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# TEST REPORT

CEPRI-EETC08-2019-0037 (E)

Client: Shenzhen Woer Electric Technology Co., Ltd.

Object: Termination with composite insulator for 64/110 kV  
XLPE cable

Type: WYJZWFY4 64/110 1×1600

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-EETC08-2019-0037(E) Total 11 Page 2
Client	Shenzhen Woer Electric Technology Co., Ltd.	Manufacturer	Shenzhen Woer Electric Technology Co., Ltd.
Object	Termination with composite insulator for 64/110 kV XLPE cable	Type	WYJZWFY4 64/110 1×1600
Sampling procedure	Taken by client self	Serial No.	EETC08-19/01/10-002
Test Category	Type tests	Date	2019.02.18~2019.08.15
Requirements	1. GB/T 11017.3—2014 Power cables with cross-linked polyethylene insulation and their accessories for rated voltage of 110 kV ( $U_m=126$ kV) —Part 3: Accessories 2. IEC 60840(Edition 4.0): 2011 Power cables with extruded insulation and their accessories for rated voltages above 30 kV ( $U_m=36$ kV) up to 150 kV ( $U_m=170$ kV) -Test methods and requirements		
Conclusion	The termination with composite insulator for 64/110 kV XLPE cable, the type and size of which is WYJZWFY4 64/110 1×1600 taken to test by the client's own self has successfully passed the type tests specified in GB/T 11017.3—2014 and IEC 60840(Edition 4.0): 2011.		
Note	In the event of any difference in meanings, the Chinese report shall take priority over the English version.		
Compiled by: 胡庆春  倪玉林 			
Checked by: 徐明忠  Verified by: 阎孟昆 			
Approved by: 郭雄  Date of issue: 2019-09-29			

### Test Results

No.	Item	Requirements	Results	Evaluation
1	Partial discharge test at ambient temperature	No detectable discharge from the test assembly at 96 kV under a background noise	No detectable discharge was found at 96 kV under a background noise of 1.64 pC	Passed
2	Heating cycle voltage test	As per clause 1.2 of content in this report	Subjected to heating cycle voltage test, and heating cycle had been carried out 20 times	Passed
3	Partial discharge test at high temperature	No detectable discharge from the test assembly at 96 kV under a background noise	No detectable discharge was found at 96 kV under a background noise of 1.64 pC	Passed
4	Partial discharge test at ambient temperature	No detectable discharge from the test assembly at 96 kV under a background noise	No detectable discharge was found at 96 kV under a background noise of 1.64 pC	Passed
5	Lightning impulse voltage test	The assembly shall withstand without failure or flashover 10 positive and 10 negative voltage impulses of 550 kV	No breakdown or flashover occurred at 10 positive and 10 negative voltage impulses of 550 kV	Passed
6	Power frequency voltage test after lightning impulse voltage test	The assembly shall be subjected to a power frequency voltage test at 160 kV for 15 min, and no breakdown of the insulation or flashover shall occurred	No breakdown or flashover occurred at 160 kV for 15 min	Passed
7	Power frequency voltage wet withstand test	The assembly shall be subjected to a power frequency voltage test at 185 kV for 1 min, and no breakdown of the insulation or flashover shall occurred	No breakdown or flashover occurred at 185 kV for 1 min	Passed
8	Radio influence voltage test *	Radio influence voltage shall not exceed 450 $\mu$ V at 1 MHz and 81 kV	The radio influence voltage measured is 18 $\mu$ V at 1MHz and 81 kV	Passed
9	Pressure leak test	(250 $\pm$ 10) kPa for 1 h , no leakage shall occur	(250 $\pm$ 10) kPa for 1 h , no leakage occurred	Passed
10	Vacuum leak test	As per clause 1.7 of content in this report	The increased value of vacuum pressure did not exceed 10 kPa	Passed
11	Voltage test of pedestal insulator	The insulators shall be subjected to dc voltage of 25 kV for 1min and 10 positive and 10 negative impulse voltage of 37.5 kV, no breakdown or flashover shall occur	No breakdown or flashover occurred at dc 25 kV for 1 min and 10 positive and 10 negative impulses of 37.5 kV	Passed
12	Examination	As per clause 1.9 of content in this report	No signs of deterioration which could affect the system in service operation was found	Passed

Note: \* According to Q / GDW 371—2009 Technical standard for power cable line with rated voltages from 10(6) kV up to 500 kV ,the additional radio influence voltage test was performed after type tests as the requirements of the client.

