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TESTING
CNAS L0699

CEPRI

TEST REPORT

CEPRI-EETC08-2021-0013(E)

Client: ZGHD ELECTRIC CO., LTD.

Object: 8.7/15kV screened separable connector

Type: GHD-15/630A 3×185

Test Category: Type Tests

POWER INDUSTRY QUALITY INSPECTION AND TEST CENTER FOR ELECTRIC EQUIPMENT

Catalogue

Test Report	Power Industry Quality Inspection and Test Center for Electric Equipment		CEPRI-EETC08-2021-0013(E) Total 15 Page 2
Client	ZGHD ELECTRIC CO., LTD.	Manufacturer	ZGHD ELECTRIC CO., LTD.
Object	8.7/15 kV screened separable connector	Type	GHD-15/630A 3×185
Sampling procedure	by the Client	Serial No.	EETC08-21/01/26-003
Test Category	Type Tests	Date	2021.01.27~2021.05.14
Requirements	1. GB/T 12706.4—2020 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) 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)		
Conclusion	According to GB/T 12706.4—2020 and IEC 60502-4:2010, type tests were performed on 8.7/15 kV screened separable connectors which were provided by ZGHD ELECTRIC CO., LTD. All the results were in accordance with the requirements.		
Note	/		

Tested by: 韩卫京 韩卫京 周诚 周诚

Checked by: 彭超 彭超 **Verified by:** 苗付贵 苗付贵

Approved by: 阎孟昆 阎孟昆 **Date of issue:** 2021-05-24

Test Results

No.	Item	Requirements	Results				Evaluation
1	Sequence 4.1	/	/				/
1.1	AC voltage test	No breakdown shall occur at 39 kV for 5 min	No breakdown occurred on the combination samples at 39 kV for 5 min				passed
1.2	DC voltage test	No breakdown shall occur at 35 kV for 15 min	No breakdown occurred on the combination samples at 35 kV for 15 min				passed
1.3	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	
1.4	Impulse voltage test at 95 ℃～100 ℃	No breakdown shall occur at 10 positive and 10 negative impulses of 95 kV	No breakdown occurred on the combination samples at 10 positive and 10 negative impulses of 95kV (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℃ to 100℃ and 22 kV	No breakdown occurred on the combination samples during 30 cycles in air and 30 cycles under water at the conductor temperature of 95℃ to 100℃ and 22 kV				passed
1.6	Partial discharge test at 95℃～100℃	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)	2.0	2.0	2.0	
			Discharge (pC)	2.0	2.0	2.0	
1.7	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)	2.0	2.0	2.0	
			Discharge (pC)	2.0	2.0	2.0	

No.	Item	Requirements	Results	Evaluation
1.8	Impulse voltage test	No breakdown shall occur at 10 positive and 10 negative impulses of 95 kV	No breakdown occurred on the combination samples at 10 positive and 10 negative impulses of 95 kV (See Appendix C.2)	passed
1.9	AC voltage test	No breakdown shall occur at 22 kV for 15 min	No breakdown occurred on the combination samples at 22 kV for 15 min	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 39 kV for 5 min	No breakdown occurred on the combination samples at 39 kV for 5 min	passed
2.2	DC voltage test	No breakdown shall occur at 35 kV for 15 min	No breakdown 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 3.567 kA, 1.02 s and 3.509 kA, 1.02 s (See Appendix C.4)	passed
2.4	Thermal short-circuit test (conductor)	No visible deterioration at 23.7 kA, 2 s, twice	No visible deterioration at 24.04 kA, 2.03s and 24.05 kA, 2.03 s (See Appendix C.5)	passed
2.5	Dynamic short-circuit test	No visible deterioration at 83.9 kA, not less than 10 ms	No visible deterioration at 84.71 kA, 91 ms (See Appendix C.6)	passed
2.6	Impulse voltage test	No breakdown shall occur at 10 positive and 10 negative impulses of 95 kV	No breakdown occurred on the combination samples at 10 positive and 10 negative impulses of 95 kV (See Appendix C.3)	passed

