China Electric Power Research Institute
Quality Inspection and Test Center for Electric Equipment of Power Industry

EETC2014DL342J

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Test Report

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China Electric Power Research Institute
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Test Report

EETC2014DL342J

1 Client

Shenzhen Woer Heat-Shrinkable Material Co., Ltd.

2 Sample Description

Name: 18/20(18/30) kV cold shrinkable outdoor termination
Type & Size: WLW-18/20(18/30) 3×185
Manufacturer: Shenzhen Woer Heat-Shrinkable Material Co., Ltd.
Manufacture Date: July, 2014
Sample No. /Details: DL2014-342

3 Standards/Specifications

GB/T 12706.4—2008 Power cables with extruded insulation and their accessories for rated voltages from 1 kV (U_m=1.2 kV) up to 35 kV (U_m=40.5 kV) — Part 4: Test requirements on accessories for cables with rated voltages from 6 kV (U_m=7.2 kV)up to 35kV (U_m=40.5 kV)

IEC 60502-4:2010 Power cables with extruded insulation and their accessories for rated voltages from 1 kV(U_m =1.2 kV)up to 30 kV(U_m =36 kV) Part 4:Test requirements on accessories for cables with rated voltages from 6 kV(U_m =7.2 kV)up to 30 kV(U_m =36 kV)

4 Test Category

Type Tests

5 Test Date

05/08/2014-11/11/2014

6 Conclusion

The 18/20(18/30) kV cold shrinkable outdoor terminations, the type and size of which is WLW-18/20(18/30) 3×185 taken to test by the client's own self have passed the type tests specified in GB/T 12706.4—2008 and IEC 60502-4:2010.

Note: In the event of any difference in meanings of the text, the Chinese report shall take priority over the English version.

Tested by: 韩卫东 赫图泽

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Approved by: [illegible]

Date of issue: 2014-12-03

7 The Number and Installation of Combination Samples

It was required that four sets of terminations to be tested were installed by the manufacturer on two length of cables forming No.1 and No.2 combination samples. The length of the cable in the combination sample was greater than 5 m between the two terminations. The cable used in the combination sample was a XLPE insulated three-core cable for rated voltage 18/30 kV, a cross-section of 185 sq.mm. The type tests sequence 1.1, 1.2 and 1.3 were carried out on No.1 combination samples. The type tests sequence 1.5 were carried out on No.2 combination samples.

8 Test Sequence and Results

The test sequence and results were given in Table 1 (sequence 1.1), Table 2(sequence 1.2, 1.3) and Table 3 (sequence 1.5).

Table 1

No.	Items	Requirements	Results				Evaluation
1	AC withstand voltage test	Neither breakdown nor flashover shall occur at 81 kV for 5 min	No breakdown and flashover occurred on the combination samples at 81 kV for 5 min				Pass
2	AC withstand voltage test under rain	Neither breakdown nor flashover shall occur at 72 kV for 1 min	No breakdown and flashover occurred on the combination samples at 72 kV for 1 min				Pass
3	Partial discharge test at ambient temperature	The magnitude of the discharge at 30 kV shall not exceed 10 pC	Phase	Y	G	R	Pass
			Voltage (kV)	30	30	30	
			Noise background (pC)	1.3	1.3	1.3	
			Discharge (pC)	≤1.3	1.8	≤1.3	
4	Impulse withstand voltage test at 95 ℃～100 ℃	Neither breakdown nor flashover shall occur at 10 positive and 10 negative impulses of 170 kV	No breakdown and flashover occurred on the combination samples at 10 positive and 10 negative impulses of 170 kV (See Annex B)				Pass
5	Heating cycle voltage test in air	Neither breakdown nor flashover shall occur during 60 cycles in air at the conductor temperature of 95 ℃ to 100 ℃ and 45 kV	No breakdown and flashover occurred on the combination samples during 60 cycles in air at the conductor temperature of 95 ℃ to 100 ℃ and 45 kV				Pass
6	Partial discharge test at 95 ℃～100 ℃	The magnitude of the discharge at 30 kV shall not exceed 10 pC	Phase	Y	G	R	Pass
			Voltage (kV)	30	30	30	
			Noise background (pC)	1.6	1.6	1.6	
			Discharge (pC)	≤1.6	2.0	≤1.6	

