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TEST REPORT

CEPRI-EETC08-2017-0363

Client: Shanghai Chardon Electrical Ltd.

Object: 36kV 630A screened separable connector

Type: 36-FDT630/36-RDT630 1×185

Test Category: Type Tests



**POWER INDUSTRY QUALITY INSPECTION AND TEST
CENTER FOR ELECTRIC EQUIPMENT**

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Test Report	Power Industry Quality Inspection and Test Center for Electric Equipment		CEPRI-EETC08-2017-0363 Total 15 Page 2
Client	Shanghai Chardon Electrical Ltd.	Manufacturer	Shanghai Chardon Electrical Ltd.
Object	36kV 630A screened separable connector	Type	36-FDT630/36-RDT630 1×185
Sampling procedure	by the Client	Serial No.	EETC08-17/05/31-004
Test Category	Type Tests	Date	2017.06.12~2017.11.10
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>		
Conclusion	<p>According to GB/T 12706.4—2008 and IEC 60502-4:2010, type tests were performed on 36kV 630A screened separable connectors which were provided by Shanghai Chardon Electrical Ltd. All the results were in accordance with the requirements.</p>		
Note	/		
<p>Compiled 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: 2017.11.23.</p>			

Test Results

No.	Item	Requirements	Results			Evaluation
1	Sequence 4.1	/	/			/
1.1	AC voltage test	No breakdown shall occur at 81 kV for 5 min	No breakdown occurred on the combination samples at 81 kV for 5 min			passed
1.2	Partial discharge test at ambient temperature	The magnitude of the discharge at 30 kV shall not exceed 10 pC	Phase	No.1& No.4	No.2& No.3	passed
			Voltage (kV)	30	30	
			Noise background (pC)	1.9	1.9	
			Discharge (pC)	1.9	2.6	
1.3	Impulse voltage test at 95 °C ~ 100 °C	No breakdown shall occur at 10 positive and 10 negative impulses of 170 kV	No breakdown occurred on the combination samples at 10 positive and 10 negative impulses of 170 kV (See Appendix C.1)			passed
1.4	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 45 kV	No breakdown occurred on the combination samples 30 cycles in air and 30 cycles under water at the conductor temperature of 95°C to 100°C and 45 kV			passed
1.5	Partial discharge test at ambient temperature	The magnitude of the discharge at 30 kV shall not exceed 10 pC	Phase	No.1& No.4	No.2& No.3	passed
			Voltage (kV)	30	30	
			Noise background (pC)	2.0	2.0	
			Discharge (pC)	2.0	3.0	
1.6	Partial discharge test at 95 °C ~ 100 °C	The magnitude of the discharge at 30 kV shall not exceed 10 pC	Phase	No.1& No.4	No.2& No.3	passed
			Voltage (kV)	30	30	
			Noise background (pC)	2.0	2.0	
			Discharge (pC)	2.0	3.3	

1.7	Impulse voltage test	No breakdown shall occur at 10 positive and 10 negative impulses of 170 kV	No breakdown occurred on the combination samples at 10 positive and 10 negative impulses of 170 kV (See Appendix C.2)	passed
1.8	AC voltage test	No breakdown shall occur at 45 kV for 15 min	No breakdown occurred on the combination samples at 45 kV for 15 min	passed
1.9	Examination	It is advised that the accessory be 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 81 kV for 5 min	No breakdown occurred on the combination samples at 81 kV for 5 min	passed
2.2	Thermal short-circuit test (conductor)	No visible deterioration at 24.2 kA, 2 s, twice	No visible deterioration at 24.73 kA, 2.01 s and 24.78 kA, 2.01 s (See Appendix C.4)	passed
2.3	Dynamic short-circuit test (conductor)	No visible deterioration at 85.4 kA, not less than 10 ms	No visible deterioration at 86.23 kA, 80 ms (See Appendix C.5)	passed
2.4	Impulse voltage test	No breakdown shall occur at 10 positive and 10 negative impulses of 170 kV	No breakdown occurred on the combination samples at 10 positive and 10 negative impulses of 170 kV (See Appendix C.3)	passed

2.5	AC voltage test	No breakdown shall occur at 45 kV for 15 min	No breakdown occurred on the combination samples at 45 kV for 15 min			passed
2.6	Examination	It is advised that the accessory be 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	type	before ageing	after ageing	passed
			36-FDT630	502 Ω	244 Ω	
			36-RDT630	382 Ω	203 Ω	
3.2	Screen leakage current	Screen leakage shall not exceed 0.5 mA at 36 kV	Screen leakage didn't exceed 0.5 mA at 36 kV			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, clause 4. No breakdown shall occur at 81 kV for 5 min.

