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CNAS L0699



# TEST REPORT

CEPRI-EETC08-2019-0659 (E)

Client: Shenzhen Woer Electric Technology Co., Ltd.

Object: 24kV screened separable connector

Type: WEB(K)-24/630 3×185

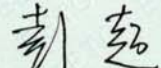
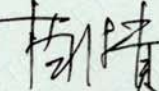

Test Category: Type Tests



POWER INDUSTRY QUALITY INSPECTION AND TEST  
CENTER FOR ELECTRIC EQUIPMENT

### Catalogue

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Test Report	Power Industry Quality Inspection and Test Center for Electric Equipment		CEPRI-EETC08-2019-0659(E) Total 16 Page 2
Client	Shenzhen Woer Electric Technology Co., Ltd.	Manufacturer	Shenzhen Woer Electric Technology Co., Ltd.
Object	24kV screened separable connector	Type	WEB(K)-24/630 3×185
Sampling procedure	by the Client	Serial No.	EETC08-19/09/20-004
Test Category	Type Tests	Date	2019.10.16~2020.06.24
Requirements	<p>1. GB/T 12706.4—2008 Power cables with extruded insulation and their accessories for rated voltages from 1 kV (<math>U_m=1.2</math> kV) up to 35 kV (<math>U_m=40.5</math> kV) — Part 4: Test requirements on accessories for cables with rated voltages from 6 kV (<math>U_m=7.2</math> kV) up to 35 kV (<math>U_m=40.5</math> kV)</p> <p>2. IEC 60502-4:2010 Power cables with extruded insulation and their accessories for rated voltages from 1 kV (<math>U_m=1.2</math> kV) up to 30 kV (<math>U_m=36</math> kV) - Part 4: Test requirements on accessories for cables with rated voltages from 6 kV (<math>U_m=7.2</math> kV) up to 30 kV (<math>U_m=36</math> kV)</p>		
Conclusion	<p>According to GB/T 12706.4—2008 and IEC 60502-4:2010, type tests were performed on 24kV screened separable connectors which were provided by Shenzhen Woer Electric Technology Co., Ltd. All the results were in accordance with the requirements.</p>		
Note	/		
<p>Compiled by: 赫留洋  周诚 </p>			
<p>Checked by: 彭超  Verified by: 苗付贵 </p>			
<p>Approved by: 阎孟昆  Date of issue:</p>			

## Test Results

No.	Item	Requirements	Results				Evaluation
1	Sequence 4.1	/	/				/
1.1	AC voltage test	No breakdown shall occur at 54kV for 5min	No breakdown occurred on the combination samples at 54kV for 5min				passed
1.2	DC voltage test	No breakdown shall occur at 48kV for 15min	No breakdown occurred on the combination samples at 48kV for 15min				passed
1.3	Partial discharge test at ambient temperature	The magnitude of the discharge at 20kV shall not exceed 10pC	Phase	Y	G	R	passed
			Voltage (kV)	20	20	20	
			Noise background (pC)	2.1	2.1	2.1	
			Discharge (pC)	2.1	2.1	2.1	
1.4	Impulse voltage test at 95 °C~100 °C	No breakdown shall occur at 10 positive and 10 negative impulses of 125kV	No breakdown occurred on the combination samples at 10 positive and 10 negative impulses of 125kV (See Appendix C.1)				passed
1.5	Heating cycle voltage test	No breakdown shall occur during 30 cycles in air and 30 cycles under water at the conductor temperature of 95°C to 100°C and 30kV	No breakdown occurred on the combination samples during 30 cycles in air and 30 cycles under water at the conductor temperature of 95°C to 100°C and 30kV				passed
1.6	Partial discharge test at 95°C~100°C	The magnitude of the discharge at 20kV shall not exceed 10pC	Phase	Y	G	R	passed
			Voltage (kV)	20	20	20	
			Noise background (pC)	1.7	1.7	1.7	
			Discharge (pC)	1.7	1.7	1.7	
1.7	Partial discharge test at ambient temperature	The magnitude of the discharge at 20kV shall not exceed 10pC	Phase	Y	G	R	passed
			Voltage (kV)	20	20	20	
			Noise background (pC)	1.8	1.8	1.8	
			Discharge (pC)	1.8	1.8	1.8	

