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XIHARI

No. 190038B

TEST REPORT

APPARATUS: YH10W-216/562W Polymer-housed metal-oxide surge arresters without gaps

CLIENT: NanYang JinNiu Electric Co.,Ltd.

TEST CLASSIFICATION: Type Test

XI'AN HIGH VOLTAGE APPARATUS RESEARCH INSTITUTE CO., LTD.

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Summary

Apparatus		YH10W-216/562W Polymer-housed metal-oxide surge arresters without gaps
Client	Name	NanYang JinNiu Electric Co.,Ltd.
	Connection	Add: South of Zhongyuan Road, Industrial Cluster Zone, Tongbai County, NanYang Henan Province (474750) Tel: 0377-68356606 Fax: 0377-68356608
Manufacturer		NanYang JinNiu Electric Co.,Ltd.
Manufacture date		2019.01
Manufacture serial No.		19101

Main technical data assigned by the manufac-turer				
Nominal voltage U_n		$kV_{r.m.s.}$	220	
Arrester rated voltage U_r		$kV_{r.m.s.}$	216	
Arrester continuous operating voltage U_c		$kV_{r.m.s.}$	168	
A.C. reference voltage($I_{a.c.ref}$=1mA)	≥	$kV_p/\sqrt{2}$	216	
DC reference voltage($I_{d.c.ref}$=1mA)	≥	$kV_{d.c.}$	314	
Nominal discharge current I_n		kA_p	10	
Lightning impulse residual voltage	≤	kV_p	562	
Steep current impulse residual voltage	≤	kV_p	630	
Switching impulse residual voltage	≤	kV_p	478	
Line discharge class		class	3	
Shape and dimension		"Product drawings" of page 42、43 and "Photographs "of page 44 of this report.		
The size of resistors		mm	Φ52×20	
Materials and colors of housing		red, silicone rubber		

The tested object is guaranteed by the manufacturer to comply with the following technical documents and drawings	Q/JN 1001-2018 Enterprise standard of polymer-housed metal-oxide surge arresters without gaps
	JN-1005-2018 Type tests outline for YH10W-216/562W Polymer-housed metal-oxide surge arresters without gaps
	JN.1005.2019 Outline Drawing of YH10W-216/562W Polymer-housed metal-oxide surge arresters
	JN.2005.2019 Outline Drawing of YH10W-216/562W Polymer-housed metal-oxide surge arresters unit without gaps
Note	1. Serial Number: Arresters No.1; Housing No.W; Sections No. B1~No.B3. 2. Client express:The DC reference voltage $U_{1mA.DC}$≤320kV_{DC}, load rate η =85%, the arrester consists of two units in series, the unit is arrester YH10WZ-108/281. The arrester YH10W-216/562W and the arrester YH10WZ-108/281 (in test report No.190007B) are of the same series. The two products have the same structure and dimension、the size of resistors、 test technical requirements, so the following test project data of product YH10W-216/562W: long duration current impulse withstand test、operating duty test、power-frequency voltage-versus-time characteristics test、arrester weather ageing test、arrester moisture ingress test, come from report of No.190007B.
Tests witnessed by:	Zhang Yu
Date of sample arrived:	2019-01-22
Date of tests:	From 2019-02-26 To 2019-07-31
Address of tests:	All the tests are performed at No.642, Daqing Area.

Test Conclusion

Client: NanYang JinNiu Electric Co.,Ltd.
Type: YH10W-216/562W
Apparatus: Polymer-housed metal-oxide surge arresters without gaps
Manufacturer: NanYang JinNiu Electric Co.,Ltd.
Test Classification: Type test
Tests have been performed:

Visual inspection of polymer housing
Inspection of creepage distance
Direct current reference voltage test
Leakage current at $0.75U_{d.c.ref}$ test
Power frequency reference voltage test
Continuous current test
Internal partial discharge test
Radio interference voltage test
Seal test
Residual voltage test
Long duration current impulse withstand test [Class 3 line discharge,18 times]
Operating duty test [4/10μs,100kA, 2 times]
Power-frequency voltage-versus-time characteristics test
Insulation withstand tests on the arrester housing
Bending moment test
Arrester moisture ingress test
Arrester weather ageing test
Environment test

Test Judge:

GB/T 11032-2010 Metal-oxide surge arresters without gaps for a.c. systems (IEC 60099-4:2006, MOD)

Conclusion:

All the tests above satisfied the requirements of standards.

Validity:

This test report from the date of approval, full three years must be required content of the regular test reports, to continue the effectiveness this report.

Translated by: Date: 2019-08-14
Checked by: Date: 2019-08-15
Approved by: Date: 2019-08-19

XIHARI

Visual Inspection of Polymer Housing

Date: 2019-03-04

Atmospheric conditions: P=97.6kPa t=13.3℃ RH=38%

Serial No.: 1~3

By checked, no visible defects on the polymer housing surface.

Test result: Passed.

Inspection of Creepage Distance

Date: 2019-03-04

Atmospheric conditions: P=97.6kPa t=13.3℃ RH=38%

Max. operating voltage of equipment U_m=126kV

Serial No.	Creepage distance (mm)	Ratio of creepage distance (mm/kV)
1	8390	33.3
Req.	/	≥31

Test result: Passed.

Note:Ratio of creepage distance= Actual measured creepage distance/U_m.

Direct Current Reference Voltage Test

Date: 2019-03-15

Atmospheric conditions: P=98.4kPa t=16.8℃ RH=34%

Serial No.	D.C. reference voltage $U_{d.c.ref}$ at $I_{d.c.ref}$ =1mA (kV)
1	318.3
Req.	≥314

Test result: Passed.

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Leakage Current at $0.75U_{d.c.ref}$ Test

Date: 2019-03-15

Atmospheric conditions: P=98.4kPa t=16.8℃ RH=34%

Serial No.	Leakage current at $0.75U_{d.c.ref}$ (μA)
1	6
Req.	≤50

Test result: Passed.

Power Frequency Reference Voltage Test

Date: 2019-03-15

Atmospheric conditions: P=98.4kPa t=16.8℃ RH=34%

Serial No.	A.C. reference voltage $U_{a.c.ref}$ at $I_{a.c.ref}$=1mA(peak/√2) (kV)
1	226.6
Req.	≥216

Test result: Passed.

Continuous Current Test

Date: 2019-03-15

Atmospheric conditions: P=98.4kPa t=16.8℃ RH=34%

Serial No.	Applied U_c (kV)	Continuous current	
		I_r(Peak) (μA)	I_x(r.m.s.) (μA)
1	168.3	120	525
Req.	168	≤300	≤1000

Test result: Passed.

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Internal Partial Discharge Test

Date: 2019-03-15

Atmospheric conditions: P=98.4kPa t=16.8℃ RH=34%

Serial No.	Applied U_r (kV)	Continuous time at U_r (s)	Applied $1.05U_c$ (kV)	PD value (pC)
1	216.4	10	176.8	4.5
Req.	216	2~10	176.4	≤ 10

Test result: Passed.

Radio Interference Voltage Test

Date: 2019-03-15

Atmospheric conditions: P=98.4kPa t=16.8℃ RH=34%

Testing frequency:1.0MHz

Serial No.	Applied $1.05U_c$ (kV)	Field density (dB)	RIV value (μV)
1	177.1	40.3	103.5
Req.	176.4	/	≤2500

Test result: Passed.

Seal Test

Date: 2019-05-22~2019-05-24

1 Immersed in boiling water test

NaCl content of boiling water is 1kg/m^3

Serial No.	Test items	Keep time (h)	Req. (h)
1	In boiling water	42	42
	Immersed in water	/	/
	Placed in air	6	≤8

Seal Test

Date: 2019-03-15~2019-05-24

2 Verification test

2.1 Direct current reference voltage at $I_{d.c.ref}$=1mA

Serial No.	Before (kV)	After (kV)	Req. of $U_{1mA.DC}$ (kV)	Change (%)	Req. of change (%)
1	318.3	317.7	≥314	0.2	≤5

2.2 Leakage current at $0.75U_{d.c.ref}$

Serial No.	Before (μA)	After (μA)	Req. of I_{lek} (μA)	Change (μA)	Req. of change (μA)
1	6	8	≤50	2	≤20

2.3 Internal partial discharge at $1.05U_c$

Serial No.	Before (pC)	After (pC)	Req. of PD (pC)	Change (pC)	Req. of change (pC)
1	4.5	4.9	≤10	0.4	≤10

Test result: Passed.

Note: Seal test、immersed in boiling water test and verification test of bending moment test combined.

Residual Voltage Test

Date: 2019-03-15

Atmospheric conditions: P=98.4kPa t=16.8℃ RH=34%

I_n=10kA Ratio n=320/4.26=75.12

1. Lightning impulse residual voltage test

Typical oscillogram see Fig. 190038B 3-1~190038B 3-3.

Serial No.	$U_{1mA.DC}$ (kV)	Residual voltage of sections (kV)			Residual voltage of arrester at I_n (kV)	Max. residual voltage of arrester at I_n (kV)	Req. (kV)
		$0.5I_n$ (kA)	I_n (kA)	$2I_n$ (kA)			
		5	10	20			
B1	4.26	7.03	7.37	8.07	553.6	553.6	≤562
B2	4.26	7.05	7.35	8.09	552.1		
B3	4.26	7.03	7.36	8.08	552.9		

Residual Voltage Test

Date: 2019-03-15

Atmospheric conditions: P=98.4kPa t=16.8℃ RH=34%

2. Steep current impulse residual voltage test

Serial No.	$U_{1mA.DC}$ (kV)	Residual voltage at I_n of sections (kV)	Residual voltage of arrester at I_n (kV)	Max. residual voltage of arrester at I_n (kV)	Req. (kV)
B1	4.26	7.88	591.9	591.9	≤630
B2	4.26	7.86	590.4		
B3	4.26	7.86	590.4		

Note:

A steep current impulse at 10kA is applied to a metal block having the same dimensions as the resistor samples, the peak value on the metal block is 0.15kV, 0.15/7.86=1.9%≤2%,so no inductive correction is required.

Residual Voltage Test

Date: 2019-03-15

Atmospheric conditions: P=98.4kPa t=16.8℃ RH=34%

3. Switching impulse residual voltage test

Serial No.	$U_{1mA.DC}$ (kV)	Residual voltage at 500A of sections (kV)	Residual voltage of arrester at 500A (kV)	Max. residual voltage of arrester at 500A (kV)	Req. (kV)
B1	4.26	5.57	418.4	418.4	≤478
B2	4.26	5.55	416.9		
B3	4.26	5.57	418.4		

Test result: Passed.

Long Duration Current Impulse Withstand Test

Date: 2019-07-15

Atmospheric conditions: P=95.7kPa t=31.8℃ RH=47 %

Typical oscillogram see Fig. 190038B 9-4~190038B 9-6.

Serial No.			B4	B5	B6	Req.
$U_{1mA.DC}$		(kV)	4.38	4.38	4.38	/
U_{sf}		(kV)	3.01	3.01	3.01	3~6
8/20μs,U_{10kA}, before		(kV)	7.55	7.57	7.55	/
30/60μs,U_{125A},before		(kV)	5.54	5.57	5.55	/
W		(kJ)	9.81（class 3 line discharge）			
T		(μs)	2417（class 3 line discharge）			2400(100%~120%)
1st.	Current	(A)	692	689	695	/
	Voltage	(kV)	5.88	5.92	5.89	/
	Energy	(kJ)	9.83	9.86	9.89	9.81 (90%~110%)
2nd.	Current	(A)	688	675	686	/
	Voltage	(kV)	5.92	6.06	5.96	/
	Energy	(kJ)	9.84	9.89	9.88	9.81(100%~110%)
3rd.	Current	(A)	685	671	678	/
	Voltage	(kV)	5.93	6.09	5.99	/
	Energy	(kJ)	9.82	9.88	9.82	9.81(100%~110%)
4th.	Current	(A)	693	692	694	/
	Voltage	(kV)	5.88	5.93	5.90	/
	Energy	(kJ)	9.85	9.92	9.90	9.81(100%~110%)
5th.	Current	(A)	685	678	683	/
	Voltage	(kV)	5.93	6.08	5.97	/
	Energy	(kJ)	9.82	9.96	9.86	9.81(100%~110%)
6th.	Current	(A)	683	672	678	/
	Voltage	(kV)	5.95	6.12	5.99	/
	Energy	(kJ)	9.82	9.94	9.82	9.81(100%~110%)

Long Duration Current Impulse Withstand Test

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Serial No.		B4	B5	B6	Req.
7th.	Current (A)	692	692	694	/
	Voltage (kV)	5.92	5.93	5.90	/
	Energy (kJ)	9.90	9.92	9.90	9.81(100%~110%)
8th.	Current (A)	678	673	672	/
	Voltage (kV)	6.01	6.08	6.05	/
	Energy (kJ)	9.85	9.89	9.83	9.81(100%~110%)
9th.	Current (A)	675	663	668	/
	Voltage (kV)	6.05	6.13	6.09	/
	Energy (kJ)	9.87	9.82	9.83	9.81(100%~110%)
10th.	Current (A)	689	696	682	/
	Voltage (kV)	5.92	5.96	5.97	/
	Energy (kJ)	9.86	10.03	9.84	9.81(100%~110%)
11th.	Current (A)	676	673	668	/
	Voltage (kV)	6.03	6.09	6.08	/
	Energy (kJ)	9.85	9.91	9.82	9.81(100%~110%)
12th.	Current (A)	673	668	665	/
	Voltage (kV)	6.07	6.11	6.13	/
	Energy (kJ)	9.87	9.86	9.85	9.81(100%~110%)
13th.	Current (A)	695	691	682	/
	Voltage (kV)	5.89	5.98	5.97	/
	Energy (kJ)	9.89	9.99	9.84	9.81(100%~110%)
14th.	Current (A)	678	672	675	/
	Voltage (kV)	6.05	6.09	6.05	/
	Energy (kJ)	9.91	9.89	9.87	9.81(100%~110%)

Long Duration Current Impulse Withstand Test

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Serial No.		B4	B5	B6	Req.
15th.	Current (A)	668	665	668	/
	Voltage (kV)	6.08	6.15	6.10	/
	Energy (kJ)	9.82	9.88	9.85	9.81(100%~110%)
16th.	Current (A)	689	685	688	/
	Voltage (kV)	5.91	6.02	5.99	/
	Energy (kJ)	9.84	9.97	9.96	9.81(100%~110%)
17th.	Current (A)	671	668	678	/
	Voltage (kV)	6.05	6.11	6.08	/
	Energy (kJ)	9.81	9.86	9.96	9.81(100%~110%)
18th.	Current (A)	668	659	665	/
	Voltage (kV)	6.11	6.17	6.14	/
	Energy (kJ)	9.86	9.83	9.87	9.81(100%~110%)
Withstand times		18	18	18	18
Checking samples		All right	All right	All right	All right
8/20μs, U_{10kA}, after (kV)		7.51	7.64	7.59	/
Change of U_{10kA} (%)		0.5	0.9	0.5	≤5

Test result: Passed. (Test data come from the No.190007B test report.)

Note:

1) Each sample shall be subjected to 18 current impulses in six groups of three impulse, with time between impulses within a group of 50s to 60s and time between groups sufficient for cooling to ambient temperature.
2) This test is the class 3 line discharge withstand test.

