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TEST REPORT

CEPRI-EETC08-2022-0132 (E)

Client: ZGHD ELECTRIC CO.,LTD.

Object: 26/35 kV screened separable connector

Type: GHD-35/630A 3×185

Test Category: Type Tests



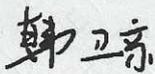
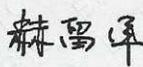
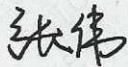
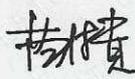
POWER INDUSTRY QUALITY INSPECTION AND TEST
CENTER FOR ELECTRIC EQUIPMENT



Catalogue

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Test Report	Power Industry Quality Inspection and Test Center for Electric Equipment		CEPRI-EETC08-2022-0132(E) Total 18 Page 2
Client	ZGHD ELECTRIC CO.,LTD.	Manufacturer	ZGHD ELECTRIC CO.,LTD.
Object	26/35 kV screened separable connector	Type	GHD-35/630A 3×185
Sampling procedure	by the Client	Serial No.	EETC08-22/03/11-001
Test Category	Type Tests	Date	2022.03.14~2022.07.20
Requirements	<p>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)</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>		
Conclusion	<p>According to GB/T 12706.4—2020 and IEC 60502-4:2010, type tests were performed on 26/35 kV screened separable connectors which were provided by ZGHD ELECTRIC CO.,LTD. All the results were in accordance with the requirements.</p>		
Note	In the event of any difference in meanings, the Chinese report shall take priority over the English version.		
<p>Tested by: 韩卫京  赫留洋 </p>			
<p>Checked by: 张伟  Verified by: 苗付贵 </p>			
<p>Approved by: 阎孟昆  Date of issue: 2022-07-28</p>			



Test Results

No.	Item	Requirements	Results	Evaluation		
1	Sequence 4.1	/	/	/		
1.1	AC voltage test	No breakdown shall occur at 117 kV for 5 min	No breakdown occurred on the combination samples at 117 kV for 5 min	passed		
1.2	DC voltage test	No breakdown shall occur at 104 kV for 15 min	No breakdown occurred on the combination samples at 104 kV for 15 min	passed		
1.3	Partial discharge test at ambient temperature	The magnitude of the discharge at 45 kV shall not exceed 10 pC	Phase	Y	G	passed
			Voltage (kV)	45	45	
			Sensitivity (pC)	4.0	4.0	
			Discharge (pC)	No detectable discharge exceeding the sensitivity		
1.4	Impulse voltage test at 95 °C ~ 100 °C	No breakdown shall occur at 10 positive and 10 negative impulses of 200 kV	No breakdown occurred on the combination samples at 10 positive and 10 negative impulses of 200kV (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 65 kV	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 65 kV	passed		
1.6	Partial discharge test at 95 °C ~ 100 °C	The magnitude of the discharge at 45 kV shall not exceed 10 pC	Phase	Y	G	passed
			Voltage (kV)	45	45	
			Sensitivity (pC)	4.0	4.0	
			Discharge (pC)	2.0	6.9	
1.7	Partial discharge test at ambient temperature	The magnitude of the discharge at 45 kV shall not exceed 10 pC	Phase	Y	G	passed
			Voltage (kV)	45	45	
			Sensitivity (pC)	4.4	4.4	
			Discharge (pC)	2.2	8.1	
1.8	Impulse voltage test	No breakdown shall occur at 10 positive and 10 negative impulses of 200 kV	No breakdown occurred on the combination samples at 10 positive and 10 negative impulses of 200 kV (See Appendix C.2)	passed		

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No.	Item	Requirements	Results	Evaluation
1.9	AC voltage test	No breakdown shall occur at 65 kV for 15 min	No breakdown occurred on the combination samples at 65 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 117 kV for 5 min	No breakdown occurred on the combination samples at 117 kV for 5 min	passed
2.2	DC voltage test	No breakdown shall occur at 104 kV for 15 min	No breakdown occurred on the combination samples at 104 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 3.535 kA, 1.04 s and 3.530 kA, 1.04 s (See Appendix C.4)	passed
2.4	Thermal short-circuit test (conductor)	No visible deterioration at 23.2 kA, 2 s, twice	No visible deterioration at 23.93 kA, 2.03s and 24.09 kA, 2.04 s (See Appendix C.5)	passed
2.5	Dynamic short-circuit test	No visible deterioration at 82.1 kA, not less than 10 ms	No visible deterioration at 82.73 kA, 100 ms (See Appendix C.6)	passed
2.6	Impulse voltage test	No breakdown shall occur at 10 positive and 10 negative impulses of 200 kV	No breakdown occurred on the combination samples at 10 positive and 10 negative impulses of 200 kV (See Appendix C.3)	passed
2.7	AC voltage test	No breakdown shall occur at 65 kV for 15 min	No breakdown occurred on the combination samples at 65 kV for 15 min	passed



