

Test Report

PPR 1662


12,7/22 kV
 Indoor Termination EPKT-R for Screened Single Core
 Plastic and Rubber Insulated Cables
 tested in accordance to
 CENELEC HD 629.1 S1:1996


Pages: 13

Appendix: -

Date: 26.Sep.2003

Tested by: E. Liegl (Senior Technician, Energy Products)	Signature: 	Date: Dec. 13 th , 2002
---	---	------------------------------------

Prepared by: P.C. Olving (Product Manager, Energy Products)	Signature: 	Date: Sep. 26 th , 2003
--	---	------------------------------------

Released by: R. Strobl (Product Manager, Energy Products)	Signature: 	Date: Sep. 26 th , 2003
--	---	------------------------------------

© Raychem Reports may only be used in their original form
TYCO ELECTRONICS Raychem GmbH
 Energy Division
 Finsinger Feld 1
 D-85521 Ottobrunn
 Munich, Germany
 Tel. +49 89 6089-380
 Fax +49 89 6089-654

PPR 1662:

- Subject of Test:** 24kV Indoor Termination EPKT-R 24C1XI
For Single Core Plastic and Rubber Insulated Cables
- Date of Tests:** Juli 2002 – Februar 2003
- Requirements:** CENELEC HD 629.1 S1: 1996 including IEC 50502-4
The current CENELEC HD 629.1 S1: 1996 specification exceeds the requirements of the current IEC 60502-4 specification.
- Manufacturer:** Tyco Electronics Raychem GmbH, Ottobrunn - Germany
- Location of Tests:** Tyco Electronics Raychem GmbH EPD Laboratories,
Ottobrunn - Germany
- Test Purpose:** Qualification according to CENELEC HD 629.1 S1: 1996
specification
- Reference:** Laboratory Book 4442 page 18
- Test Results:** *The tests were carried out according to CENELEC HD 629.1 S1: 1996+A1:2001. For all termination tests 24kV, 150mm² XLPE insulated single core polymeric cables were used. Two loops with 4 terminations were tested.*
- All samples passed the test requirements in accordance with the CENELEC HD 629.1 S1: 1996+A1:2001 12,7/20(24) kV specification including IEC-50502-4. The EPKT-R termination is qualified for a cross section of 95mm²-300mm².*

Content:

1. CENELEC TEST EPKT-R 24C-1XI FOR CROSS-SECTIONS 95-300 MM².	4
1.1. Test Programme	4
1.2. Test Samples	5
1.3. Test Sequence A1	6
1.3.1. D.C. Voltage Test according to Section 5 HD 628	6
1.3.2. A.C. Voltage Test according to Section 4 HD 628	6
1.3.3. PD Test at ambient temperature according to Section 7 HD 628	6
1.3.4. Nominal Impulse Voltage Withstand Test at elevated temperature according to Section 6 HD 628	7
1.3.5. Continuous A.C. Voltage Test with Cyclic Current Load according to Section 9 HD 628	8
1.3.6. PD Test according to Section 7 HD 628	8
1.3.7. Continuous A.C. Voltage Test with Cyclic Current Load according to Section 9 HD 628	10
1.3.8. PD Test according to Section 7 HD 628	10
1.3.9. Nominal Impulse Voltage Withstand Test at ambient temperature according to Section 6 HD 628	11
1.3.10. A.C. Voltage Test according to Section 4 HD 628	11
1.4. Test Sequence A3	11
1.5. Summary Test Results	12

1. CENELEC TEST EPKT-R 24C1XI for Cross-Sections 95-300 mm².

1.1. Test Programme

The test sequence of the EPKT24C1XI Indoor Termination for 12,7 / 20 (24)kV was done in accordance to HD 629.1 S1:1996+A1: 2001 table 3, page 12.

Table 1: Indoor Terminations for extruded insulation cables

	Test	Test clause of HD 628	Test sequence			Test requirements
			A1	A2	A3	
1	DC voltage dry withstand	5	X			15 min. at 76 kV
2	AC voltage dry withstand	4	X			5 min. at 57 kV
3	Partial discharge at ambient temperature	7	X			max. 10 pC at 22 kV
4	Impulse voltage at elevated temperature	6	X			10 +/- 125 kV 95°C – 100°C
5	Electrical heat cycling in air	9	X			3 Cycles 5/3 32 kV 95-100°C
6	Partial discharge at ambient - ambient temperature - elevated temperature	7	X X			max. 10 pC at 22 kV max. 10 pC at 22 kV
7	Electrical heat cycling in air	9	X			123 Cycles 5/3 32 kV 95-100°C
8	Partial Discharge at ambient - ambient temperature - elevated temperature	7	X X			max. 10 pC at 22 kV max. 10 pC at 22 kV
9	Thermal short circuit (conductor)	11				2 short circuit 1s
10	Impulse voltage at ambient temperature	6	X			10 +/- 22 kV
11	AC voltage dry withstand	4	X			15 min. at 32 kV
12	Humidity test	13			X	300 h duration at 16 kV, 700µS/cm
13	Examination		X		X	For information only