1.2 Partial discharge test at ambient temperature

1.2.1 Test method

The test voltage shall be raised gradually to and held at 36 kV for 10 s and then slowly reduced to 30 kV. The test shall be carried out in accordance with GB/T 18889—2002, clause 7.

1.3 Impulse voltage test at 95 °C~100 °C**1.3.1 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 °C~100 °C. No breakdown shall occur at 10 positive and 10 negative impulses of 170 kV.

1.4 Heating cycle voltage test**1.4.1 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 °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. No breakdown shall occur 30 cycles in air and 30 cycles under water at the conductor temperature of 95°C to 100°C and 45 kV.

1.5 Partial discharge test at 95 °C~100 °C**1.5.1 Test method**

The test voltage shall be raised gradually to and held at 36 kV for 10 s and then slowly reduced to 30 kV. The test shall be carried out in accordance with GB/T 18889—2002, clause 7. The conductor temperature shall be of 95°C to 100°C during the test.

1.6 Partial discharge test at ambient temperature**1.6.1 Test method**

The test voltage shall be raised gradually to and held at 36 kV for 10 s and then slowly reduced to 30 kV. The test shall be carried out in accordance with GB/T 18889—2002, clause 7.

1.7 Impulse voltage test**1.7.1 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 170 kV.

1.8 AC voltage test**1.8.1 Test method**

The test shall be carried out in accordance with GB/T 18889—2002, clause 4. No breakdown shall occur at 45 kV for 15 min.

1.9 Examination**1.9.1 Test method**

It is advised that the accessory be 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, clause 4. No breakdown shall occur at 81 kV for 5 min.

2.2 Thermal short-circuit test (conductor)

2.2.1 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°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.

2.3 Dynamic short-circuit test (conductor)

2.3.1 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 10s.

2.4 Impulse voltage test

2.4.1 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 170 kV.

2.5 AC voltage test

2.5.1 Test method

The test shall be carried out in accordance with GB/T 18889—2002, clause 4. No breakdown shall occur at 45 kV for 15 min.

2.6 Examination

2.6.1 Test method

It is advised that the accessory be 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, 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 after the heating period shall be placed in the air oven at the temperature of $(120 \pm 2)^\circ\text{C}$ for 168 h.

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 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 36kV 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 31/05/2017. 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 four sets of samples to be tested were installed by the manufacturer on eight length of cables forming No.1, No.2, No.3 and No.4 combination samples on which the type tests sequence 4.1, 4.2 and 4.3 were carried out. Eight 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 single-core cable for rated voltage 18/30 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 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	TRF300-0.002 AC voltage measurement system	110650	(0~300) kV	Grade 3	National high voltage measurement station	2018.07.21
2	JFD-2H PD measurement system	20041202	(0.5~1000) pC	Class 10	National high voltage measurement station	2018.05.19
3	FY I 900/600 Weakly damped capacitive voltage divider	1165-2-1	(0~900) kV	Class 3	National high voltage measurement station	2018.06.29
4	H-DJF-2 Data collected system	CJ06	(0~100) kA	Class 0.5	National high voltage measurement station	2020.01.03
5	LM-0.5 Current transformer	3306	(0~3000) A	Class 0.5	National high voltage measurement station	2020.10.26
6	MAS- II digital microammeter	20001	(0-2000) uA	Class 1.5	Vkan Certification & Testing Co., Ltd. Measuring Center	2018.10.16
7	287C Digital voltage meter	31470016	(0~700) V	Class 1	Vkan Certification & Testing Co., Ltd. Measuring Center	2018.07.02