No.	Item	Requirements	Results		Evaluation
2.7	AC voltage test	No breakdown shall occur at 22 kV for 15 min	No breakdown 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	Other items	/	/		/
3.1	Screen resistance tests	Screen resistance before and after the heating period shall not exceed 5000 Ω	before ageing	161.6 Ω	passed
			after ageing	74.9 Ω	
3.2	Screen leakage current	Screen leakage shall not exceed 0.5 mA at 17.5 kV	Screen leakage didn't exceed 0.5 mA at 17.5 kV		passed

Content

1. Sequence 4.1 in Table 5 of GB/T 12706.4—2020

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. No breakdown 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. Neither breakdown nor flashover shall occur at 35 kV for 15 min.

1.3 Partial discharge test at ambient temperature

1.3.1 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.

1.4 Impulse voltage test at 95 ℃～100 ℃

1.4.1 Test method

The test shall be carried out in accordance with GB/T 18889—2002, clause 6. The conductor of the cable

shall be heated and stabilized for at least 2 h at a temperature of 95 ℃～100 ℃. No breakdown shall occur at 10 positive and 10 negative impulses of 95 kV.

1.5 Heating cycle voltage test

1.5.1 Test method

The test shall be carried out in accordance with GB/T 18889—2002, clause 9. Each heating cycle shall be of at least 8 h duration with at least 2 h at a steady temperature of 5 ℃ to 10 ℃ above the maximum cable conductor temperature in normal operation, followed by at least 3 h of natural cooling to within 10 ℃ of ambient temperature. No breakdown shall occur during 30 cycles in air and 30 cycles under water at the conductor temperature of 95℃ to 100℃ and 22 kV.

1.6 Partial discharge test at 95 ℃～100 ℃

1.6.1 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. The conductor temperature shall be of 95℃ to 100℃ 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 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.

1.8 Impulse voltage test

1.8.1 Test method

The test shall be carried out in accordance with GB/T 18889—2002, clause 6. No breakdown shall occur at 10 positive and 10 negative impulses of 95 kV.

1.9 AC voltage test

1.9.1 Test method

The test shall be carried out in accordance with GB/T 18889—2002, clause 4. No breakdown shall occur at 22 kV for 15 min.

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 5 of GB/T 12706.4－2020

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. No breakdown 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. 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. At the beginning of the test, the cable conductor shall be heated to reach a steady temperature of 5 ℃ to 10 ℃ 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 ℃ 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. Two short-circuits shall be applied using AC to raise the conductor temperature to the maximum permissible short-circuit temperature(250℃) 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 ℃ above its temperature prior to the first short-circuit. There shall be no visible deterioration on the samples.

2.5 Dynamic short-circuit test

2.5.1 Test method

The test shall be carried out in accordance with GB/T 18889—2002, 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. No breakdown 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. No breakdown 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. Other items in Table 5 of GB/T 12706.4－2020

3.1 Screen resistance tests

3.1.1 Test method

The test shall be carried out in accordance with GB/T 18889—2002, clause 14. 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 shall be placed in the air oven at the temperature of (120±2)℃for 168 h during the heating period.

3.2 Screen leakage current

3.2.1 Test method

The test shall be carried out in accordance with GB/T 18889—2002, clause 15. A metal foil of 25 cm^2 (namely 5cm×5cm) 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 2000Ω , and an AC voltage of 17.5kV shall be applied between the cable conductor of the combination samples and the ground to measure the leakage current.