## Content

**1. Test methods****1.1 Partial discharge tests**

The tests were carried out at ambient temperature and high temperature in accordance with GB/T 3048.12 and IEC 60885-3, There shall be no detectable discharge exceeding the declared sensitivity from the test object at 96 kV. The background noise is no more than 1.64 pC during these tests.

The test voltage shall be raised gradually to and held at 112 kV for 10 s and then slowly reduced to 96 kV and the partial discharge tests were carried out at 96 kV. At high temperature the test shall be performed on the sample at a conductor temperature of (95~100) °C. The conductor temperature shall be maintained within the stated temperature limits for at least 2 h.

**1.2 Heating cycle voltage test**

According to GB/T 11017.3—2014 and IEC 60840(Edition 4.0): 2011, the test assembly shall be heated by conductor current until the cable conductor reaches a temperature of (95~100) °C. The heating shall be applied for at least 8 h. The conductor temperature shall be maintained within the stated temperature limits for at least 2 h of each heating period. This shall be followed by at least 16 h of natural cooling to a conductor temperature less than or equal to 30 °C or within 10 K of ambient temperature, whichever is the higher. The cycle of heating and cooling shall be carried out 20 times. During the whole of the test period a voltage of 128 kV shall be applied to the sample.

**1.3 Lightning impulse voltage test followed by a power frequency voltage test**

The assembly shall be heated by conductor current only, until the cable conductor reaches a steady temperature of (95~100) °C. The conductor temperature shall be maintained within the stated temperature limits for at least 2 h.

The lightning impulse voltage shall be applied according to the GB/T 3048.13. The assembly shall withstand without failure or flashover 10 positive and 10 negative voltage impulses of 550 kV. After the lightning impulse voltage test, the test assembly shall be subjected to a power frequency voltage test at 160 kV for 15 min. No breakdown of the insulation or flashover shall occur.

**1.4 Power frequency voltage wet withstand test**

The test shall be carried out in accordance with GB/T 16927.1 at a power frequency voltage of 185 kV for 1 min. no breakdown or flashover shall occur.

**1.5 Radio influence voltage test**

The radio influence voltage test on the sample shall be measured according to GB/T 11604 at 1 MHz with the applied voltage of 81 kV.

**1.6 Pressure leak test**

After the sample was installed, the sample shall be filled to a pressure of (250±10) kPa and maintained for 1 h at ambient temperature, no gas leakage shall occur at the sealed surface.

**1.7 Vacuum leak test**

After the sample was installed, the sample at environment temperature vacuum to the residual pressure is 10 kPa and maintained for 1 h. At the end of the test, the increased value of vacuum pressure shall not exceed 10 kPa.

**1.8 Voltage test of pedestal insulator**

After the sample was tested, dc voltage of 25 kV for 1min and impulse voltage test of 37.5 kV at 10 positive and 10 negative shall be performed on the insulators, no breakdown or flashover shall occur.

**1.9 Examination**

Examination of the accessories by dissection of a sample and, whenever possible, of the accessories by dismantling with normal or corrected vision without magnification shall reveal no signs of deterioration (e.g. electrical degradation, leakage, corrosion or harmful shrinkage) which could affect the system in service operation.