1.2. Test Samples

Cable: Cable:

Manufacturer:	NEXANS
Type:	NA2XS2Y
Construction:	XLPE extruded
Conductor:	Stranded Aluminium
Cross section:	150mm ²
Voltage rating:	24 kV
Length of test loops:	3m
Cable lug:	Al
Number of loops:	2

Product:

Kit Description:	EPKT 24C1XI	
Non-tracking outer tubing:	HVOT-50/16-450-01/89	EZ 12921-00
Screen cut filler:	S1189-1-100(A3)-(C2100)	TF 30513
Stress control tubing	SCTM-38/16-190/U(S3)	EC 40601-03
Sheds:	205W325-103/89	
Sealant tape:	S1085-1-300(C1000)	

Installation:

Instruction sheet:	EPP-0275-8/92
--------------------	---------------

1.3. Test Sequence A1

1.3.1. D.C. Voltage Test according to Section 5 HD 628

The test loops were subjected to a D.C. voltage of 76 kV for 15 minutes.

Result: All samples passed

1.3.2. A.C. Voltage Test according to Section 4 HD 628

A.C. voltage of 57 kV_{rms}, 50 Hz was applied between the conductor and the grounded screen for 5 minutes. The voltage was continuously increased within 10 seconds to the specified value and then held constant during the required test period.

relative humidity of air	atmospheric pressure	temperature
50 %	943hPa	26° C

Result: All samples passed

1.3.3. PD Test at ambient temperature according to Section 7 HD 628

The lugs were made corona-free by using ring electrodes and an A.C. test voltage of 1,98 U₀ was applied for 1 minute. Then the voltage was decreased to the A.C. test voltage U_{PD} = 22 kV and within 1 minute the maximum value of the partial discharge magnitude was measured.

relative humidity of air	atmospheric pressure	temperature
50 %	943hPa	26° C

	Loop 1	Loop 2
	150mm ²	150mm ²
PD value [pC] @ 22kV	< 1	< 1

Admissible Partial Discharge Magnitude: 10 pC

Result: All samples passed

1.3.4. Nominal Impulse Voltage Withstand Test at elevated temperature according to Section 6 HD 628

An impulse voltage with rise time approx. 1.2 μs and half-value decay time with approx. 50 μs was applied. The test loops were exposed to 10 impulses each of an impulse voltage of 125 kV of positive and negative polarity between the conductor and the grounded screen. The test loops were heated up to a temperature of 95-100° C.

relative humidity of air	atmospheric pressure	temperature
52 %	938 hPa	25° C

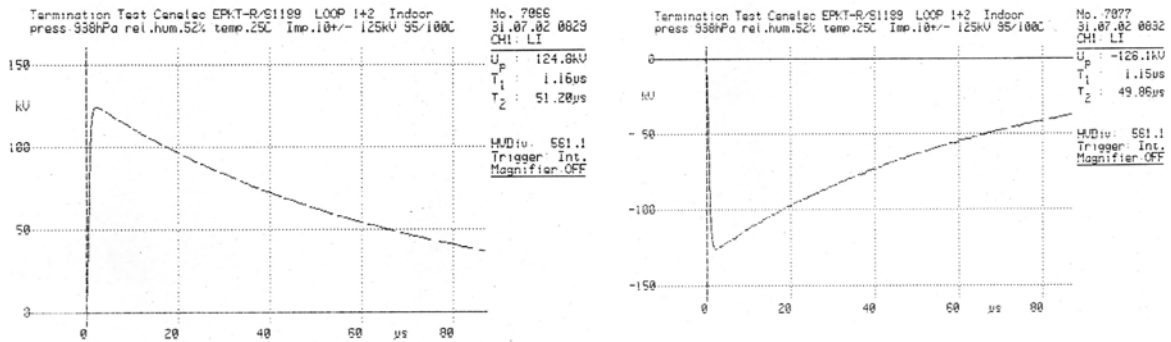


Fig. 1: Impulse oscillograms for 150mm² XLPE cables, loop 1 & 2

The impulse oscillograms in figure 1 does not show any discrepancies from the calibration oscillogram.