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

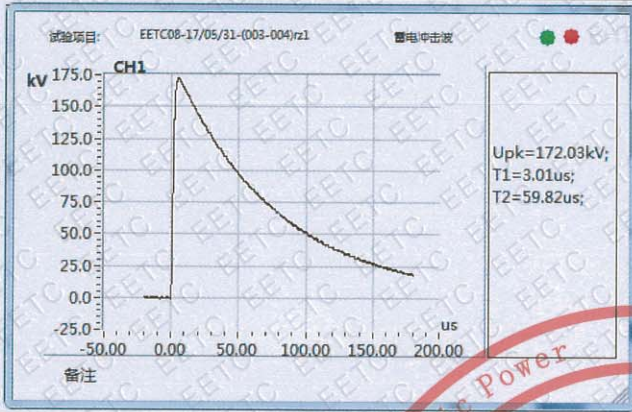
Ambient temperature: 30°C

Relative humidity: 72%

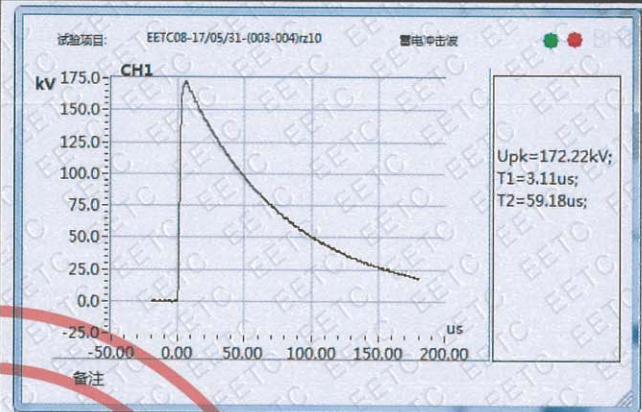
Atmosphere: 0.1012MPa

Positive polarity (kV)	172	171	171	172	170	171	171	171	172	172
Negative polarity (kV)	171	170	170	171	171	172	170	169	171	168

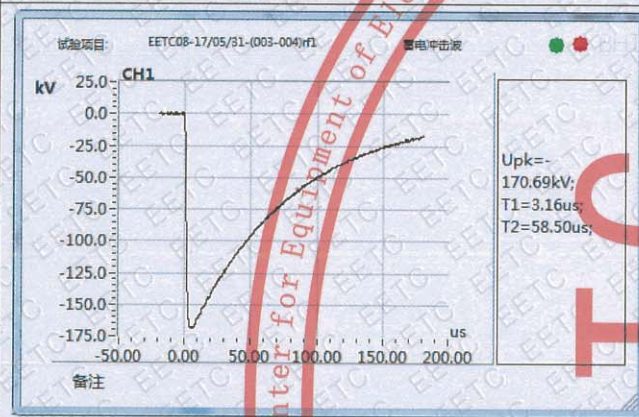
C.1.2 The waveforms of impulse voltage test