Operating Duty Test

Date: 2019-02-26~2019-04-09

1、Accelerated ageing test

Parameters of arrester

U_r = 108kV U_c = 84kV U_{1mA}≥157kV load rate η=85%（Declared by client）

Required voltage value $U_{ct}=(\eta \times U_{1mA})/\sqrt{2}$

Testing time:1000h+100h; Actual time:1001h

Required testing temperature:115℃±4K

Serial No.	A1	A2	A3	Req.
U_{1mA} (kV)	4.14	4.14	4.14	/
U_{ct} (kV)	2.49	2.49	2.49	2.49

Time	Power losses (W)			Temperature (℃)
	A1	A2	A3	
2019.02.26 16:00	2.072	2.033	2.058	115.1
2019.02.26 17:00	2.345	2.252	2.249	115.3
2019.02.26 19:00	2.212	2.223	2.226	115.4
2019.03.02 23:00	2.206	2.212	2.222	115.3
2019.03.07 03:00	2.203	2.208	2.212	115.3
2019.03.11 07:00	2.172	2.178	2.165	115.2
2019.03.15 11:00	2.136	2.132	2.141	115.0
2019.03.19 15:00	2.112	2.108	2.102	115.4
2019.03.23 19:00	2.025	2.013	2.011	115.2
2019.03.27 23:00	1.934	1.943	1.937	115.2
2019.04.01 03:00	1.927	1.932	1.923	115.2
2019.04.05 07:00	1.918	1.925	1.916	115.1
2019.04.09 11:00	1.886	1.916	1.905	115.2
P_{1ct}	2.345	2.252	2.249	$P_{2ct}<1.1\times P_{3ct}$ $P_{1ct}>P_{2ct}$
P_{2ct}	1.886	1.916	1.905	
P_{3ct}	1.886	1.916	1.905	

Operating Duty Test

Date: 2019-04-23

Atmospheric conditions: P=96.0kPa t=22.8℃ RH=69%

2、Switching impulse operating duty test

Serial No.		B7	B8	B9
$U_{1mA.DC}$	(kV)	8.20	8.20	8.20
8/20μs, $U_{10kA,}$ before	(kV)	14.62	14.60	14.66
30/60μs,U_{125A},before	(kV)	10.42	10.40	10.42
U_{sr}	(kV)	5.64	5.64	5.64
U_{sc}	(kV)	4.38	4.38	4.38
Conditioning test :Applied power frequency voltage 1.2U_{sc}=5.26kV, 8/20μs,I_n=10kA, 20 times, 60°before peak.				
Current (kA)	1st.	10.12	10.24	10.00
	2nd.	10.11	10.35	10.46
	3rd.	10.28	10.18	10.28
	4th.	10.47	10.16	10.15
	5th.	10.20	10.35	10.40
	6th.	10.34	10.49	10.45
	7th.	10.38	10.27	10.33
	8th.	10.01	10.45	10.39
	9th.	10.23	10.32	10.23
	10th.	10.24	10.32	10.43
	11th.	10.48	10.25	10.37
	12th.	10.09	10.42	10.06
	13th.	10.19	10.18	10.07
	14th.	10.39	10.04	10.10
	15th.	10.42	10.46	10.47
	16th.	10.05	10.03	10.31
	17th.	10.44	10.02	10.12
	18th.	10.17	10.31	10.29
	19th.	10.04	10.31	10.08
	20th.	10.26	10.49	10.14

Operating Duty Test

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Serial No.			B7	B8	B9
4/10μs high current impulse withstand	1st. current	(kA)	100.3	99.9	99.6
	Cool to 23℃				
	2nd. current	(kA)	104.7	95.8	97.5
Heated to 60℃,applied 2 times class 3 line discharge withstand					
Applied class 3 line discharge impulse energy		(kJ)	18.36(100%~110%)		
Virtual time T		(μs)	2417 [2400(100%~120%)]		
1st. class 3 line discharge impulse energy	Current	(A)	690	696	692
	Voltage	(kV)	11.44	11.54	11.5
	Energy	(kJ)	19.08	19.41	19.23
2nd.class 3 line discharge impulse energy	Current	(A)	679	674	681
	Voltage	(kV)	11.58	11.62	11.62
	Energy	(kJ)	19.00	18.93	19.13
Applied power frequency voltage within 42ms					
Applied U_{sr}		(kV)	5.64	5.64	5.64
Keeping time at U_{sr}		(s)	10	10	10
Applied U_{sc}		(kV)	4.38	4.38	4.38
Power losses at U_{sc} (W)	1st. minute		6.15	6.27	6.11
	15th. minute		3.03	2.98	3.02
	30th. minute		1.96	1.88	1.89
Checking samples			All right	All right	All right
8/20μs, U_{10kA} after		(kV)	14.60	14.62	14.62
Change U_{10kA} (Req.≤5)		(%)	0.1	0.1	0.3

Test result: Passed. (Test data come from the No.190007B test report.)

Power-frequency Voltage-versus-time Characteristics Test

Date: 2019-04-23

Atmospheric conditions: P=96.0kPa t=22.8℃ RH=69%

Serial No.			B10	B11	B12	B13
$U_{1mA.DC}$		(kV)	8.28	8.28	8.28	8.28
U_{sr}		(kV)	5.70	5.70	5.70	5.70
U_{sc}		(kV)	4.44	4.44	4.44	4.44
30/60μs,U_{125A}		(kV)	10.46	10.50	10.50	10.48
Heated to 60℃, applied 2 times class 3 line discharge withstand						
Applied class 3 line discharge impulse energy (kJ)			18.63 (100%~110%)			
Virtual time T		(μs)	2417 [2400(100%~120%)]			
1st. class 3 line discharge impulse energy	Current	(A)	682	685	679	689
	Voltage	(kV)	11.66	11.62	11.7	11.62
	Energy	(kJ)	19.22	19.24	19.20	19.35
2nd.class 3 line discharge impulse energy	Current	(A)	668	669	663	668
	Voltage	(kV)	11.76	11.62	11.84	11.72
	Energy	(kJ)	18.99	18.79	18.97	18.92
Over-voltage times K			1.2	1.1	1.05	1.0
Applied over-voltage KU_{sr}		(kV)	6.84	6.28	5.98	5.70
Keeping time			0.1s	10s	30s	1200s
Applied U_{sc}		(kV)	4.44	4.44	4.44	4.44
Keeping time at U_{sc}		(min)	30	30	30	30
Checking samples			All right	All right	All right	All right
Req.	Over-voltage times K		1.2	1.1	1.05	1.0
	Keeping time		0.1s	10s	30s	1200s

Test result: Passed. (Test data come from the No.190007B test report.)

Insulation Withstand Tests on The Arrester Housing

Date: 2019-07-16

Atmospheric conditions: P= 96.1 kPa t= 29.5℃ RH= 66 %

1.Lightning impulse voltage withstand test

U_e=950kV Arc distance =2364mm

Correction factor: K_t=1.007

Applied voltage after adj. $U_s = U_e \times K_t$ =956.7kV

Serial No.	U_s (kV_p)		Test value U_t (kV)						Times	Result
W	956.7	+	1st.~ 5th.	963.6	965.2	967.8	961.8	963.8	15	No puncture No flashover
			6th.~ 10th.	963.0	957.9	959.4	959.0	961.5		
			11th.~ 15th.	964.7	963.8	960.5	961.5	961.6		
		-	1st.~ 5th.	959.8	964.6	961.4	964.7	967.4	15	No puncture No flashover
			6th.~ 10th.	958.1	966.5	960.2	967.0	966.6		
			11th.~ 15th.	964.2	965.9	959.0	958.0	963.1		

XIHARI	Test Report	No.190038B
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Insulation Withstand Tests on The Arrester Housing

Date: 2019-07-16

Atmospheric conditions : P= 96.1 kPa t= 29.5℃ RH= 66 %

2. Power-frequency withstand voltage test

Arc distance L=2364mm t_{water}=26.5℃

Rain conductivity: 105.1μS/cm

Rainfall: horizon: 1.29mm/min, vertical: 1.39mm/min

Wet: Correction factor: K_1= 0.991

U_e=395kV Applied voltage after adj. $U_s = U_e \times K_1$ =391.4kV

Serial No.	Test voltage U_t ($kV_{r.m.s.}$)		Keeping time (min)	Result
W	Wet	392.2	1	No puncture No flashover

Test result: Passed.

Bending Moment Test

Date: 2019-07-29

1、Bending moment test

F_1=980 N, F_2 = 417.2 N, Applied bend load F=2.5 × (F_1+F_2/2)= 2971.5 N（Applied on the arrester top.）

Serial No.	Bending moment F (N)	Keeping time (s)	Offset Max (mm)	Offset (mm)	Offset/Housing height (%)	Checking samples
1	3.0	90	730.5	102.0	3.7	No suddenly change
Req.	2.9715	60~90	/	/	≤5	No suddenly change

Bending Moment Test

Date: 2019-07-29

Atmospheric conditions: P=96.4kPa t=30.8℃ RH=59%

2. Sealing check(hot water immersion method)

Serial No.	Hot water temperature (℃)	Environment temperature (℃)	Temperature difference (K)	Immersion time (min)	Checking samples
1	77	30.8	46.2	35	There is no continuity air bubbles
Req.	/	/	45±5	≥30	There is no continuity air bubbles

Bending Moment Test

Date: 2019-07-29~2019-07-31

3. Immersed in boiling water test

NaCl content of boiling water is 1kg/m^3

Serial No.	Test items	Keep time (h)	Req. (h)
1	In boiling water	42	42
	Immersed in water	/	/
	Placed in air	6	≤8

Bending Moment Test

Date: 2019-07-01~2019-07-31

4. Verification test

4.1. Direct current reference voltage at $I_{d.c.ref}$ =1mA

Serial No.	Before (kV)	After (kV)	Req. of $U_{1mA.DC}$ (kV)	Change (%)	Req. of change (%)
1	318.3	317.7	≥314	0.2	≤5

4.2. Leakage current at $0.75U_{d.c.ref}$

Serial No.	Before (μA)	After (μA)	Req. of I_{lek} (μA)	Change (μA)	Req. of change (μA)
1	6	8	≤50	2	≤20

4.3. Internal partial discharge at $1.05U_c$

Serial No.	Before (pC)	After (pC)	Req. of PD (pC)	Change (pC)	Req. of change (pC)
1	4.5	4.9	≤10	0.4	≤10

4.4 8/20μs ,residual voltage at 5kA

Serial No.	Before (kV)	After (kV)	Req. of U_{res} (kV)	Change (%)	Req. of change (%)
1	526.3	527.2	/	0.2	≤5

4.5 Resistive current at U_c

Serial No.	Before(peak) (μA)	After(peak) (μA)	Req. of I_r(peak) (μA)	Change (%)	Req. of change (%)
1	120	130	≤300	8.3	≤20

Test result: Passed.

Arrester Moisture Ingress Test

Date: 2019-04-12

1. Terminal torque preconditioning test

Serial No.	Torque applied (N·m)	Tolerance time (s)	Checking samples
5	100	30	All right
Req.	100	30	All right

Arrester Moisture Ingress Test

Date: 2019-04-12~2019-04-16

2. Thermo-mechanical preconditioning test

Client express: applied bend load F=1.8kN (Applied on the arrester top)

Serial No.	Test time(keeping warm)	Testing temperature (℃)	Applied bend load F		Keeping time (h)
			Angle degrees (°)	Bend load (kN)	
5	04.12 16:50 ~ 04.13 08:51	+60.0	0	1.8	16
	04.13 17:20 ~ 04.14 09:23	-25.2	180	1.8	16
	04.14 17:00 ~ 04.15 09:04	+45.2	270	1.8	16
	04.15 17:30 ~ 04.16 09:31	-40.0	90	1.8	16
Req.	Twice cycles of heat and cold	60℃→-25℃ →45℃→-40℃	0 ~ 360	1.8	≥16

Arrester Moisture Ingress Test

Date: 2019-05-22~2019-05-24

3. Immersed in boiling water test

NaCl content of boiling water is 1kg/m^3

Serial No.	Test items	Keep time (h)	Req. (h)
5	In boiling water	42	42
	Immersed in water	/	/
	Placed in air	6	≤8

Arrester Moisture Ingress Test

Date: 2019-03-15~2019-05-24

4. Verification test

4.1. Direct current reference voltage at $I_{d.c.ref}$=1mA

Serial No.	Before (kV)	After (kV)	Req. of $U_{1mA.DC}$ (kV)	Change (%)	Req. of change (%)
5	162.2	161.8	≥157	0.2	≤5

4.2. Leakage current at $0.75U_{d.c.ref}$

Serial No.	Before (μA)	After (μA)	Req. of I_{lek} (μA)	Change (μA)	Req. of change (μA)
5	4	6	≤50	2	≤20

4.3. Internal partial discharge at $1.05U_c$

Serial No.	Before (pC)	After (pC)	Req. of PD (pC)	Change (pC)	Req. of change (pC)
5	4.1	4.8	≤10	0.7	≤10

4.4 8/20μs ,residual voltage at 5kA

Serial No.	Before (kV)	After (kV)	Req. of U_{res} (kV)	Change (%)	Req. of change (%)
5	268.8	268.3	/	0.2	≤5

4.5 Resistive current at U_c

Serial No.	Before(peak) (μA)	After(peak) (μA)	Req. of I_r(peak) (μA)	Change (%)	Req. of change (%)
5	120	125	≤300	4.1	≤20

Test result: Passed. (Test data come from the No.190007B test report.)

Arrester Weather Ageing Test

Date: 2019-02-26~2019-04-09

1. Weather ageing test

Start time: 2019.02.26 17:00 End time: 2019.04.09 09:00

Fog room volume: 10.83m^3

Serial No.	Date	Fog room temperature (℃)	Applied voltage U_t (U_c) (kV)	Flowmeter rate (L/h)	Water flow rate (L/(m^3·h))
BL	2019.02.26 17:00	21	14.0	4.4	0.41
	2019.03.02 17:00	20	14.0	4.4	0.41
	2019.03.06 17:00	22	14.0	4.4	0.41
	2019.03.10 17:00	20	14.0	4.4	0.41
	2019.03.14 17:00	20	14.0	4.4	0.41
	2019.03.18 17:00	21	14.0	4.0	0.37
	2019.03.22 17:00	21	14.0	4.0	0.37
	2019.03.26 17:00	21	14.0	4.0	0.37
	2019.03.30 17:00	20	14.0	4.4	0.41
	2019.04.03 17:00	20	14.0	4.0	0.37
	2019.04.07 17:00	20	14.0	4.0	0.37
	2019.04.09 09:00	20	14.0	4.0	0.37
Req.	1000h	20±5	14	/	0.4±0.1

Note:

1) There is no flashover during the test, the test sample is all right after the test;

2) The salt content is 5kg/m^3 when the test started.

3) Creepage distance of arrester =4195mm,

Creepage distance of sample(Req.)≤673mm,

Creepage distance of sample(Actual measured) =668mm.

Arrester Weather Ageing Test

Date: 2019-02-26~2019-04-09

2. Verification test

2.1. Direct current reference voltage at $I_{d.c.ref}$=1mA

Serial No.	Before (kV)	After (kV)	Req. of $U_{1mA.DC}$ (kV)	Change (%)	Req. of change (%)
BL	25.2	24.9	/	1.2	≤5

2.2 Internal partial discharge at $1.05U_e$

Serial No.	Before (pC)	After (pC)	Req. of PD (pC)	Change (pC)	Req. of change (pC)
BL	4.3	4.9	≤10	0.6	≤10

Test result: Passed. (Test data come from the No.190007B test report.)

Environment Test

Date: 2019-03-11

Atmospheric conditions: P=97.8kPa t=13.2℃ RH=52%

1、Partial discharge test before environment test

Serial No.	Applied U_r (kV)	Continuous time at U_r (s)	Applied 1.05U_c (kV)	PD value (pC)
6	108.5	10	88.5	4.1
Req.	108	2~10	88.2	≤10

Environment Test

Date: 2019-03-11

Atmospheric conditions: P=97.8kPa t=13.2℃ RH=52%

2、Sealing check(hot water immersion method)

Serial No.	Hot water temperature (℃)	Environment temperature (℃)	Temperature difference (K)	Immersion time (min)	Checking samples
6	60	13.2	46.8	35	There is no continuity air bubbles
Req.	/	/	45±5	≥30	There is no continuity air bubbles

Environment Test

Date: 2019-03-11~2019-03-31

3、SO_2 test

Serial No.	Test date	SO_2 Flow rate (V_0L/V_0L)	Ambient temperature (℃)	Relative humidity (%)
6	2019.03.11	25×10^{-6}	25	77
	2019.03.12	25×10^{-6}	25	77
	2019.03.13	25×10^{-6}	24	76
	2019.03.14	24×10^{-6}	24	76
	2019.03.15	25×10^{-6}	24	76
	2019.03.16	24×10^{-6}	24	76
	2019.03.17	26×10^{-6}	25	75
	2019.03.18	26×10^{-6}	26	76
	2019.03.19	25×10^{-6}	24	76
	2019.03.20	25×10^{-6}	25	77
	2019.03.21	25×10^{-6}	25	77
	2019.03.22	25×10^{-6}	25	77
	2019.03.23	25×10^{-6}	24	77
	2019.03.24	24×10^{-6}	25	76
	2019.03.25	26×10^{-6}	25	75
	2019.03.26	24×10^{-6}	26	77
	2019.03.27	25×10^{-6}	25	75
	2019.03.28	25×10^{-6}	24	76
	2019.03.29	24×10^{-6}	24	76
	2019.03.30	25×10^{-6}	24	76
	2019.03.31	24×10^{-6}	24	76
Req.	20 × 24h	$(25\pm5)\times10^{-6}$	25 ± 2	75 ± 5

Environment Test

Date: 2019-04-01~2019-04-05

4、Salt mist test

Salt solutions concentration: 5%

Serial No.	Test date	Temperature (℃)	Relative humidity (%)	PH value of the salt solutions before atomized
6	2019.04.01 09:30	36	85	7.1
	2019.04.02 09:30	35	85	6.8
	2019.04.03 09:30	36	85	7.0
	2019.04.04 09:30	36	85	7.1
	2019.04.05 09:30	35	86	6.9
	2019.04.05 09:31	Test Stop		
Req.	96h	35±2	≥85	6.5~7.2

Note: No visible damage after the test.