Result: All samples passed

1.3.5. Continuous A.C. Voltage Test with Cyclic Current Load according to Section 9 HD 628

The test loops, suspended free in air, were subjected to 3 load cycles with a continuously applied A.C. test voltage of 32kV. Each load cycle consists of a 3 hours load period; 2 hours hold period and 3 hours cooling period. The current was adjusted to a level that heated up the cable core to a temperature of 98° C. The ambient temperature during the load cycles was approx. 22° C.

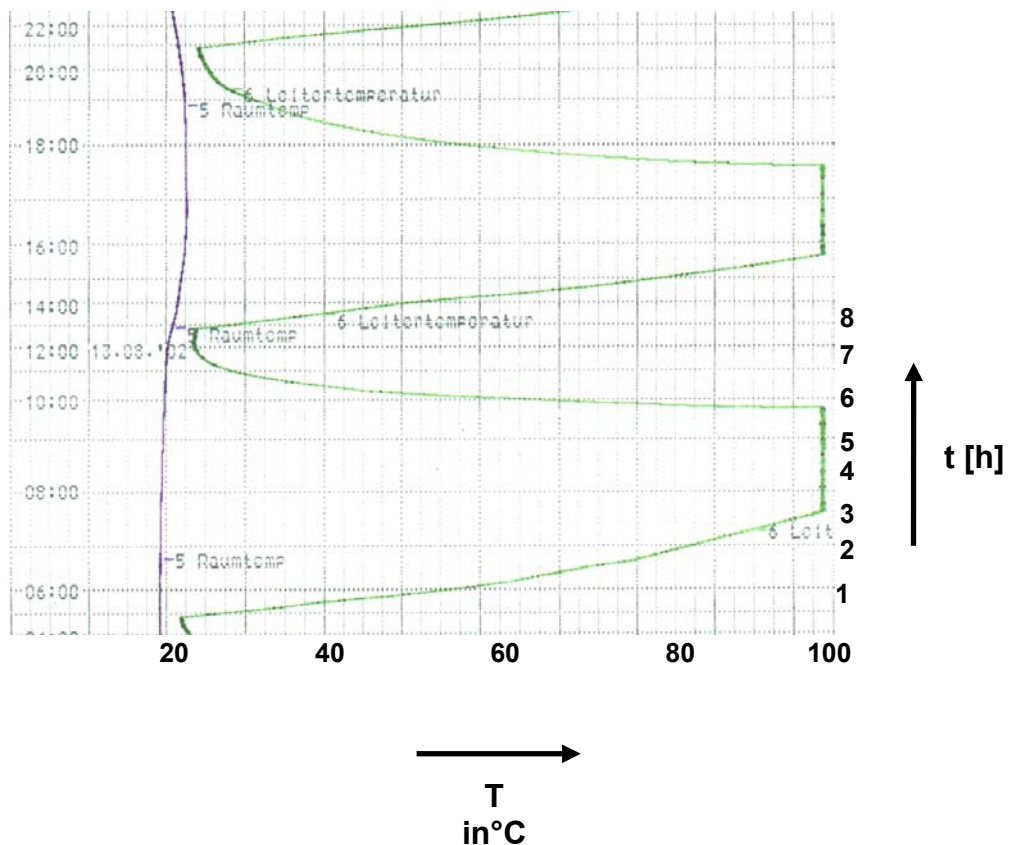


Fig. 2: Temperature during one load cycle

Result: All samples passed

1.3.6. PD Test according to Section 7 HD 628

After the 3rd load cycle the Partial Discharge test as in 1.3.3 was repeated.

a) Partial Discharge Test at ambient temperature

relative humidity of air	atmospheric pressure	temperature
48 %	945 hPa	25° C

	Loop 1	Loop 2
	150mm ²	150mm ²
PD value [pC] @ 22kV	< 1	< 1

Admissible Partial Discharge Magnitude: 10 pC

Result: All samples passed

b) Partial Discharge Test at elevated temperature

The PD-Measurement was done as in 1.3.3, but the conductors were heated up to a temperature of 95 - 100° C.