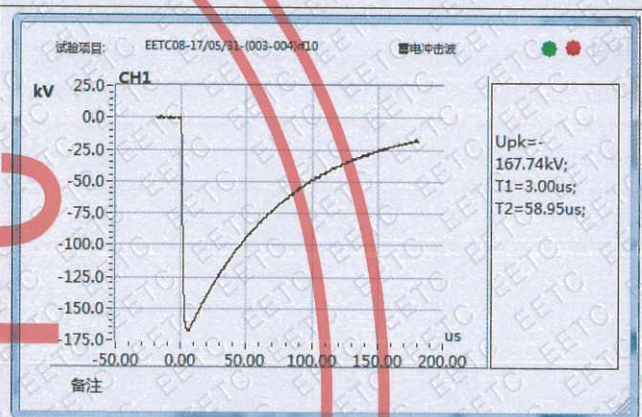
The 1st positive impulses waveform



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

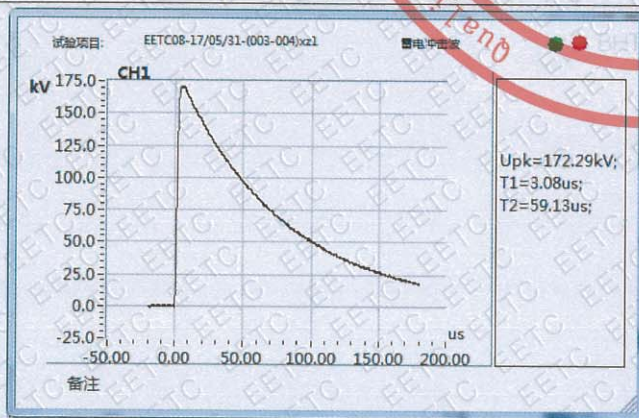
Ambient temperature: 17.0°C

Relative humidity: 61%

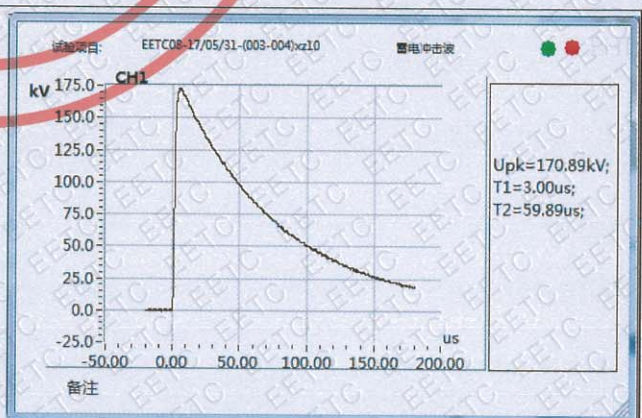
Atmosphere: 0.1018MPa

Positive polarity (kV)	172	171	171	172	172	172	172	170	171	171
Negative polarity (kV)	172	172	171	171	172	171	172	171	172	170

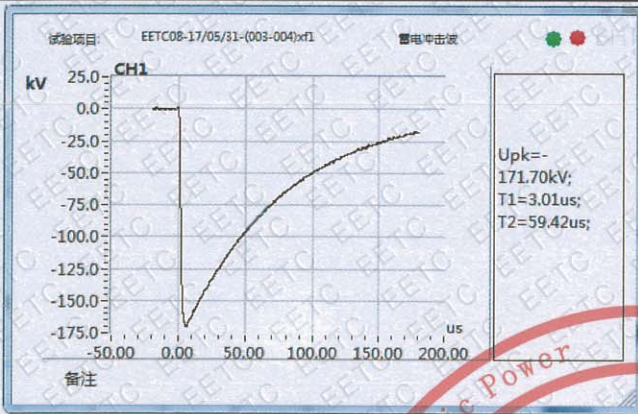
C.2.2 The waveforms of impulse voltage test