No.	Item	Requirements	Results	Evaluation
1.8	Impulse voltage test	No breakdown shall occur at 10 positive and 10 negative impulses of 125kV	No breakdown occurred on the combination samples at 10 positive and 10 negative impulses of 125kV (See Appendix C.2)	passed
1.9	AC voltage test	No breakdown shall occur at 30kV for 15min	No breakdown occurred on the combination samples at 30kV for 15min	passed
1.10	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 4.2 and 4.3	/	/	/
2.1	AC voltage test	No breakdown shall occur at 54kV for 5min	No breakdown occurred on the combination samples at 54kV for 5min	passed
2.2	DC voltage test	No breakdown shall occur at 48kV for 15min	No breakdown occurred on the combination samples at 48kV for 15min	passed
2.3	Thermal short-circuit test (screen)	No visible deterioration at 3.5kA, 1s, twice	No visible deterioration at 3.526kA, 1.02s and 3.518kA, 1.02s (See Appendix C.4)	passed
2.4	Thermal short-circuit test (conductor)	No visible deterioration at 23.0kA, 2s, twice	No visible deterioration at 23.47kA, 2.00s and 23.49kA, 2.01s (See Appendix C.5)	passed

No.	Item	Requirements	Results		Evaluation
2.5	Dynamic short-circuit test (conductor)	No visible deterioration at 81.3kA, not less than 10ms	No visible deterioration at 82.16kA, 91ms (See Appendix C.6)		passed
2.6	Impulse voltage test	No breakdown shall occur at 10 positive and 10 negative impulses of 125kV	No breakdown occurred on the combination samples at 10 positive and 10 negative impulses of 125kV (See Appendix C.3)		passed
2.7	AC voltage test	No breakdown shall occur at 30kV for 15min	No breakdown occurred on the combination samples at 30kV for 15min		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	Other items	/	/		/
3.1	Screen resistance tests	Screen resistance before and after the heating period shall not exceed 5000Ω	before ageing	after ageing	passed
			247Ω	197Ω	
3.2	Screen leakage current	Screen leakage shall not exceed 0.5mA at 24kV	Screen leakage didn't exceed 0.5mA at 24kV		passed

**Content****1. Sequence 4.1 in Table 7 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, clause4 and IEC 61442:2005,clause4. No breakdown shall occur at 54kV for 5min.

**1.2 DC voltage test****1.2.1 Test method**

The test shall be carried out in accordance with GB/T 18889—2002, clause5 and IEC 61442:2005,clause5. No breakdown shall occur at 48kV for 15min.

**1.3 Partial discharge test at ambient temperature****1.3.1 Test method**

The test voltage shall be raised gradually to and held at 24kV for 10s and then slowly reduced to 20kV. The test shall be carried out in accordance with GB/T 18889—2002, clause7 and IEC 61442:2005,clause7.

**1.4 Impulse voltage test at 95°C~100°C****1.4.1 Test method**

The test shall be carried out in accordance with GB/T 18889—2002, clause6 and IEC 61442:2005,clause6. The conductor of the cable shall be heated and stabilized for at least 2h at a temperature of 95°C~100°C. No breakdown shall occur at 10 positive and 10 negative impulses of 125kV.

**1.5 Heating cycle voltage test****1.5.1 Test method**

The test shall be carried out in accordance with GB/T 18889—2002, clause9 and IEC 61442:2005,clause9. Each heating cycle shall be of at least 8h duration with at least 2h at a steady temperature of 5°C to 10°C above the maximum cable conductor temperature in normal operation, followed by at least 3h of natural cooling to within 10°C of ambient temperature. No breakdown shall occur during 30 cycles in air and 30 cycles under water at the conductor temperature of 95°C to 100°C and 30kV.