**2. Test data**

The values of lightning impulse voltages on the test assembly after heating cycle voltage test (at high temperature, 550 kV, ±3 % tolerance)

Ambient temperature: 13.0 °C    Relative humidity: 45 %    Barometric pressure: 0.1012 MPa

unit: kV

Positive voltages	546	548	544	550	548	547	547	549	552	552
Negative voltages	549	549	548	545	552	552	551	551	550	550

## Appendix A Object Parameters

### A.1 Specification of sample

#### A.1.1 Sample state

The sample was manufactured in January, 2019, and was received on January 10, 2019 at Power Cable Quality Inspection Station of Power Industry Quality Inspection and Test Center for Electric Equipment, and it was in good condition without breakage.

#### A.1.2 Related information of sample

The material of connector is copper T<sub>2</sub>, the material used for stress relief cone is EPDM rubber, the filler for the insulation in termination is polyisobutylene, and the cable conductor is compacted with the connector by pressure.

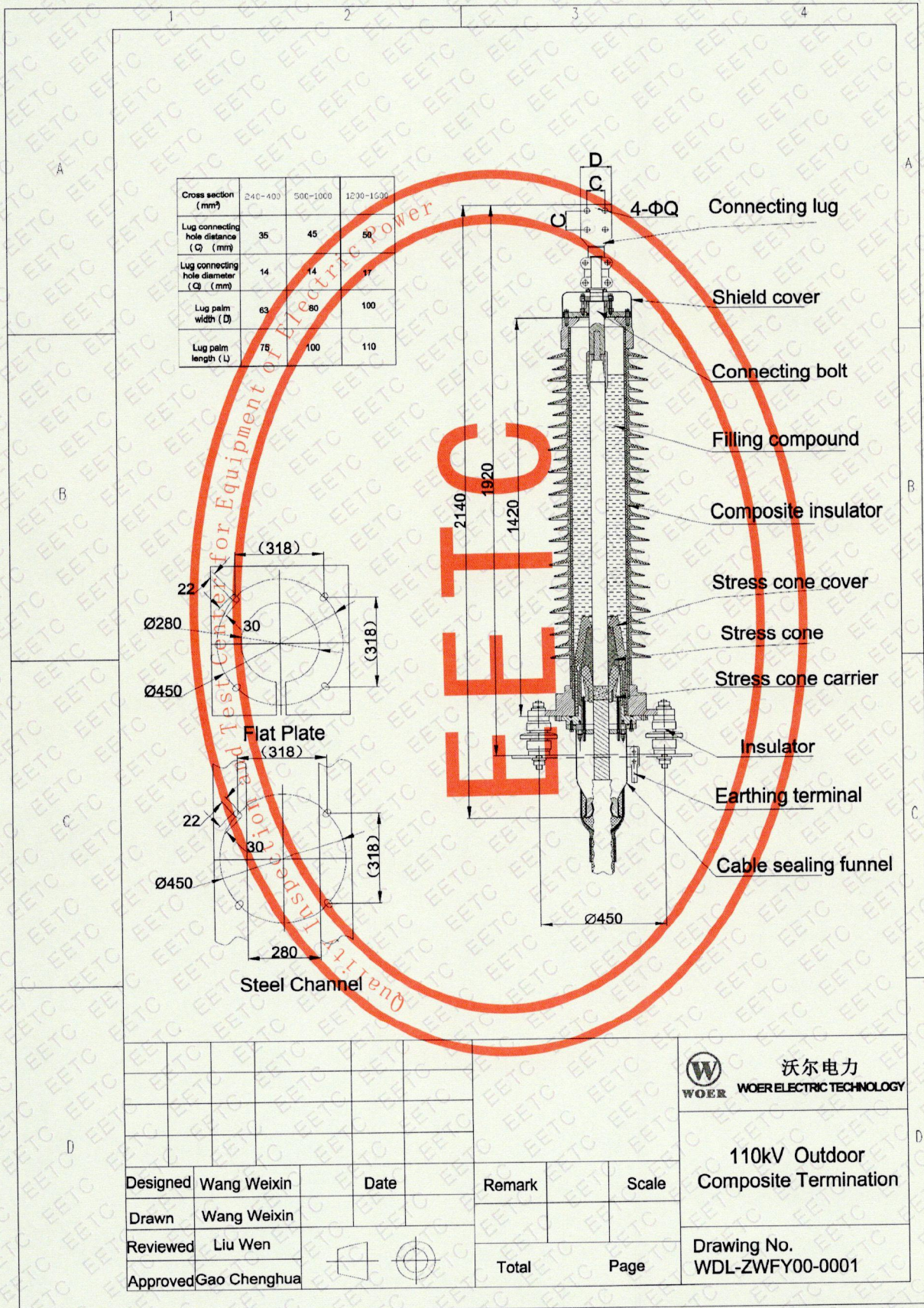
#### A.1.3 Installation description

The sample to be tested has been installed by the manufacturer on a XLPE insulated single core cable with rated voltage 64/110 kV and having a cross-section of 1600 mm<sup>2</sup>, the type and size of cable is YJLW03-Z 64/110 1×1600.

### A.2 Photograph of sample



A.3 The dimensions of main construction of the sample tested



110kV Outdoor Composite Termination

Drawing No. WDL-ZWFY00-0001

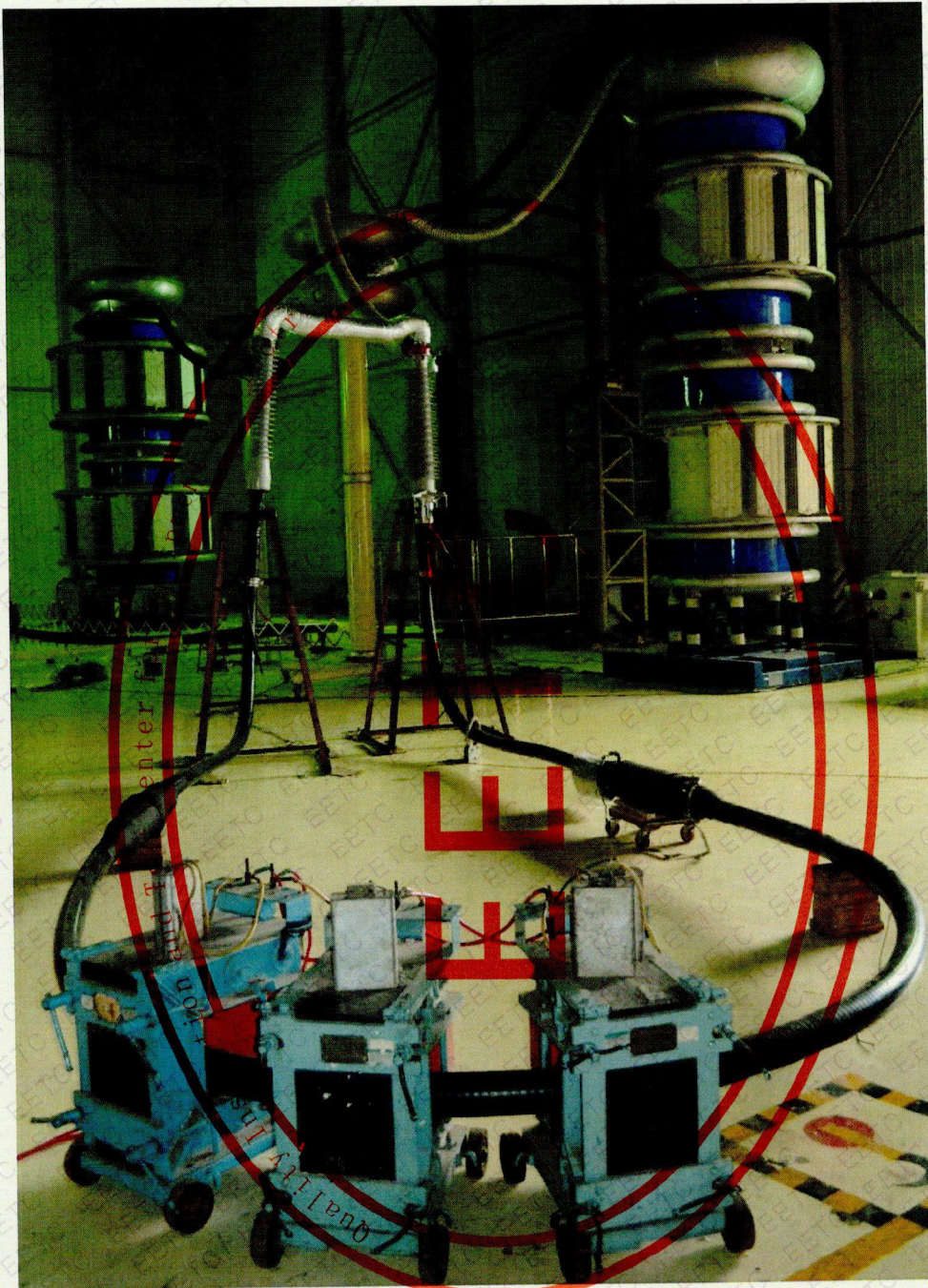
Designed	Wang Weixin	Date		Remark	Scale
Drawn	Wang Weixin				
Reviewed	Liu Wen				
Approved	Gao Chenghua			Total	Page