No.	Item	Requirements	Results	Evaluation				
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	<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:50%;">before ageing</td> <td style="width:50%; text-align: right;">196.6 Ω</td> </tr> <tr> <td>after ageing</td> <td style="text-align: right;">89.4 Ω</td> </tr> </table>	before ageing	196.6 Ω	after ageing	89.4 Ω	passed
before ageing	196.6 Ω							
after ageing	89.4 Ω							
3.2	Screen leakage current	Screen leakage current shall not exceed 0.5 mA at 40.5 kV	Screen leakage current didn't exceed 0.5 mA at 40.5 kV	passed				

Content

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

1.1 AC voltage test

No breakdown occur at 117kV for 5 min.

Result: Passed.

1.2 DC voltage test

No breakdown occurred at 104kV for 15min.

Result: Passed.

1.3 Partial discharge test at ambient temperature

The test voltage was raised gradually to and held at 54kV for 10s and then slowly reduced to 45kV.

Requirements	Result		
45kV, the magnitude of the discharge shall not exceed 10pC	Phase	Sensitivity (pC)	Discharge (pC)
	Y	4.0	3.8
	G	4.0	2.0

Result: Passed.

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

The conductor of the cable was heated and stabilized for at least 2h at a temperature of 95 °C ~ 100 °C.

No breakdown occurred at 10 positive and 10 negative impulses of 200kV.

Result: Passed.



1.5 Heating cycle voltage test

Each heating cycle in air was at least 8 h 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 occurred during 60 cycles in air at the conductor temperature of 95°C to 100°C and 65kV.

Result: Passed.

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

The test voltage was raised gradually to and held at 54kV for 10s and then slowly reduced to 45kV. The conductor temperature was 95°C to 100°C during the test.

Requirements	Result		
	Phase	Sensitivity (pC)	Discharge (pC)
45kV, the magnitude of the discharge shall not exceed 10pC	Y	4.0	2.0
	G	4.0	6.9

Result: Passed.

1.7 Partial discharge test at ambient temperature

The test voltage was raised gradually to and held at 54kV for 10 s and then slowly reduced to 45kV.

Requirements	Result		
	Phase	Sensitivity (pC)	Discharge (pC)
45kV, the magnitude of the discharge shall not exceed 10pC	Y	4.4	2.2
	G	4.4	8.1

Result: Passed.

1.8 Impulse voltage test

No breakdown occurred at 10 positive and 10 negative impulses of 200kV.

Result: Passed.

1.9 AC voltage test

No breakdown occurred at 65kV for 15 min.

Result: 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.

Result: Passed.

2. Sequence 4.2 and 4.3 in Table 5 of GB/T 12706.4—2020**2.1 AC voltage test**

No breakdown occurred at 117kV for 5 min.

Result: Passed.

2.2 DC voltage test

No breakdown occurred at 104kV for 15 min.

Result: Passed.



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2.3 Thermal short-circuit test (screen)

At the beginning of the test, the cable conductor was 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 were applied to the screen. The short-circuit current and duration time was 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 was allowed to cool to a temperature less than 10 °C above its temperature prior to the first short-circuit. There was no visible deterioration on the samples.

Ambient temperature: 27.0 °C

Requirements	Result
No visible deterioration at 3.5kA, 1 s, twice	No visible deterioration at 3.535kA, 1.04 s and 3.530kA, 1.04 s (See Appendix C.4)

Result: Passed.

2.4 Thermal short-circuit test (conductor)

Two short-circuits were 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 was allowed to cool to a temperature less than 10 °C above its temperature prior to the first short-circuit. There was no visible deterioration on the samples.

Ambient temperature: 27.0 °C

Requirements	Result
No visible deterioration at 23.2kA, 2 s, twice	No visible deterioration at 23.93kA, 2.03s and 24.09kA, 2.04 s (See Appendix C.5)

Result: Passed.

