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CNAS L0699



TEST REPORT

CEPRI-EETC08-2019-0329 (E)

Client: Shenzhen Woer Electric Technology Co., Ltd.

Object: 8.7/15 kV cold shrinkable outdoor termination

Type: WLW-8.7/15-3×185

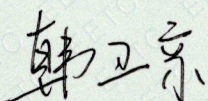
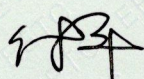
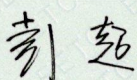
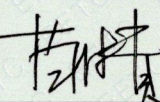
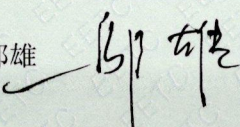
Test Category: Type Tests



POWER INDUSTRY QUALITY INSPECTION AND TEST
CENTER FOR ELECTRIC EQUIPMENT

Catalogue

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Client	Shenzhen Woer Electric Technology Co., Ltd.	Manufacturer	Shenzhen Woer Electric Technology Co., Ltd.
Object	8.7/15 kV cold shrinkable outdoor termination Type		WLW-8.7/15-3×185
Sampling procedure	by the Client	Serial No.	EETC08-19/06/01-003
Test Category	Type Tests	Date	2019.06.13~2019.09.16
Requirements	<p>1. 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 35 kV ($U_m=40.5$ kV)</p> <p>2. 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)</p> <p>3. T/CEC 118—2016 Technical requirements of cold shrinkable accessories for power cables for rated voltages up to 35 kV ($U_m=40.5$ kV)</p>		
Conclusion	<p>According to GB/T 12706.4—2008 , IEC 60502-4:2010 and T/CEC 118—2016, type tests were performed on 8.7/15 kV cold shrinkable outdoor terminations which were provided by Shenzhen Woer Electric Technology Co., Ltd. All the results were in accordance with the requirements.</p>		
Note	/		
<p>Tested by: 韩卫京  付平 </p>			
<p>Checked by: 彭超  Verified by: 苗付贵 </p>			
<p>Approved by: 郭雄  Date of issue: 2019.10.14.</p>			

Test Results

No.	Item	Requirements	Results	Evaluation			
1	Sequence 1.1	/	/	/			
1.1	AC voltage test	Neither breakdown nor flashover shall occur at 39 kV for 5 min	No breakdown and flashover occurred on the combination samples at 39 kV for 5 min	passed			
1.2	DC voltage test	Neither breakdown nor flashover shall occur at 35 kV for 15 min	No breakdown and flashover occurred on the combination samples at 35 kV for 15 min	passed			
1.3	AC voltage test under rain	Neither breakdown nor flashover shall occur at 35 kV for 1 min	No breakdown and flashover occurred on the combination samples at 35 kV for 1 min	passed			
1.4	Partial discharge test at ambient temperature	The magnitude of the discharge at 15 kV shall not exceed 10 pC	Phase	Y	G	R	passed
			Voltage (kV)	15	15	15	
			Noise background (pC)	1.7	1.7	1.7	
			Discharge (pC)	1.7	1.7	1.7	
1.5	Impulse voltage test at 95 °C ~ 100 °C	Neither breakdown nor flashover shall occur at 10 positive and 10 negative impulses of 95 kV	No breakdown and flashover occurred on the combination samples at 10 positive and 10 negative impulses of 95 kV (See Appendix C.1)	passed			
1.6	Heating cycle voltage test in air	Neither breakdown nor flashover shall occur during 60 cycles in air at the conductor temperature of 95°C to 100°C and 22 kV	No breakdown and flashover occurred on the combination samples during 60 cycles in air at the conductor temperature of 95°C to 100°C and 22 kV	passed			
1.7	Immersion test	10 cycles in water at the conductor temperature of 95 °C to 100 °C, each cycle lasts for 8h, whereas 5h for heating, 3h for cooling	The Immersion test was finished according to standards	/			
1.8	Partial discharge test at 95°C ~ 100°C	The magnitude of the discharge at 15 kV shall not exceed 10 pC	Phase	Y	G	R	passed
			Voltage (kV)	15	15	15	
			Noise background (pC)	2.2	2.2	2.2	
			Discharge (pC)	2.2	2.2	2.2	

No.	Item	Requirements	Results				Evaluation
			Phase	Y	G	R	
1.9	Partial discharge test at ambient temperature	The magnitude of the discharge at 15 kV shall not exceed 10 pC	Phase	Y	G	R	passed
			Voltage (kV)	15	15	15	
			Noise background (pC)	2.1	2.1	2.1	
			Discharge (pC)	2.1	2.1	2.1	
1.10	Impulse voltage test	Neither breakdown nor flashover shall occur at 10 positive and 10 negative impulses of 95 kV	No breakdown and flashover occurred on the combination samples at 10 positive and 10 negative impulses of 95 kV (See Appendix C.2)				passed
1.11	AC voltage test	Neither breakdown nor flashover shall occur at 22 kV for 15 min	No breakdown and flashover occurred on the combination samples at 22 kV for 15 min				passed
1.12	Examination	It is advised that the accessory is examined for signs of any of the following: (i) cracking in the filling media and/or tape or tube components; (ii) a moisture path across a primary seal; (iii) corrosion and/or tracking and/or erosion; (iv) leakage of an insulating material.	(i) No cracking in the filling media and tape or tube components; (ii) No moisture path across a primary seal; (iii) No evident corrosion, tracking and erosion; (iv) No leakage of an insulating material.				passed
2	Sequence 1.2 and 1.3	/	/				/
2.1	AC voltage test	Neither breakdown nor flashover shall occur at 39 kV for 5 min	No breakdown and flashover occurred on the combination samples at 39 kV for 5 min				passed
2.2	DC voltage test	Neither breakdown nor flashover shall occur at 35 kV for 15 min	No breakdown and flashover occurred on the combination samples at 35 kV for 15 min				passed
2.3	Thermal short-circuit test (screen)	No visible deterioration at 3.5 kA, 1 s, twice	No visible deterioration at 3.539 kA, 1.04 s and 3.533 kA, 1.04 s (See Appendix C.4)				passed