Environment Test

Date: 2019-04-08

Atmospheric conditions: P=96.1kPa t=21.9℃ RH=46%

5、Internal partial discharge test after environment test

Serial No.	Applied U_r (kV)	Continuous time at U_r (s)	Applied $1.05U_c$ (kV)	PD value (pC)
6	108.5	10	88.4	4.9
Req.	108	2~10	88.2	≤10

Environment Test

Date: 2019-04-08

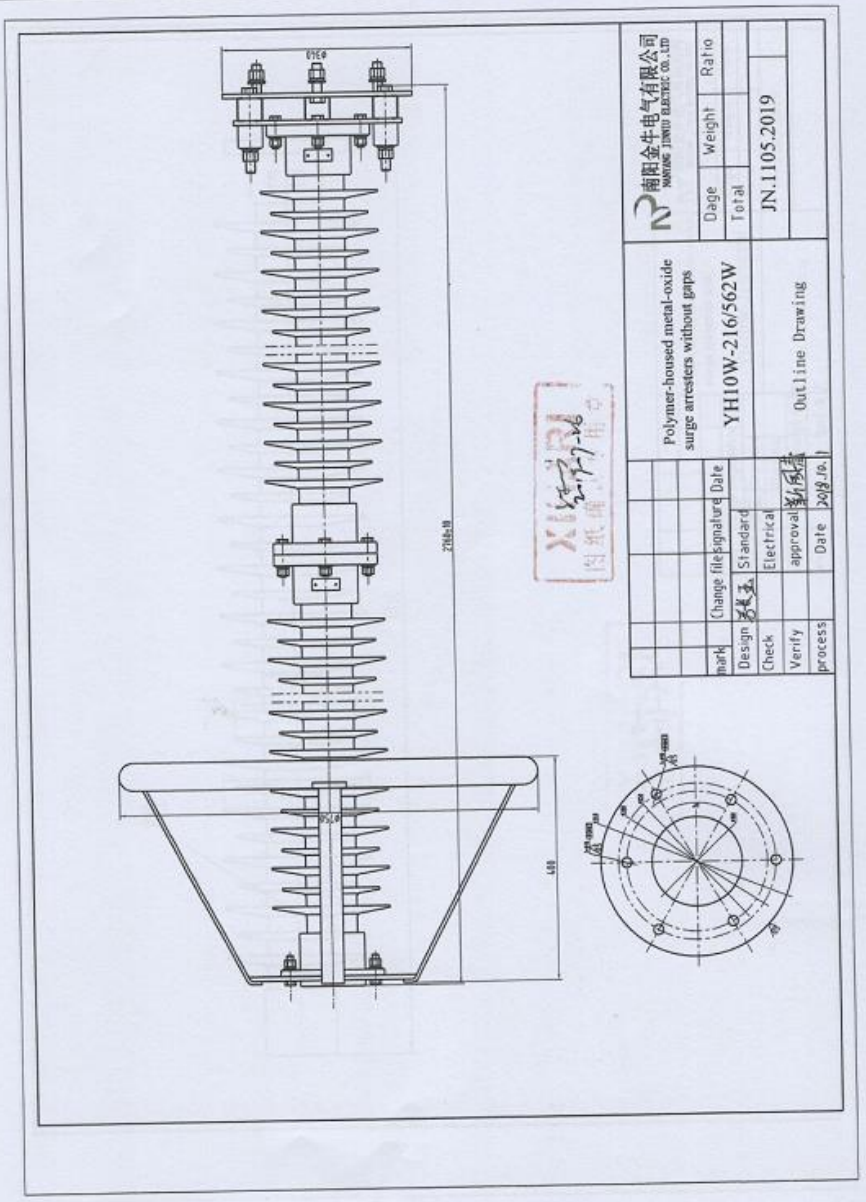
Atmospheric conditions: P=96.1kPa t=21.9℃ RH=46%

6. Sealing check after environment test (hot water immersion method)

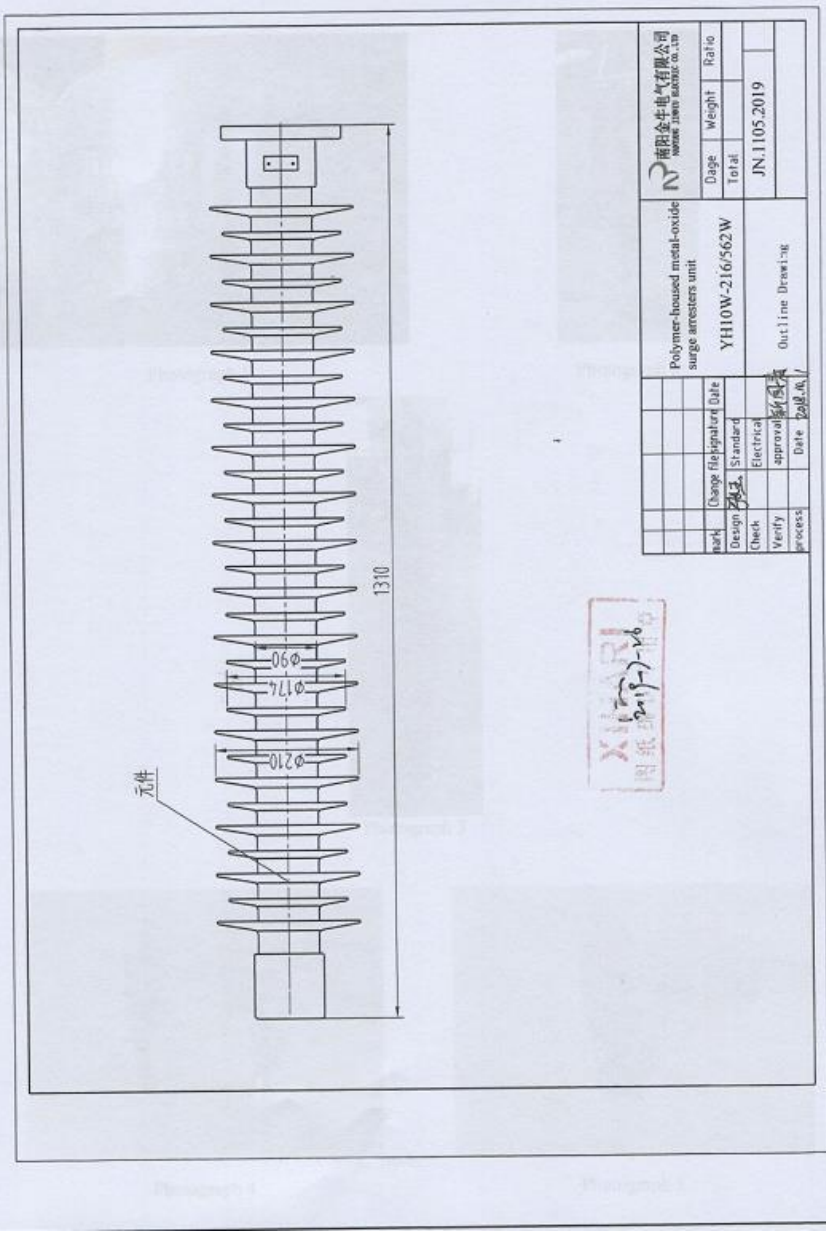
Serial No.	Hot water temperature (℃)	Environment temperature (℃)	Temperature difference (K)	Immersion time (min)	Checking samples
6	65	21.9	43.1	35	There is no continuity air bubbles
Req.	/	/	45±5	≥30	There is no continuity air bubbles

Test result: Passed. (Test data come from the No.190007B test report.)

Product Drawings



Product Drawings



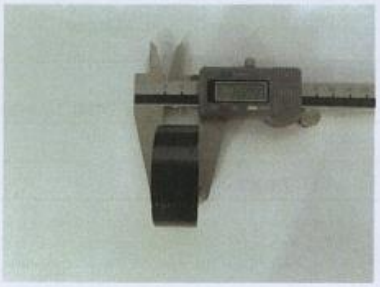
Photographs

Photograph 1

Photograph 2

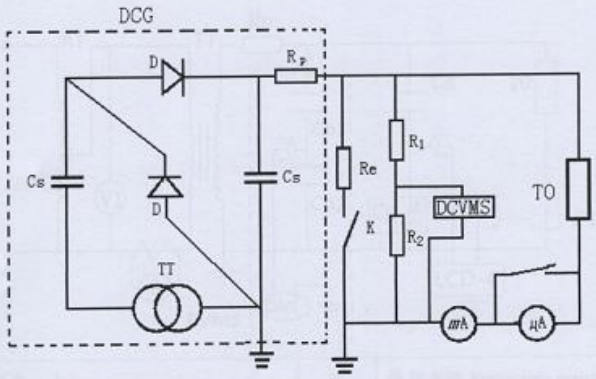
Photograph 3

Photograph 4



Photograph 5

DC Reference Voltage Test and Leakage Current at $0.75U_{d.c.ref}$ Test Circuit



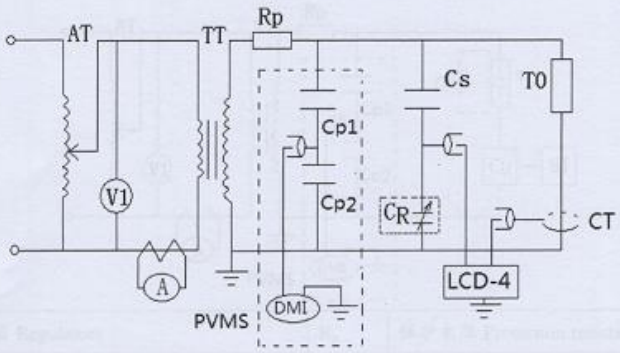
TT	工频变压器 PF transformer	μA/mA	微安表/毫安表 μA meter/mA meter
D	整流硅堆 Rectifier diode	R_e&K	接地装置 Grounding device
R_1	高压臂电阻 H.V arm resistance	R_2	低压臂电阻 L.V arm resistance
C_s	滤波电容 Filter capacitor	TO	试品 Test object
R_p	保护电阻 Protection resistance	DCG	串级直流电压发生器 DC generator
DCVMS	直流电压测量系统 DC voltage measuring systems		

名称 Name	型号 Type	编号 SN
直流电压测量系统 DC voltage measuring system	ZF750-500	04712
直流微安表 DC microammeter	C63	12050
直流微安表 DC microammeter	C31/1-mA	1134.12
多功能记录仪（温湿度） Temperature & humidity & barometer recorder (temperature & humidity)	testo622	39510602
多功能记录仪（大气压） Temperature & humidity & barometer recorder (barometer)	testo622	39510602

直流系统主要参数 Parameters of DCG system

U/I (kV/mA)	R_1(MΩ)	分压比 ratio
750/500	517.33	1000:1

Power Frequency Reference Voltage Test and Continuous Current Test Circuit



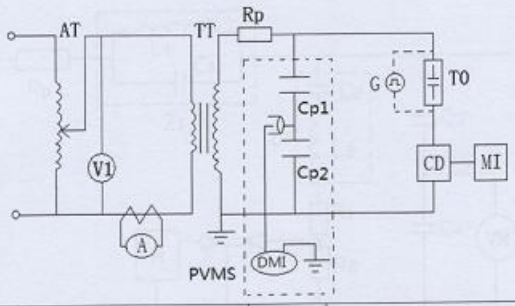
AT	调压器 Regulators	R_p	保护电阻 Protection resistance
TT	工频试验变压器 Testing transformer	TO	试品 Test object
V1	电压表 Voltmeter	A	电流表 Ammeter
C_S	补偿电容器 Compensating capacitor	C_R	可调电容箱 Adjustable capacitor
C_{p1}/C_{p2}	分压器高压臂/低压臂电容 H.V/L.V arm capacitance	CT	电流互感器 Current transformer
DMI	数字测量仪 Digital measuring instrument	LCD-4	泄漏电流检测仪 Leakage current measuring instrument
PVMS	工频电压测量系统 Power frequency voltage measuring system		

名称 Name	型号 Type	编号 SN
工频电压测量系统 Power frequency voltage measuring system	TRF150-0.0005	160395
多功能记录仪（温湿度） Temperature & humidity & barometer recorder (temperature & humidity)	testo622	39510602
多功能记录仪（大气压） Temperature & humidity & barometer recorder (barometer)	testo622	39510602
泄漏电流检测仪 Leakage current measuring instrument	LCD-4	058

工频系统主要参数(Parameters of TT system)

U/W(kV/kVA)	f_{TT}(Hz)	C_{p1}(pF)	C_{p2}(μF)
150/150	50	500	0.556

Partial Discharge Measurement Circuit



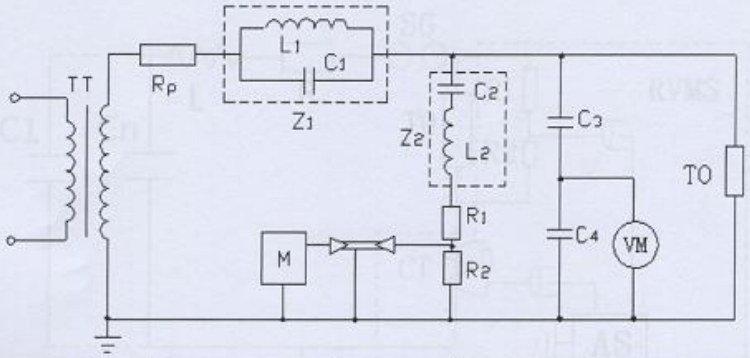
AT	调压器 Regulators	R_p	保护电阻 Protection resistance
TT	工频试验变压器 Testing transformer	TO	试品 Test object
V1	电压表 Voltmeter	A	电流表 Ammeter
C_{p1}/C_{p2}	分压器高压臂/低压臂电容 H.V/L.V arm capacitance	DMI	数字测量仪 Digital measuring instrument
CD	耦合单元 Coupling device	G	校正脉冲发生器 Step voltage generator
MI	局部放电测试仪 Partial discharge Measuring instrument	PVMS	工频电压测量系统 Power frequency voltage measuring system

名称 Name	型号 Type	编号 SN
工频电压测量系统 Power frequency voltage measuring system	TAWF-300/150	1607089
局部放电测试仪 P.D Measuring instrument	TCD-9302	140218
校正脉冲发生器 Step voltage generator	JZF-10	/
多功能记录仪（温湿度） Temperature & humidity & barometer recorder (temperature & humidity)	testo622	39510625
多功能记录仪（大气压） Temperature & humidity & barometer recorder (barometer)	testo622	39510625
机械秒表 Stopwatch	504	9#

工频系统主要参数(Parameters of TT system)