Appendix A Object Parameters

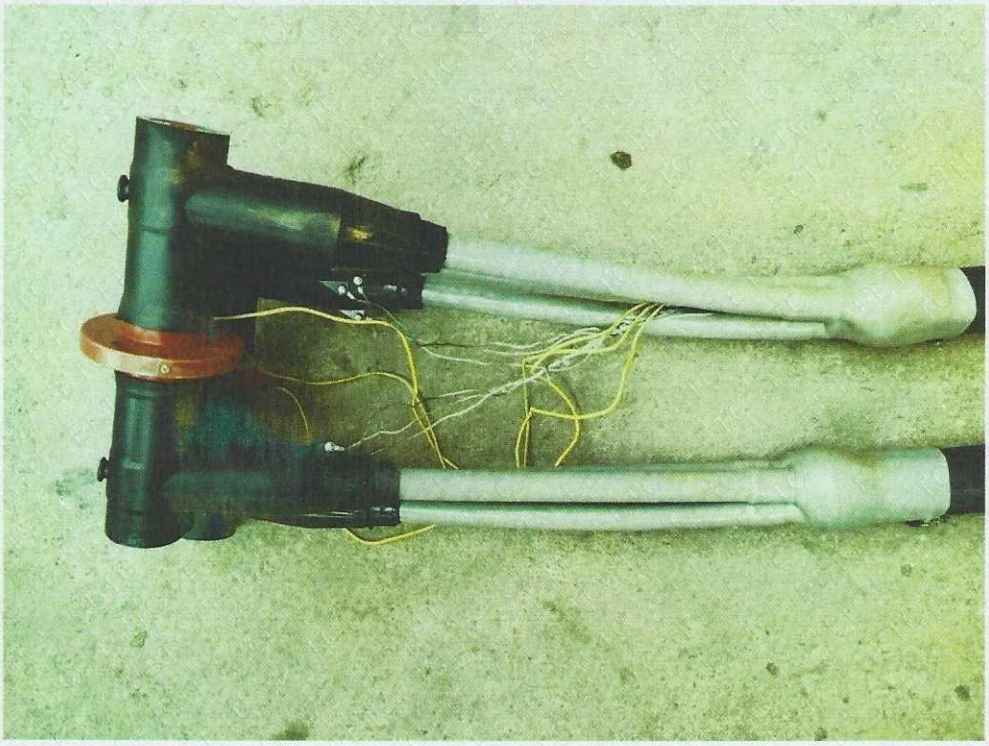
A.1 Sample information

The sample was received by Power Cable Station on 26/01/2021. The sample was in good condition.

A.2 The number and installation of samples

According to GB/T 12706.4—2020, 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 and a XLPE insulated single-core cable both for rated voltage 8.7/15 kV, a cross-section of 185 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 5 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	EETC08-0069	(0～150)kV	Grade 3	National high voltage measurement station	2021.07.17
2	CQSB(J)-120/60 60 kV Power frequency test device	EETC08-0053	(0~60) kV	Class 3	National high voltage measurement station	2021.07.16
3	JFD-2H PD measurement system	EETC08-0013	(0.5~1000) pC	Class 10	National high voltage measurement station	2021.05.19
4	FY Ⅰ 900/600 Weakly damped capacitive voltage divider	EETC08-0019	(0~900) kV	Class 3	National high voltage measurement station	2022.06.28
5	H-DJF-2 Data collected system	EETC05-2055	(0~100) kA	Class 0.5	National high voltage measurement station	2022.01.03
6	LCC-V Heating cycle monitoring system	EETC08-0042	(0~3000) A	Class 3	National high voltage measurement station	2021.10.26
7	287C Digital voltage meter	EETC08-0148	(0~700) V	Class 1	Vkan Certification & Testing Co., Ltd. Measuring Center	2022.05.10

Appendix C Waveforms

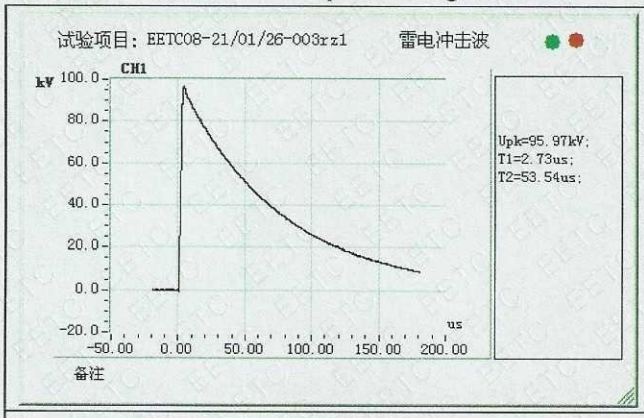
C.1 The values and waveforms of impulse voltage on the combination samples before heating cycles voltage test