No.	Item	Requirements	Results	Evaluation
2.4	Thermal short-circuit test (conductor)	No visible deterioration at 23.0 kA, 2 s, twice	No visible deterioration at 23.86 kA, 2.03 s and 23.98 kA, 2.02 s (See Appendix C.5)	passed
2.5	Dynamic short-circuit test	No visible deterioration at 81.3 kA, not less than 10 ms	No visible deterioration at 82.8 kA, 77.0 ms (See Appendix C.6)	passed
2.6	Impulse voltage test	Neither breakdown nor flashover shall occur at 10 positive and 10 negative impulses of 95 kV	No breakdown and flashover occurred on the combination samples at 10 positive and 10 negative impulses of 95 kV (See Appendix C.3)	passed
2.7	AC voltage test	Neither breakdown nor flashover shall occur at 22 kV for 15 min	No breakdown and flashover occurred on the combination samples at 22 kV for 15 min	passed
2.8	Examination	It is advised that the accessory is examined for signs of any of the following: (i) cracking in the filling media and/or tape or tube components; (ii) a moisture path across a primary seal; (iii) corrosion and/or tracking and/or erosion; (iv) leakage of an insulating material.	(i) No cracking in the filling media and tape or tube components; (ii) No moisture path across a primary seal; (iii) No evident corrosion, tracking and erosion; (iv) No leakage of an insulating material.	passed
3	Sequence 1.5	/	/	/
3.1	Salt fog tests	Neither breakdown nor flashover, no more than three trippings, no substantial damage shall occur at 11 kV for 1000 h	No breakdown, flashover, tripping, substantial damage occurred on the combination samples at 11 kV for 1000 h	passed

No.	Item	Requirements	Results	Evaluation
3.2	Examination	It is advised that the accessory is examined for signs of any of the following: (i) cracking in the filling media and/or tape or tube components; (ii) a moisture path across a primary seal; (iii) corrosion and/or tracking and/or erosion; (iv) leakage of an insulating material.	(i) No cracking in the filling media and tape or tube components; (ii) No moisture path across a primary seal; (iii) No evident corrosion, tracking and erosion; (iv) No leakage of an insulating material.	passed

Content

1. Sequence 1.1 in Table 4 of GB/T 12706.4—2008

1.1 AC voltage test

1.1.1 Test method

The test shall be carried out in accordance with GB/T 18889—2002, clause 4 and IEC 61442:2005, clause 4. Neither breakdown nor flashover shall occur at 39 kV for 5 min.

1.2 DC voltage test

1.2.1 Test method

The test was carried out in accordance with GB/T 18889—2002, clause 5 and IEC 61442:2005, clause 5. Neither breakdown nor flashover shall occur at 35 kV for 15 min.

1.3 AC voltage test under rain

1.3.1 Test method

The test shall be carried out in accordance with GB/T 18889—2002, clause 4 and IEC 61442:2005, clause 4. Neither breakdown nor flashover shall occur at 35 kV for 1 min.

1.4 Partial discharge test at ambient temperature

1.4.1 Test method

The test voltage shall be raised gradually to and held at 18 kV for 10 s and then slowly reduced to 15 kV. The test shall be carried out in accordance with GB/T 18889—2002, clause 7 and IEC 61442:2005, clause 7.

1.5 Impulse voltage test at 95 °C~100 °C

1.5.1 Test method

The test shall be carried out in accordance with GB/T 18889—2002, clause 6 and IEC 61442:2005, clause 6. The conductor of the cable shall be heated and stabilized for at least 2 h at a temperature of 95 °C~100 °C. Neither breakdown nor flashover shall occur at 10 positive and 10 negative impulses of 95 kV.

1.6 Heating cycle voltage test in air

1.6.1 Test method

The test shall be carried out in accordance with GB/T 18889—2002, clause 9 and IEC 61442:2005, clause 9. Each heating cycle in air shall be of at least 8 h duration with at least 2 h at a steady temperature of 5 °C

to 10 °C above the maximum cable conductor temperature in normal operation, followed by at least 3 h of natural cooling to within 10 °C of ambient temperature. Neither breakdown nor flashover shall occur during 60 cycles in air at the conductor temperature of 95°C to 100°C and 22 kV.

1.7 Immersion test

1.7.1 Test method

The two terminations shall be immersed in water at ambient temperature for a depth not less than $0.03^{+0.02}$ m. The test loop shall be erected upside down in water box. The terminations shall be totally immersed in water including the end of the sealing part. The test shall be carried out in accordance with IEC 61442:2005, clause 9. Each heating cycle in air shall be of at least 8 h duration with at least 2 h at a steady temperature of 5 °C to 10 °C above the maximum cable conductor temperature in normal operation, followed by at least 3 h of natural cooling to within 10 °C of ambient temperature. Neither breakdown nor flashover shall occur during 10 cycles in air at the conductor temperature of 95°C to 100°C. No voltage shall be applied to the test loop.