**1.6 Partial discharge test at 95°C~100°C****1.6.1 Test method**

The test voltage shall be raised gradually to and held at 24kV for 10s and then slowly reduced to 20kV. The test shall be carried out in accordance with GB/T 18889—2002, clause7 and IEC 61442:2005,clause7. The conductor temperature shall be of 95°C to 100°C during the test.

**1.7 Partial discharge test at ambient temperature****1.7.1 Test method**

The test voltage shall be raised gradually to and held at 24kV for 10s and then slowly reduced to 20kV. The test shall be carried out in accordance with GB/T 18889—2002, clause7 and IEC 61442:2005,clause7.

**1.8 Impulse voltage test****1.8.1 Test method**

The test shall be carried out in accordance with GB/T 18889—2002, clause6 and IEC 61442:2005,clause6. No breakdown shall occur at 10 positive and 10 negative impulses of 125kV.

**1.9 AC voltage test****1.9.1 Test method**

The test shall be carried out in accordance with GB/T 18889—2002, clause4 and IEC 61442:2005,clause4. No breakdown shall occur at 30kV for 15min.

**1.10 Examination****1.10.1 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 4.2 and 4.3 in Table 7 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, clause4 and IEC 61442:2005,clause4. No breakdown shall occur at 54kV for 5min.

**2.2 DC voltage test****2.2.1 Test method**

The test shall be carried out in accordance with GB/T 18889—2002, clause5 and IEC 61442:2005,clause5. No breakdown shall occur at 48kV for 15min.

**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, clause11 and IEC 61442:2005,clause11. 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 5s. 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, clause12 and IEC 61442:2005,clause12. 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 10s.



**2.6 Impulse voltage test****2.6.1 Test method**

The test shall be carried out in accordance with GB/T 18889—2002, clause6 and IEC 61442:2005,clause6. No breakdown shall occur at 10 positive and 10 negative impulses of 125kV.

**2.7 AC voltage test****2.7.1 Test method**

The test shall be carried out in accordance with GB/T 18889—2002, clause4 and IEC 61442:2005,clause4. No breakdown shall occur at 30kV for 15min.

**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. Other items in Table 7 of GB/T 12706.4—2008****3.1 Screen resistance tests****3.1.1 Test method**

The test shall be carried out in accordance with GB/T 18889—2002, clause14 and IEC 61442:2005,clause15. Screen resistance before and after the heating period shall be measured at ambient temperature. According to clause 8.1 in GB/T 2951.2, the sample after the heating period shall be placed in the air oven at the temperature of  $(120 \pm 2)^\circ\text{C}$  for 168h.

**3.2 Screen leakage current****3.2.1 Test method**

The test shall be carried out in accordance with GB/T 18889—2002, clause15 and IEC 61442:2005,clause16. A metal foil of  $25\text{cm}^2$  (namely  $5\text{cm} \times 5\text{cm}$ ) shall be fixed to the outer shield of the separable connector as far as possible from the ground point (There shall be no air gap between the metal foil and the outer shield). The metal foil shall be grounded through a resistance of  $2000\ \Omega$ , and an AC voltage of 24kV shall be applied between the cable conductor of the combination samples and the ground to measure the leakage current.

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

The sample was received by Power Cable Station on 20/09/2019. The sample was in good condition with 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 samples to be tested were installed by the manufacturer on two length of cables forming combination samples on which the type tests sequence 4.1, 4.2 and 4.3 were carried out. Two sets of outdoor terminations 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 12/20kV, a cross-section of  $185\text{sq.mm}$ . The length of the cable in the combination sample was greater than 5 m between terminations and the samples. Other type tests listed in table 7 were carried out on other samples.

