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CEPRI

TEST REPORT

CEPRI-EETC08-2020-0729(E)

Client: SHANGHAI CHARDON ELECTRIC LTD.

Object: 26/35（40.5）kV cold shrinkable straight joint

Type: 35-CSCJ 1×185

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-EETC08-2020-0729(E) Total 23 Page 2
Client	SHANGHAI CHARDON ELECTRIC LTD.	Manufacturer	SHANGHAI CHARDON ELECTRIC LTD.
Object	26/35（40.5）kV cold shrinkable straight joint	Type	35-CSCJ 1×185
Sampling procedure	by the Client	Serial No.	EETC08-20/08/12-004
Test Category	Type Tests	Date	2020.08.14~2021.01.12
Requirements	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) 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 12706.4－2008 and IEC 60502-4:2010, type tests were performed on 26/35（40.5）kV cold shrinkable straight joints which were provided by SHANGHAI CHARDON ELECTRIC LTD. All the results were in accordance with the requirements.		
Note	/		

Tested by: 邓凯 邓凯　　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:** 2021-01-28

Test Results

No.	Item	Requirements	Results	Evaluation
1	Sequence 2.1	/	/	/
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: 1 / 2 / 3 / 4 Voltage (kV): 45 / 45 / 45 / 45 Noise background (pC): 2.3 / 2.3 / 1.7 / 1.7 Discharge (pC): 2.3 / 2.3 / 1.7 / 1.7	passed
1.4	Impulse voltage test at 95 ℃～100 ℃	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.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 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℃ to 100℃ and 65 kV	passed
1.6	Partial discharge test at 95℃～100℃	The magnitude of the discharge at 45 kV shall not exceed 10 pC	Phase: 1 / 2 / 3 / 4 Voltage (kV): 45 / 45 / 45 / 45 Noise background (pC): 2.0 / 2.0 / 1.6 / 1.6 Discharge (pC): 2.0 / 2.0 / 1.6 / 1.6	passed
1.7	Partial discharge test at ambient temperature	The magnitude of the discharge at 45 kV shall not exceed 10 pC	Phase: 1 / 2 / 3 / 4 Voltage (kV): 45 / 45 / 45 / 45 Noise background (pC): 1.9 / 1.9 / 2.4 / 2.4 Discharge (pC): 1.9 / 1.9 / 2.4 / 2.4	passed

No.	Item	Requirements	Results	Evaluation
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
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 2.2 and 2.3	/	/	/
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 3.502 kA, 1.01 s and 3.569 kA, 1.02 s (See Appendix C.4)	passed
2.4	Thermal short-circuit test (conductor)	No visible deterioration at 24.5kA, 2 s, twice	No visible deterioration at 24.97 kA, 2.03s and 24.81 kA, 2.03s (See Appendix C.5)	passed
2.5	Dynamic short-circuit test (conductor)	No visible deterioration at 86.5 kA, not less than 10 ms	No visible deterioration at 86.92 kA, 86 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

No.	Item	Requirements	Results	Evaluation
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
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

Content

1. Sequence 2.1 in Table 5 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. No breakdown shall occur at 117 kV for 5 min.

1.2 DC voltage test

1.2.1 Test method

The test shall be carried out in accordance with GB/T 18889—2002, clause 5 and IEC 61442:2005,clause 5. No breakdown shall occur at 104 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 54 kV for 10 s and then slowly reduced to 45 kV. The test shall be carried out in accordance with GB/T 18889—2002,clause 7 and IEC 61442:2005,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 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 ℃～100 ℃. No breakdown shall occur at 10 positive and 10 negative impulses of 200 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 and IEC 61442:2005,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 65 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 54 kV for 10 s and then slowly reduced to 45 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℃ 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 54 kV for 10 s and then slowly reduced to 45 kV. The test shall be carried out in accordance with GB/T 18889—2002,clause 7 and IEC 61442:2005,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 and IEC 61442:2005,clause 6. No breakdown shall occur at 10 positive and 10 negative impulses of 200 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 and IEC 61442:2005,clause 4. No breakdown shall occur at 65 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 2.2 and 2.3 in Table 5 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. No breakdown shall occur at 117 kV for 5 min.

2.2 DC voltage test

2.2.1 Test method

The test shall be carried out in accordance with GB/T 18889—2002, clause 5 and IEC 61442:2005,clause 5. No breakdown shall occur at 104 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 ℃ 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 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℃) 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 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. No breakdown shall occur at 10 positive and 10 negative impulses of 200 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. No breakdown shall occur at 65 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.

Appendix A Object Parameters

A.1 Sample information

The sample was received by Power Cable Station on 12/08/2020. The sample was in good condition with the factory number 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 four sets of straight joints to be tested were installed by the manufacturer on four length of cables forming No.1, NO.2, NO.3 and No.4 combination samples on which the type tests sequence 2.1, 2.2 and 2.3 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 26/35 kV, a cross-section of 185 sq.mm.