C.1.1 The values of impulse voltage test

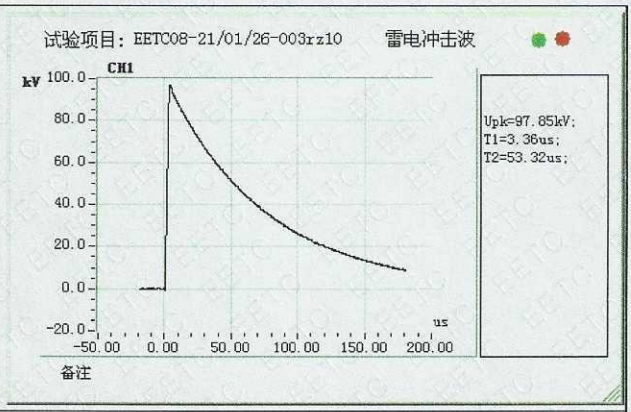
Ambient temperature: 20.7℃ Relative humidity:74% Atmosphere: 0.1001MPa

Positive polarity (kV)	96.0	96.8	97.2	96.1	97.3	97.7	96.2	96.7	96.5	97.8
Negative polarity (kV)	95.8	96.6	96.4	96.4	96.2	95.5	96.1	97.9	97.3	96.7

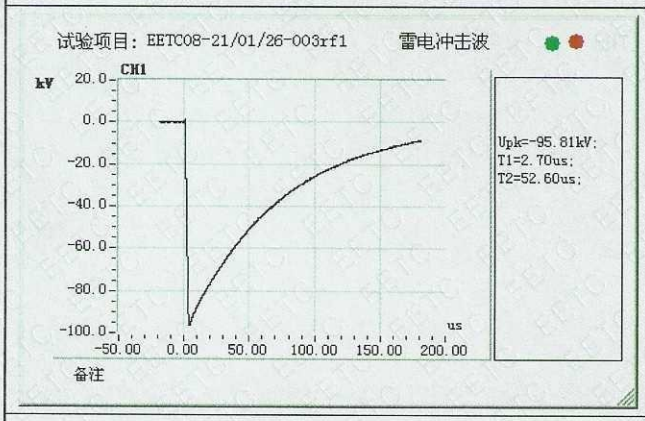
C.1.2 The waveforms of impulse voltage test