2.5 Dynamic short-circuit test

The dynamic short-circuit current value was 2.5 times of the thermal short-circuit value when the thermal short-circuit time equals 1s. There was no visible deterioration on the samples after the short-circuit lasts for at least 10ms.

Ambient temperature: 27.0 °C

Requirements	Result
No visible deterioration at 82.1 kA, not less than 10 ms	No visible deterioration at 82.73 kA, 100 ms (See Appendix C.6)

Result: Passed.

2.6 Impulse voltage test

No breakdown occurred at 10 positive and 10 negative impulses of 200kV.

Result: Passed.

2.7 AC voltage test

No breakdown occurred at 65kV for 15min.

Result: 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.

Result: Passed.



3. Other items in Table 5 of GB/T 12706.4—2020

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 $(120 \pm 2)^\circ\text{C}$ for 168 h during the heating period.

Requirements	Result	
	before ageing	after ageing
Screen resistance before and after the heating period shall not exceed 5000 Ω	196.6 Ω	89.4 Ω

Result:passed.

3.1 Screen leakage current

A metal foil of 25 cm² (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 2000 Ω , and an AC voltage of 40.5kV shall be applied between the cable conductor of the combination samples and the ground to measure the leakage current. The magnitude of screen leakage current wasn't exceed 0.5mA.

Result:passed.

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

The sample was received by Power Cable Station on 11/03/2022. The sample was in good condition. The sample is designed with stress cone structure and the raw liquid material is EPDM. The material of connector is T2 copper. The cable conductor is compacted with the connector by confining pressure.

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 4.2 and 4.3. The yellow phase and green phase of samples to be tested on which the type tests 4.1 were carried out. 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 26/35 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	TRF300-0.002 AC voltage measurement system	EETC08- 0046	(0~300)kV	Class 3	National high voltage measurement station	2023.06.27
2	YD(W)-JZ-30/15 0 AC/DC Test Device	EETC08- 0069	(0~150)kV	Grade 3	National high voltage measurement station	2023.06.27
3	JFD-2H PD measurement system	EETC08- 0013	(0.5~1000) pC	Class 10	National high voltage measurement station	2023.05.09
4	FY I 900/600 Weakly damped capacitive voltage divider	EETC08- 0019	(0~900) kV	Class 3	National high voltage measurement station	2024.06.15
5	H-DJF-2 Data collected system	EETC05- 2055	(0~100) kA	Class 0.5	National high voltage measurement station	2024.05.23
6	LCC-V Heating cycle monitoring system	EETC08- 0044	(0~3000) A	Class 3	National high voltage measurement station	2023.03.30
7	TP700 Multichannel data recorder	EETC08- 0153	(0~200)°C	±2°C	Vkan Certification & Testing Co., Ltd. Measuring Center	2022.11.31



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

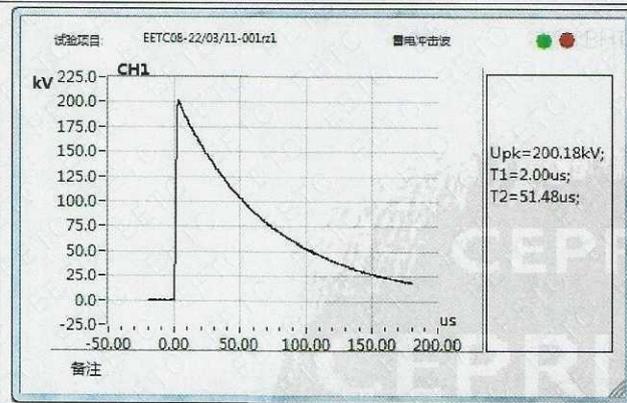
Ambient temperature: 26.6°C

Relative humidity: 78%

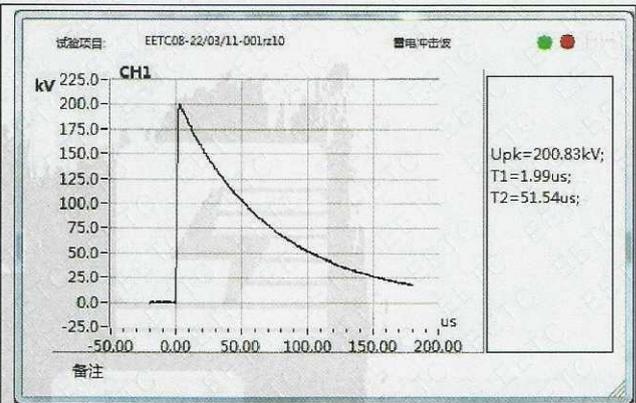
Atmosphere: 0.1001MPa

Positive polarity (kV)	200.2	201.0	199.6	200.0	201.6	200.0	200.4	200.5	199.3	200.8
Negative polarity (kV)	199.8	201.5	205.2	205.2	201.4	201.5	202.3	199.2	200.4	200.5