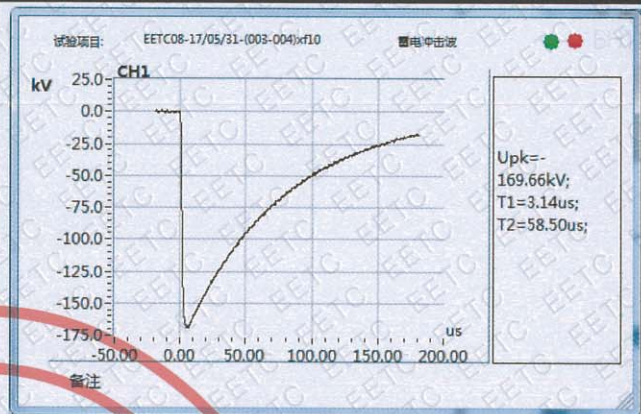
The 1st positive impulses waveform



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

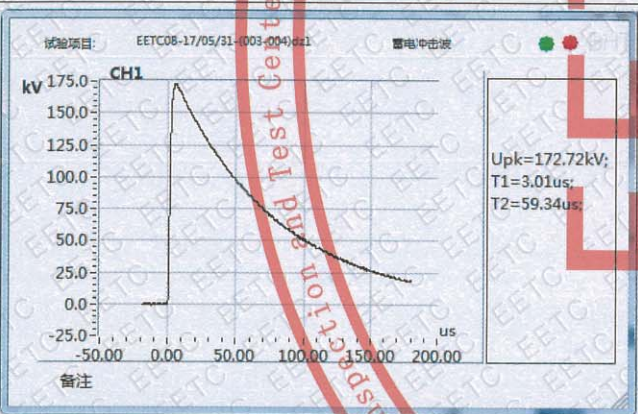
Ambient temperature: 19.0°C

Relative humidity: 63%

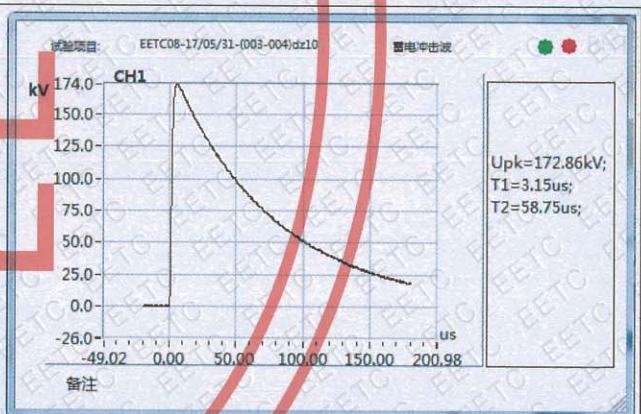
Atmosphere: 0.1019MPa

Positive polarity (kV)	173	172	171	172	172	172	173	171	172	173
Negative polarity (kV)	168	172	171	172	172	173	172	171	172	171

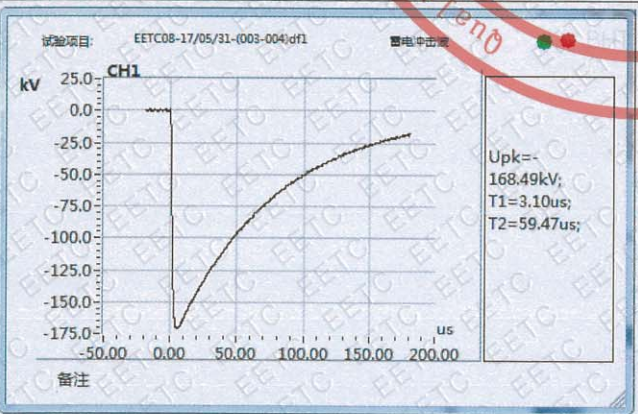
C.3.2 The waveforms of impulse voltage test