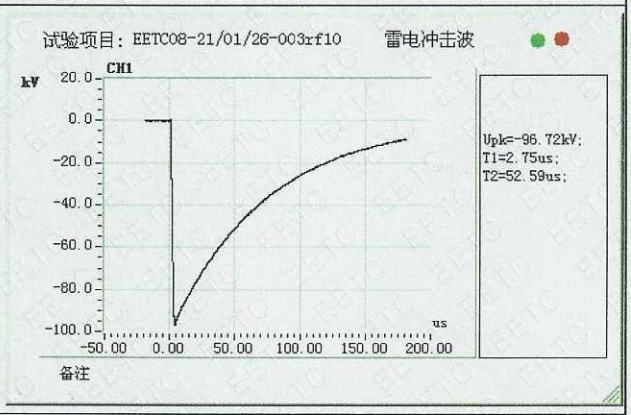
The 1st positive impulses waveform



The 10th positive impulses waveform



The 1st negative impulses waveform



The 10th negative impulses waveform

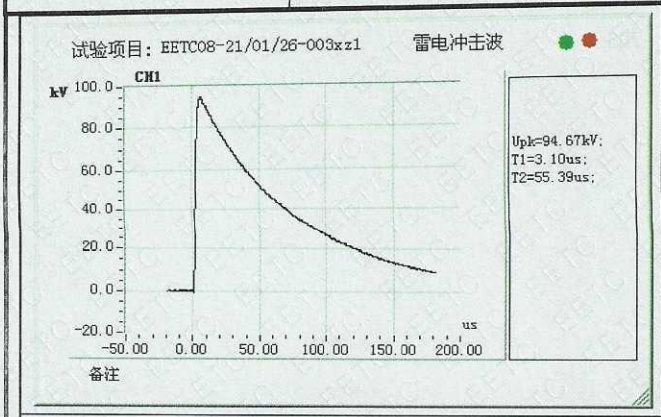
C.2 The values and waveforms of impulse voltage on the combination samples after heating cycles voltage test

C.2.1 The values of impulse voltage test

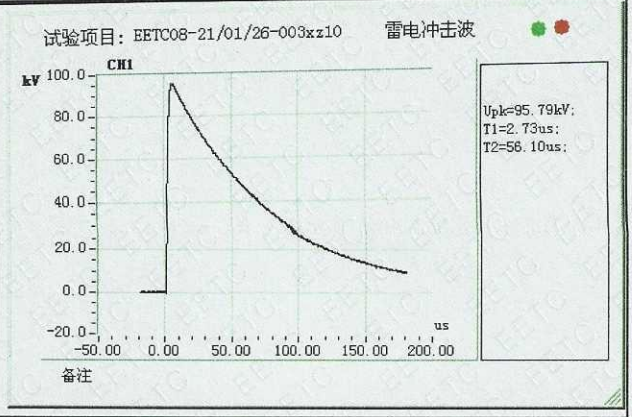
Ambient temperature:20.5℃ Relative humidity: 83% Atmosphere: 0.1008MPa

Positive polarity (kV)	94.7	94.7	94.0	95.2	94.3	94.2	95.1	95.2	95.4	95.8
Negative polarity (kV)	97.6	94.9	95.1	95.1	95.5	95.0	95.5	96.1	95.8	95.6

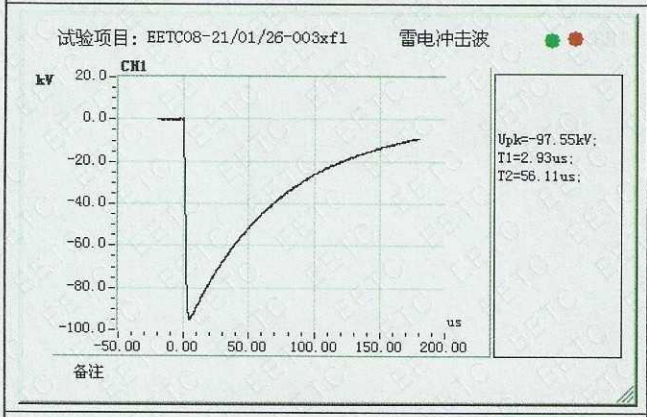
C.2.2 The waveforms of impulse voltage test