Table 1(Continued)

No.	Items	Requirements	Results				Evaluation
7	Partial discharge test at ambient temperature	The magnitude of the discharge at 30 kV shall not exceed 10 pC	Phase	Y	G	R	Pass
			Voltage (kV)	30	30	30	
			Noise background (pC)	1.6	1.6	1.6	
			Discharge (pC)	≤1.6	2.2	≤1.6	
8	Impulse withstand voltage test	Neither breakdown nor flashover shall occur at 10 positive and 10 negative impulses of 170 kV	No breakdown and flashover occurred on the combination samples at 10 positive and 10 negative impulses of 170 kV (See Annex C)				Pass
9	AC withstand voltage test	Neither breakdown nor flashover shall occur at 45 kV for 15 min	No breakdown and flashover occurred on the combination samples at 45 kV for 15 min				Pass

Table 2

No.	Items	Requirements	Results	Evaluation
1	AC withstand voltage test	Neither breakdown nor flashover shall occur at 81 kV for 5 min	No breakdown and flashover occurred on the combination samples at 81 kV for 5 min	Pass
2	Thermal short-circuit test (conductor)	No visible deterioration at 24.0 kA, 2 s,twice	No visible deterioration at 24.19 kA, 2.01 s and 24.30 kA, 2.02 s (See Annex E2)	Pass
3	Dynamic short-circuit test (conductor)	No visible deterioration at 85.0 kA, not less than 10 ms	No visible deterioration at 85.31 kA, 91 ms (See Annex E1)	Pass
4	Impulse withstand voltage test	Neither breakdown nor flashover shall occur at 10 positive and 10 negative impulses of 170 kV	No breakdown and flashover occurred on the combination samples at 10 positive and 10 negative impulses of 170 kV (See Annex D)	Pass
5	AC withstand voltage test	Neither breakdown nor flashover shall occur at 45 kV for 15 min	No breakdown and flashover occurred on the combination samples at 45 kV for 15 min	Pass

Table 3

No.	Items	Requirements	Results	Evaluation
1	Salt fog tests	Neither breakdown nor flashover, no more than three trippings, no substantial damage shall occur at 22.5 kV for 1000 h	No breakdown, flashover, tripping, substantial damage occurred on the combination samples at 22.5 kV for 1000 h	Pass

Annex A List of the main equipment and instruments used in tests

No.	Name of the equipment and instruments Model / Type	Serial No.	Measuring range	Uncertainty / Veracity	Verification /Calibration institution	Valid period
1	TRF300-0.002 AC voltage measurement system	110650	(0~300) kV	Grade 3	National high voltage measurement station	2016-10-31
2	TAWF Series resonance system	312068	(0~75) kV	Class 3	National high voltage measurement station	2015-09-08
3	JFD-2H PD measurement system	20041202	(0.5~1000) pC	Class 10	National high voltage measurement station	2016-05-20
4	FY I 900/600 Weakly damped capacitive voltage divider	11165-2-1	(0~900) kV	Class 3	National high voltage measurement station	2016-07-01
5	H-DJF-2 Data collected system	CJ06	(0~100) kA	Class 0.5	National high voltage measurement station	2016-01-03
6	LM-0.5 Current transformer	814	(0~3000) A	Class 0.5	National high voltage measurement station	2016-10-17
7	DDS-307 conductivity meter	610508110058	(0~2000) mS/m	Class 4	Hubei Institute of Measurement and Testing Technology	2015-10-08
8	UT56 Digital voltage meter	3080099522	(0~700) V	Class 1	Hubei Institute of Measurement and Testing Technology	2015-09-28