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	2022.07.14
2	JFD-2H PD measurement system	20041202	(0.5~1000) pC	Class 10	National high voltage measurement station	2021.05.19

No.	Name/ Type/ Specification	Serial No.	Measurement Range	Uncertainty / Accuracy class / Maximum Permissible Error	Calibration Institute	Valid Date
3	FY Ⅰ900/600 Weakly damped capacitive voltage divider	11165-2-1	(0~900) kV	Class 3	National high voltage measurement station	2022.06.29
4	CY2009 Data collected system	SJCJ1100 8	20A~300 kA	Class 1	The 29th Metrology and Testing Center of the Ministry of Machinery Industry (Tianshui)	2021.02.27
5	LCC-V Heating cycle monitoring system	DLRXH0 3	(0~3000) A	Class 3	National high voltage measurement station	2024.10.26
6	287C Digital voltage meter	31470016	(0~700) V	Class 1	Vkan Certification & Testing Co., Ltd. Measuring Center	2021.05.10

Appendix C Waveforms

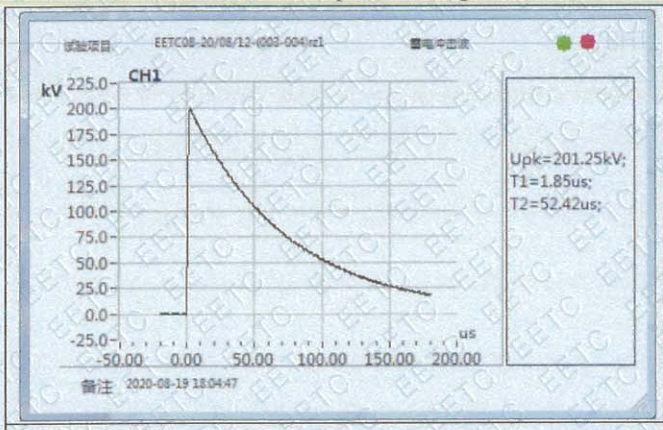
C.1 The values and waveforms of impulse voltage on the combination samples before heating cycles voltage test

C.1.1 The values of impulse voltage test

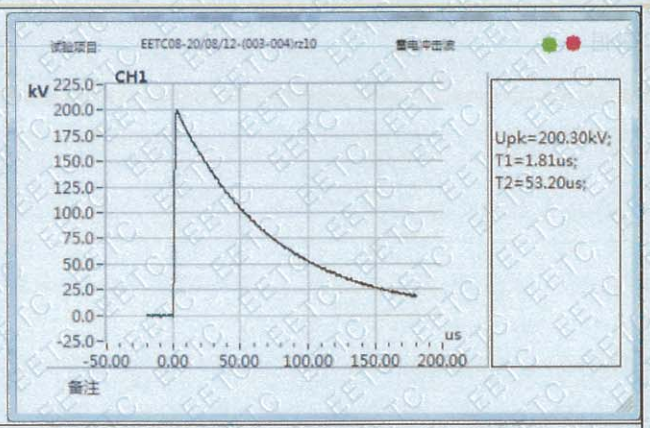
Ambient temperature: 30.5℃ Relative humidity: 60% Atmosphere: 0.1004MPa

Positive polarity (kV)	201	200	203	200	201	202	200	203	201	200
Negative polarity (kV)	202	202	200	200	200	200	199	201	201	201

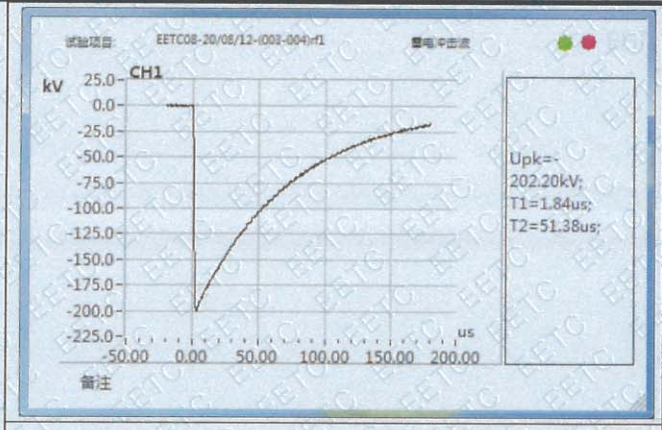
C.1.2 The waveforms of impulse voltage test