1.8 Partial discharge test at 95 °C~100 °C

1.8.1 Test method

The test voltage shall be raised gradually to and held at 18 kV for 10 s and then slowly reduced to 15 kV. The test shall be carried out in accordance with GB/T 18889—2002, clause 7 and IEC 61442:2005, clause 7. The conductor temperature shall be of 95°C to 100°C during the test.

1.9 Partial discharge test at ambient temperature

1.9.1 Test method

The test voltage shall be raised gradually to and held at 18 kV for 10 s and then slowly reduced to 15 kV. The test shall be carried out in accordance with GB/T 18889—2002, clause 7 and IEC 61442:2005, clause 7.

1.10 Impulse voltage test

1.10.1 Test method

The test shall be carried out in accordance with GB/T 18889—2002, clause 6 and IEC 61442:2005, clause 6. Neither breakdown nor flashover shall occur at 10 positive and 10 negative impulses of 95 kV.

1.11 AC voltage test

1.11.1 Test method

The test shall be carried out in accordance with GB/T 18889—2002, clause 4 and IEC 61442:2005, clause 4. Neither breakdown nor flashover shall occur at 22 kV for 15 min.

1.12 Examination

1.12.1 Test method

It is advised that the accessory is examined for signs of any of the following: (i) cracking in the filling media and/or tape or tube components; (ii) a moisture path across a primary seal; (iii) corrosion and/or tracking and/or erosion; (iv) leakage of an insulating material.

2. Sequence 1.2 and 1.3 in Table 4 of GB/T 12706.4—2008

2.1 AC voltage test

2.1.1 Test method

The test shall be carried out in accordance with GB/T 18889—2002, clause 4 and IEC 61442:2005, clause 4. Neither breakdown nor flashover shall occur at 39 kV for 5 min.

2.2 DC voltage test**2.2.1 Test method**

The test was carried out in accordance with GB/T 18889—2002, clause 5 and IEC 61442:2005, clause 5. Neither breakdown nor flashover shall occur at 35 kV for 15 min.

2.3 Thermal short-circuit test (screen)**2.3.1 Test method**

The test shall be carried out in accordance with GB/T 18889—2002, clause 10 and IEC 61442:2005, clause 10. At the beginning of the test, the cable conductor shall be heated to reach a steady temperature of 5 °C to 10 °C above the maximum cable conductor temperature in normal operation and shall last for at least 2 h. Then two short-circuits shall be applied to the screen. The short-circuit current and duration time shall be specified as the agreement between manufacturer and user according to the actual short-circuit condition of the power grid. Between the two short-circuits, the test loop shall be allowed to cool to a temperature less than 10 °C above its temperature prior to the first short-circuit. There shall be no visible deterioration on the samples.

2.4 Thermal short-circuit test (conductor)**2.4.1 Test method**

The test shall be carried out in accordance with GB/T 18889—2002, clause 11 and IEC 61442:2005, clause 11. Two short-circuits shall be applied using AC to raise the conductor temperature to the maximum permissible short-circuit temperature (250 °C) of the cable within 5 s. Between the two short-circuits, the test loop shall be allowed to cool to a temperature less than 10 °C above its temperature prior to the first short-circuit. There shall be no visible deterioration on the samples.

2.5 Dynamic short-circuit test (conductor)**2.5.1 Test method**

The test shall be carried out in accordance with GB/T 18889—2002, clause 12 and IEC 61442:2005, clause 12. The dynamic short-circuit current value shall be 2.5 times of the thermal short-circuit value when the thermal short-circuit time equals 1s. There shall be no visible deterioration on the samples after the short-circuit lasts for at least 10ms.

2.6 Impulse voltage test**2.6.1 Test method**

The test shall be carried out in accordance with GB/T 18889—2002, clause 6 and IEC 61442:2005, clause 6. Neither breakdown nor flashover shall occur at 10 positive and 10 negative impulses of 95 kV.

2.7 AC voltage test**2.7.1 Test method**

The test shall be carried out in accordance with GB/T 18889—2002, clause 4 and IEC 61442:2005, clause 4. Neither breakdown nor flashover shall occur at 22 kV for 15 min.

2.8 Examination**2.8.1 Test method**

It is advised that the accessory is examined for signs of any of the following: (i) cracking in the filling media and/or tape or tube components; (ii) a moisture path across a primary seal; (iii) corrosion and/or tracking and/or erosion; (iv) leakage of an insulating material.

3. Sequence 1.5 in Table 4 of GB/T 12706.4—2008**3.1 Salt fog tests****3.1.1 Test method**

The test shall be carried out in accordance with GB/T 18889—2002, clause 13 and IEC 61442:2005, clause 13. Throughout the test duration, the mist spray shall be sprinkled at a rate of (0.4 ± 0.1) L/h/m³ and its conductivity shall be $(1\ 600 \pm 200)$ mS/m. Neither breakdown nor flashover, no more than three trippings, no substantial damage shall occur at 11 kV for 1000 h.