Annex B The values and oscillograms of impulse voltages on the combination samples before heating cycles voltage test (at high temperature, 170 kV,±3% tolerance)

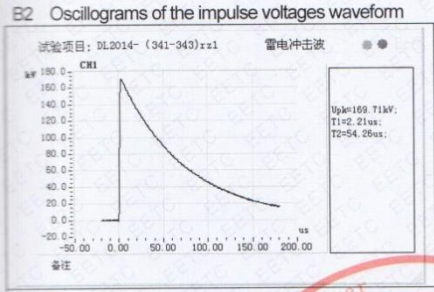
B1 The values of impulse voltages

Ambient temperature: 31.0 ℃, Relative humidity: 72 %, Atmosphere: 0.1000 MPa

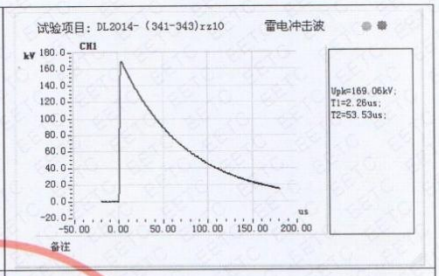
Unit: kV

Positive polarity	169.7	170.6	170.5	170.2	170.5	170.5	170.7	170.2	170.3	169.1
Negative polarity	169.4	170.8	170.4	170.3	170.1	171.2	170.8	170.6	170.1	170.8

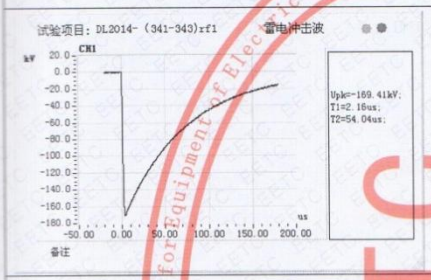
B2 Oscillograms of the impulse voltages waveform



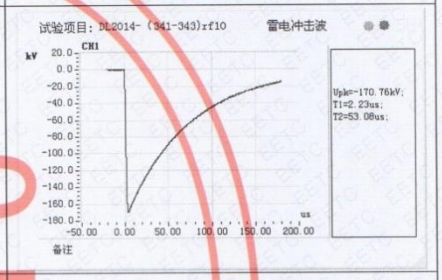
The 1st positive impulses waveform



The 10th positive impulses waveform



The 1st negative impulses waveform



The 10th negative impulses waveform

Annex C The values and oscillograms of impulse voltages on the combination samples after heating cycles voltage test (at ambient temperature, 170 kV,±3 % tolerance)

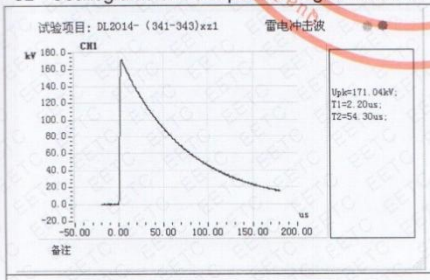
C1 The values of impulse voltages

Ambient temperature: 27.0 ℃, Relative humidity: 66 %, Atmosphere: 0.1000 MPa

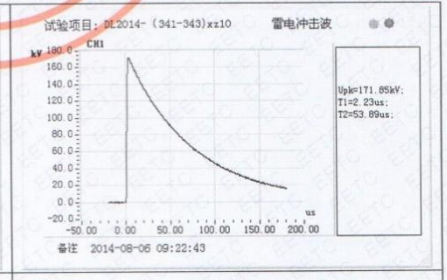
Unit: kV

Positive polarity	171.0	170.0	170.8	170.9	171.2	170.3	170.3	170.5	170.6	171.8
Negative polarity	170.6	170.1	170.2	170.3	170.3	171.2	170.8	170.7	170.7	169.1