## Appendix B The Main Test Devices

Sequence	Name of the equipment and instruments Type/Size	Serial No.	Full-scale range	Uncertainty / Accuracy	Verification / Calibration authority	Term of validity
1	RSZ-800-6-50 Corona-free series-resonant test system	204488	(0~800) kV	—	—	—
2	KKF-800-5 Power frequency voltage divider	454485	(0~800) kV	Class 1	National Meterage Center of High Voltage and Heavy Current	2020.07.21
3	Digital partial discharge detectot	2013-023	(0.1~999) pC	10 %	National Meterage Center of High Voltage and Heavy Current	2019.11.04
4	CJDY-3000/600 Impulse voltage generator	01	(0~3000) kV	—	—	—
5	CJDY-3000 HV divider for impulse voltage divider measurement	001	(0~3000) kV	Class 1	National Meterage Center of High Voltage and Heavy Current	2020.07.07
6	HiAS1214 Digital impulse Voltage analysis system	20050512	(0~3000) kV	Class 3	National Meterage Center of High Voltage and Heavy Current	2020.05.20
7	272 Wet and dry bulb hygrometer	304	(0~50) °C	General	Hubei Meteorological Metrology Station	2019.10.11
8	ESHS10 Radio influence voltage receiver	EMI-02	10kHz~3 GHz	±1 dB	Wuhan Measurement Station of CSIC	2020.08.01