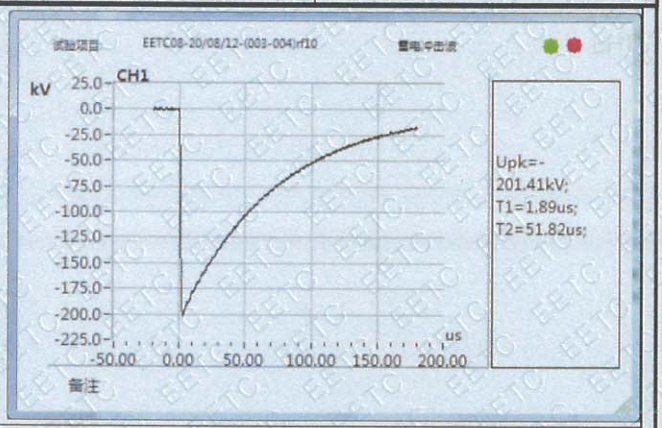
The 1st positive impulses waveform



The 10th positive impulses waveform



The 1st negative impulses waveform



The 10th negative impulses waveform

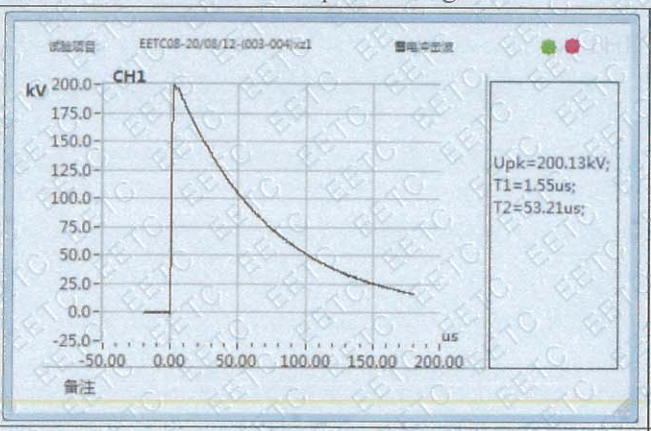
C.2 The values and waveforms of impulse voltage on the combination samples after heating cycles voltage test

C.2.1 The values of impulse voltage test

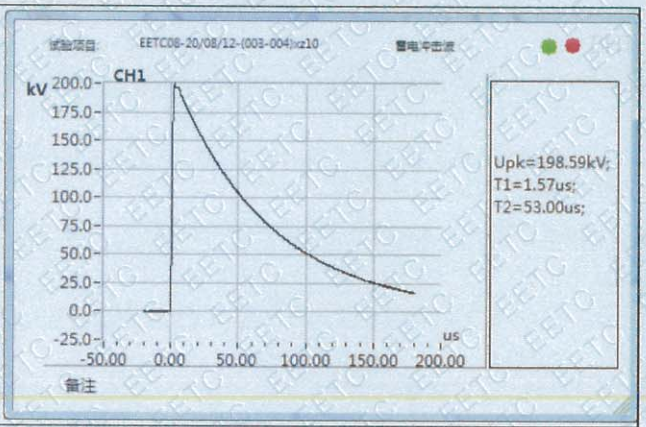
Ambient temperature:16.5℃ Relative humidity:55% Atmosphere: 0.1009MPa

Positive polarity (kV)	200	201	199	198	203	200	199	201	200	199
Negative polarity (kV)	199	198	198	201	201	201	201	198	199	199

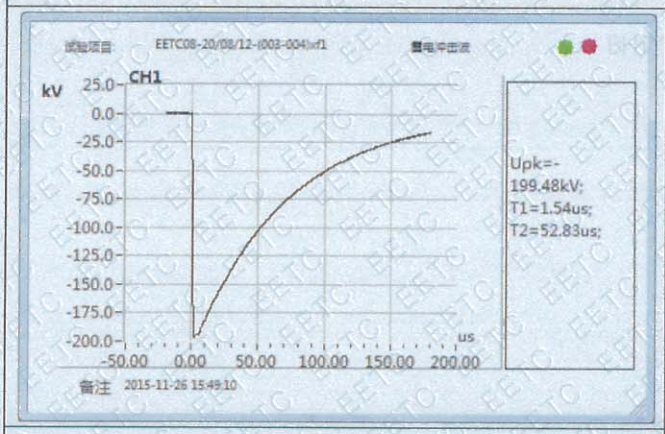
C.2.2 The waveforms of impulse voltage test