3.2 Examination**3.2.1 Test method**

It is advised that the accessory is examined for signs of any of the following: (i) cracking in the filling media and/or tape or tube components; (ii) a moisture path across a primary seal; (iii) corrosion and/or tracking and/or erosion; (iv) leakage of an insulating material.

Appendix A Object Parameters**A.1 Sample information**

The sample was received by Power Cable Station on 01/06/2019. The sample was in good condition with the factory number of 2019-096 and the date of manufacture not provided.

A.2 The number and installation of samples

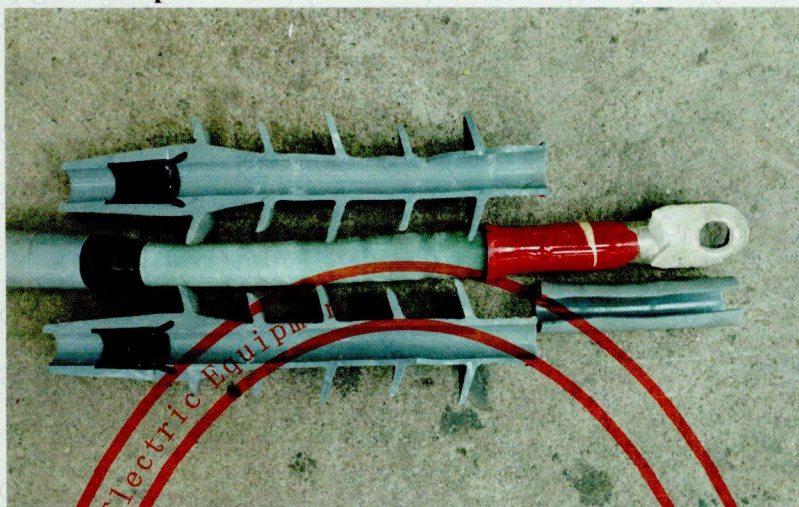
According to GB/T 12706.4—2008, it was required that two sets of terminations to be tested were installed by the manufacturer on two lengths of cables forming No.1 and No.2 combination samples on which the type tests sequence 1.1, 1.2 and 1.3 were carried out. Two sets of indoor terminations and two sets of straight joints were also installed by the manufacturer on the combination samples. The cable used in the combination samples was a XLPE insulated three-core cable for rated voltage 8.7/15 kV, a cross-section of 185 sq.mm. In addition, another two sets of terminations to be tested were installed by the manufacturer on one length of cables forming combination samples on which the type tests sequence 1.5 were carried out.

A.3 Photograph of samples

The appearance of the sample

After salt fog test
(the front view)After salt fog test
(the rear view)

A.4 Photograph of dissected samples



Appendix B The Main Test Devices

No.	Name/ Type/ Specification	Serial No.	Measurement Range	Uncertainty / Accuracy class / Maximum Permissible Error	Calibration Institute	Valid Date
1	YD(W)-JZ-15/150 AC/DC Test Device	084326	(0~150)kV	Grade 3	National high voltage measurement station	2020.07.18
2	CQSB(J)-120/60 60 kV Power frequency test device	R12366	(0~60) kV	Class 3	National high voltage measurement station	2020.07.17
3	JFD-2H PD measurement system	20041202	(0.5~1000) pC	Class 10	National high voltage measurement station	2020.03.25
4	FY I 900/600 Weakly damped capacitive voltage divider	11165-2-1	(0~900) kV	Class 3	National high voltage measurement station	2020.06.29
5	H-DJF-2 Data collected system	CJ06	(0~100)kA	Class 0.5	National high voltage measurement station	2020.01.03
6	LCC-V Heating cycle monitoring system	DLRXH02	(0~3000) A	Class 3	National high voltage measurement station	2020.10.26
7	287C Digital voltage meter	31470016	(0~700) V	Class 1	Vkan Certification & Testing Co., Ltd. Measuring Center	2020.05.20
8	DDS-307 conductivity meter	61050811 0058	(0~2000) mS/m	Grade 3.0	Vkan Certification & Testing Co., Ltd. Measuring Center	2020.10.06

Appendix C Waveforms

C.1 The values and waveforms of impulse voltage on the combination samples before heating cycles voltage test