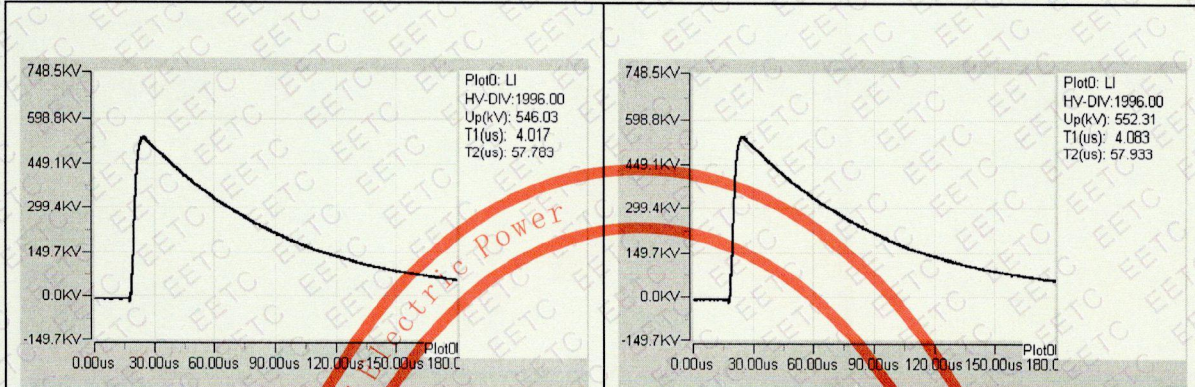


Appendix C Test Circuit Diagrams



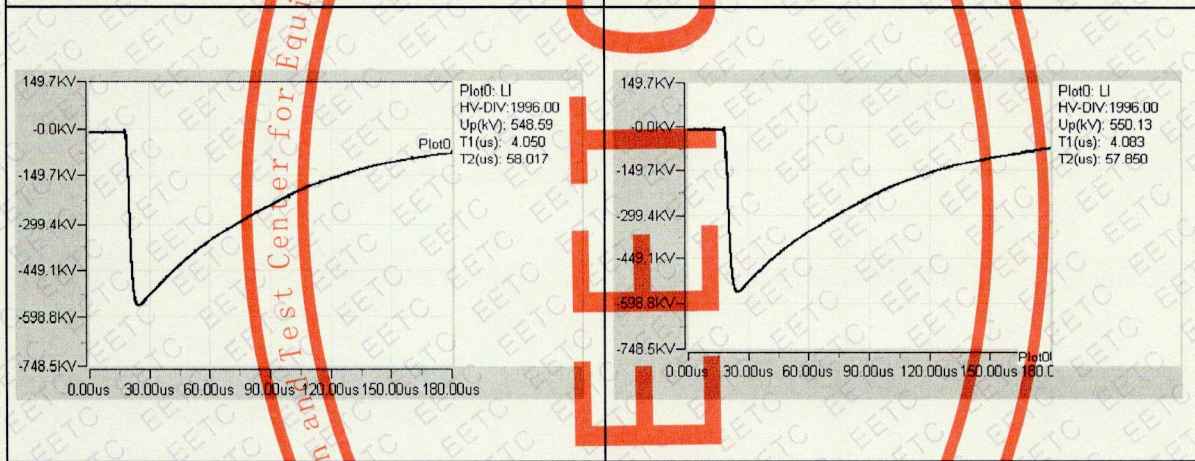
Appendix D Waveform

D.1 Oscillograms of the lightning impulse voltages waveform



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

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



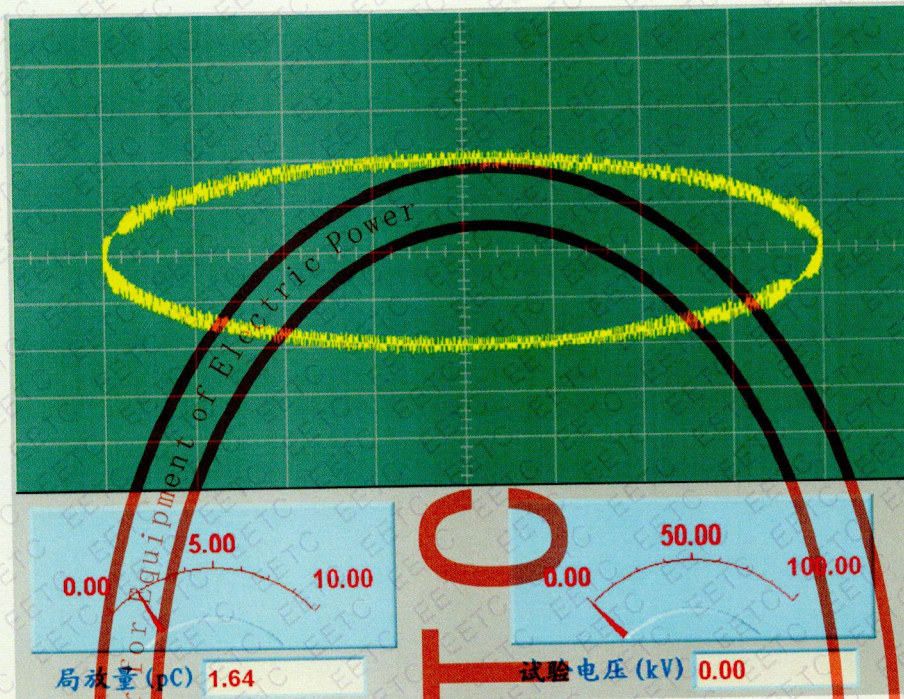
The 1<sup>st</sup> negative impulse waveform