A.3 Photograph of samples



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	Class 3	National high voltage measurement station	2020.07.18
2	TRF300-0.002 AC voltage measurement system	110650	(0~300) kV	Class 3	National high voltage measurement station	2020.07.21
3	JFD-2H PD measurement system	20041202	(0.5~1000) pC	Class 10	National high voltage measurement station	2022.03.25
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	2020.12.30
6	LCC-V Heating cycle monitoring system	DLRXH03	(0~3000) A	Class 0.5	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	2021.05.20

**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

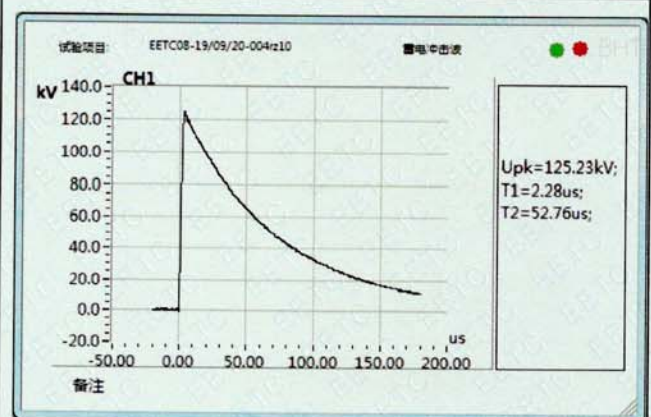
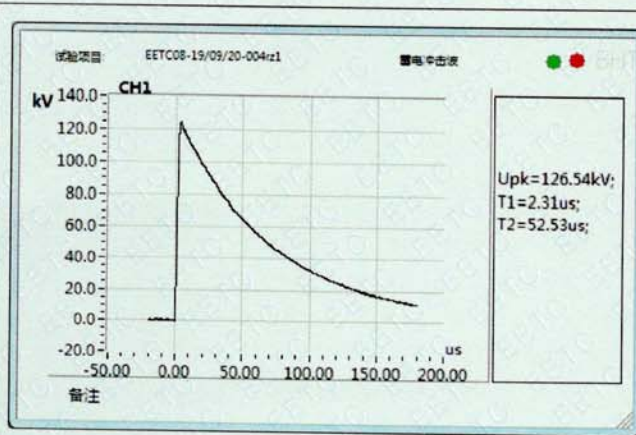
Ambient temperature: 19.0°C

Relative humidity: 63%

Atmosphere: 0.1024MPa

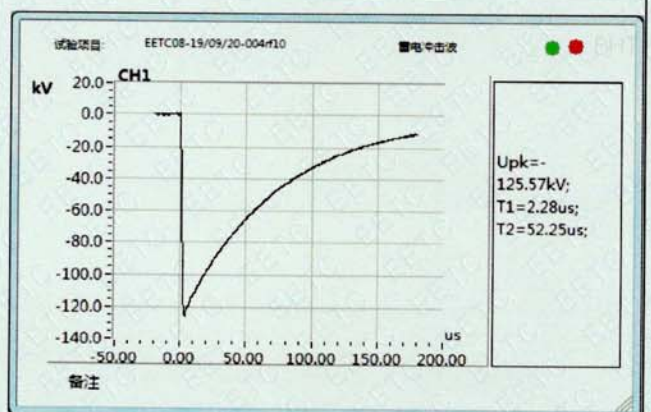
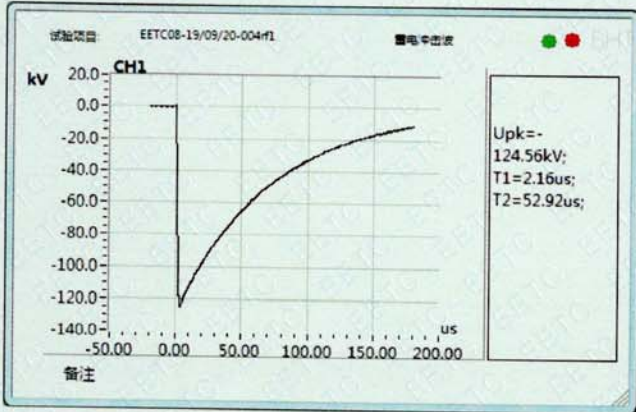
Positive polarity (kV)	126.5	125.1	125.8	126.1	125.9	125.7	125.2	126.0	125.4	125.2
Negative polarity (kV)	124.6	125.8	127.3	127.3	124.9	125.9	125.0	125.6	125.2	125.6

