cable
-	2003-09-05	dimensional data for 11 kV 3x240 +3x45,7 mm^2 cable

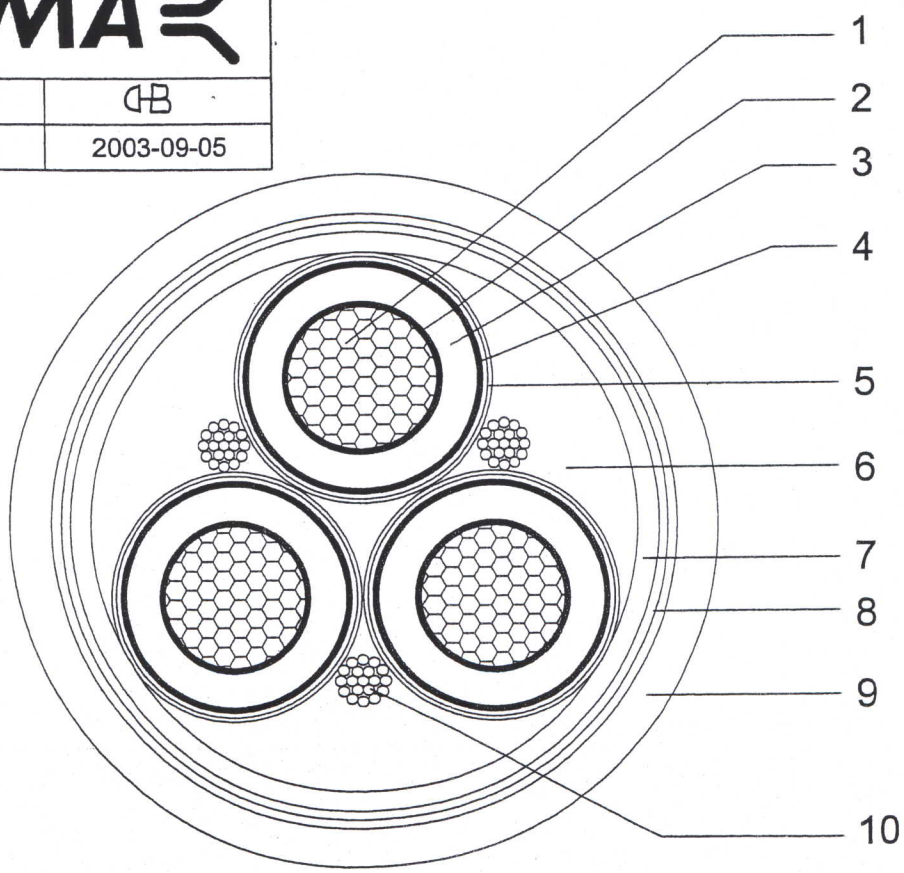
11kV - 3x240+3x45.7 mm², CU/XLPE/STA/PVC Cable

REFERENCE STANDARD : **IEC 60502-2 & ADWEA Specification.**

1.	Conductor	:	Copper round stranded compacted.
2.	Conductor Screen	:	Extruded semi-conductive compound
3.	Insulation	:	Extruded cross-linked polyethylene (XLPE)
4.	Insulation screen	:	Extruded semi-conductive compound strippable
5.	Metallic screen	:	Plain annealed Copper tapes applied with Suitable overlap
6.	Filler	:	Polypropylene strings
7.	Inner sheath	:	Extruded polyvinyl chloride (PVC Type ST-2), Colour: Black
8.	Armour	:	Double galvanized steel tapes
9.	Outer sheath	:	Extruded polyvinyl chloride (PVC Type ST-2), Colour: RED
10.	Copper conductors	:	45.7 mm² copper conductor one in each interstice

KEMA

Verification	
Date	2003-09-05



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KEMA

Verification	GB
Date	2003-09-05

DIMENSIONAL DATA FOR 11 kV
3x240 mm² + 3x45.7 mm² - CU/XLPE/STA/PVC

DESCRIPTION	UNIT	DETAILS
Reference Standard		IEC 60502-2
Rated voltage of cable	kV	11
Number of cores	No.	3
Nominal Cross sectional area	mm²	240
Form of stranding		Stranded, circular compacted
Conductor material		Copper
Diameter of conductor (Approx.)	mm	18.4
Minimum thickness of conductor shield	mm	0.7
Diameter over conductor shield (Approx.)	mm	20.2
Minimum thickness of XLPE Insulation	mm	3.4
Maximum thickness of XLPE Insulation	mm	3.7
Diameter over insulation (Approx.)	mm	27.4
Nominal thickness of extruded insulation shield	mm	0.9
Minimum thickness of extruded insulation shield	mm	0.7
Nominal thickness of copper tape screen	mm	0.075
Diameter over copper tape screen (Approx.)	mm	29.5
No. and size of CU ground conductor in assembly	No/mm²	3 x 45.7
Construction of each CU ground conductor	Noxmm²	19 x 2.405
Diameter over assembled cores (Approx.)	mm	63.9
Nominal thickness of PVC inner sheath (ST-2)	mm	1.8
Nominal thickness of polyester tape	mm	0.1
Nominal thickness of steel tape armour	mm	0.5
Nominal thickness of Red PVC outer sheath (ST-2)	mm	3.4
Minimum thickness of PVC outer sheath	mm	2.52
Overall diameter of cable (Approx.)	mm	78