C.1.1 The values of impulse voltage test

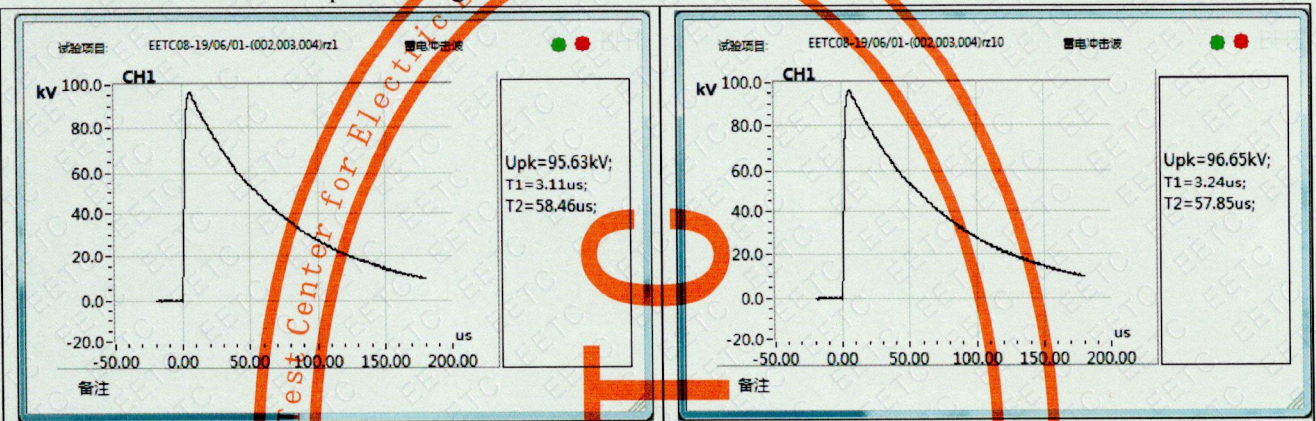
Ambient temperature: 30.0°C

Relative humidity: 59%

Atmosphere: 0.0997MPa

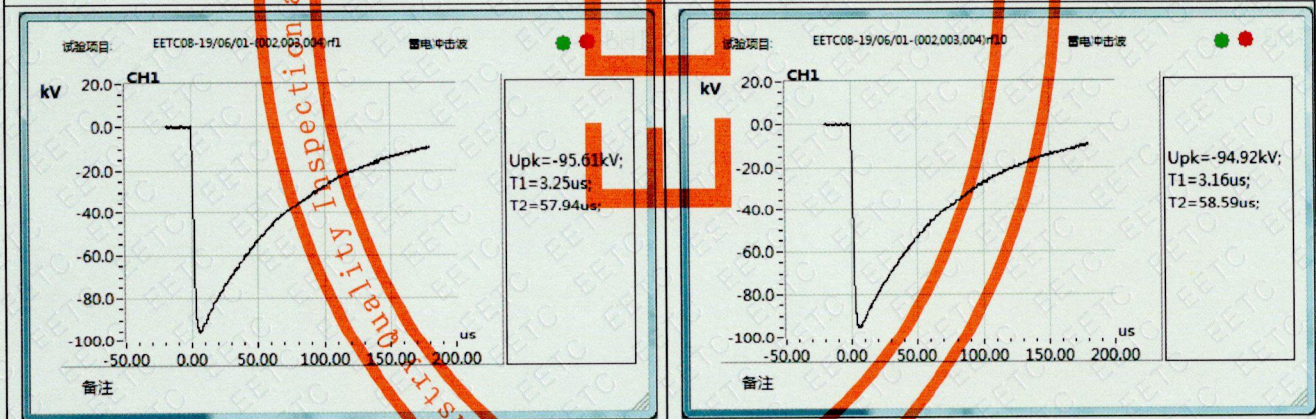
Positive polarity (kV)	95.6	95.9	96.0	96.0	93.7	95.0	95.1	95.7	95.4	96.6
Negative polarity (kV)	95.6	95.9	95.4	95.8	93.8	95.2	95.3	95.2	94.6	94.9

C.1.2 The waveforms of impulse voltage test



The 1st positive impulses waveform

The 10th positive impulses waveform



The 1st negative impulses waveform

The 10th negative impulses waveform

C.2 The values and waveforms of impulse voltage on the combination samples after heating cycles voltage test

C.2.1 The values of impulse voltage test

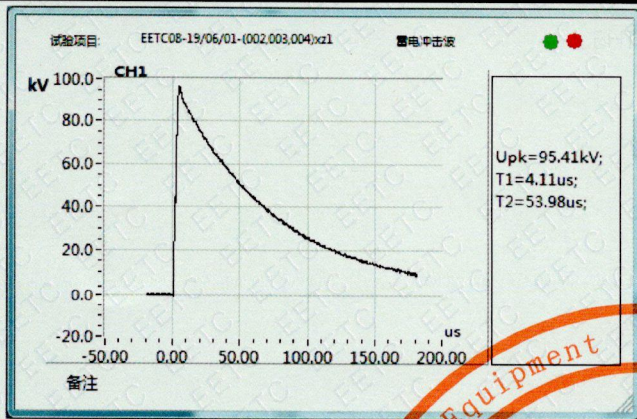
Ambient temperature: 31.0°C

Relative humidity: 62%

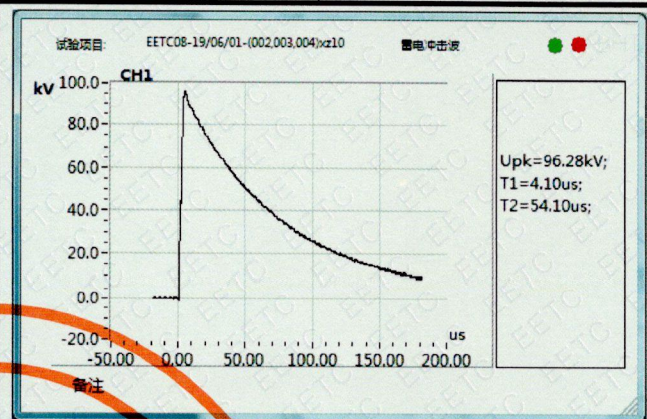
Atmosphere: 0.0999MPa

Positive polarity (kV)	95.4	96.4	96.0	97.4	96.3	95.6	96.2	96.9	96.7	96.3
Negative polarity (kV)	94.5	96.2	95.4	95.6	95.3	94.8	95.5	95.9	95.9	94.2