C.1.2 The waveforms of impulse voltage test



The 1<sup>st</sup> positive impulses waveform

The 10<sup>th</sup> positive impulses waveform



The 1<sup>st</sup> negative impulses waveform

The 10<sup>th</sup> 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

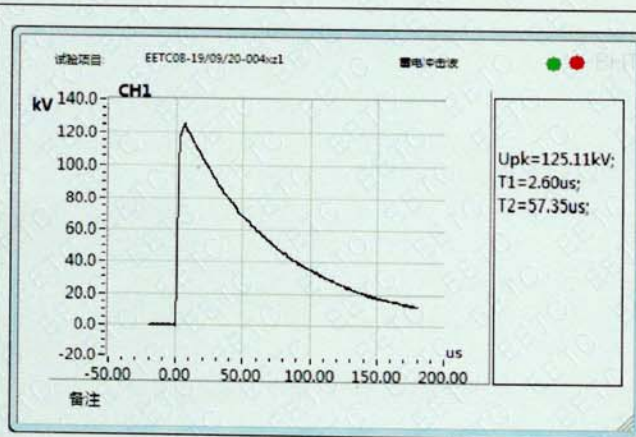
Ambient temperature: 11.0°C

Relative humidity: 54%

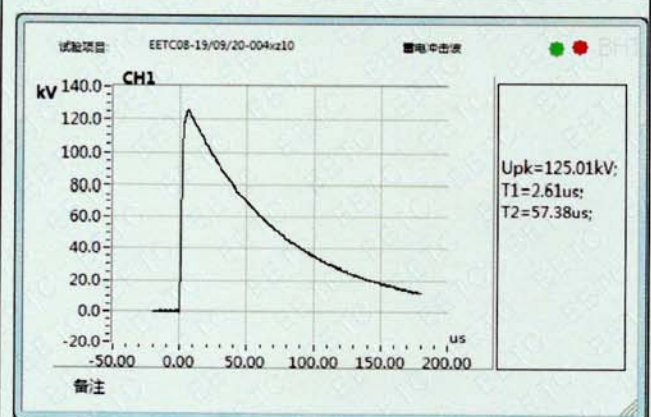
Atmosphere: 0.1023MPa

Positive polarity (kV)	125.1	125.3	125.0	125.0	125.6	125.2	125.1	125.4	125.4	125.0
Negative polarity (kV)	124.7	125.1	124.6	125.0	125.4	124.9	125.0	124.4	124.9	124.9

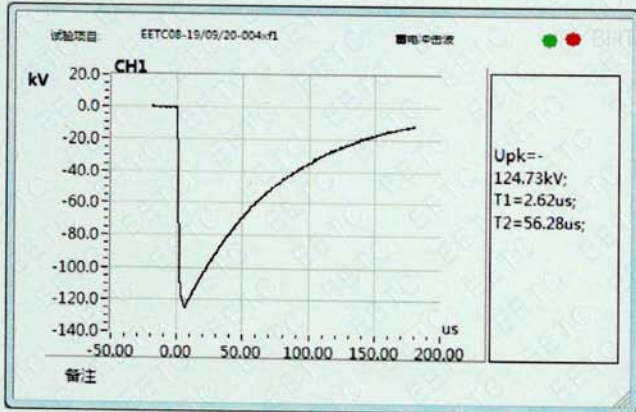
C.2.2 The waveforms of impulse voltage test