U/W(kV/kVA)	f_{TT}(Hz)	C_{p1}(pF)	C_{p2}(μF)
150/150	50	278.8	0.2785

Radio Interference Voltage Test Circuit



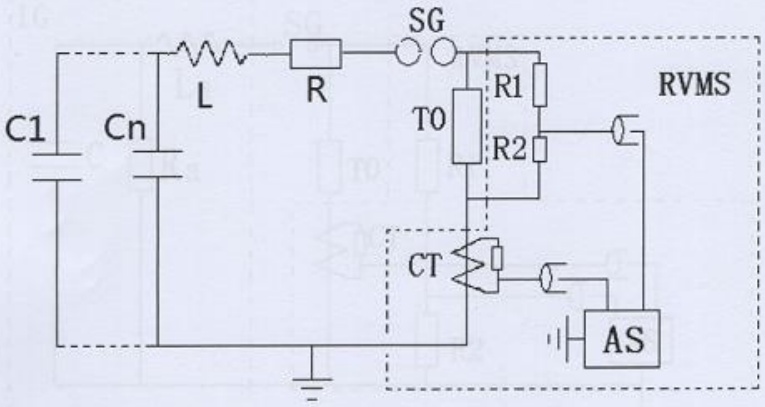
TT	工频试验变压器	PF transformer	R_p	保护电阻	protection resistance
Z_1	阻塞阻抗	blocking impedance	Z_2	耦合阻抗	coupling impedance
C_3	高压臂电容	H.Varm capacitance	C_4	低压臂电容	L.V arm capacitance
TO	试品	test object	VM	数字电压表	voltmeter
M	RIV 测量仪(RIV measuring device) 型号(type): PMM9010			编号(SN): 153WJ80210	

550kV/2200kVA 工频电压测量系统(编号: 1809096) 550kV/2200kVA power frequency voltage measuring system(SN: 1809096)	有效日期(validity): 2019-11-19
PMM9010 无线电干扰电压测量系统(编号: 153WJ80210) PMM9010 radio interference voltage measuring system(SN: 153WJ80210)	有效日期(validity): 2019-09-24
testo 数字式温湿度大气压力表(编号: 39516042/804) testo digital temperature and humidity atmospheric pressure gauge (SN: 39516042/804)	有效日期(validity): 2019-08-23
DYM3 空盒气压表(编号: 0169) DYM3 air pressure meter(SN: 0169)	有效日期(validity): 2020-01-03
1/10 机械秒表(编号: 6#) 1/10 mechanical stopwatch(SN: 6#)	有效日期(validity): 2019-11-08

工频系统主要参数 Parameters of TT system

U/S (kV/kVA)	f_{TT}(Hz)	R_p(kΩ)	C_1(pF)	C_2(μF)
550/2200	50	2	500	2.12

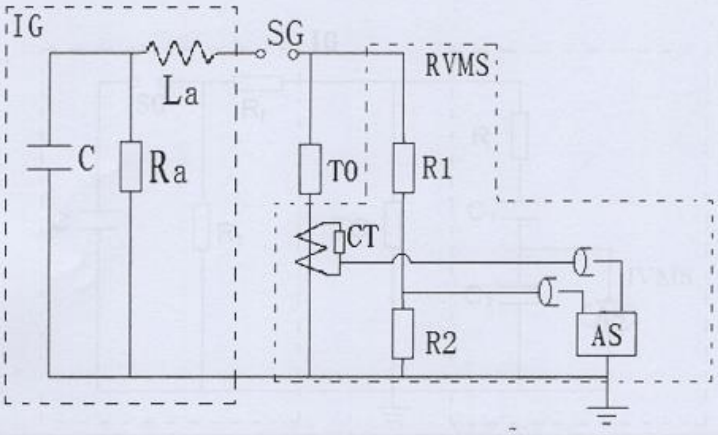
Residual Voltage Test Circuit



C1~Cn	并联电容器 Parallel capacitor	TO	试品 Test object
L	回路电感 circuit inductor	R	回路电阻 circuit resistor
R_1/R_2	高压臂/低压臂电阻 H.V/L.V arm resistance	SG	点火球隙 Sphere gap
AS	采集装置 Acquisition device	CT	电流互感器 Current transformer
RVMS	残压测量系统 Residual voltage measuring system		

名称 Name	型号 Type	编号 SN
残压测量系统 Residual voltage measuring system	DL-CY	CY-8/20-1
残压测量系统 Residual voltage measuring system	DL-CY	CY-30/60-1
残压测量系统 Residual voltage measuring system	DL-CY	CY-1/5-1
避雷器阀片直流参数测试仪 Varistor DC parameter measuring instrument	MOA-III	1207045
数字式温湿度大气压力表（温湿度） Temperature & humidity & barometer recorder (temperature & humidity)	testo622	39510625
数字式温湿度大气压力表（大气压） Temperature & humidity & barometer recorder (barometer)	testo622	39510625

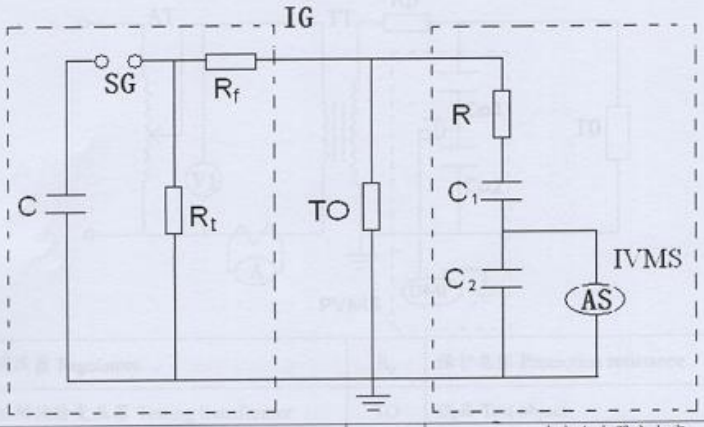
Complete Arrester Residual Voltage Test Circuit



IG	冲击发生器 Impulse generator	C	冲击发生器主电容 Capacitor of impulse generator
Ra	调波电阻 Generator adjust resistor	La	调波电感 Generator adjust inductance
SG	点火球隙 Sphere gap	TO	试品 Test object
R1/ R2	分压器高压臂/低压臂电阻 H.V/ L.V arm resistance	CT	电流互感器 Current transformer
AS	采集系统 Acquisition system		
RVMS	残压测量系统 Residual voltage measuring system		

名称 Name	型号 Type	编号 SN
20kA 整体残压测量系统 Residual voltage measuring system	20kA	554479-1
多功能记录仪（温湿度） Temperature & humidity & barometer recorder (temperature & humidity)	testo622	39510602
多功能记录仪（大气压） Temperature & humidity & barometer recorder (barometer)	testo622	39510602

Impulse Voltage Test Circuit



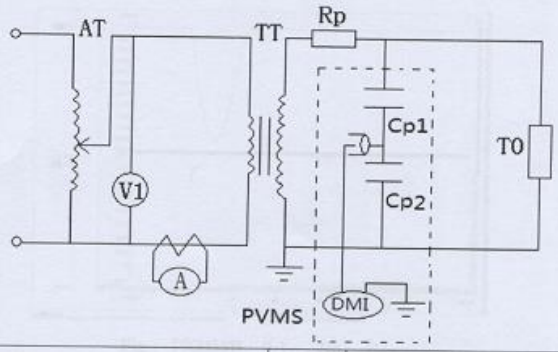
IG	冲击发生器 Impulse generator	C	冲击发生器主电容 Capacitor of impulse generator
SG	点火球隙 Sphere gap	R_f	波头电阻 Front resistance
R_t	波尾电阻 Tail resistance	TO	试品 Test object
C_1/ C_2	分压器高压臂/低压臂电容 H.V/L.V arm capacitance	R	阻尼电阻 Damping resistance
AS	采集装置 Acquisition device		
IVMS	冲击电压测量系统 Impulse voltage measuring system		

名称 Name	型号 Type	编号 SN
冲击电压测量系统 Impulse voltage measuring system	FY I	0434-2
温湿度记录仪 Temperature & humidity recorder	THP-2000	000000000528
空盒气压表 Barometer	DYM3	1193

冲击系统主要参数(Parameters of IG system)

波形 Wave shape	U/W(kv/kJ)	C（μF）	Rf（Ω）	Rt（Ω）	C1（pF）	C2（pF）
雷电波 Lightning impulse	1500/28	0.0625	800	1160	398	0.419

Power-frequency Voltage Test Circuit



AT	调压器 Regulators	R_p	保护电阻 Protection resistance
TT	工频试验变压器 Testing transformer	TO	试品 Test object
V1	电压表 Voltmeter	A	电流表 Ammeter
C_{p1}/C_{p2}	分压器高压臂/低压臂电容 H.V/L.V arm capacitance	DMI	数字测量仪 Digital measuring instrument
PVMS	工频电压测量系统 Power frequency voltage measuring system		

名称 Name	型号 Type	编号 SN
工频电压测量系统 Power frequency voltage measuring system	TRF300-0.001	110432
温湿度记录仪 Temperature & humidity recorder	THP-2000	000000000528
空盒气压表 Barometer	DYM3	1193
机械秒表 Stopwatch	504	9#

工频系统主要参数(Parameters of TT system)

U/W(kV/kVA)	f_{TT}(Hz)	C_{p1}(pF)	C_{p2}(μF)
300/1200	50	1000	2.01

Typical Oscillogram

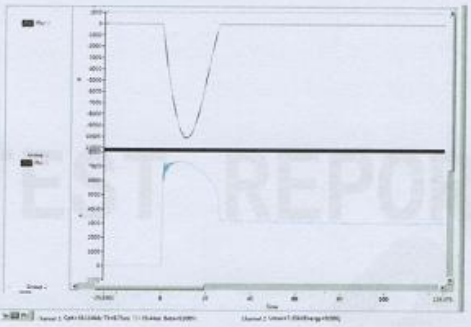


Fig.: 190038B 9-1 No.: B1
8/20 μ s Lightning impulse residual voltage test (10kA)

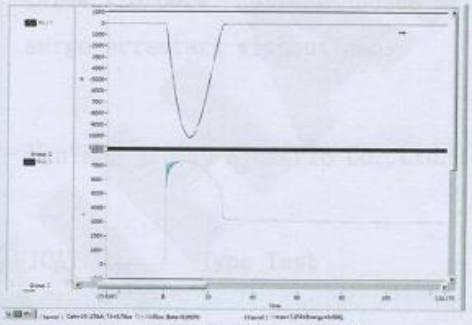


Fig.: 190038B 9-2 No.: B2
8/20 μ s Lightning impulse residual voltage test (10kA)

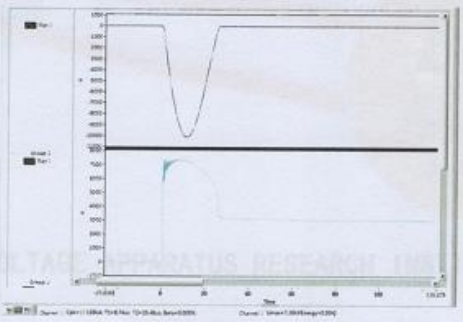


Fig.: 190038B 9-3 No.: B3
8/20 μ s Lightning impulse residual voltage test (10kA)

DNV·GL

KEMA INSPECTION REPORT

3037-19

Object	Polymer-housed metal oxide surge arresters without gaps for AC system
Type	YH10W-3, YH10W-6, YH10W-9, YH10W-12, YH10W-15, YH10W-18, YH10W-21, YH10W-24, YH10W-27, YH10W-30, YH10W-33, YH10W-36 **Serial No.** See chapter 1.2
	3 kV ~ 36 kV AC system
Client	Nanyang Jinniu electric co., Ltd., Industry park of Tongbai, Henan Province, 47450 Nanyang City, China
Manufacturer	Nanyang Jinniu electric co., Ltd., Industry park of Tongbai, Henan Province, 47450 Nanyang City, China
Inspected by	KEMA B.V., Utrechtseweg 310, Arnhem, the Netherlands
Test location	Power Industry Quality Inspection and Test Center for Electric Equipment, Wuhan, China
Date of tests	3 December 2018 to 3 March 2019
Test specification	The tests were in accordance with the client's instructions. Test procedure and test parameters were based on IEC 60099-4:2014.
Regarding	Type Tests
Summary and conclusion	The object passed the tests.

This report applies only to the object tested. The responsibility for conformity of any object having the same type references as that tested rests with the Manufacturer.

This report consists of 96 pages in total.

KEMA B.V.

Bas Verhoeven
Director, High-Voltage Laboratory

KEMA Laboratories

Arnhem, 2 August 2019

INFORMATION SHEET

1. Inspection Reports

An Inspection Report contains a record of one or more tests which have been carried out according to the client's instructions. These tests are not necessarily in accordance with a recognized standard. The test results do not verify ratings of the test object.
KEMA Laboratories issues three types of Inspection Reports:

1.1 The tests have been carried out in accordance with....

This sentence will appear on the front page of an Inspection Report if all type tests have been performed in accordance with a recognized standard. The Inspection Report contains verified drawings and a description of the equipment tested. Detailed rules are given in KEMA's Inspection procedure. The condition of the test object after the tests is assessed and recorded in the Inspection Report.

1.2 The tests were in accordance with the client's instructions. Test procedure and test parameters were based on....

This sentence will appear on the front page of an Inspection Report if the number of tests, the test procedure and the test parameters are based on a recognized standard and related to the ratings assigned by the manufacturer. If the object does not pass the tests, such behaviour will be mentioned on the front sheet. Verification of the drawings (if submitted) and assessment of the condition after the tests are only done on the client's request.

1.3 The tests were in accordance with the client's instructions.

This sentence will appear on the front page of an Inspection Report if the tests, test procedure and/or test parameters are not in accordance with a recognized standard.

2 Standards

When reference is made to a standard, and the date of issue is not stated, this standard refers to the latest issue, including amendments which have been officially published prior to the date of the tests.

3 Official and uncontrolled test documents

The official test documents of DNV GL are issued in bound form. Uncontrolled copies may be provided as a digital file for convenience of reproduction by the client. The copyright has to be respected at all times.

TABLE OF CONTENTS

1 IDENTIFICATION OF THE OBJECT TESTED

1.1 Ratings/characteristics of the object tested

Rated voltage (U_r)	3 ~ 36 kV
Rated frequency	50/60 Hz
Number of phases	1

1.2 Description of the object tested

Object	Polymer-housed metal oxide surge arresters without gaps for AC system	
Manufacturer of Arrester	Nanyang jinniu electric co.,LTD	
Type	YH10W-3, YH10W-6, YH10W-9, YH10W-12, YH10W-15, YH10W-18, YH10W-21, YH10W-24, YH10W-27, YH10W-30, YH10W-33, YH10W-36	
Serial number	5 arrester (001~005) 10 thermally prorated sections (201～210) 16 resistors (301～316) 12 housings (401~412) 1 dielectrically prorated section (501) 3 specimens of shed and housing materials (601～603)	
AC reference voltage (1 mA)	3,2 - ≥ 38,4	kV
Nominal discharge current	10	kA
Continuous operating voltage (U_{cov})	2,55 ~ 29	kV
Residual voltage at		
nominal discharge current (8/20 µs)	≤ 8,5 ~ 102	kV
steep current (1/5 µs)	≤ 10,5 ~115	kV
Arrester class	Distribution	
Insulation level		
Lightning impulse	60 ~ 185	kV
Switching impule	28 ~ 90	kV
Block dimensions		
Outer diameter	42	mm
Height	22,5	mm
Number of metal oxide blocks	1 - 12	
Manufacturer of ZnO blocks	Nanyang jinniu electric co.,LTD	

1.3 List of drawings

The manufacturer has guaranteed that the object submitted for tests has been manufactured in accordance with the following drawings and/or documents. KEMA Laboratories has verified that these drawings and/or documents adequately represent the object tested. The manufacturer is responsible for the correctness of these drawings and/or documents and the technical data presented.

The following drawings and/or documents have been included in this report:

Drawing no./document no.	Revision
Assembly drawing	-
JNKH1003	A
JNKH1006	A
JNKH1009	A
JNKH1012	A
JNKH1015	A
JNKH1018	A
JNKH1011	A
JNKH1014	A
JNKH1017	A
JNKH1030	A
JNKH1033	A
JNKH1036	A

2 GENERAL INFORMATION

2.1 Persons attending the inspection

Name	Company
Zhongqiu Zuo	Power Industry Quality Inspection and Test, Wuhan, China
Lulu Wang	
Jiarui Huang	
Li Chen	
Juxia Liang	
Jie Huang	Nanyang Jinniu Electric co., Ltd., Nanyang,China
Yu Zhang	

2.2 The inspection was carried out by

Name	Company
André van Stijn	KEMA B.V., Arnhem, the Netherlands

2.3 Purpose of the tests

Purpose of the tests was to verify whether the material complies with the specified requirements.