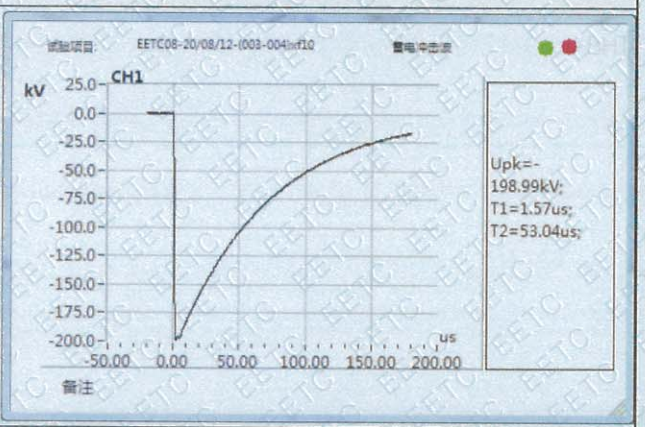
The 1st positive impulses waveform



The 10th positive impulses waveform



The 1st negative impulses waveform



The 10th negative impulses waveform

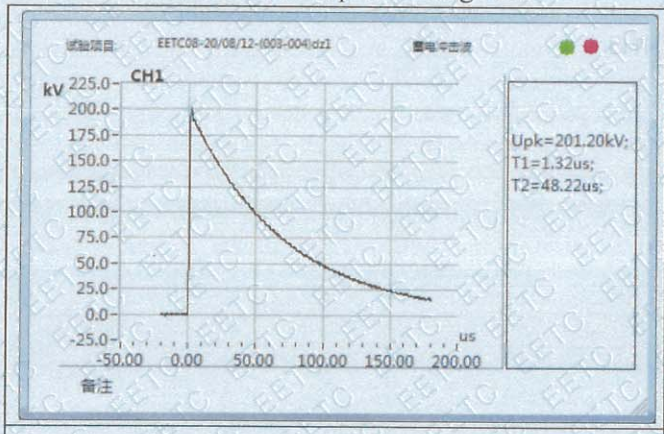
C.3 The values and waveforms of impulse voltage on the combination samples after thermal and dynamic short-circuit tests

C.3.1 The values of impulse voltage test

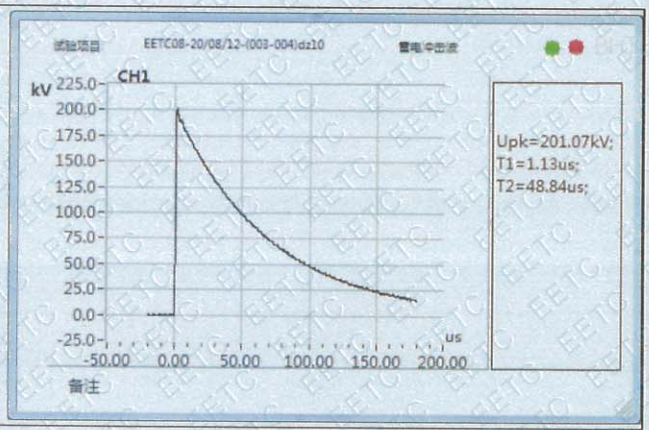
Ambient temperature:8.8℃ Relative humidity: 60% Atmosphere: 0.1010MPa

Positive polarity (kV)	201	201	201	202	202	201	203	201	204	201
Negative polarity (kV)	202	202	202	201	202	202	202	201	203	202

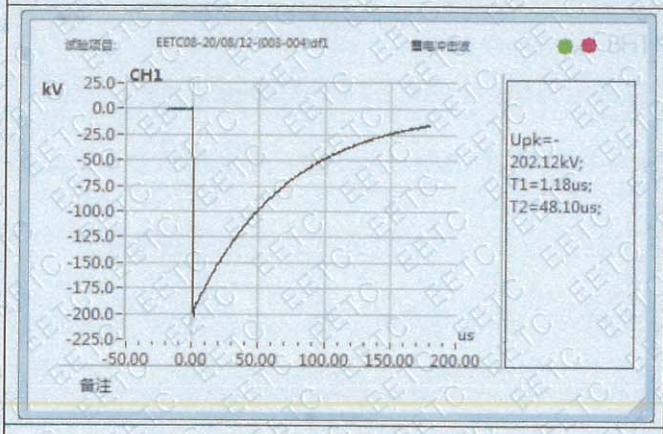
C.3.2 The waveforms of impulse voltage test