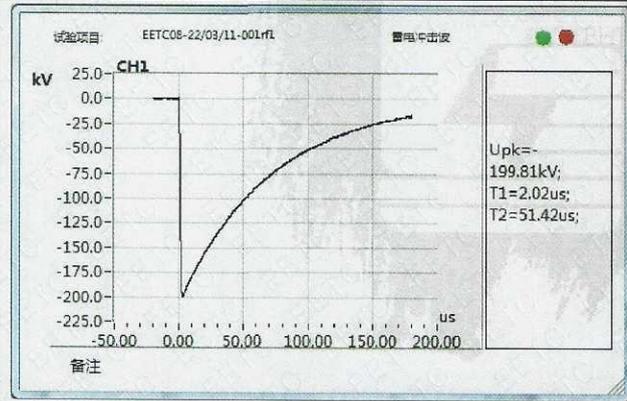
C.1.2 The waveforms of impulse voltage test



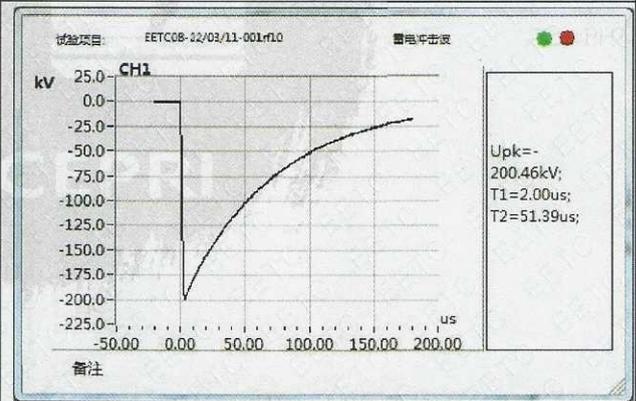
The 1st positive impulses waveform



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: 29.5°C

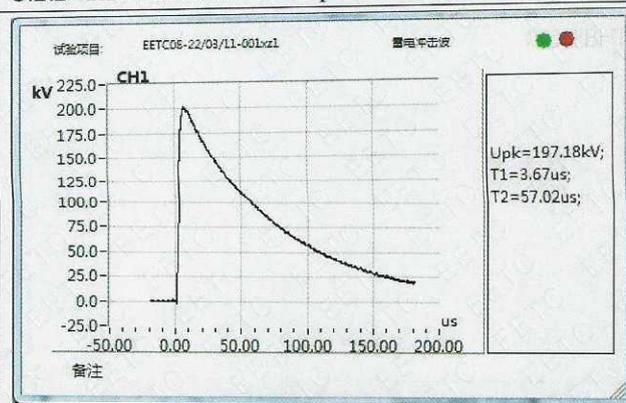
Relative humidity: 64%

Atmosphere: 0.0999MPa

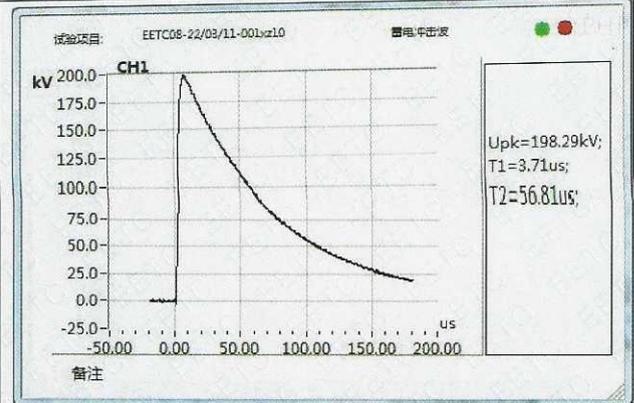
Positive polarity (kV)	197.2	198.3	198.3	198.1	200.6	198.4	199.8	199.8	200.5	198.3
Negative polarity (kV)	197.4	198.7	201.9	201.7	197.0	200.0	202.0	199.1	202.3	200.2