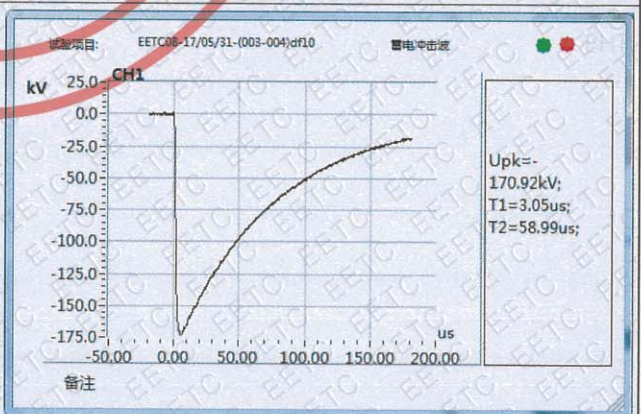
The 1st positive impulses waveform



The 10th positive impulses waveform



The 1st negative impulses waveform

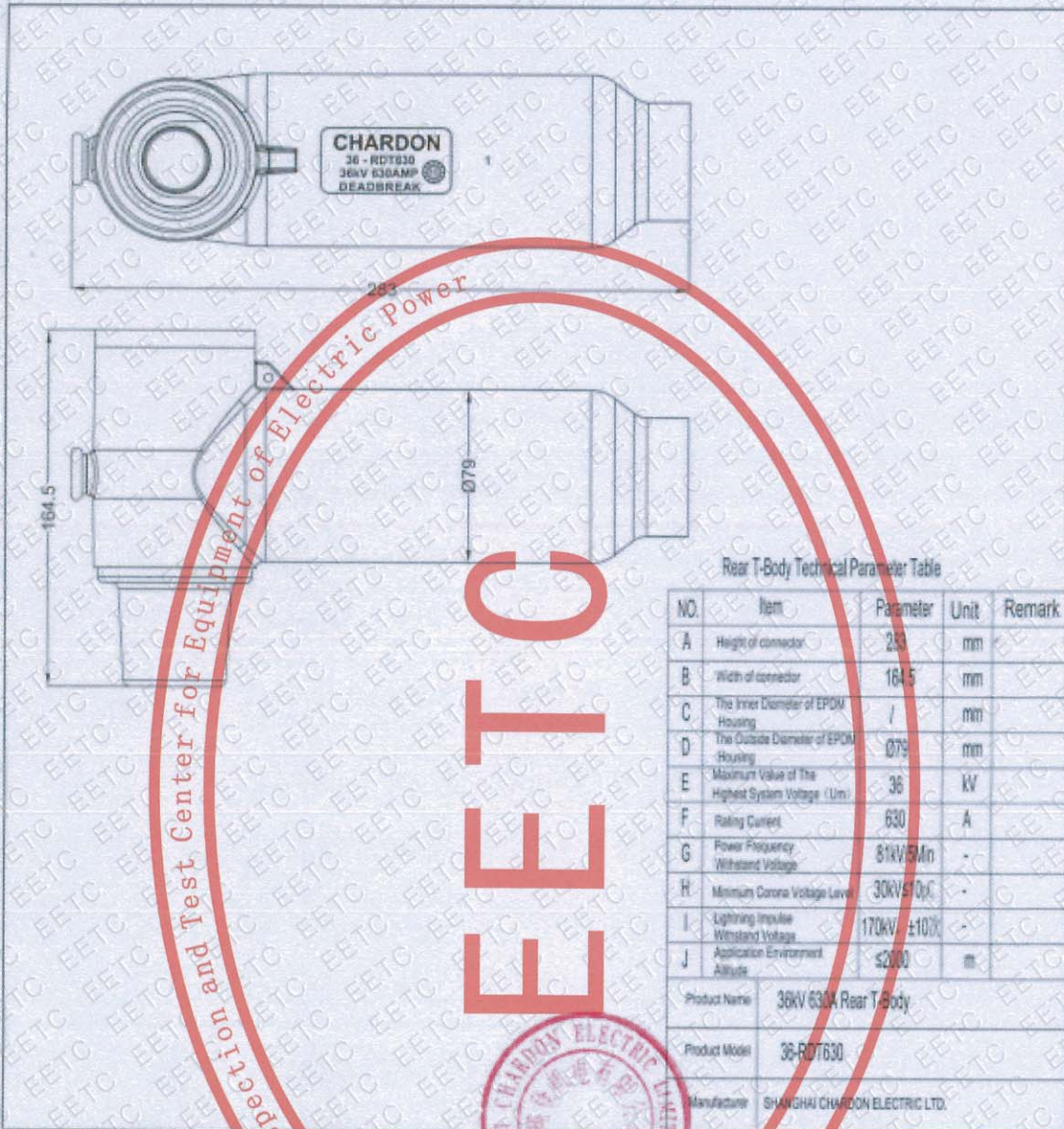


The 10th negative impulses waveform

Appendix D Other Information

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

rated voltage $U_0/U(U_m)$		18/30(36) kV
construction	core	single-core
	construction of screen	single phase screen
conductor	material	copper
	type	round compact stranded
	cross section	185 mm ²
	diameter	16.2 mm
insulation	material	XLPE
	thickness	8.0 mm
	diameter	34.3 mm
screen	thickness of conductor screen	0.9 mm
	thickness of insulation screen	0.9 mm
	strippability of insulation screen	strippable
	diameter of insulation screen	36.1 mm
	metallic screen	copper tape
armour		/
oversheath	material	PVC
	diameter	43.0mm
mark of cable		YJV-18/30 1×185



Rear T-Body Technical Parameter Table

NO.	Item	Parameter	Unit	Remark
A	Height of connector	283	mm	
B	Width of connector	164.5	mm	
C	The Inner Diameter of EPDM Housing	7	mm	
D	The Outside Diameter of EPDM Housing	Ø79	mm	
E	Maximum Value of the Highest System Voltage (Um)	36	KV	
F	Rating Current	630	A	
G	Power Frequency Withstand Voltage	81kV/5min	-	
H	Minimally Corona Voltage Level	30KV/50µC	-	
I	Lightning Impulse Withstand Voltage	170kV ±10%	-	
J	Application Environment Altitude	≤2000	m	
Product Name		36KV 630A Rear T-Body		
Product Model		36-RD7630		
Manufacturer		SHANGHAI CHARDON ELECTRIC LTD.		