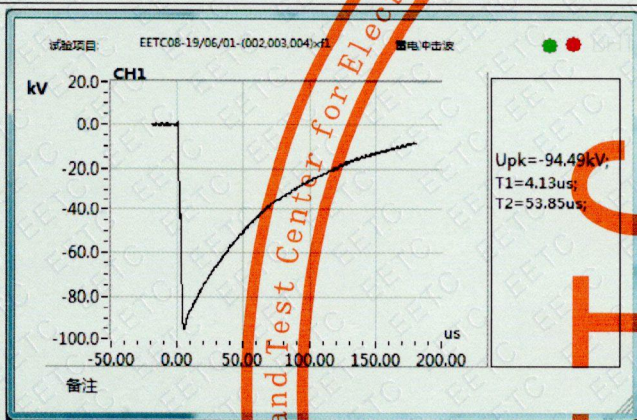
C.2.2 The waveforms of impulse voltage test



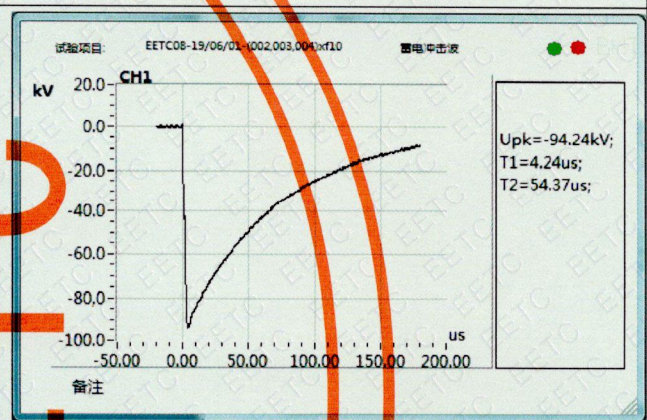
The 1st positive impulses waveform



The 10th positive impulses waveform



The 1st negative impulses waveform



The 10th negative impulses waveform

C.3 The values and waveforms of impulse voltage on the combination samples after thermal and dynamic short-circuit tests

C.3.1 The values of impulse voltage test

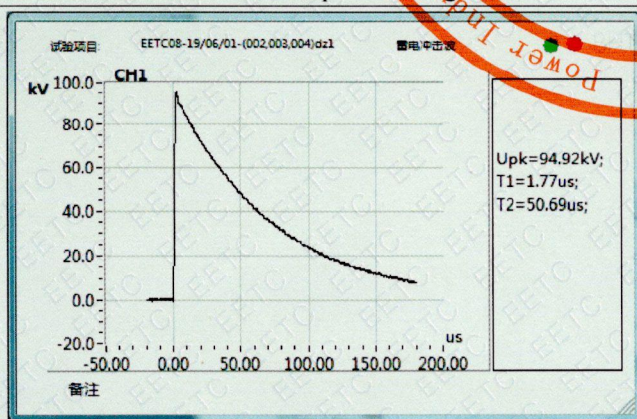
Ambient temperature: 30.3°C

Relative humidity: 57%

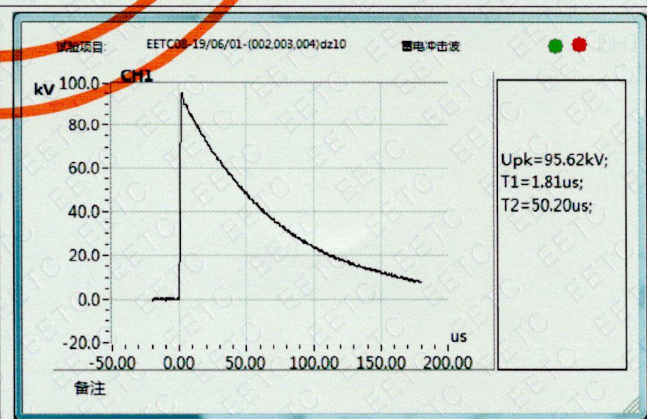
Atmosphere: 0.1006MPa

Positive polarity (kV)	94.9	95.4	95.1	94.9	95.1	95.6	96.0	96.1	94.9	95.6
Negative polarity (kV)	94.8	95.7	95.7	94.7	95.3	95.2	94.2	94.8	96.2	94.3

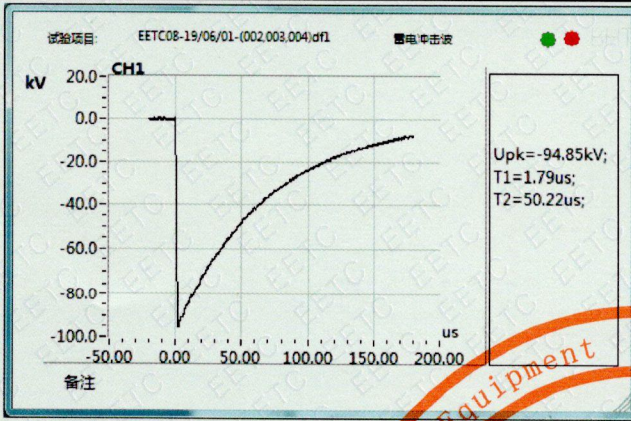
C.3.2 The waveforms of impulse voltage test