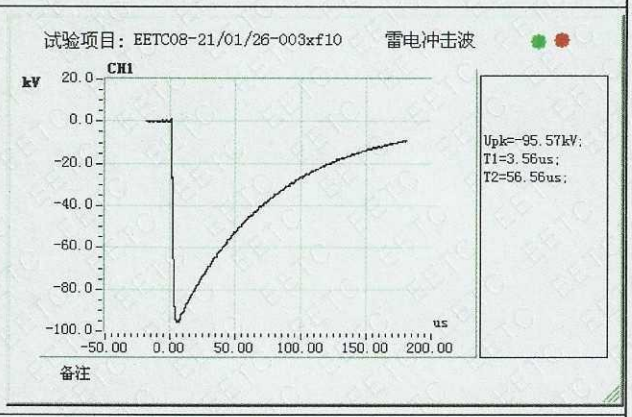
The 1st positive impulses waveform



The 10th positive impulses waveform



The 1st negative impulses waveform



The 10th negative impulses waveform

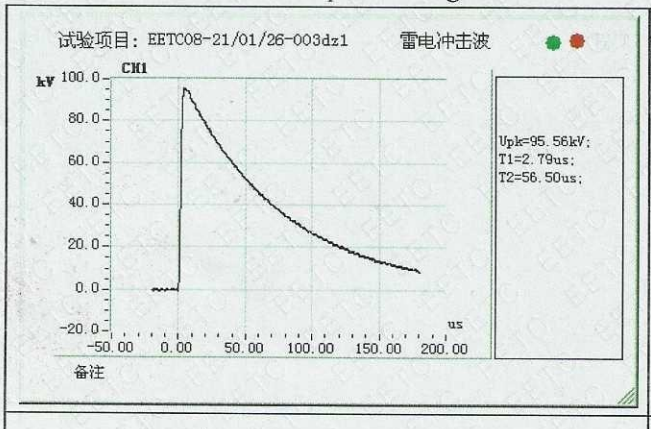
C.3 The values and waveforms of impulse voltage on the combination samples after thermal and dynamic short-circuit tests

C.3.1 The values of impulse voltage test

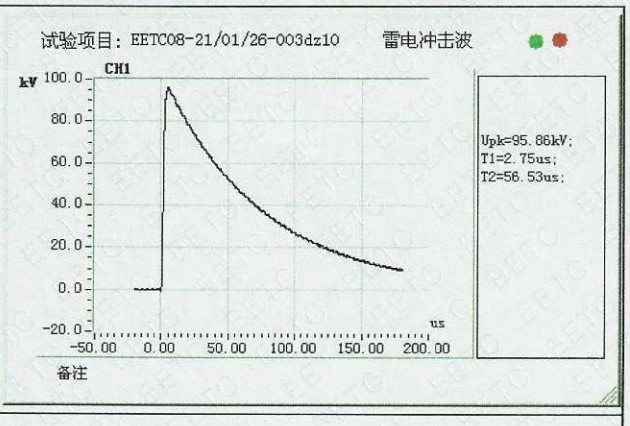
Ambient temperature:24.1℃ Relative humidity: 69% Atmosphere: 0.1008MPa

Positive polarity (kV)	95.6	95.8	95.5	95.6	97.0	95.2	95.1	95.3	97.5	95.9
Negative polarity (kV)	97.9	94.3	95.8	95.8	95.7	94.9	95.5	95.7	94.4	95.4

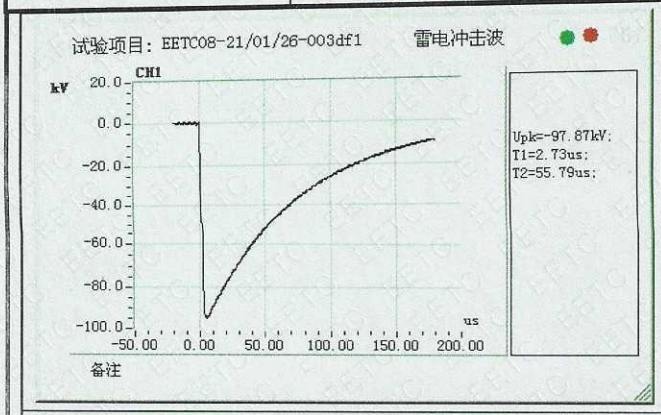
C.3.2 The waveforms of impulse voltage test