relative humidity of air	atmospheric pressure	temperature
48 %	945 hPa	25° C

	Loop 1	Loop 2
	150mm ²	150mm ²
PD value [pC] @ 22kV	< 1	< 1

Admissible Partial Discharge Magnitude: 10 pC

Result: All samples passed

1.3.7. Continuous A.C. Voltage Test with Cyclic Current Load according to Section 9 HD 628

Identical Test as in 1.3.5, but 123 load cycles in air

Result: All samples passed

1.3.8. PD Test according to Section 7 HD 628

After 123 load cycles the Partial Discharge Test as in 1.3.3 was repeated.

a) Partial Discharge Test at ambient temperature

relative humidity of air	atmospheric pressure	temperature
39%	954 hPa	24° C

	Loop 1	Loop 2
	150mm ²	150mm ²
PD value [pC] @ 22kV	< 1	< 1

Admissible Partial Discharge Magnitude: 10 pC

Result: All samples passed

b) Partial Discharge Test at elevated temperature

The PD-Measurement was done as in 1.3.3, but the conductors were heated up to a temperature of 95 - 100° C.

relative humidity of air	atmospheric pressure	temperature
39%	954 hPa	24° C

	Loop 1	Loop 2
	150mm ²	150mm ²
PD value [pC] @ 22kV	< 1	< 1

Admissible Partial Discharge Magnitude: 10 pC

Result: All samples passed

1.3.9. Nominal Impulse Voltage Withstand Test at ambient temperature according to Section 6 HD 628

An impulse voltage with rise time approx. 1.2 μ s and half-value decay time with approx. 50 μ s was applied. The test loops were exposed to 10 impulses each of an impulse voltage of 125 kV of positive and negative polarity between the conductor and the grounded screen.

relative humidity of air	atmospheric pressure	temperature
51 %	953 hPa	24° C

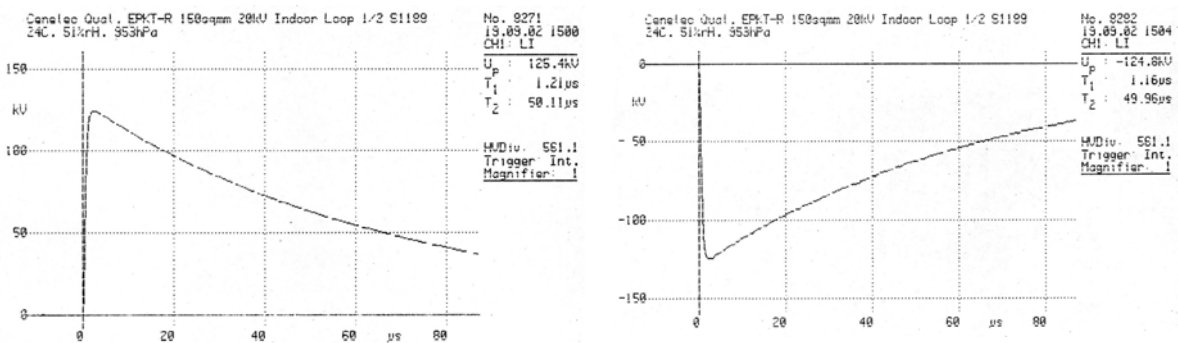


Fig. 3: Impulse oscillograms for 150mm² XLPE cables, loop 1 & 2

The impulse oscillograms in figure 3 do not show any discrepancies from the calibration oscillogram.

Result: All samples passed

1.3.10. A.C. Voltage Test according to Section 4 HD 628

A.C. voltage of 22 kV_{rms}, 50 Hz was applied between the conductor and the grounded screen for 15 minutes. The voltage was continuously increased within 10 seconds to the specified value and then held constant during the required test period.

relative humidity of air	atmospheric pressure	temperature
51 %	953 hPa	24° C

Result: All samples passed

1.4. Test Sequence A3

The 300 h humidity test was done according to Section 13 HD 628.

A.C. voltage of 16 kV_{rms}, 50 Hz was applied between the conductor and the grounded screen for 300 h. The voltage was continuously increased within 10 seconds to the specified value and was then held constant during the required test period. The water with a conductivity of 700 +/- 100 µS/cm was sprayed at a rate of 0,4 +/- 0,1 l/h per cubic meter of the test chamber.