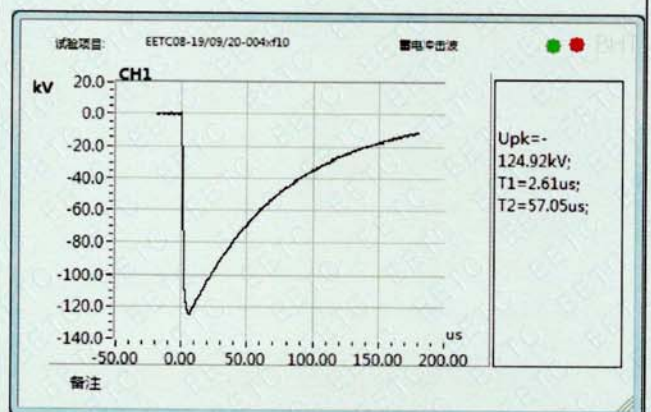
The 1<sup>st</sup> positive impulses waveform



The 10<sup>th</sup> positive impulses waveform



The 1<sup>st</sup> negative impulses waveform



The 10<sup>th</sup> 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

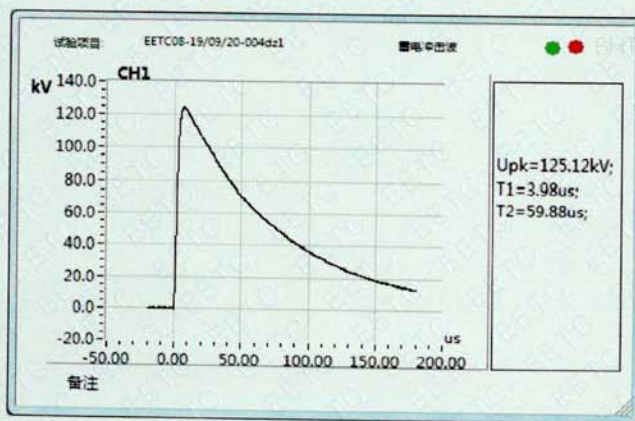
Ambient temperature: 29.0°C

Relative humidity: 63%

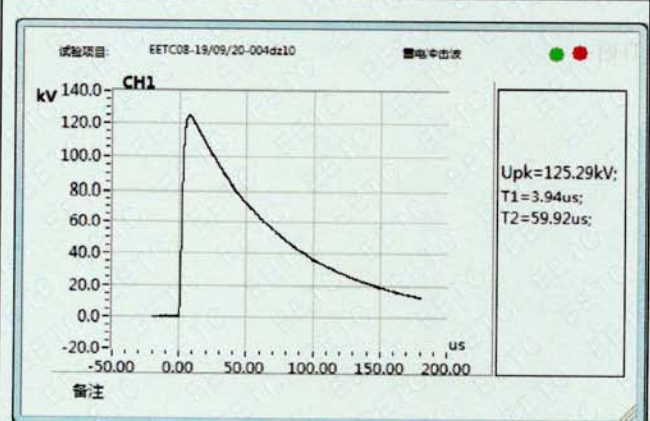
Atmosphere: 0.1003MPa

Positive polarity (kV)	125.1	124.8	124.8	125.1	124.6	124.7	125.3	124.7	124.6	125.3
Negative polarity (kV)	125.0	125.0	124.2	124.4	125.7	124.9	125.2	124.7	125.6	125.2

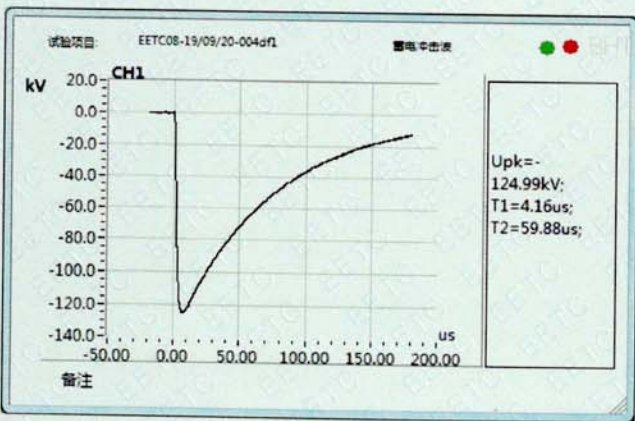
C.3.2 The waveforms of impulse voltage test