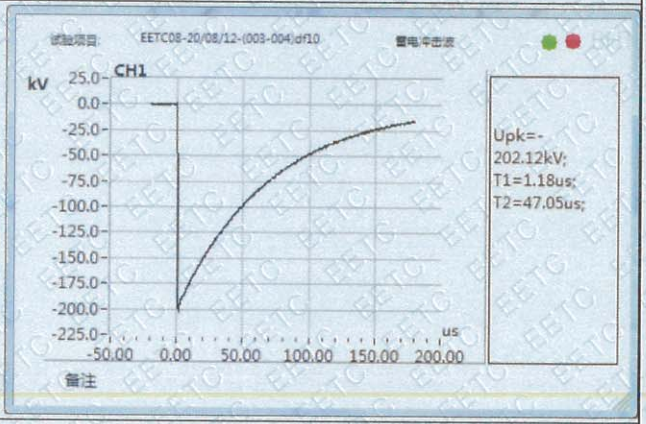
The 1st positive impulses waveform



The 10th positive impulses waveform



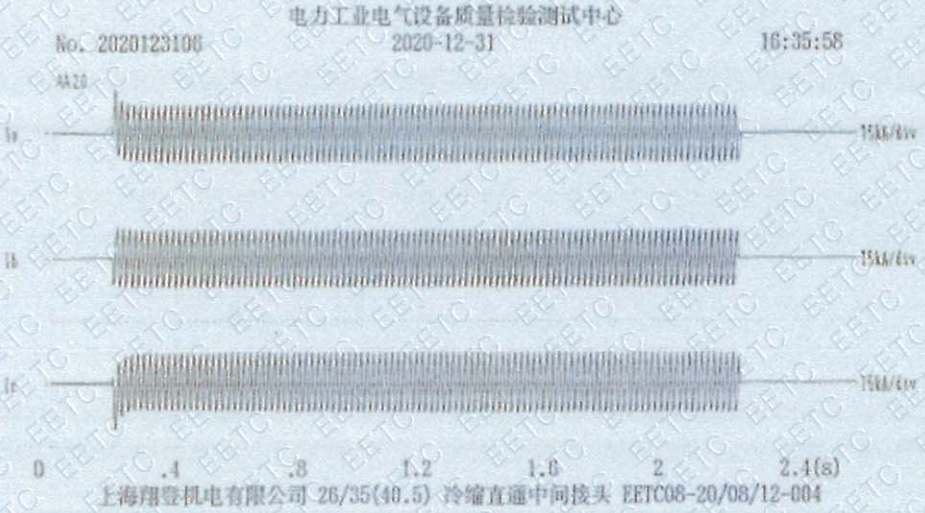
The 1st negative impulses waveform

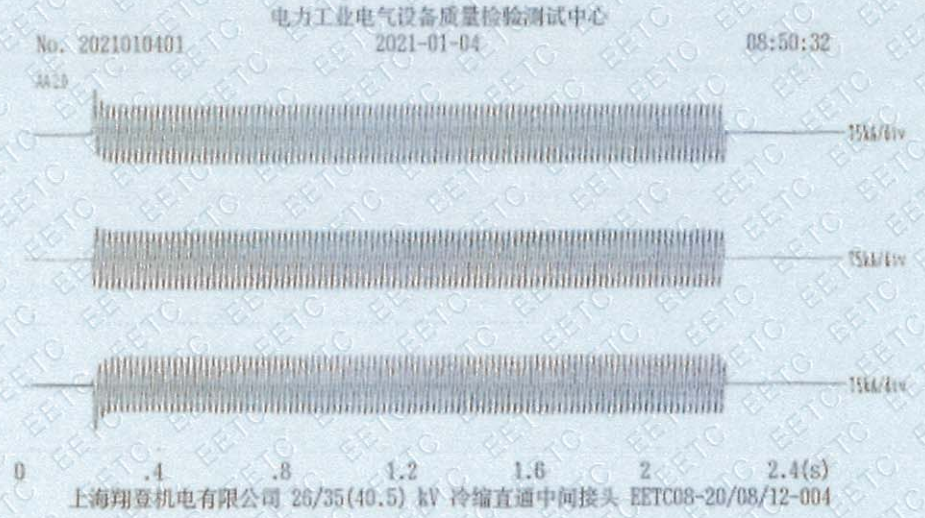


The 10th negative impulses waveform

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

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

Appendix D Other Information

D.1 Sample packing list

CHARDON GROUP

35kV Cold Shrinkable Cable Joint Packing List

No.	Product Name	QTY	Unit	Remark
1	Cold shrink Joint	1	PC	
2	Sealing tape	6	PCS	
3	Silicone lubricant	2	PC	
4	Paper towel	6	PC	
5	PVC tape	1	PC	
6	Sandpaper belt	2	PCS	
7	Gloves	1	Pair	
8	Constant-force spring	4	PC	
9	Armor tape	3	PC	
10	Shield net	1	PC	
11	Semi-conductive tape	1	PC	
12	Certificate of conformity	1	PC	
13	Installation Instructions	1	PC	
14	Packing List	1	PC	

Part NO:

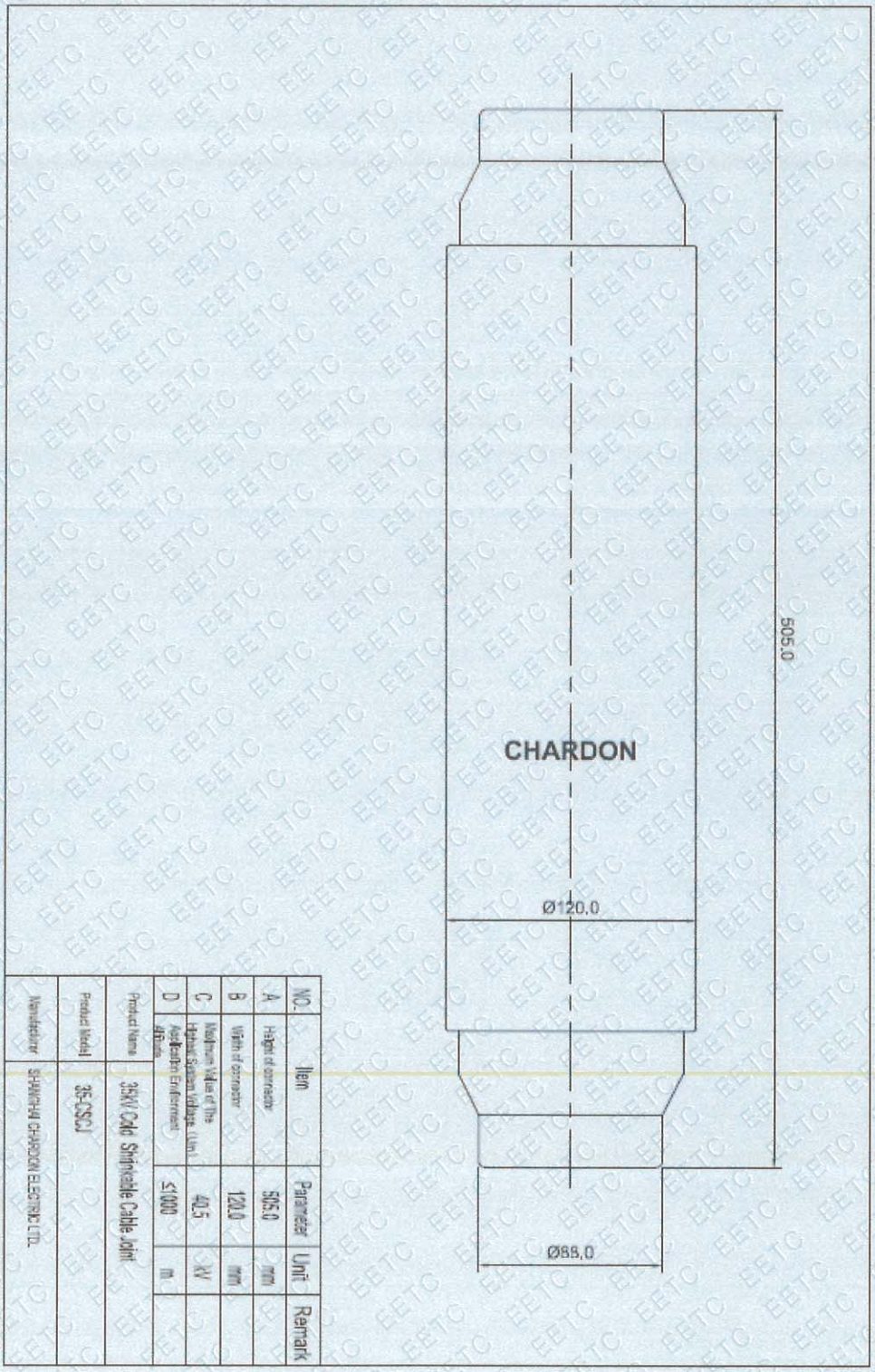
REV: A

D.2 Identification of test cable (specified in GB/T 12706.3—2008)

Appendix E

rated voltage $U_0/U(U_m)$		26/35(40.5) kV
construction	core	single-core
	construction of screen	single-phase screen
conductor	material	copper
	type	round compact stranded
	cross section	185 mm^2
	diameter	16.3 mm
insulation	material	XLPE
	thickness	10.5 mm
	diameter	39.5mm
screen	thickness of conductor screen	0.9 mm
	thickness of insulation screen	1.0 mm
	strippability of insulation screen	unstrippable
	diameter of insulation screen	41.6 mm
	metallic screen	copper tape
armour		/
oversheath	material	PVC
	diameter	49.3mm
mark of cable		YJV-26/35 3×185

E.1 Main structure dimensions of the samples



NO.	Item	Parameter	Unit	Remark
A	Height of connector	505.0	mm	
B	Width of connector	120.0	mm	
C	Maximum Value of The Highest System Voltage (Um)	40.5	kV	
D	Application Environment Altitude	≤1000	m	

Product Name	35kV Cold Shrinkable Cable Joint
Product Model	35-CSCJ
Manufacturer	SHANGHAI CHARDON ELECTRIC LTD.

E.2 Installation Description

CHARDON GROUP

35kV Cold Shrinkable Cable Joint INSTALLATION

DESCRIPTION

The Chardon Cold Shrinkable Cable Joint offers easy installation and reliable performance on Joint indoor and outdoor medium voltage cables. Made from high quality, UV resistant, silicone rubber, the Chardon Cold Shrinkable Cable Joint offers a combination of durability and high performance in the field.

The Chardon Cold Shrinkable Cable Joint include a stress controlling compound housing, preassembled on a plastic "hold out" tube. As the plastic hold out is removed, the stress-relief housing shrinks onto the cable. Chardon Joints are therefore easy to install, and have a wide application range. No tools or heat sources are required. The products are designed to last the entire life of the cable. The Chardon Cold Shrinkable Cable Joint are tested according to IEEE Standard 48 and IEC 60502.