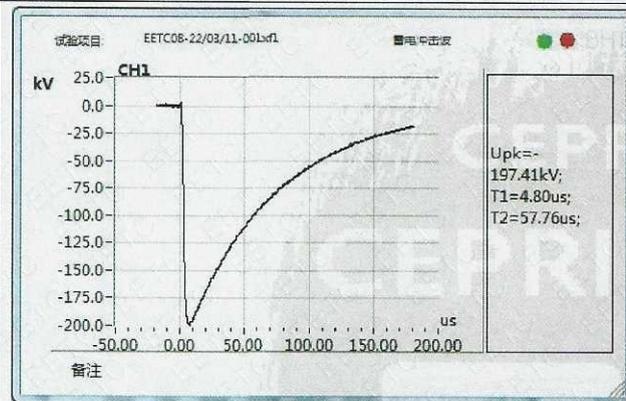
C.2.2 The waveforms of impulse voltage test



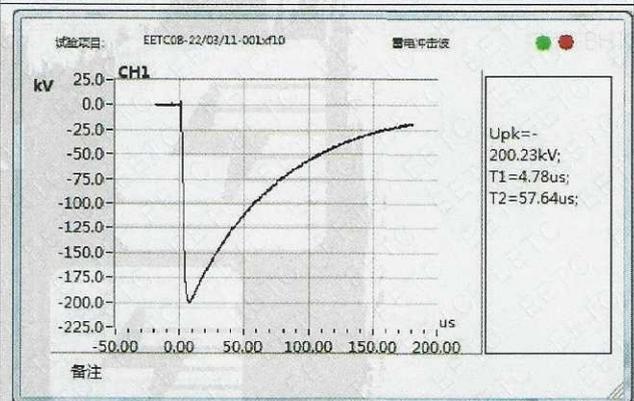
The 1st positive impulses waveform



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

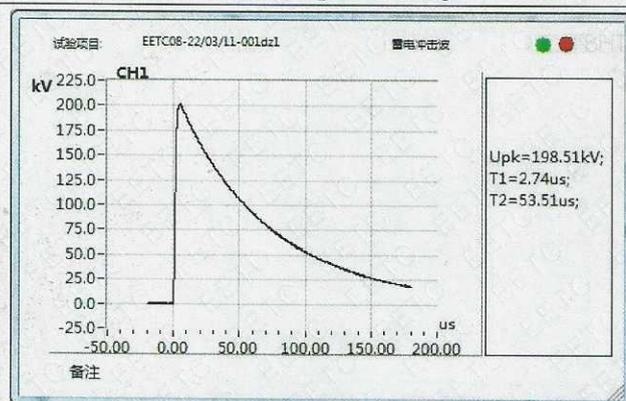
Ambient temperature:31.1℃

Relative humidity: 70%

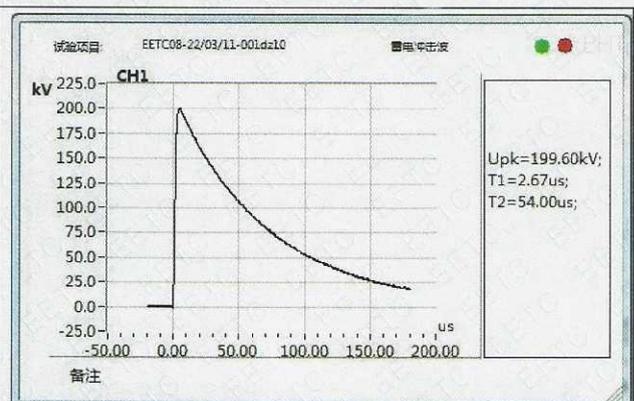
Atmosphere: 0.1000MPa

Positive polarity (kV)	198.5	200.8	200.0	199.4	200.3	200.5	200.0	199.3	200.5	199.6
Negative polarity (kV)	198.1	200.2	200.7	200.7	200.8	199.6	199.1	200.8	200.4	200.5