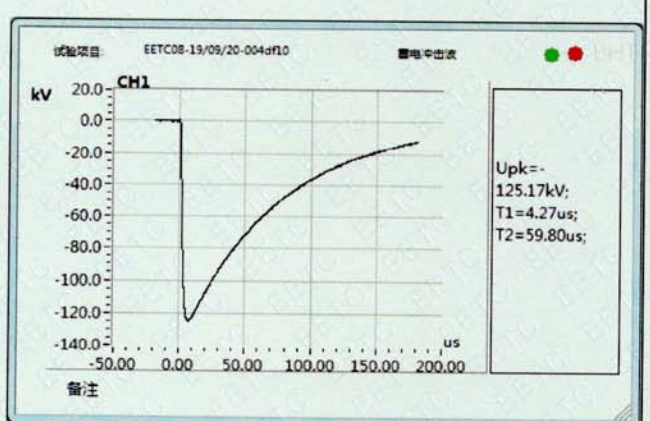
The 1<sup>st</sup> positive impulses waveform



The 10<sup>th</sup> positive impulses waveform

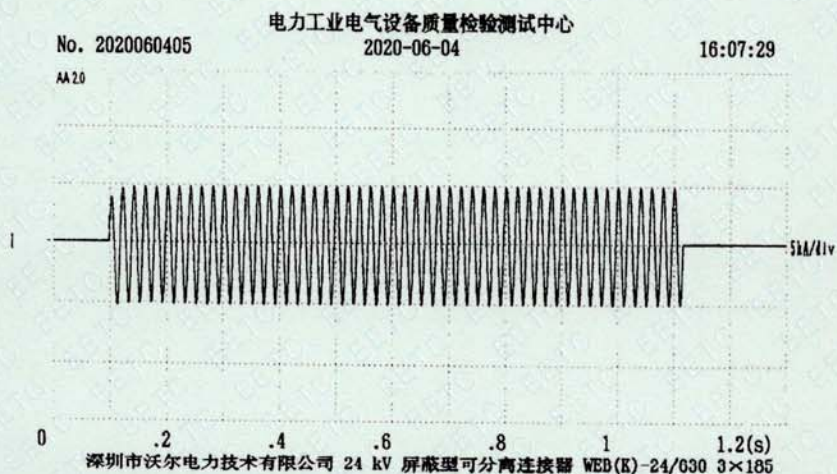


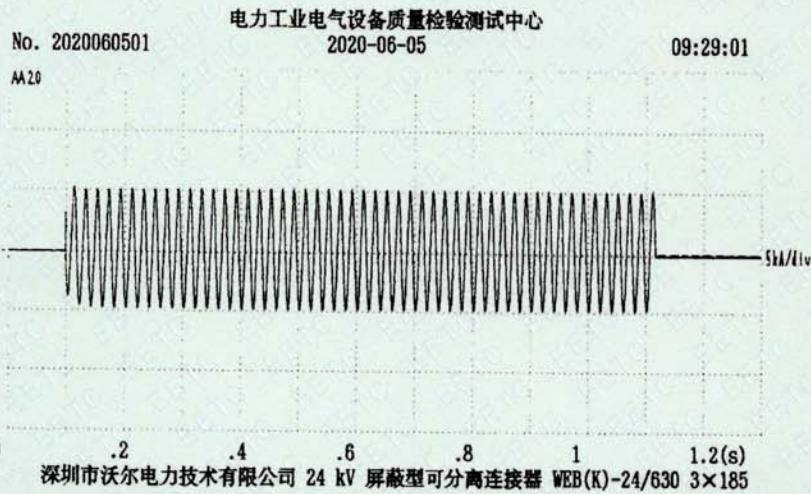
The 1<sup>st</sup> negative impulses waveform