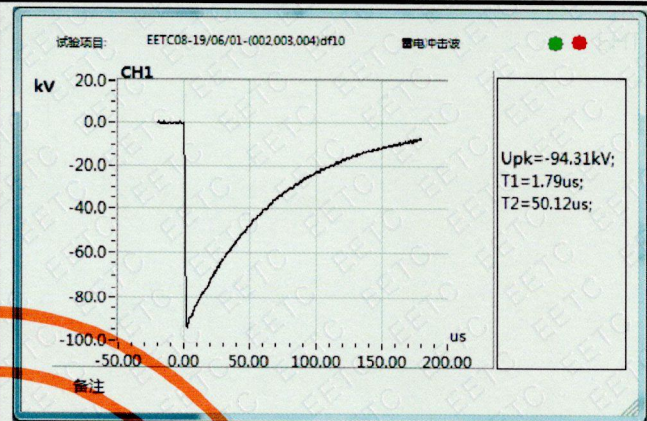
The 1st positive impulses waveform



The 10th positive impulses waveform



The 1st negative impulses waveform



The 10th negative impulses waveform

C.4 The waveform of thermal short-circuit tests of the combination samples (screen)

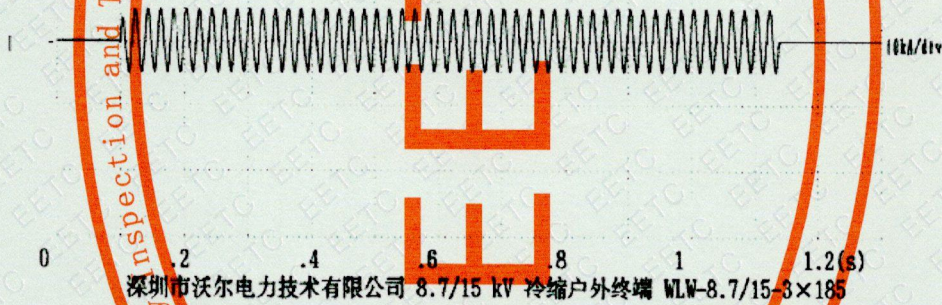
No. 2019072604

电力工业电气设备质量检验测试中心

2019-07-26

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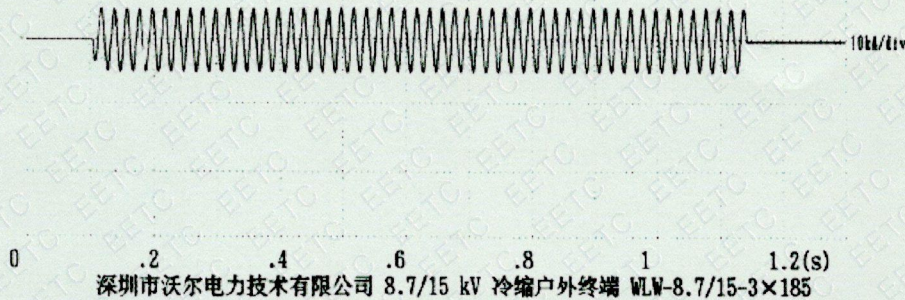
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2019-07-26

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Appendix D Other Information

D.1 Termination main body dimensions(specified in T/CEC 118—2016)

The external insulation minimum creepage distance for the main body of the termination after installation shall meet the requirements as shown in the table below:

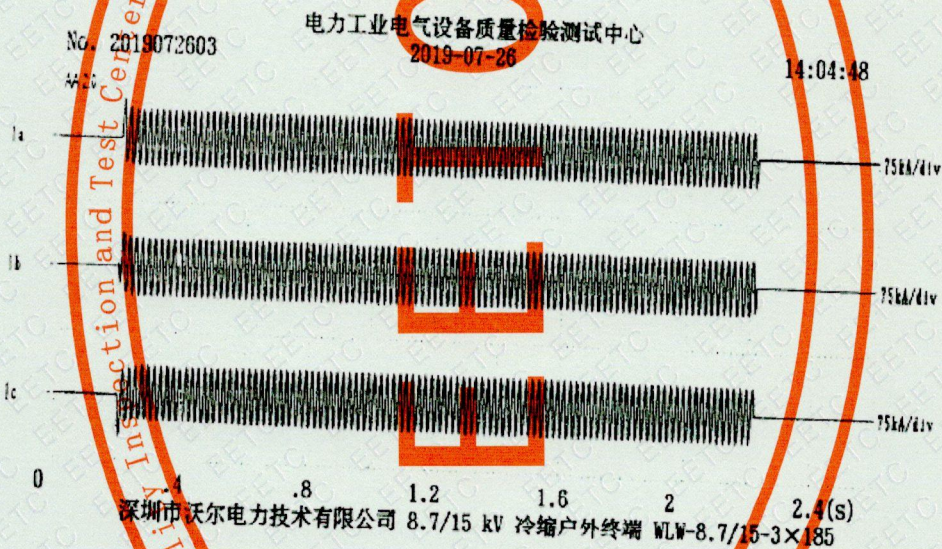
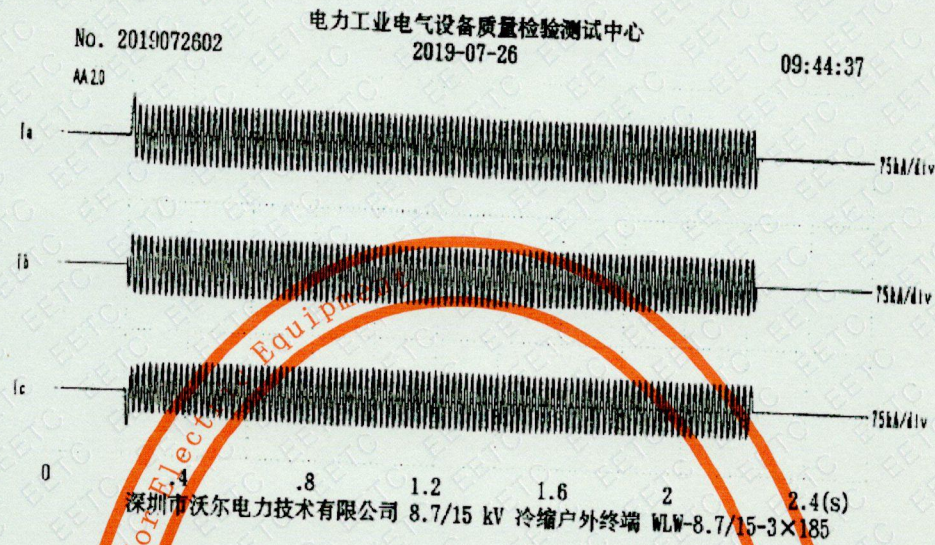
rated voltage (kV)	minimum creepage distance of the external insulation	
	outdoor termination	indoor termination
10	360	240
20	720	480
35	1050	700