C.3.2 The waveforms of impulse voltage test

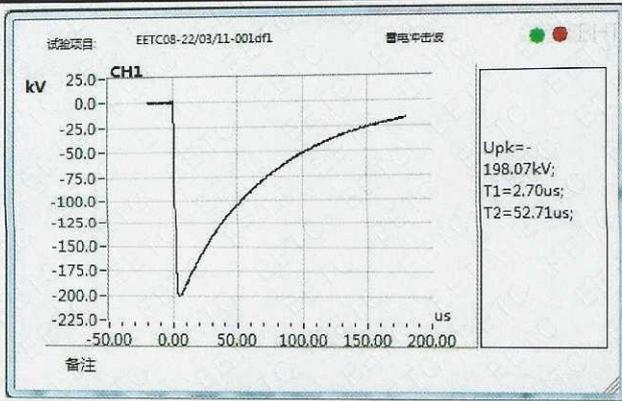


The 1st positive impulses waveform

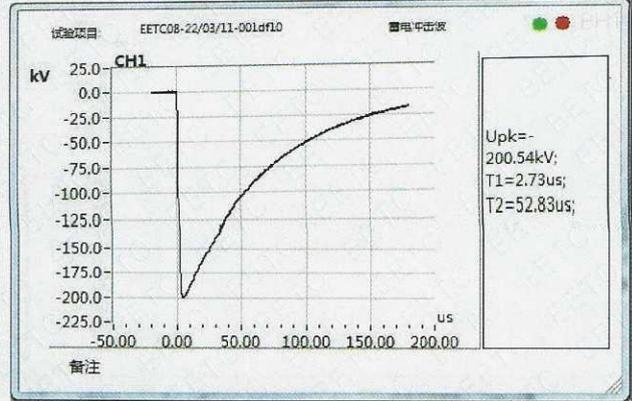


The 10th positive impulses waveform



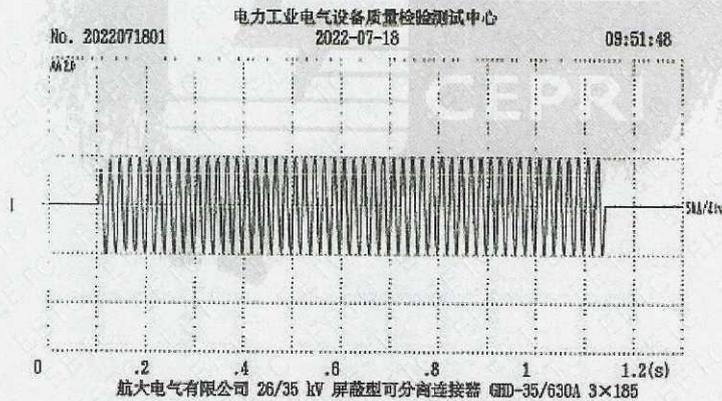
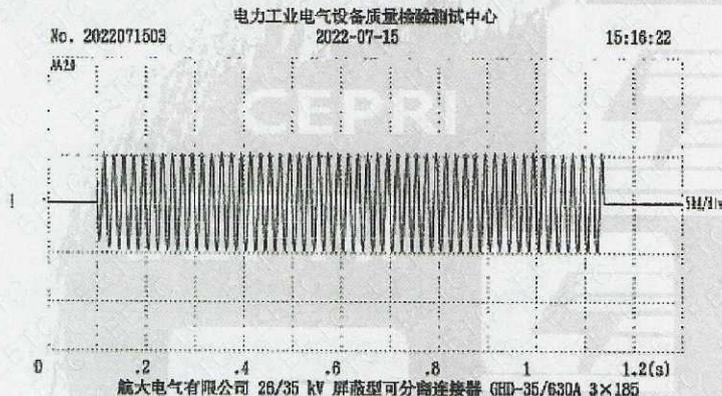