2.4 Inspection of the test set-up

The tests were carried out at the laboratory of Wuhan High Voltage Research Institute of State Grid. The results of the inspection activities are based on the witnessed tests and information about measuring devices and the test set-up as provided by the manufacturer. The measuring devices, the test set-up and the provided calibration reports were verified by KEMA Laboratories.

Result
The inspection did not give rise to remarks

3 ARRESTER

3.1 Test of the bending moment

Standard and date

Standard	IEC 60099-4, subclause 8.11
Test date	3th December to 9th December 2018

The test was performed on a complete arrester with the maximum physical length of this design. For this test three samples were used.

The following initial measurements were performed:

- Watt loss
- Internal partial discharge
- Residual voltage.

This test consists of two parts:

- Bending moment
- Mechanical/thermal preconditioning.

After the above mentioned test all three samples were subjected to a water immersion test, were the samples were immersed in boiling water with 1 kg/m^3 of NaCl during 42 h.

After all test were completed the initial measurements were repeated and the results compared with the first initial results.

3.1.1 Bending moment

Procedure

For this test two samples were used. The bending load was increased smoothly to the specified short-term load (SSL) of 400 N during 63 s. During this time the deflection was measured. Then the load was realised smoothly. Next the residual deflection was measured.

Result

The object passed the test.

The results of this measurement are summarized in appendix A, page 19 to 21 and 24.

3.1.2 Mechanical/thermal preconditioning

Procedure

For this test one sample was used and subjected to a torque test. The sample was vertically mounted on a rigid support. At the top of the sample an axial torque was applied of 80 N.m during. Next the sample was mounted on a rigid base inside an environmental chamber. A test load of 80 N was applied in one initial direction for 24h. After this 24 h the sample was turned 90 physical degrees. This repeated for 180 and 270 physical degrees. During this time span of in total 96h the temperature in the environmental chamber was changed accordance figure 11 of IEC 60099-4.

Result

The object passed the test.

The results of this measurement are summarized in appendix A, page 20.

3.2 Weather ageing test

Standard and date

Standard	IEC 60099-4, subclause 10.8.17
Test date	5 December 2018 to 16 January 2019

This test consists of two tests:

- Salt fog test
- UV light test.

3.2.1 Salt-fog

Procedure

The used test sample was the longest electrical section with the minimum specific leakage distance and the highest rated voltage of this type. The sample was cleaned with deionized water before starting the test.

The following initial measurements were performed:

- Reference voltage
- Partial discharge.

Next a time-limited continuous test under salt fog, at constant power-frequency voltage equal to 39,4 kV, was carried out in a moisture-sealed corrosion-proof chamber. An aperture of not more than 80 cm² was provided for the natural exhaust air. A room humidifier of constant spraying capacity was used as the water atomizer.

The fog filled the chamber and was not directly sprayed onto the test sample. The salt water, prepared with NaCl and deionized water, was supplied to the sprayer. For power-frequency test voltage, a test transformer was used.

The test sample was mounted vertically. There was enough clearance between the roof of the chamber and test sample and from the walls in order to avoid electrical field disturbance.
After this test the initial measurements were repeated and the results compared with the first initial results.

Result

The object passed the test.
The results of this measurement are summarized in appendix A, page 22.

3.2.2 UV-light test

For this test three samples were used. The insulator housing material was subjected to a 1000 h UV light according ISO 4892-1 and 4892-3, using type 1 fluorescent UV lamp with exposure method 1.

Result
The object passed the test.
The results of this measurement are summarized in appendix A, page 23.

4 ARRESTER HOUSING

Standard and date

Standard	IEC 60099-4, subclause 8.2
Test date	5 December 2018

4.1 Lightning impulse voltage test

If the dry arcing distance or the sum of the partial dry arcing distances in m is larger than the test voltage in kV divided by 500 kV/m, this test is not required. this test is not required. In this case is was measured and it was confirmed to omit this test. Reference is made to the report of the test laboratory which is summarized in appendix A, page 5.

4.2 Power-frequency voltage test

The housings of arresters intended for outdoor use shall be tested in wet conditions, unless the dry arcing distance or the sum of the partial dry arcing distances is larger than given by the equation d = [1,82 (e (U/859) – 1)] 0,833 , where d is the distance in m and U is the peak value of the power-frequency test voltage in kV, this test is not required. In this case is was measured and it was confirmed to omit this test. Reference is made to the report of the test laboratory which are summarized in appendix A, page 5.

5 ARRESTER SECTION

Standard and date

Standard	IEC 60099-4, subclauses 8.3 to 8.8 and 8.15
Test date	6 December 2018

5.1 Residual voltage test

All residual voltage tests were carried out on arrester sections. The rated voltage of one section is 3 kV and consisted of one metal-oxide block. By multiplying the measured residual voltage by the number of sections per arrester the equivalent residual voltage of the arrester was calculated.

5.2 Lightning impulse

Procedure
Three lightning current impulses with a waveform of 8/20 µs with a peak value of respectively 5 kA, 10 kA and 20 kA, this is respectively 0.5, 1 and 2 times the nominal discharge current, were applied to each of the three sections. The maximum value of the residual voltage was recorded.

Requirement
The equivalent residual voltage of the arrester at nominal discharge current (10 kA) should be below the specified residual voltage given in appendix A.

Result
The object passed the test.

The results of this measurement are summarized in appendix A, page 7 and 8.

5.2.1 Steep current

Procedure
One steep current impulse with a waveform of 1/5 µs and a peak value of 10 kA was applied to each of the three sections. The maximum value of the residual voltage was recorded.

Requirement
The equivalent residual voltage of the arrester at nominal discharge current should be below the specified steep current impulse residual voltage given in appendix A, page 6.

Result
The object passed the test.

The results of this measurement are summarized in appendix A, page 9 and 10.

5.3 Test to verify the repetitive charge transfer rating

Standard and date

Standard	IEC 60099-4, subclauses 8.5
Test date	3 to 5 December 2018

Procedure

For this test 10 samples were used. The following initial measurements were performed:

- Residual voltage ate nominal discharge current
- Reference voltage.

All samples were subjected to 20 long duration impulse currents with a transfer charge of $1{,}1 \times Q_{rs} = 1{,}1 \times 0{,}4 = 0{,}44$ C.

After this test the initial measurements were repeated and the results compared with the first initial results.

Requirement

- No evidence of puncture, flashover or other significant damage.
- Change of residual and reference voltage should be less than 5%.

Result

The object passed the test.

The results of this measurement are summarized in appendix A, page 11 and 12.

5.4 Test to verify long term stability under continuous operating voltage

Standard and date

Standard	IEC 60099-4, subclauses 8.16
Test date	4 December 2018 to 15 January 2019

Procedure

The test was performed on three new samples placed in a temperature controlled oven heated to 115 °C. The three samples were subjected to a long duration test with a corrected U_{cov} of 2,70 kV during 1000 hours. During the whole test duration the resistive power losses are measured.

Requirement

- The overall increase of $P_{min} < 1,3 \times P_{min}$.
- The final measurement $P_{end} <= 1,1 \times P_{start}$.

Result

The object passed the test.

The results of this measurement are summarized in appendix A, page 12 to 14.

5.5 Heat dissipation behavior verification of test sample

Standard and date

Standard	IEC 60099-4, subclauses 8.6
Test date	9 December 2018

In order to prove that the test samples as used during the operating duty test are thermal equivalent to the complete arrester a test following the procedure in IEC 60099-4, Annex B has been carried out.

The result of this test is summarized in appendix A, page 15, it was proved that the test sample is thermal equivalent.

5.6 Operating duty test

Standard and date

Standard	IEC 60099-4, subclauses 8.7
Test date	2 March 2019

Procedure

The operating duty test was carried out on three arrester sections mounted in a thermal equivalent test housing. The rated voltage of one section is 3 kV and consisted of one metal-oxide block. Successively the following tests were carried out according figure 3 of IEC 60099-4.

Each sample was subjected to an weather ageing test as described in chapter 4 of this report. During this test the tests samples were placed in a prorated section. The thermal equivalency was determined in chapter 5.5 of this report.

The following initial measurements were performed:

- Residual voltage ate nominal discharge current
- Reference voltage.

Next, each sample was subjected to two high current impulses of 100 kA as conditioning. After this the samples were pre-heated to 60 °C. Next two lightning current impulses of 8/20 µs were applied, within 1 minutes, each with a Q_{th} of 0,56 C to obtain a total Q_{th} of 1,1 C. Next, within 100 ms, a power frequency of 3,2 kV during 10 s and 2,6 kV during 30 min was applied.
During these 30 min the power dissipation of the sample was measured.

Following this and after the samples are cooled down to ambient temperature the initial measurements were repeated and the results compared with the first initial results.

Requirement

- The measurement of the losses during the voltage application did not show thermal instability
- Change of residual voltage should be less than 5%
- No evidence of puncture, flashover or other significant damage.

Result

The object passed the test.
The results of this measurement are summarized in appendix A, page 16.

5.7 Power-frequency voltage-versus-time test

Standard and date

Standard	IEC 60099-4, subclauses 8.8
Test date	2 and 3 March 2019

Procedure

For this test six samples were used. Two samples were used for the test sequence without prior duty. The samples were pre-heated to 60 °C. For the test sequence with prior duty each sample was subjected to two lightning current impulses of 8/20 µs was applied. During test a voltage of 3,68 kV was applied during 0,1 s for the fourth sample and 3,14 kV during 1000 s for the first sample, followed by a applied voltage of 2,59 kV during 30 min.

Result

The object passed the test.

The results of this measurement are summarized in appendix A, page 17 to 18.

5.8 Test to verify the dielectric withstand of the internal components of an arrester

Standard and date

Standard	IEC 60099-4, subclauses 8.15
Test date	3 March 2019

Procedure

This test was performed on one sample. The following initial measurements were performed:

- Residual voltage ate nominal discharge current
- Reference voltage.

Next, the sample was pre-heated to 60 °C and subjected to a high current impulse of 100 kA. After the sample was allowed to cool down the initial measurements were repeated and the results compared with the first initial results.

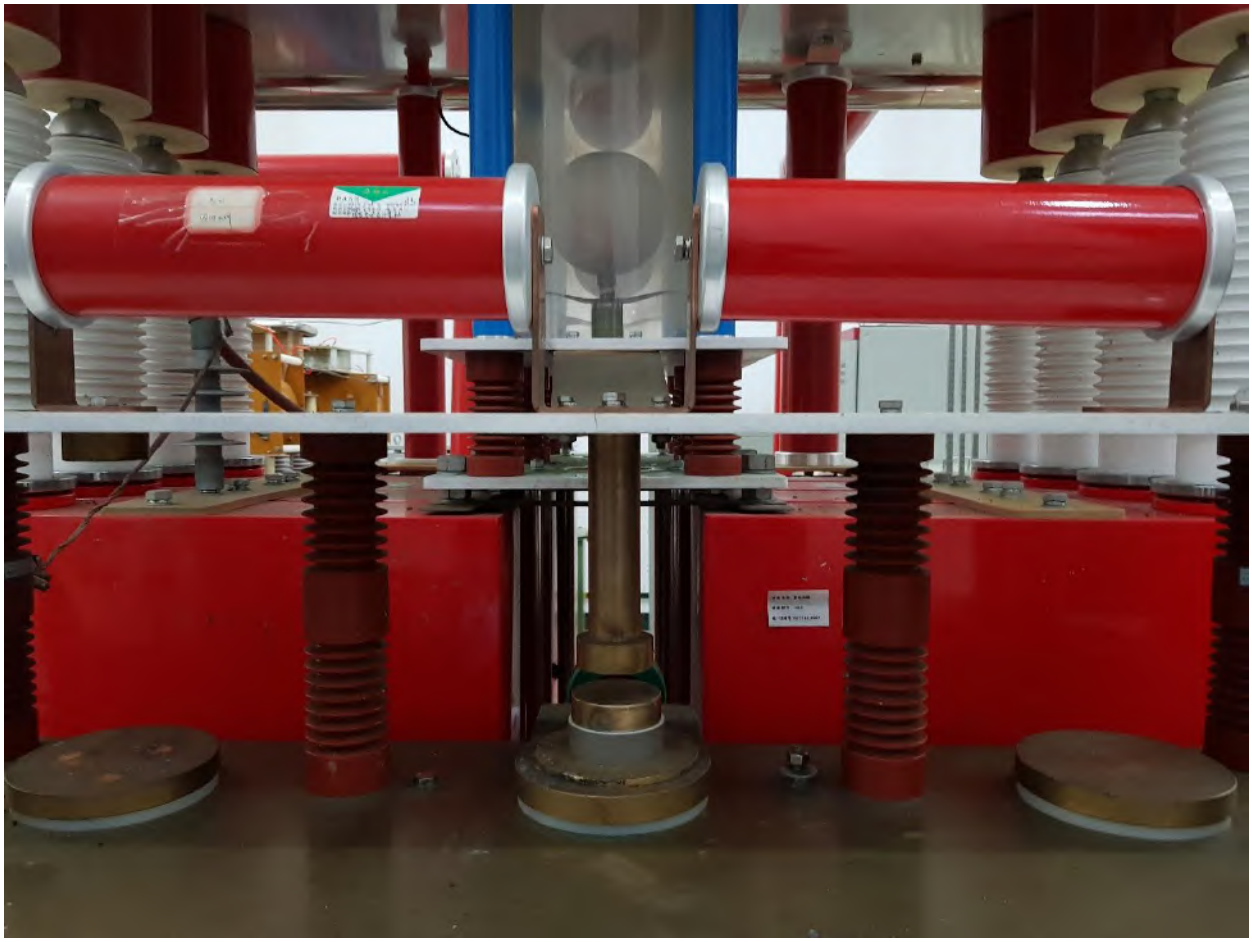
Result

The object passed the test.