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

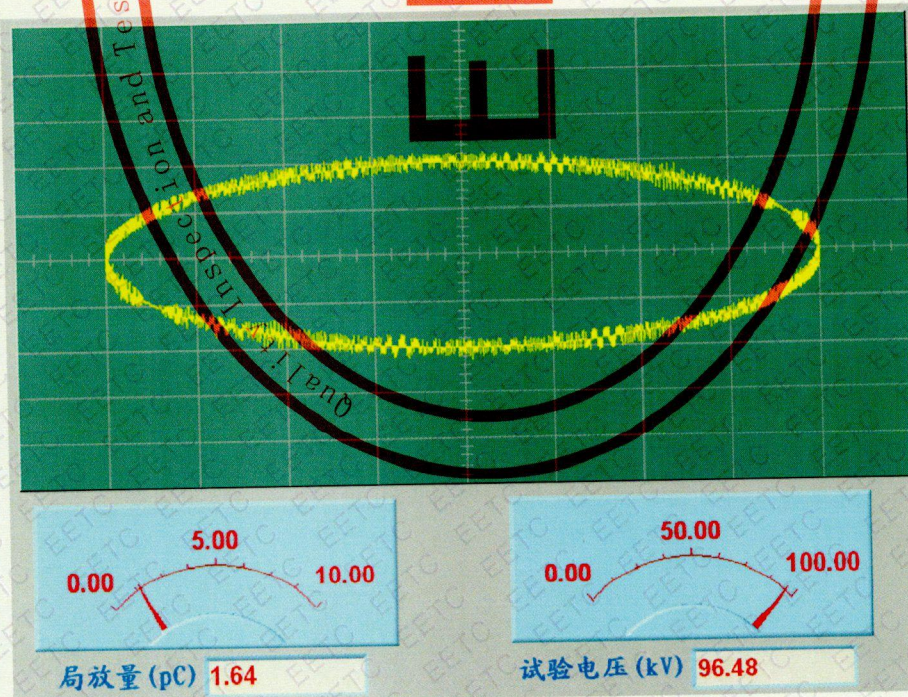
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### D.2 Oscillograms of partial discharges

#### D.2.1 The background noise during partial discharge tests



#### D.2.2 The oscillogram of partial discharges at 96 kV (After heating cycle voltage test at high temperature)



## Appendix E Identification of test cable

Rated voltage $U_0/U(U_m)$ kV		64/110 (126) kV
Construction	Core	Single core
Conductor	Material	Copper TR
	Construction	Milliken conductor
	Cross section	1600 mm <sup>2</sup>
	Diameter	48.3 mm
	Average thickness of conductor screen	1.9 mm
Insulation	Material	XLPE
	Average thickness	16.2 mm
	Diameter	85.9 mm
Screen	Average thickness of insulation screen	1.0 mm
	Diameter of insulation screen	87.9 mm
Cushion and longitudinal water impermeable barrier	Material	Two layers of semi-conducting elastic water impermeable swell tape
Corrugated metallic sheath	Material	Aluminum
	Average thickness	2.3 mm
	Manufacturing technology of metallic sheath	Seam welded corrugated aluminum sheath
Oversheath	Material	PE
	Average thickness	5.6 mm
	Diameter	119.8 mm
Capacitance		256 pF/m
Outer diameter of complete cable		119.8 mm
Marking of cable		江苏上上电缆集团有限公司 YJLW03-Z 64/110 kV 1×1600 HA20180827.03