The 1st negative impulses waveform



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

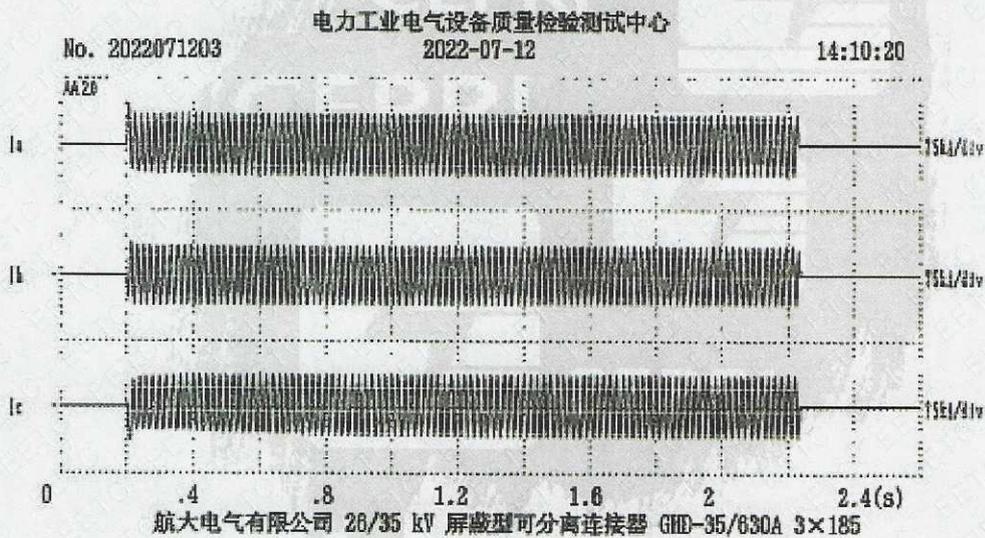
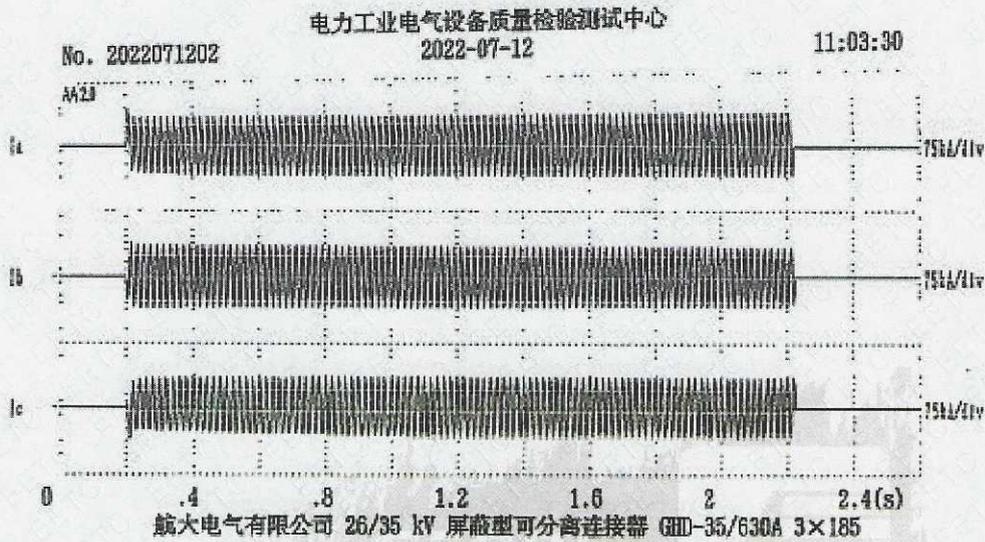
示波图编号	试验电流峰值(kA)			动稳定 通电时 间(s)	试验电流周期分量 有效值(kA)			热稳定 通电时 间(s)	热稳定值 (AAs) 10E6		
	A	B	C		A	B	C		A	B	C
2022071503					3.535			1.04	12.98		

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
2022071801					3.530			1.04	12.93		



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



动、热稳定试验

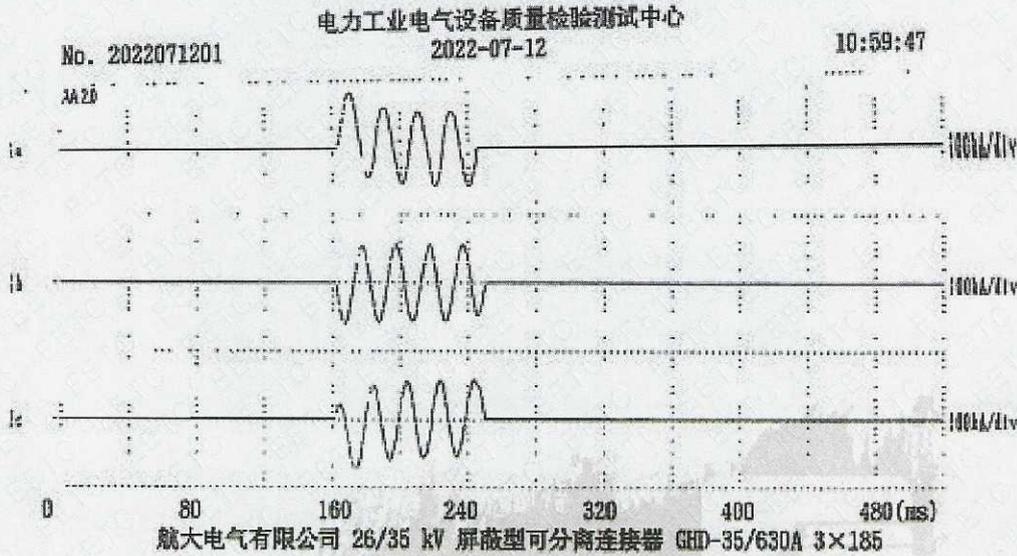
示波图编号	试验电流峰值 (kA)			动稳定 通电时 间 (s)	试验电流周期分量 有效值 (kA)			热稳定 通电时 间 (s)	热稳定值 (AAs) 10E6		
	A	B	C		A	B	C		A	B	C
2022071202					23.52	23.93	23.63	2.03	1120	1160	1131