The results of this measurement are summarized in appendix A, page 19

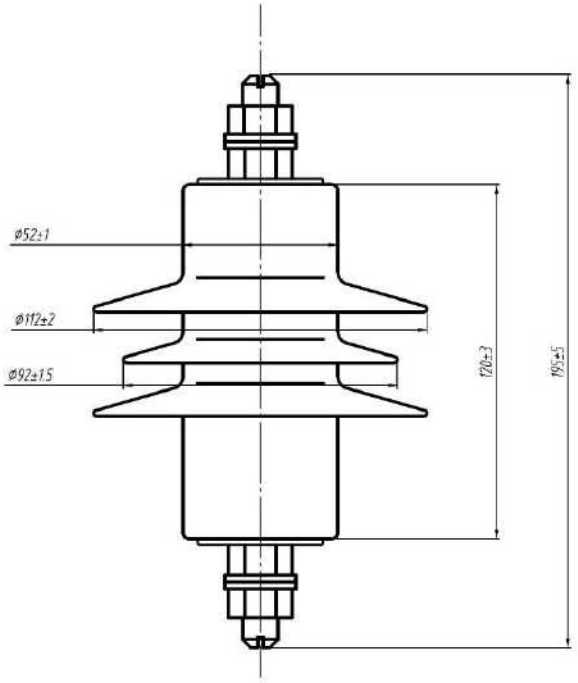
6 PHOTOGRAPHS OF TEST OBJECT

Object under power frequency voltage test



Test to verify the dielectric withstand of the internal components of an arrester

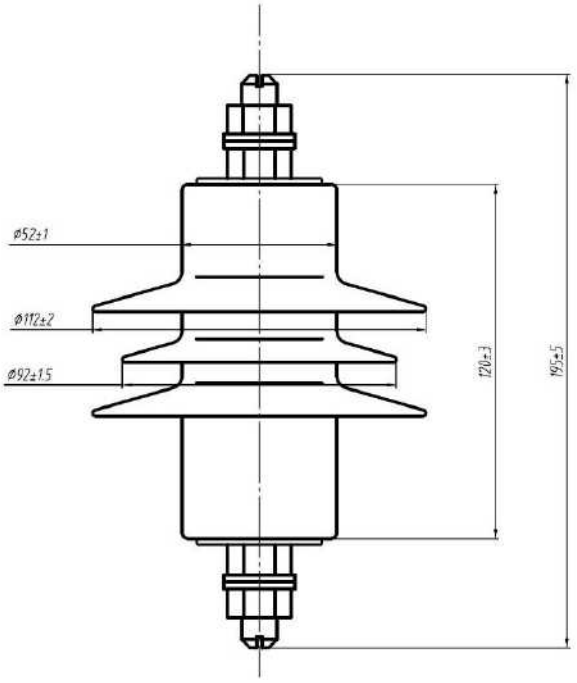
7 DRAWINGS OF THE TEST OBJECTS



Surge arrester structure data			
No	Item	Data	Noted
1	Structure height	120	mm
2	Small shed diameter	92	mm
3	Big shed diameter	112	mm
4	Housing inner diameter	46	mm
5	Housing external diameter	52	mm
6	Creepage distance	250	mm
7	Dry arcing distance	146	mm
8	Size of ZnO block Quantity	Ø42x22.5 1	mm piece

Surge arrester performance data				
No	Item	Data	Unit	Noted
1	Arrester class	Distribution		
2	Designation	DH		
3	Rated voltage	3	kV	
4	Continuous operating voltage	2.55	kV	
5	Nominal discharge current	10	kA	
6	Partial discharge	≤10	pc	
7	Power frequence reference voltage	≥3.2	kV	1mA
8	1/5μS residual voltage of steep impulse current	≤10.5	kV	peak
9	8/20μS residual voltage of lightning impulse current	≤8.5	kV	peak
10	Repetitive charge transfer rating Q_{rs}	≥0.4	C	
11	High current impulse of 4/10μS	100	kA	peak
12	Short-circuit / pressure relief capability	20 600±200	kA A	
13	The power-frequency voltage-versus-time characteristics	0.1s/1.18Ur 1.1s/1.05Ur 10.1s/1.00Ur 1000s/0.95Ur		
14	Thermal charge transfer rating Qth	1.1	C	
15	Lightning impulse withstand of housing	60	kV	peak
16	Power frenquce withstand of housing	28	kV	peak
17	Specified short-term load(SSL)	400	N	

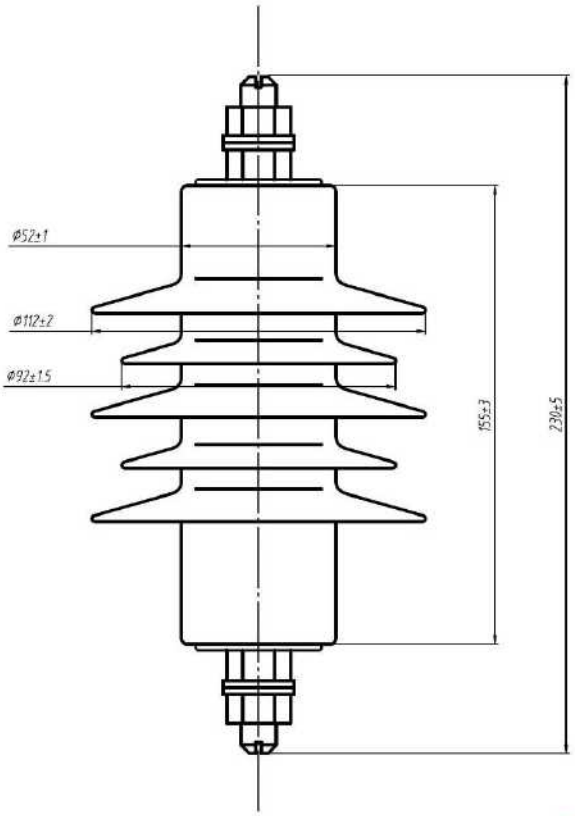
Product	3kV polymer-housed suger arresters	Drawing No.	JINKM1003
Product type	YH10W-3	Revision	A
Factory	Nanyang jinniu electric co., LTD		



Surge arrester structure data			
No	Item	Data	Noted
1	Structure height	120	mm
2	Small shed diameter	92	mm
3	Big shed diameter	112	mm
4	Housing inner diameter	46	mm
5	Housing external diameter	52	mm
6	Creepage distance	250	mm
7	Dry arcing distance	146	mm
8	Size of ZnO block Quantity	ø42x22.5 2	mm piece

Surge arrester performance data				
No	Item	Data	Unit	Noted
1	Arrester class	Distribution		
2	Designation	DH		
3	Rated voltage	6	kV	
4	Continuous operating voltage	5.10	kV	
5	Nominal discharge current	10	kA	
6	Partial discharge	≤10	pc	
7	Power frequence reference voltage	≥6.4	kV	1mA
8	1/5μS residual voltage of steep impulse current	≤20.0	kV	peak
9	8/20μS residual voltage of lightning impulse current	≤17.0	kV	peak
10	Repetitive charge transfer rating Q_{rs}	≥0.4	C	
11	High current impulse of 4/10μS	100	kA	peak
12	Short-circuit / pressure relief capability	20 600±200	kA A	
13	The power-frequency voltage-versus-time characteristics	0.1s/1.18Ur 1.1s/1.05Ur 10.1s/1.00Ur 1000s/0.95Ur		
14	Thermal charge transfer rating Q_{th}	1.1	C	
15	Lightning impulse withstand of housing	60	kV	peak
16	Power frenquce withstand of housing	28	kV	peak
17	Specified short-term load(SSL)	400	N	

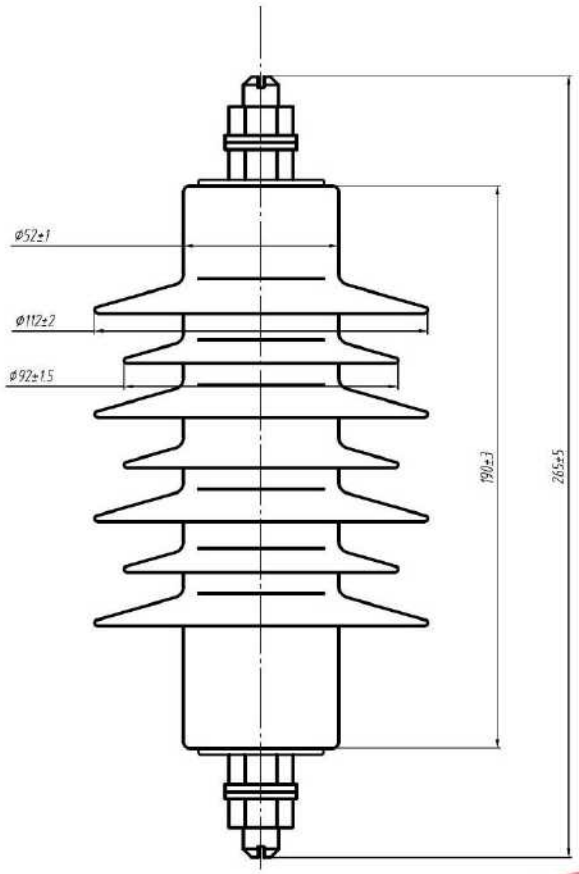
Product	6kV polymer-housed suger arresters	Drawing No.	JNKM1006
Product type	YH10W-6	Revision	A
Factory	Nanyang jinniu electric co., LTD		



Surge arrester structure data			
No	Item	Data	Noted
1	Structure height	155	mm
2	Small shed diameter	92	mm
3	Big shed diameter	112	mm
4	Housing inner diameter	46	mm
5	Housing external diameter	52	mm
6	Creepage distance	370	mm
7	Dry arcing distance	178	mm
8	Size of ZnO block Quantity	Ø32x22.5 3	mm piece

Surge arrester performance data				
No	Item	Data	Unit	Noted
1	Arrester class	Distribution		
2	Designation	DH		
3	Rated voltage	9	kV	
4	Continuous operating voltage	7.65	kV	
5	Nominal discharge current	10	kA	
6	Partial discharge	≤10	pc	
7	Power frequence reference voltage	≥9.6	kV	1mA
8	1/5μS residual voltage of steep impulse current	≤29.5	kV	peak
9	8/20μS residual voltage of lightning impulse current	≤25.5	kV	peak
10	Repetitive charge transfer rating Q_{rs}	≥0.4	C	
11	High current impulse of 4/10μS	100	kA	peak
12	Short-circuit / pressure relief capability	20 600±200	kA A	
13	The power-frequency voltage-versus-time characteristics	0.1s/1.18Ur 1.1s/1.05Ur 10.1s/1.00Ur 1000s/0.95Ur		
14	Thermal charge transfer rating Q_{th}	1.1	C	
15	Lightning impulse withstand of housing	75	kV	peak
16	Power frenquce withstand of housing	35	kV	peak
17	Specified short-term load(SSL)	400	N	

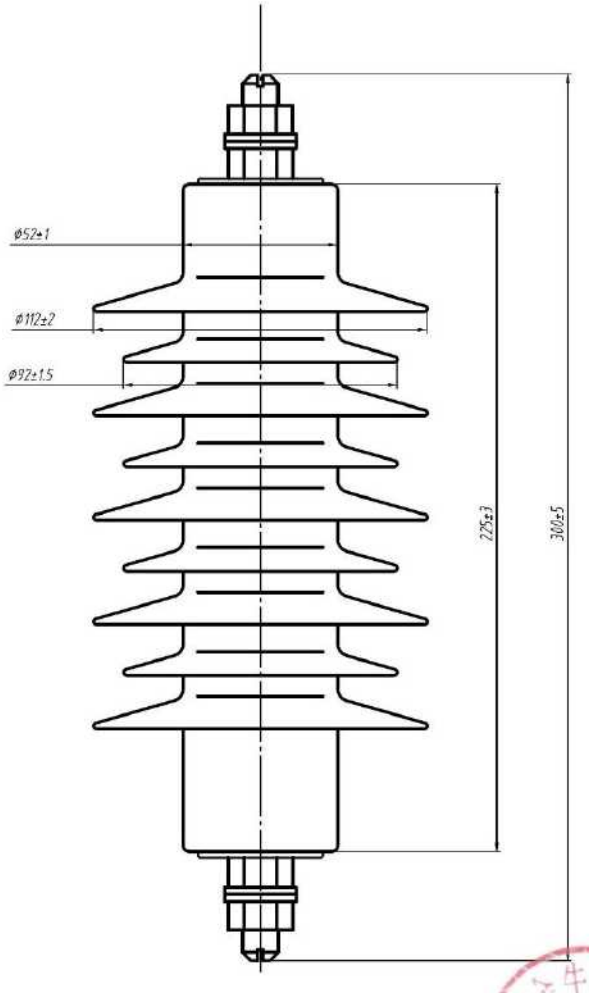
Product	9kV polymer-housed suger arresters	Drawing No.	JNKM1009
Product type	YH10W-9	Revision	A
Factory	Nanyang jinniu electric co., LTD		



Surge arrester structure data			
No	Item	Data	Noted
1	Structure height	190	mm
2	Small shed diameter	92	mm
3	Big shed diameter	112	mm
4	Housing inner diameter	46	mm
5	Housing external diameter	52	mm
6	Creepage distance	520	mm
7	Dry arcing distance	214	mm
8	Size of ZnO block Quantity	Ø42x22.5 4	mm piece

Surge arrester performance data				
No	Item	Data	Unit	Noted
1	Arrester class	Distribution		
2	Designation	DH		
3	Rated voltage	12	kV	
4	Continuous operating voltage	10.2	kV	
5	Nominal discharge current	10	kA	
6	Partial discharge	≤10	pc	
7	Power frequence reference voltage	≥12.8	kV	1mA
8	1/5μS residual voltage of steep impulse current	≤39.0	kV	peak
9	8/20μS residual voltage of lightning impulse current	≤34.0	kV	peak
10	Repetitive charge transfer rating Q_{rs}	≥0.4	C	
11	High current impulse of 4/10μS	100	kA	peak
12	Short-circuit / pressure relief capability	20 600±200	kA A	
13	The power-frequency voltage-versus-time characteristics	0.1s/1.18Ur 1.1s/1.05Ur 10.1s/1.00Ur 1000s/0.95Ur		
14	Thermal charge transfer rating Q_{th}	1.1	C	
15	Lightning impulse withstand of housing	90	kV	peak
16	Power frenquce withstand of housing	40	kV	peak
17	Specified short-term load(SSL)	400	N	

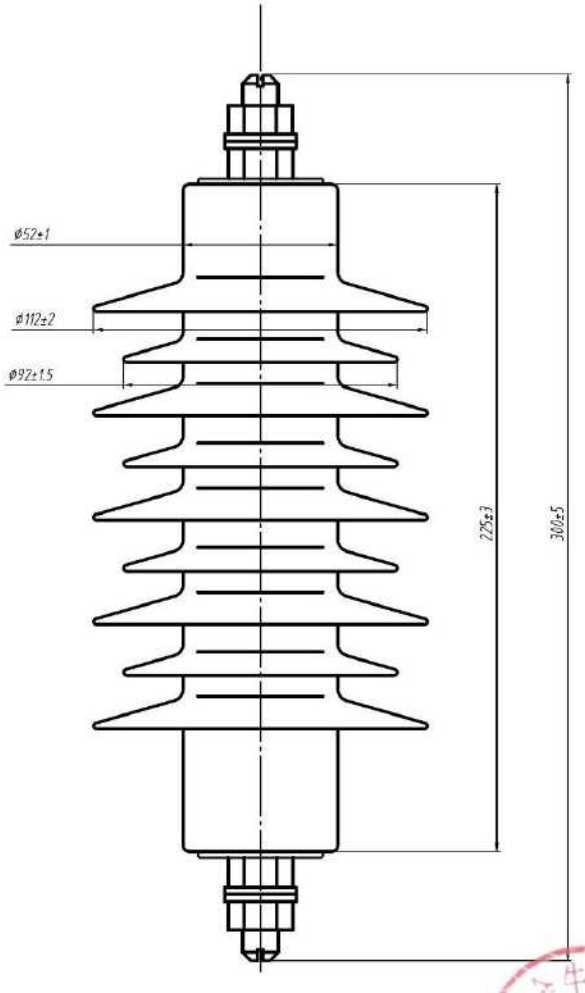
Product	12kV polymer-housed suger arresters	Drawing No.	JNKM1012
Product type	YH10W-12	Revision	A
Factory	Nanyang jinniu electric co., LTD		



Surge arrester structure data			
No	Item	Data	Noted
1	Structure height	225	mm
2	Small shed diameter	92	mm
3	Big shed diameter	112	mm
4	Housing inner diameter	46	mm
5	Housing external diameter	52	mm
6	Creepage distance	650	mm
7	Dry arcing distance	250	mm
8	Size of ZnO block Quantity	ø42x22.5 5	mm piece

Surge arrester performance data				
No	Item	Data	Unit	Noted
1	Arrester class	Distribution		
2	Designation	DH		
3	Rated voltage	15	kV	
4	Continuous operating voltage	12.7	kV	
5	Nominal discharge current	10	kA	
6	Partial discharge	≤10	pc	
7	Power frequence reference voltage	≥16	kV	1mA
8	1/5μS residual voltage of steep impulse current	≤48.5	kV	peak
9	8/20μS residual voltage of lightning impulse current	≤42.5	kV	peak
10	Repetitive charge transfer rating Q_{rs}	≥0.4	C	
11	High current impulse of 4/10μS	100	kA	peak
12	Short-circuit / pressure relief capability	20 600±200	kA A	
13	The power-frequency voltage-versus-time characteristics	0.1s/1.18Ur 1.1s/1.05Ur 10.1s/1.00Ur 1000s/0.95Ur		
14	Thermal charge transfer rating Q_{th}	1.1	C	
15	Lightning impulse withstand of housing	110	kV	peak
16	Power frenquce withstand of housing	50	kV	peak
17	Specified short-term load(SSL)	400	N	