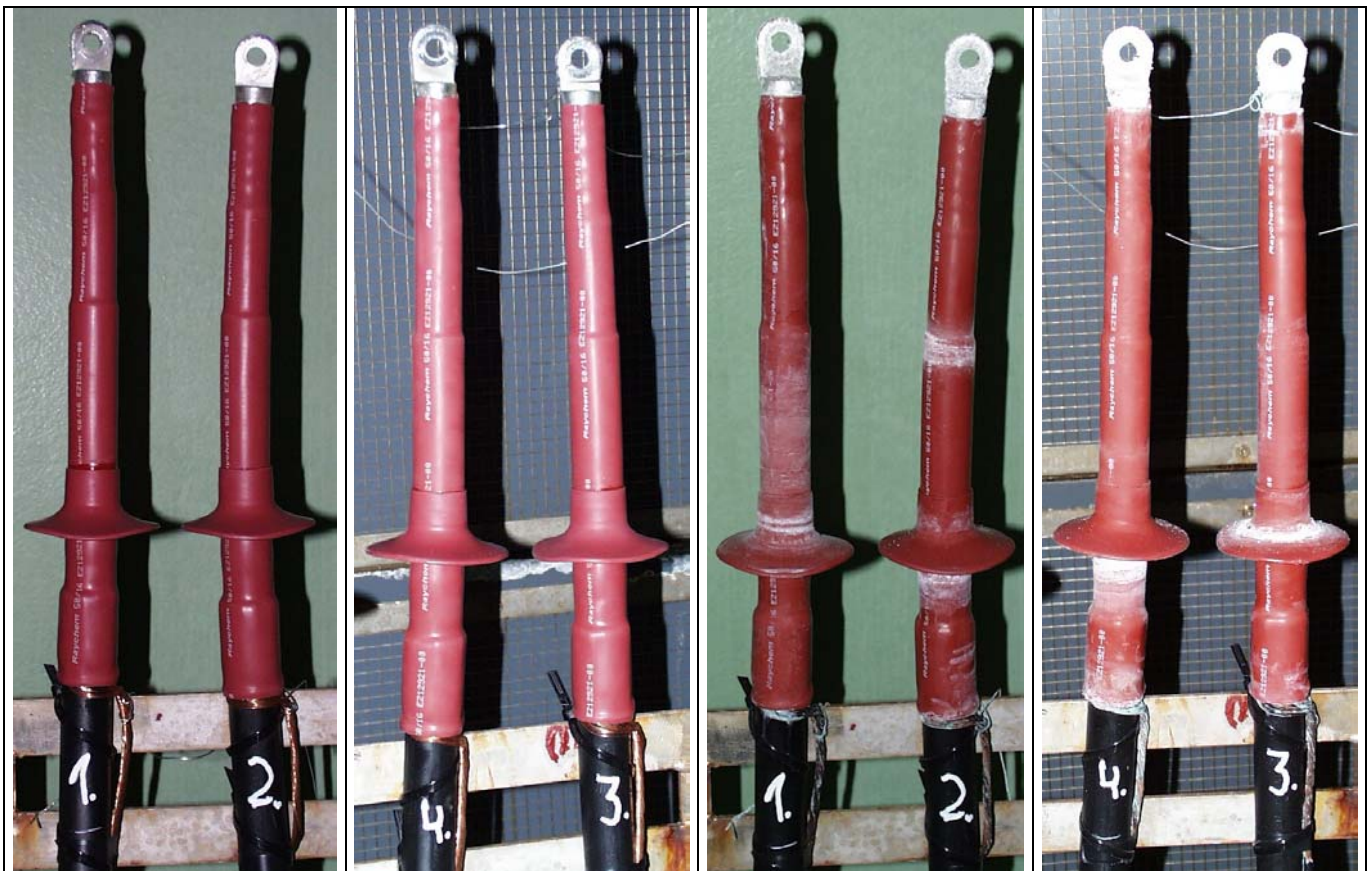


Fig. 4: Indoor terminations before and after 300h humidity test

Result: All samples passed

1.5. Summary Test Results

The EPKT-R 24C1XI 24kV Indoor Termination was tested in accordance to the CENELEC HD 629.1 S1:1996+A1:2001. The tests were carried out on 24kV XLPE cables with cross sections of 150mm². For all cross sections two loops were used.

All samples have passed the test requirements in accordance to the CENELEC HD 629.1 S1:1996+A1:2001 12,7 / 20 (24) kV specification.

The current CENELEC HD 629.1 S1:1996 specification exceeds the requirements of the current IEC 60502-4 specification.