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
2022071203					24.09	23.80	23.90	2.04	1182	1154	1164



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
2022071201	82.73	60.21	75.72	0.19							

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Appendix D Other Information

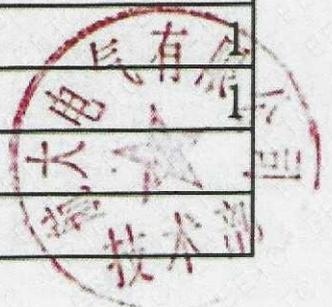
D.1 Sample packing list

航大电气有限公司35kV屏蔽可分离连接器装箱清单			
序号	名称	单位	数量
1	前接头	个	3
2	应力锥	个	3
3	后盖帽	个	3
4	接地线	条	3
5	不锈钢螺母	套	3
6	半导体自粘带	盒	1
7	绝缘自粘带	盒	1
8	清洁纸	包	12
9	硅脂膏	管	3
10	密封胶	包	3
11	砂纸条	条	6
12	堵头	个	3
13	六角套管	套	1
14	变径螺栓	套	3
15	铜连接端子	个	3
16	卷尺	个	1
17	美工刀	把	1
18	牙刷	把	1
19	安装说明书	份	1
20	装箱清单	份	1
21	合格证	张	1



航大电气有限公司35kV插拔件专用冷缩装箱清单			
序号	名称	单位	数量
1	冷缩三指套	只	1
2	冷缩绝缘管	只	3
3	冷缩密封管	只	3
4	半导体自粘带	盒	1
5	不锈钢恒力弹簧	只	3
6	接地线 (16平方800mm)	条	1
7	接地线 (16平方600mm)	条	1
8	三角锥	只	1
9	清洁纸	包	3
10	硅脂膏	管	2
11	砂纸条	条	3
12	填充胶	条	3
13	美工刀	把	1
14	密封胶	条	1
15	卷尺	只	1
16	电气胶带	个	3
17	扎带	条	3
18	安装说明书	份	1
19	装箱清单	份	1
20	合格证	张	1
21			
22			

备质

则报
用

D.2 Identification of test cable (specified in GB/T 12706.3—2020)

rated voltage $U_0/U(U_m)$		26/35(40.5) 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	10.6 mm
	diameter	39.8 mm
screen	thickness of conductor screen	1.0 mm
	thickness of insulation screen	1.0 mm
	strippability of insulation screen	un-strippable
	diameter of insulation screen	41.9 mm
	metallic screen	copper tape
armour		steel strip armour
oversheath	material	PVC
	diameter	102.8 mm
mark of cable		ZC-YJV22-26/35 3×185



D.3 Main structure dimensions of the samples

更改栏	修改人/日期	更改日期
更改内容描述		

航大电气	
130101001	1301010006
35KV前接头装配	

技术要求

1. 绝缘材料应自然干燥光滑, 无冲层;
2. 电气性能达到IEC60502.4的要求;
3. 表面电阻率≥2000Ω;
4. 漆面电阻率≤60Ω/110kV以下;
5. 耐电压试验117kV/10min;
6. 局放试验≤5KV/10pC.

图号	1301010006
图名	35KV前接头装配
比例	1:4
共张	1
第张	1

设计: [] 审核: [] 工艺: []

校核: [] 批准: []

标准: [] 审核: [] 绘图: [] 审批: []

公差: ±0.1, ±0.3, ±0.5, ±1

基本尺寸: >120, >120-170, >170-300

图例: 4mm 接地线

连接导线长800mm

发

受控文件

航大电气