The external insulation creepage distance for the main body of the cold shrinkable outdoor termination after installation is 429mm, which is in accordance with the requirements of not less than 360mm.

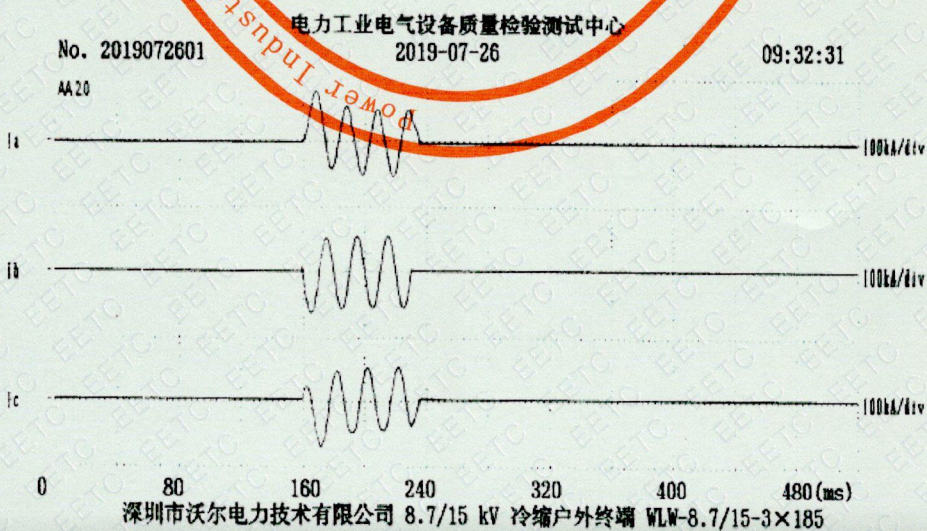
D.2 Sample packing list

序号	名称	单位	数量	备注
1	冷缩终端	个	3	终端主体
2	冷缩绝缘管	根	3	铜屏蔽绝缘密封
3	冷缩三芯指套	个	1	电缆三叉口绝缘密封
4	密封管	根	3	端子口密封
5	填充胶/密封胶	包	1	填补缝隙/防水密封
6	相色条	包	1	区分相序
7	电工胶带	卷	1	定位及临时包裹固定
8	三角垫锥	个	1	分离固定三相线芯
9	绝缘自粘带	盒	1	包裹填充胶及密封胶
10	半导体自粘带	盒	1	金属导电和半导体过渡
11	恒力弹簧	个	2	固定地线
12	盒尺	个	1	计量尺寸工具
13	PE手套	双	2	涂抹绝缘润滑脂专用手套
14	创可贴	贴	2	临时包裹意外创伤
15	绝缘润滑脂	袋	3	填补电缆绝缘层间隙
16	电缆清洁纸	包	6	清洁电缆绝缘层
17	电缆擦纸	包	1	清洁电缆外护套
18	地线	条	2	延展电缆金属屏蔽接地
19	扎带	条	1	绑扎垂地地线
20	操作手套	副	1	保护安装人员手掌
21	砂条	条	1	打磨绝缘层刀痕及导电颗粒
22	合格证	份	1	合格产品凭证
23	安装工艺	张	1	正确安装指导说明书

C.5 The waveform of thermal short-circuit tests of the combination samples (conductor)



C.6 The waveform of dynamic short-circuit tests of the combination samples



D.3 Identification of test cable (specified in GB/T 12706.2—2008)

rated voltage $U_0/U(U_m)$		8.7/15(17.5)kV
construction	core	three-core
	construction of screen	separated screen
conductor	material	copper
	type	round compact stranded
	cross section	185 mm ²
	diameter	16.0 mm
insulation	material	XLPE
	thickness	4.6 mm
	diameter	27.1 mm
screen	thickness of conductor screen	0.8 mm
	thickness of insulation screen	0.8 mm
	strippability of insulation screen	strippable
	diameter of insulation screen	28.7 mm
	metallic screen	copper tape
armour		/
oversheath	material	PVC
	diameter	68.5mm
mark of cable		YJV-8.7/15 3×185

D.4 Main structure dimensions of the samples