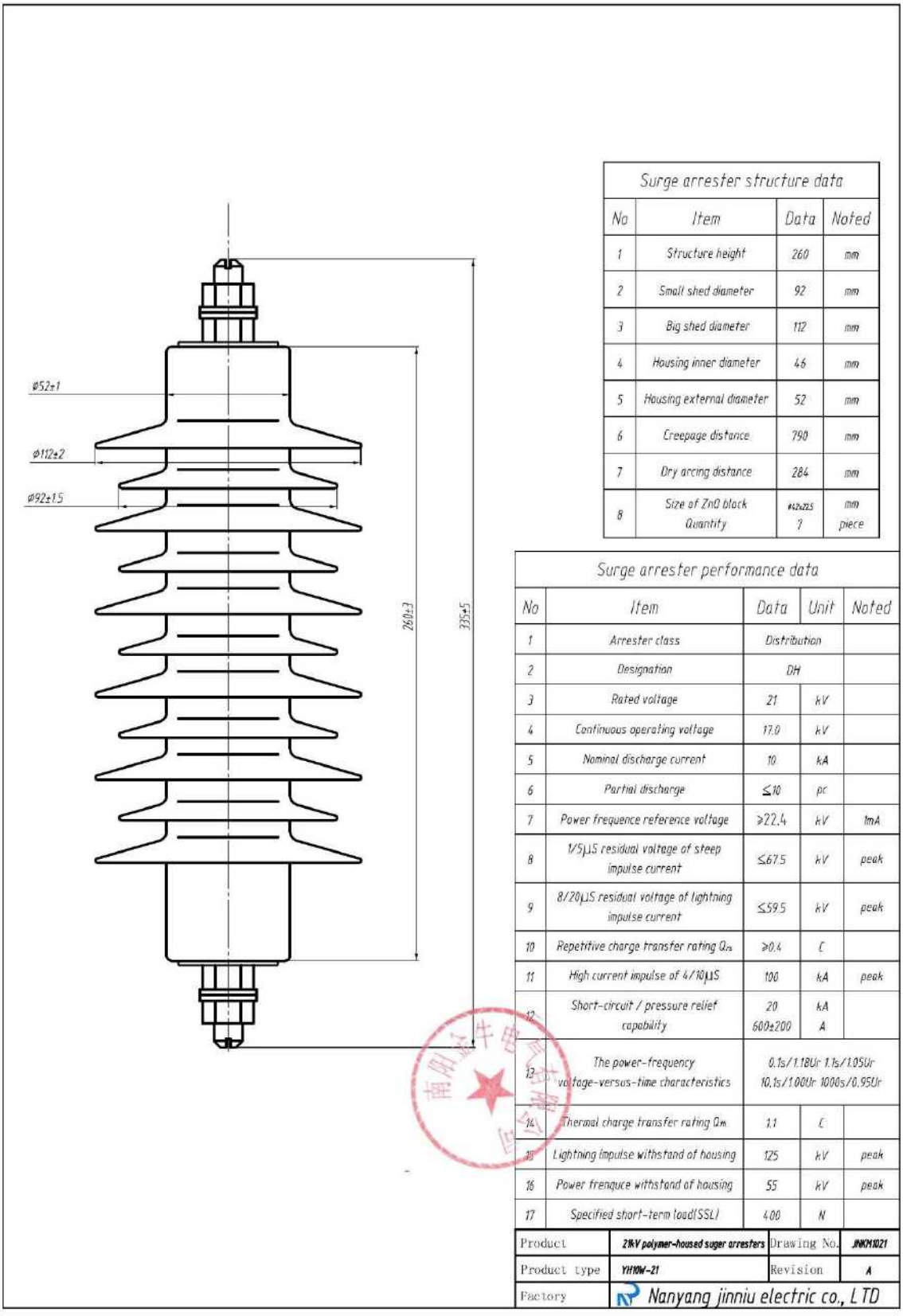
Product	15kV polymer-housed suger arresters	Drawing No.	JNKM1015
Product type	YH10W-15	Revision	A
Factory	Nanyang jinniu electric co., LTD		



Surge arrester structure data			
No	Item	Data	Noted
1	Structure height	225	mm
2	Small shed diameter	92	mm
3	Big shed diameter	112	mm
4	Housing inner diameter	46	mm
5	Housing external diameter	52	mm
6	Creepage distance	650	mm
7	Dry arcing distance	250	mm
8	Size of ZnO block Quantity	ø42x22.5 6	mm piece

Surge arrester performance data				
No	Item	Data	Unit	Noted
1	Arrester class	Distribution		
2	Designation	DH		
3	Rated voltage	18	kV	
4	Continuous operating voltage	15.3	kV	
5	Nominal discharge current	10	kA	
6	Partial discharge	≤10	pc	
7	Power frequence reference voltage	≥19.2	kV	1mA
8	1/5μS residual voltage of steep impulse current	≤58.0	kV	peak
9	8/20μS residual voltage of lightning impulse current	≤51.0	kV	peak
10	Repetitive charge transfer rating Q_{rs}	≥0.4	C	
11	High current impulse of 4/10μS	100	kA	peak
12	Short-circuit / pressure relief capability	20 600±200	kA A	
13	The power-frequency voltage-versus-time characteristics	0.1s/1.18Ur 1.1s/1.05Ur 10.1s/1.00Ur 1000s/0.95Ur		
14	Thermal charge transfer rating Q_{th}	1.1	C	
15	Lightning impulse withstand of housing	110	kV	peak
16	Power frenquce withstand of housing	50	kV	peak
17	Specified short-term load(SSL)	400	N	

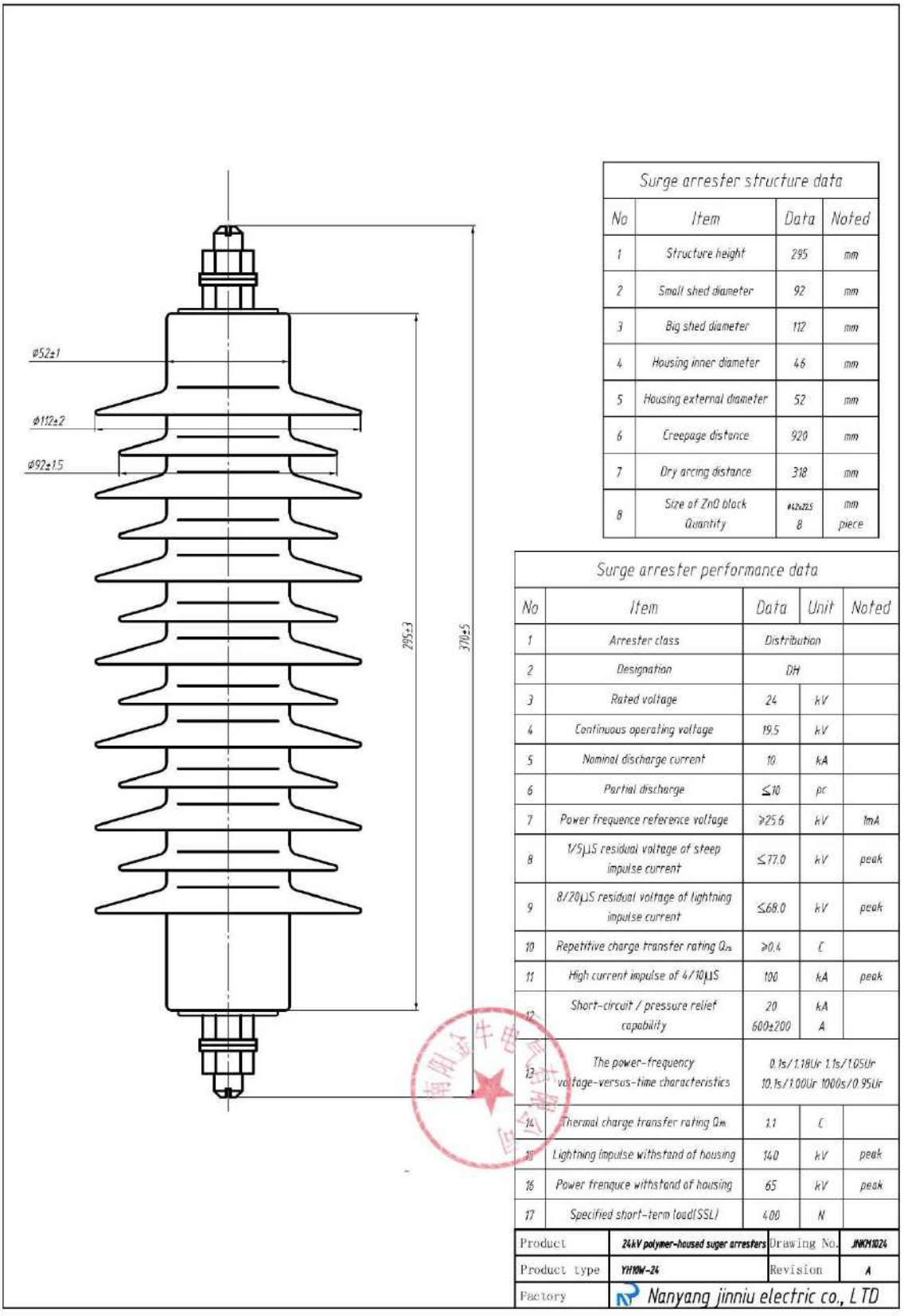
Product	18kV polymer-housed suger arresters	Drawing No.	JNKM1018
Product type	YH10W-18	Revision	A
Factory	Nanyang jinniu electric co., LTD		



Surge arrester structure data			
No	Item	Data	Noted
1	Structure height	260	mm
2	Small shed diameter	92	mm
3	Big shed diameter	112	mm
4	Housing inner diameter	46	mm
5	Housing external diameter	52	mm
6	Creepage distance	790	mm
7	Dry arcing distance	284	mm
8	Size of ZnO block Quantity	Ø42x22.5 7	mm piece

Surge arrester performance data				
No	Item	Data	Unit	Noted
1	Arrester class	Distribution		
2	Designation	DH		
3	Rated voltage	21	kV	
4	Continuous operating voltage	17.0	kV	
5	Nominal discharge current	10	kA	
6	Partial discharge	≤10	pc	
7	Power frequence reference voltage	≥22.4	kV	1mA
8	1/5μS residual voltage of steep impulse current	≤67.5	kV	peak
9	8/20μS residual voltage of lightning impulse current	≤59.5	kV	peak
10	Repetitive charge transfer rating Q_{rs}	≥0.4	C	
11	High current impulse of 4/10μS	100	kA	peak
12	Short-circuit / pressure relief capability	20 600±200	kA A	
13	The power-frequency voltage-versus-time characteristics	0.1s/1.18Ur 1.1s/1.05Ur 10.1s/1.00Ur 1000s/0.95Ur		
14	Thermal charge transfer rating Q_{th}	1.1	C	
15	Lightning impulse withstand of housing	125	kV	peak
16	Power frenquce withstand of housing	55	kV	peak
17	Specified short-term load(SSL)	400	N	

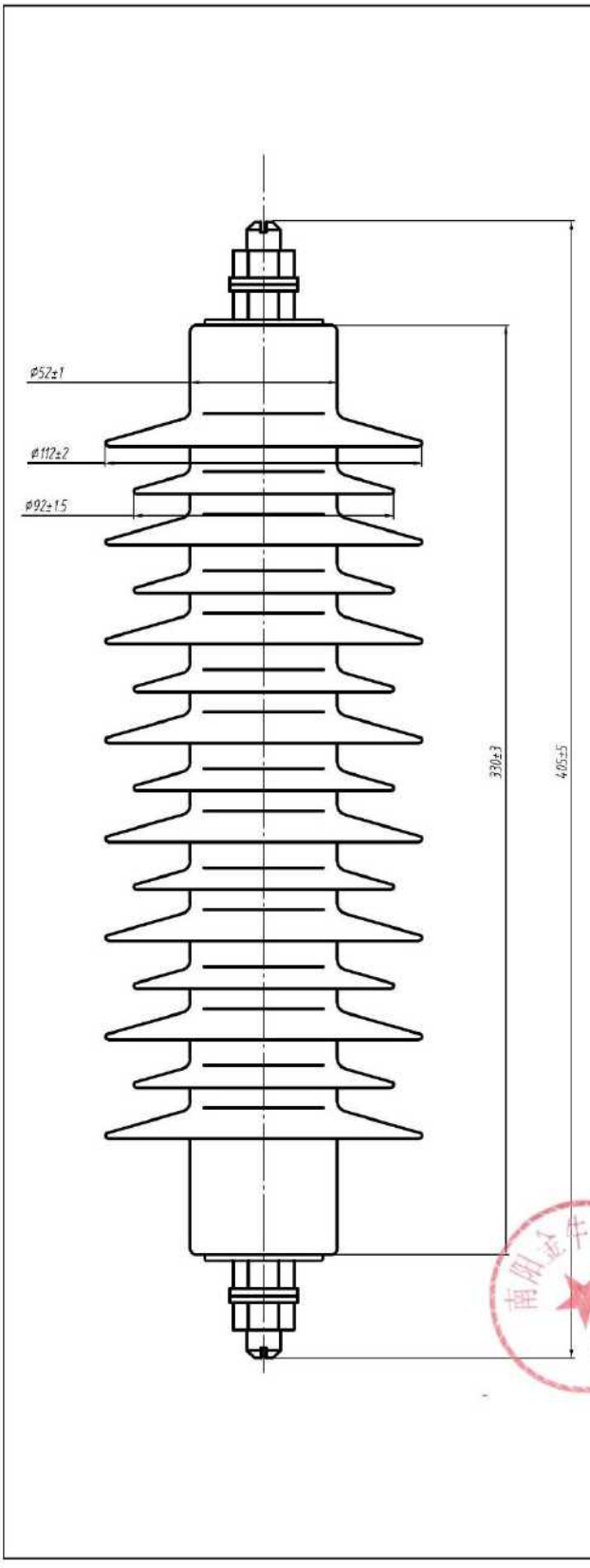
Product	21kV polymer-housed suger arresters	Drawing No.	JNKM1021
Product type	YH10W-21	Revision	A
Factory	Nanyang jinniu electric co., LTD		



Surge arrester structure data			
No	Item	Data	Noted
1	Structure height	295	mm
2	Small shed diameter	92	mm
3	Big shed diameter	112	mm
4	Housing inner diameter	46	mm
5	Housing external diameter	52	mm
6	Creepage distance	920	mm
7	Dry arcing distance	318	mm
8	Size of ZnO block Quantity	ø42x22.5 8	mm piece

Surge arrester performance data				
No	Item	Data	Unit	Noted
1	Arrester class	Distribution		
2	Designation	DH		
3	Rated voltage	24	kV	
4	Continuous operating voltage	19.5	kV	
5	Nominal discharge current	10	kA	
6	Partial discharge	≤10	pc	
7	Power frequence reference voltage	≥25.6	kV	1mA
8	1/5μS residual voltage of steep impulse current	≤77.0	kV	peak
9	8/20μS residual voltage of lightning impulse current	≤68.0	kV	peak
10	Repetitive charge transfer rating Q_{rs}	≥0.4	C	
11	High current impulse of 4/10μS	100	kA	peak
12	Short-circuit / pressure relief capability	20 600±200	kA A	
13	The power-frequency voltage-versus-time characteristics	0.1s/1.18Ur 1.1s/1.05Ur 10.1s/1.00Ur 1000s/0.95Ur		
14	Thermal charge transfer rating Q_{th}	1.1	C	
15	Lightning impulse withstand of housing	140	kV	peak
16	Power frenquce withstand of housing	65	kV	peak
17	Specified short-term load(SSL)	400	N	