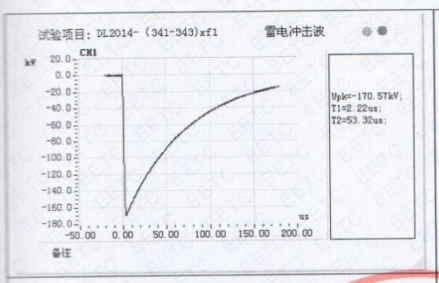
C2 Oscillograms of the impulse voltages waveform



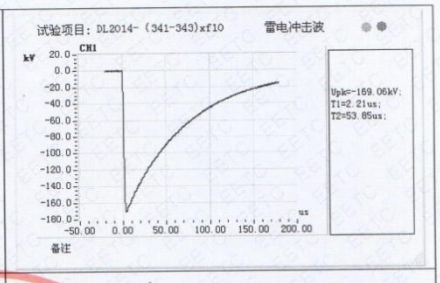
The 1st positive impulses waveform



The 10th positive impulses waveform



The 1st negative impulses waveform



The 10th negative impulses waveform

Annex D The values of impulse voltages on the combination samples after thermal short-circuit tests (at ambient temperature, 170 kV ±3 % tolerance)

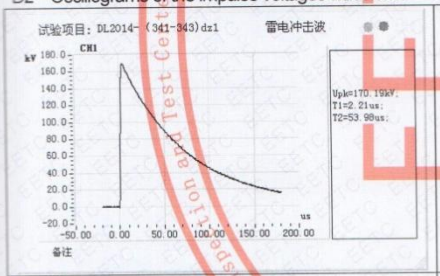
D1 The values of impulse voltages

Ambient temperature: 15.5 ℃, Relative humidity: 46 %, Atmosphere: 0.1018 MPa

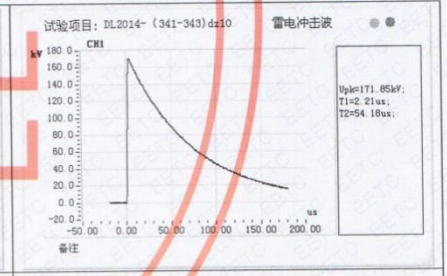
Unit: kV

Positive polarity	170.2	170.1	170.2	170.1	171.0	171.0	170.5	170.5	170.5	171.8
Negative polarity	169.8	170.0	170.1	170.0	170.3	170.2	170.5	170.4	170.7	171.0

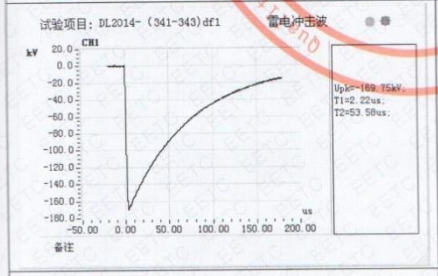
D2 Oscillograms of the impulse voltages waveform