ORDERING INSTRUCTIONS:

Standard Voltage Class	Part Number	Cable Insulation O.D. Range
35kV	35-CSCJ -A	28.0-31.0
	35-CSCJ -B	30.0-34.0
	35-CSCJ -C	33.5-37.0
	35-CSCJ -D	36.5-40.0
	35-CSCJ -E	40.0-45.0
	35-CSCJ -F	45.0-52.0

COLD SHRINKABLE Cable JOINT KIT

CONTENT:

- - Cold Shrinkable Cable Joint
- - Paper towel
- - Silicone lubricant
- - Sealing tape
- - PVC tape
- - Sandpaper belt
- - Gloves
- - Connecting pipe (Optional)
- - Grounding kit (Optional)
- - Constant-force spring
- – Armor tape
- – Shield net
- –Semi-conductive tape
- –Certificate of conformity
- –Packing List
- - Installation & Operating instructions

CAUTION: All associated apparatus must be de-energized during installation and/or maintenance.

DANGER: Do not touch or move energized product by hand. Failure to follow this instruction may result in serious or fatal injury, as well as damage to the product.

SAFETY INFORMATION

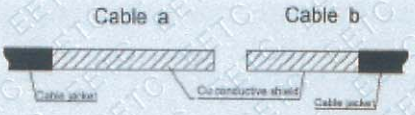
The instructions in this manual are not intended as a substitute for proper training or adequate experience in the safe operation of the equipment described. Only competent technicians, who are familiar with this equipment should install, operate and service it.

INSTALL PROCEDURE

A. Prepare Cable

STEP 1

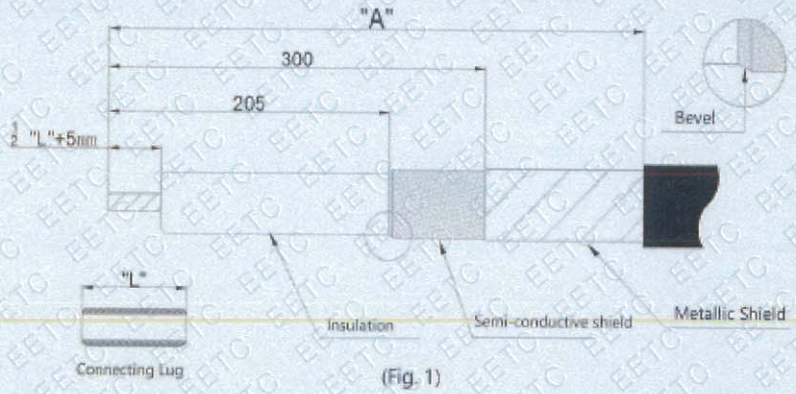
● Prepare cable using dimensions as shown in Fig.1 .



NOTE: Ensure that all parts of the cable are not damaged. If there is any irreparable damage, a new cable needs to be made .If there is any impurity or slight damage on the surface of the insulation, it can be polished with fine sandpaper.

Cable	a	b
Size "A"	750mm	400mm

Table 1

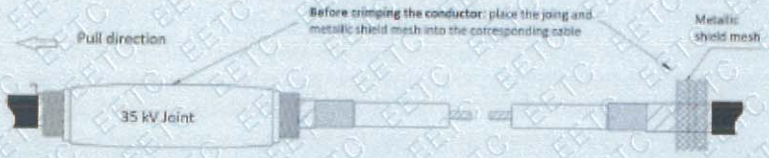


(Fig. 1)

STEP 2

- Clean the core, insulation layer, outer semiconducting layer, copper shielding layer and outer sheath of the cable.
- Cable a is sleeved into the main body of the intermediate joint, and cable b is sleeved into the metal shielding net (see Figure 2).

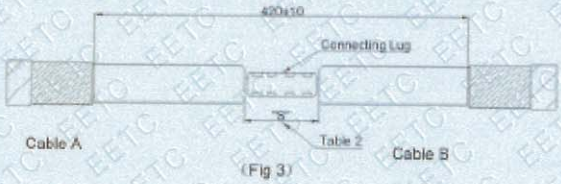
(Note: the end of the liner strip should be sheathed in the cable first).



(Fig. 2)

STEP 3

- Clean the core and connecting pipe.
- Put the cable cores into the connecting pipes and squeeze them tightly.
- Confirm that the distance S meets the requirements in Table 2, first press both ends of the connecting pipe, and then crimp the middle of the connecting pipe.



(Fig 3)

Conductor Section	Size "S"
≤150	<120mm
150-185	<130mm
≥240	<145mm

Table 2

STEP 4

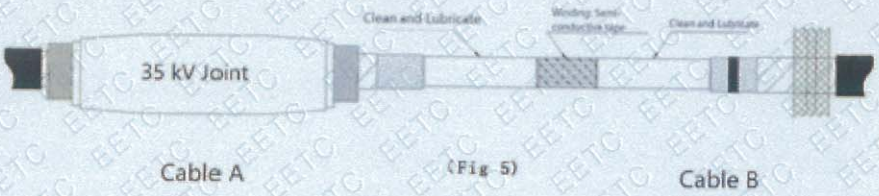
● Grind the burrs on the surface of the connecting lug to determine the center position of the insulation ends of the two cable cores, measure 245mm from the center position to the end of the shorter cable, and make a mark (see Figure 4).

Fig.4

STEP 5

● Clean the insulating layer, semi-conductive layer and the surface of the connecting pipe with a cleaning towel.