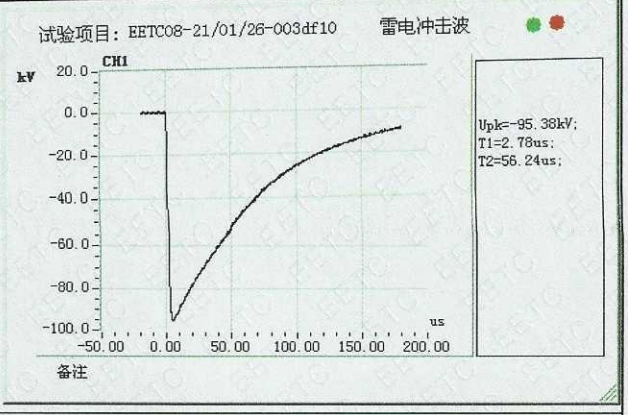
The 1st positive impulses waveform



The 10th positive impulses waveform

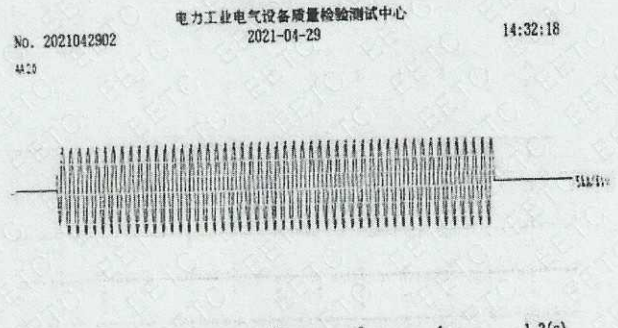


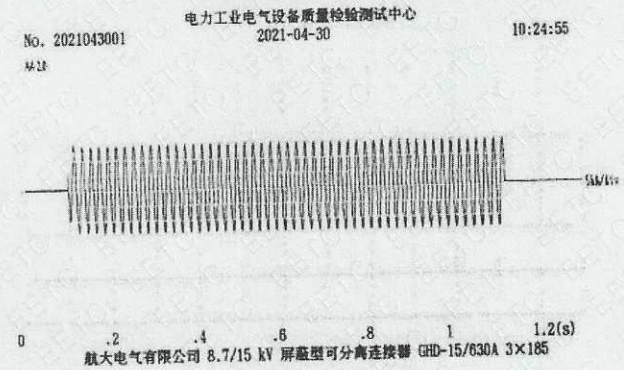
The 1st negative impulses waveform



The 10th negative impulses waveform

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





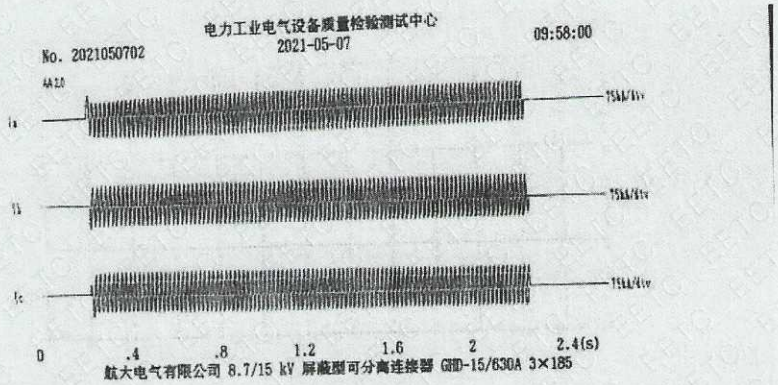
动、热 稳 定 试 验

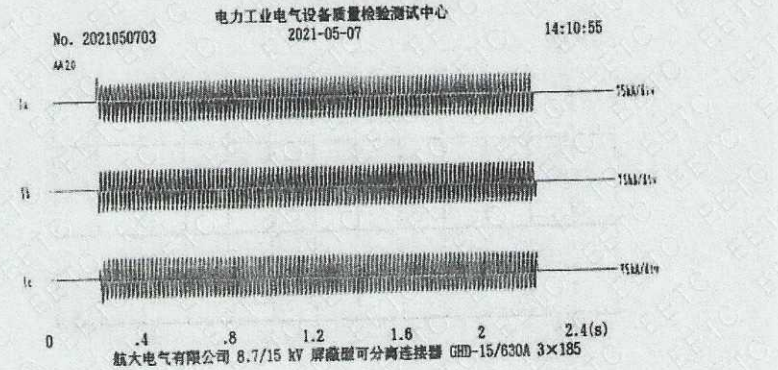
示波图编号	试验电流峰值(kA)			动稳定通电时间(s)	试验电流周期分量有效值(kA)			热稳定通电时间(s)	热稳定值(AAs) 10E6		
	A	B	C		A	B	C		A	B	C
2021042902					3.567			1.02	12.96		