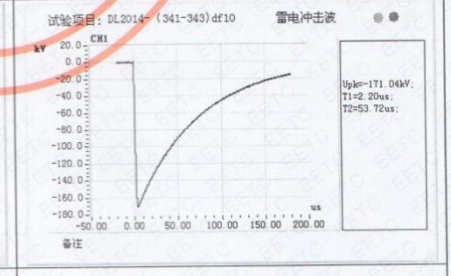
The 1st positive impulses waveform



The 10th positive impulses waveform



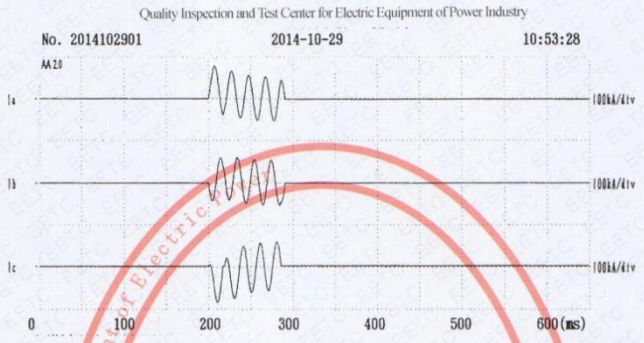
The 1st negative impulses waveform



The 10th negative impulses waveform

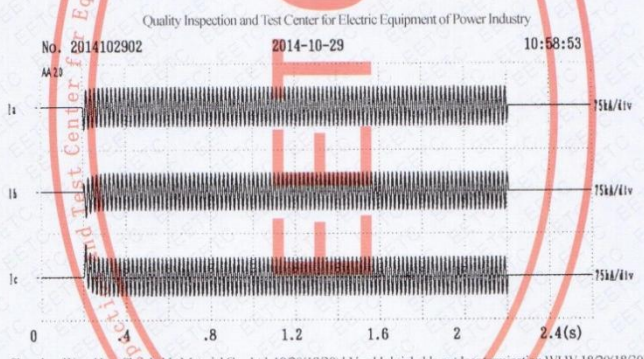
Annex E The waveform of dynamic short-circuit tests and thermal short-circuit tests of the combination sample

E1 The waveform of dynamic short-circuit tests of the combination sample(conductor)

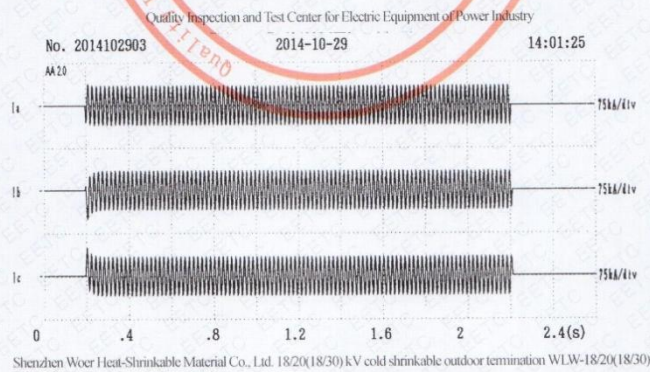


Shenzhen Woer Heat-Shrinkable Material Co., Ltd. 18/20(18/30) kV cold shrinkable outdoor termination WLW-18/20(18/30) 3×185

E2 The waveform of thermal short-circuit tests of the combination sample(conductor)

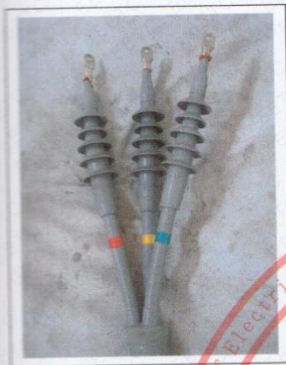
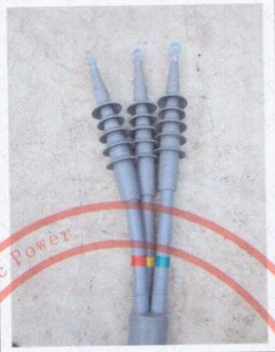


Shenzhen Woer Heat-Shrinkable Material Co., Ltd. 18/20(18/30) kV cold shrinkable outdoor termination WLW-18/20(18/30) 3×185



Shenzhen Woer Heat-Shrinkable Material Co., Ltd. 18/20(18/30) kV cold shrinkable outdoor termination WLW-18/20(18/30) 3×185

Annex F Photograph about test

		
The appearance of the sample	After salt fog test (the right side)	After salt fog test (opposite direction)

Annex G Identification of test cable(specified in GB/T 12706.2—2008)

rated voltage $U_0/U(U_m)$		18/30(36) kV
construction	core	three-core
	construction of screen	separated screen
conductor	material	copper
	type	round compact stranded
	cross section	185 mm^2
	diameter	16.5 mm
insulation	material	XLPE
	thickness	8.0 mm
	diameter	34.4 mm
screen	thickness of conductor screen	0.9 mm
	thickness of insulation screen	0.9 mm
	strippability of insulation screen	strippable
	diameter of insulation screen	36.2 mm
	metallic screen	copper tape
armour		/
oversheath	material	PVC
	diameter	90.4 mm
mark of cable		YJV-18/30 3×185