The 10<sup>th</sup> negative impulses waveform

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

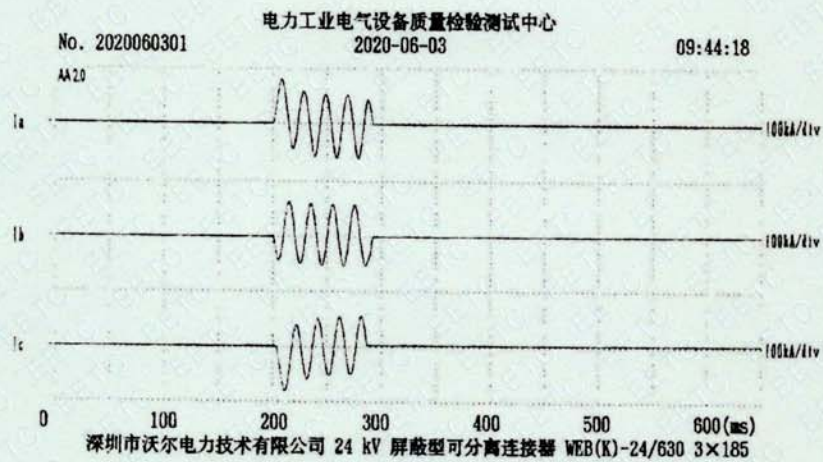




C.5 The waveform of thermal short-circuit tests of the combination samples (conductor)



## C.6 The waveform of dynamic short-circuit tests of the combination samples (conductor)



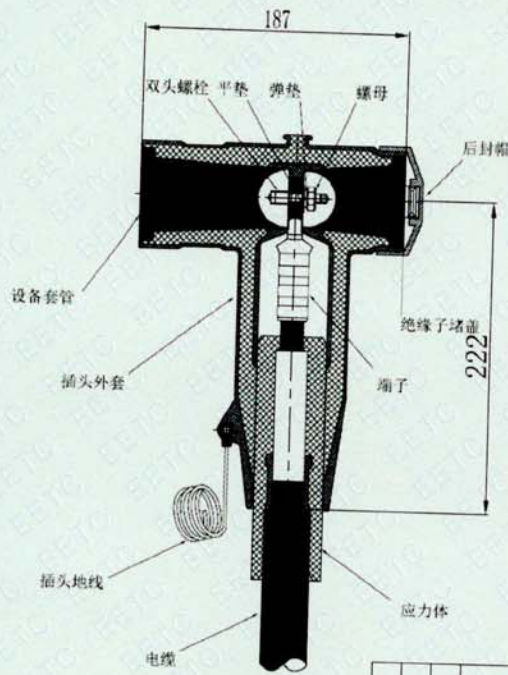
## Appendix D Other Information

## D.1 Identification of test cable (specified in GB/T 12706.2—2008)

rated voltage $U_0/U(U_m)$		12/20(24) kV
construction	core	three-core
	construction of screen	separated screen
conductor	material	copper
	type	round compact stranded
	cross section	185 mm <sup>2</sup>
	diameter	15.7mm
insulation	material	XLPE
	thickness	5.5mm
	diameter	28.4mm
screen	thickness of conductor screen	0.7mm
	thickness of insulation screen	0.8mm
	strippability of insulation screen	strippable
	diameter of insulation screen	30.2mm
	metallic screen	copper tape
armour		/
oversheath	material	PVC
	diameter	72.9mm
mark of cable		YJV-12/20 3×185



D.2 Main structure dimensions of the samples



					装配图				
								WEB-24/630	
标记	处数	分区	更改文件号	签名	年月日	比例	重量	数量	24kV 屏蔽型 可分离式断路器
制图	尹岩								
校对									
审核									
批准									
						共 1 张 第 1 张		DL WEB3.24ZP.001	