动、热 稳 定 试 验

示波图编号	试验电流峰值(kA)			动稳定通电时间(s)	试验电流周期分量有效值(kA)			热稳定通电时间(s)	热稳定值(AAs) 10E6		
	A	B	C		A	B	C		A	B	C
2021043001					3.589			1.02	12.54		

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





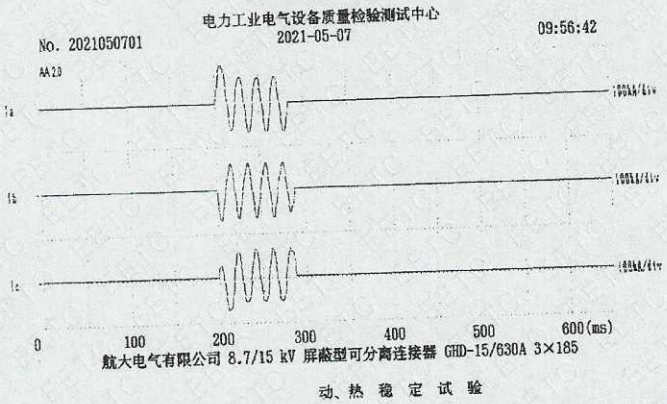
动、热 稳 定 试 验

示波图编号	试验电流峰值(kA)			动稳定通电时间(s)	试验电流周期分量有效值(kA)			热稳定通电时间(s)	热稳定值(AAs) 10E6		
	A	B	C		A	B	C		A	B	C
2021050702					23.80	24.04	24.01	2.03	1150	1172	1170

动、热 稳 定 试 验

示波图编号	试验电流峰值(kA)			动稳定通电时间(s)	试验电流周期分量有效值(kA)			热稳定通电时间(s)	热稳定值(AAs) 10E6		
	A	B	C		A	B	C		A	B	C
2021050703					23.88	24.00	24.05	2.03	1157	1169	1174

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



动、热 稳 定 试 验

示波图编号	试验电流峰值(kA)			动稳定通电时间(s)	试验电流周期分量有效值(kA)			热稳定通电时间(s)	热稳定值(AAs) 10E6		
	A	B	C		A	B	C		A	B	C
2021050701	84.71	70.85	72.18	0.091							

Appendix D Other Information

D.1 Sample packing list

GHD-15QC 前接头配置清单

序号	物料名称	规格型号	单位	数量	备注	
1	前接头本体		只	3		组在一起
2	后封帽		只	3		
3	接地线		条	3	非屏蔽型无	
4	应力锥	规格对照盒贴	只	3		配件盒
5	绝缘堵头	1#	只	3		
6	接头专用端子	规格对照盒贴	只	3		
7	双头螺栓	M16/12	套	3	含螺栓、平垫、弹垫、螺母	
8	绝缘润滑脂		支	2		
9	清洁纸		包	3		
10	纱布条		条	1		
11	安装卷尺	1M	个	1		
12	半导电自粘带	BDD-20	盒	1		
13	美工刀		把	1		
14	牙刷		支	1		
15	套筒扳手	110mm	套	1		
16	砂纸		条	1		
17	分相标识带	黄绿红	条	3		资料袋
18	安装说明书		份	1		
19	安装注意事项		份	1		
20	产品试验报告		份	1		
21	合格证		份	1		
22	产品配置清单		份	1		

注：收到货物后请核对配件规格、数量，发现问题及时与我公司联系。

技术部

D.2 Identification of test cable (specified in GB/T 12706.2—2020)

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	16.1 mm
insulation	material	XLPE
	thickness	4.5 mm
	diameter	27.0 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	28.6 mm
	metallic screen	copper tape

armour		/
oversheath	material	PVC
	diameter	71.6 mm
mark of cable		YJV-8.7/15 3×185

D.3 Main structure dimensions of the samples