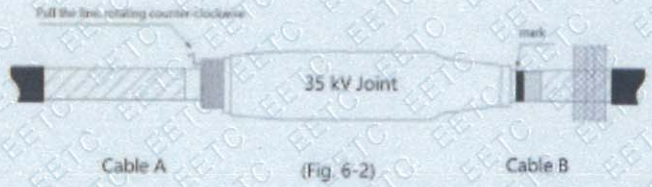
● After the cleaning agent evaporates, apply a layer of silicone grease on the insulating surface.



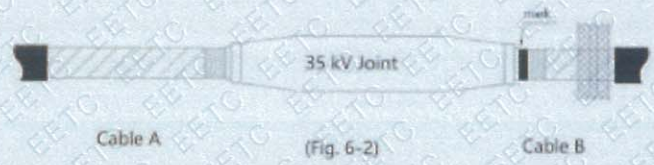
(Fig 5)

STEP 6

- Move the joint body to the center, one end of the middle joint body is flush with the mark,
- Pull out the liner strip evenly in a counterclockwise direction to shrink the main body of the joint and wipe out the extruded silicone grease (see Figure 6).



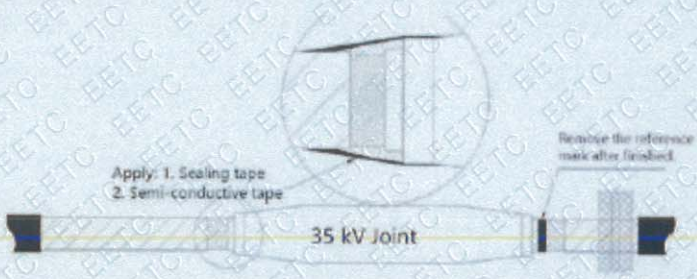
(Fig. 6-2)



(Fig. 6-2)

STEP 7

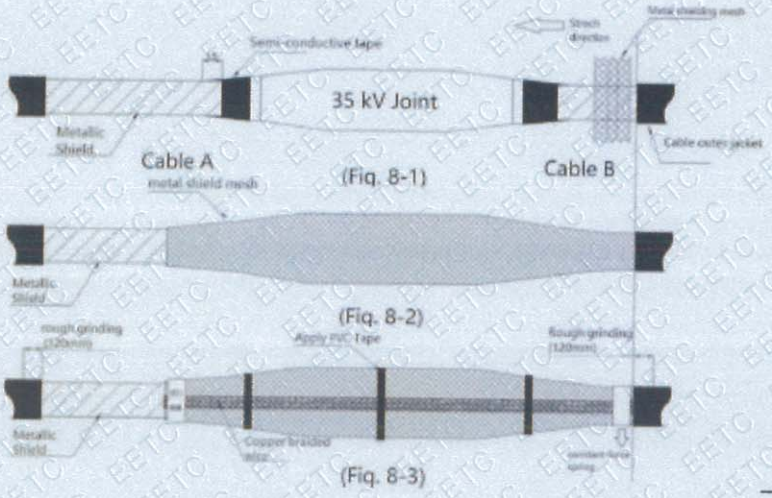
- Remove the tape fixing the copper shielding layer and clean both ends of the main body of the intermediate connector and the semi-conductive layer outside the cable.
- Starting from the end of the outer semi-conductive layer of the cable, wind the sealing tape onto the main body of the intermediate connector in a semi-lapped manner
  (Note: the steps should be filled around the bag to form a tapered transition);
- Then wrap a layer of semi-conductive tape on the sealing tape and overlap the copper shield for about 15mm (see Figure 7)



(Fig. 7)

STEP 8

- Unfold the metal shielding net, one end of the shielding net is aligned with the outer sheath of cable b, and the other end is stretched as far as possible. Then hold both ends of the short copper braid tightly with constant-force springs (see Figure 8)



STEP 9

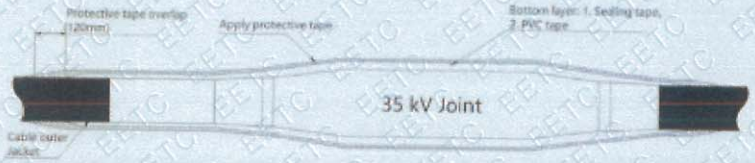
- Wrap the sealing tape from one end of the outer sheath (stretched about 1.5 times), and wrap it on the other end of the outer sheath in a half-lapped manner (both ends overlap 120mm), and wrap it back and forth 2 layers;
- Then wrap a layer of PVC adhesive tape (50mm width) outside the sealing tape in a one-third overlap manner, and it is required to completely cover the sealing tape (see Figure 9).

(Fig. 9)

STEP 10

- According to the "Armor Install Instructions ", wrap the PVC adhesive tape around the wrapping tape in a half-lap method, and wind it back and forth in 2 layers. (See Figure 10).

  Note: The intermediate joint can only be moved after the adhesive layer of the armor tape is completely cured.



(Fig. 10)