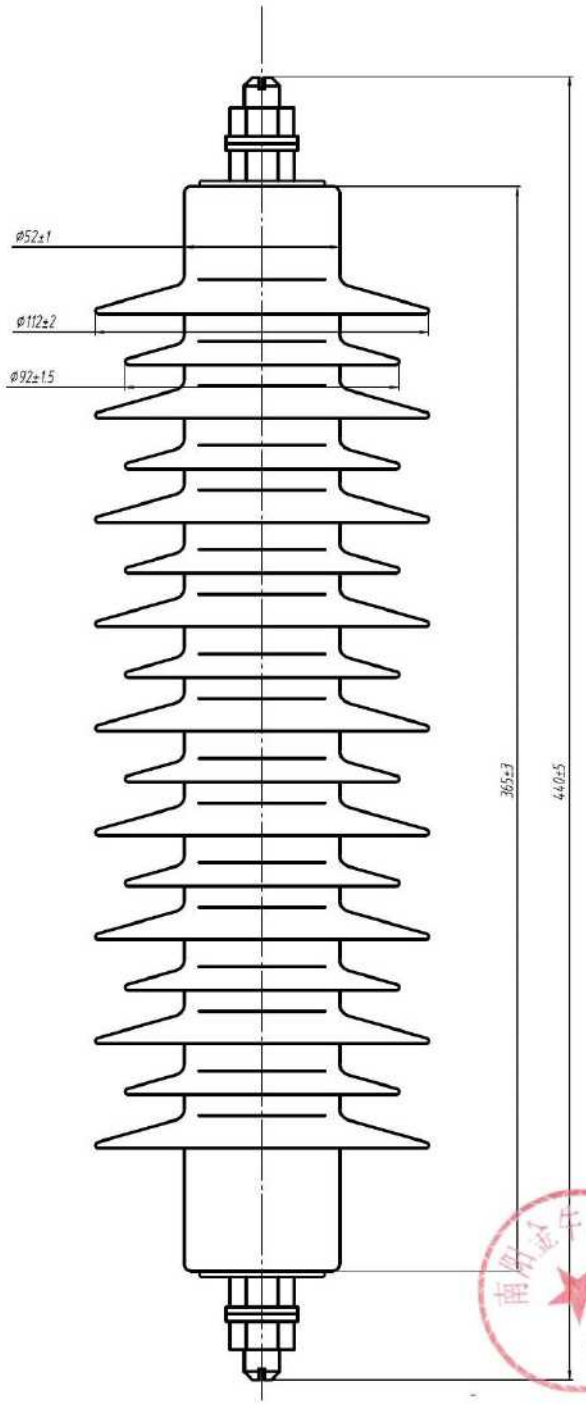
Product	24kV polymer-housed suger arresters	Drawing No.	JNKM1024
Product type	YH10W-24	Revision	A
Factory	Nanyang jinniu electric co., LTD		



Surge arrester structure data			
No	Item	Data	Noted
1	Structure height	330	mm
2	Small shed diameter	92	mm
3	Big shed diameter	112	mm
4	Housing inner diameter	46	mm
5	Housing external diameter	52	mm
6	Creepage distance	1050	mm
7	Dry arcing distance	356	mm
8	Size of ZnO block Quantity	ø42x22.5 9	mm piece

Surge arrester performance data				
No	Item	Data	Unit	Noted
1	Arrester class	Distribution		
2	Designation	DH		
3	Rated voltage	27	kV	
4	Continuous operating voltage	22.0	kV	
5	Nominal discharge current	10	kA	
6	Partial discharge	≤10	pc	
7	Power frequence reference voltage	≥28.8	kV	1mA
8	1/5μS residual voltage of steep impulse current	≤86.5	kV	peak
9	8/20μS residual voltage of lightning impulse current	≤76.5	kV	peak
10	Repetitive charge transfer rating Q_{rs}	≥0.4	C	
11	High current impulse of 4/10μS	100	kA	peak
12	Short-circuit / pressure relief capability	20 600±200	kA A	
13	The power-frequency voltage-versus-time characteristics	0.1s/1.18Ur 1.1s/1.05Ur 10.1s/1.00Ur 1000s/0.95Ur		
14	Thermal charge transfer rating Q_{th}	1.1	C	
15	Lightning impulse withstand of housing	155	kV	peak
16	Power frenquce withstand of housing	70	kV	peak
17	Specified short-term load(SSL)	400	N	

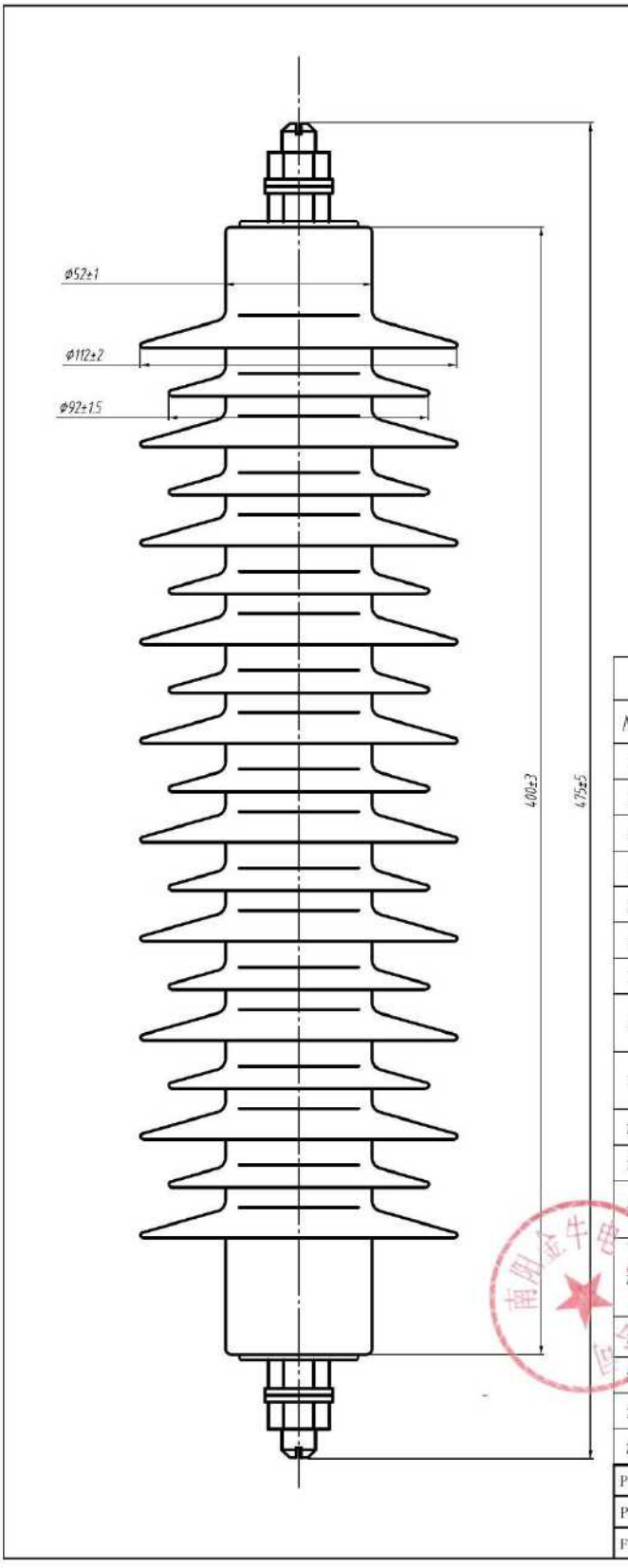
Product	27kV polymer-housed suger arresters	Drawing No.	JNKM1027
Product type	YH10W-27	Revision	A
Factory	Nanyang jinniu electric co., LTD		



Surge arrester structure data			
No	Item	Data	Noted
1	Structure height	365	mm
2	Small shed diameter	92	mm
3	Big shed diameter	112	mm
4	Housing inner diameter	46	mm
5	Housing external diameter	52	mm
6	Creepage distance	1260	mm
7	Dry arcing distance	392	mm
8	Size of ZnO block Quantity	ø42x22.5 10	mm piece

Surge arrester performance data				
No	Item	Data	Unit	Noted
1	Arrester class	Distribution		
2	Designation	DH		
3	Rated voltage	30	kV	
4	Continuous operating voltage	24.4	kV	
5	Nominal discharge current	10	kA	
6	Partial discharge	≤10	pc	
7	Power frequence reference voltage	≥32	kV	1mA
8	1/5μS residual voltage of steep impulse current	≤96.0	kV	peak
9	8/20μS residual voltage of lightning impulse current	≤85.0	kV	peak
10	Repetitive charge transfer rating Q_{rs}	≥0.4	C	
11	High current impulse of 4/10μS	100	kA	peak
12	Short-circuit / pressure relief capability	20 600±200	kA A	
13	The power-frequency voltage-versus-time characteristics	0.1s/1.18Ur 1.1s/1.05Ur 10.1s/1.00Ur 1000s/0.95Ur		
14	Thermal charge transfer rating Q_{th}	1.1	C	
15	Lightning impulse withstand of housing	170	kV	peak
16	Power frenquce withstand of housing	80	kV	peak
17	Specified short-term load(SSL)	400	N	

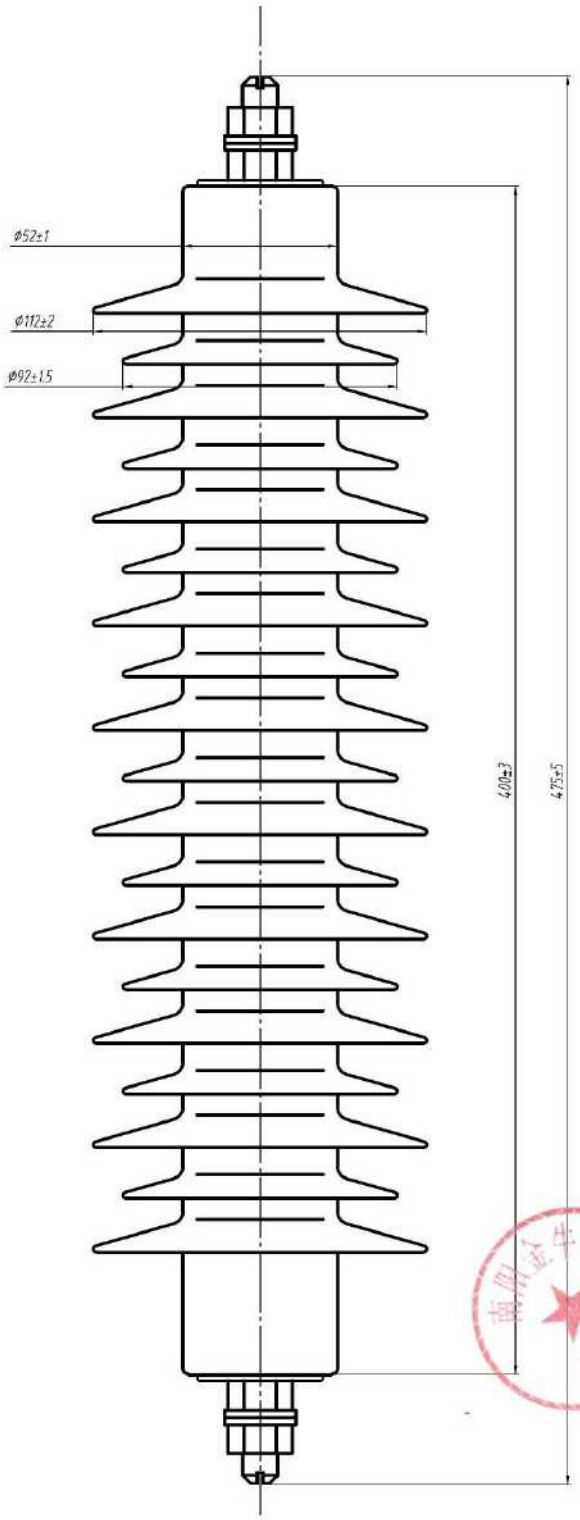
Product	30kV polymer-housed suger arresters	Drawing No.	JNKM1030
Product type	YH10W-30	Revision	A
Factory	Nanyang jinniu electric co., LTD		



Surge arrester structure data			
No	Item	Data	Noted
1	Structure height	400	mm
2	Small shed diameter	92	mm
3	Big shed diameter	112	mm
4	Housing inner diameter	46	mm
5	Housing external diameter	52	mm
6	Creepage distance	1340	mm
7	Dry arcing distance	428	mm
8	Size of ZnO block Quantity	ø42x22.5 11	mm piece

Surge arrester performance data				
No	Item	Data	Unit	Noted
1	Arrester class	Distribution		
2	Designation	DH		
3	Rated voltage	33	kV	
4	Continuous operating voltage	26.7	kV	
5	Nominal discharge current	10	kA	
6	Partial discharge	≤10	pc	
7	Power frequence reference voltage	≥35.2	kV	1mA
8	1/5μS residual voltage of steep impulse current	≤105.5	kV	peak
9	8/20μS residual voltage of lightning impulse current	≤93.5	kV	peak
10	Repetitive charge transfer rating Q_{rs}	≥0.4	C	
11	High current impulse of 4/10μS	100	kA	peak
12	Short-circuit / pressure relief capability	20 600±200	kA A	
13	The power-frequency voltage-versus-time characteristics	0.1s/1.18Ur 1.1s/1.05Ur 10.1s/1.00Ur 1000s/0.95Ur		
14	Thermal charge transfer rating Q_{th}	1.1	C	
15	Lightning impulse withstand of housing	185	kV	peak
16	Power frenquce withstand of housing	90	kV	peak
17	Specified short-term load(SSL)	4.00	N	

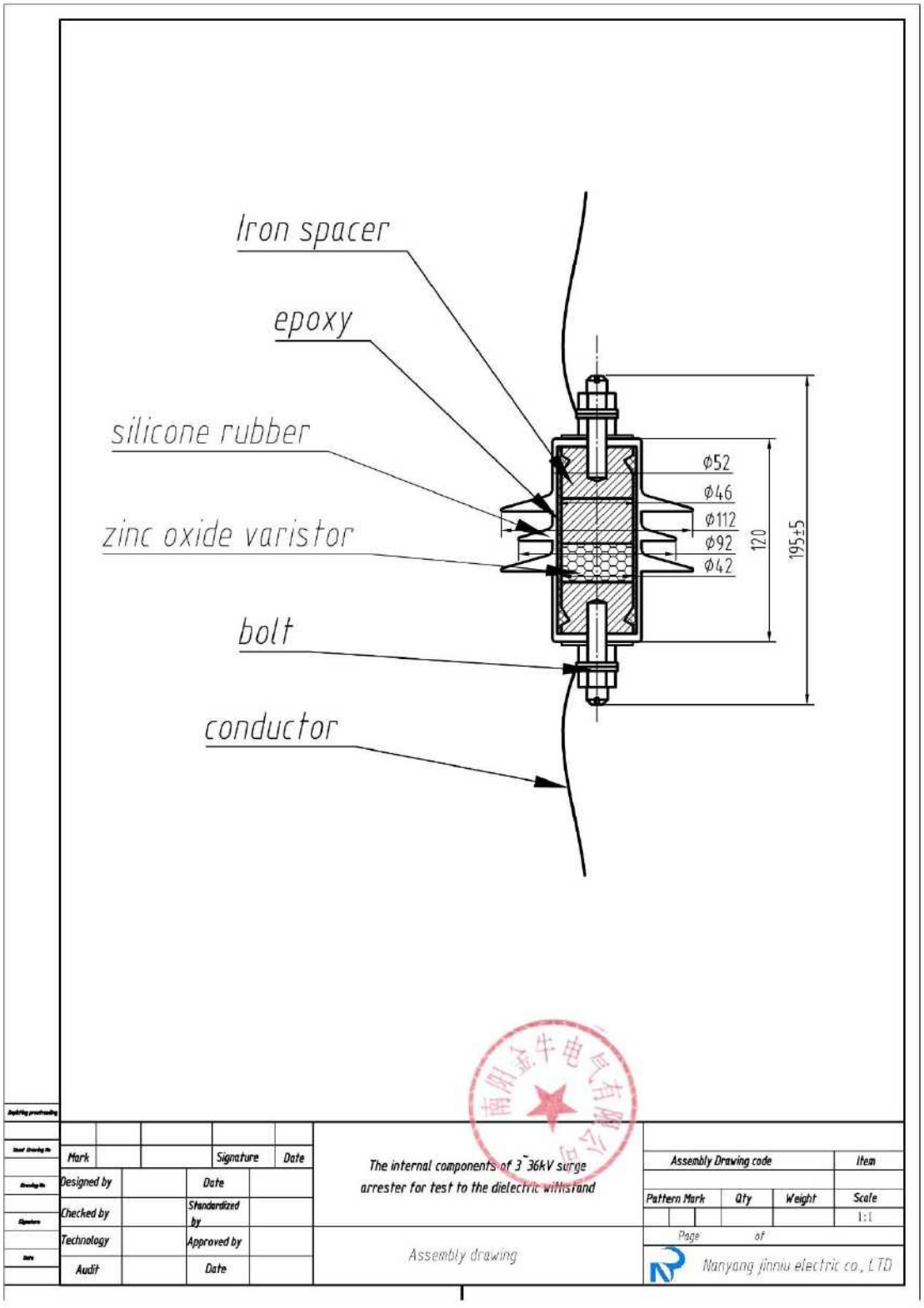
Product	33kV polymer-housed suger arresters	Drawing No.	JNKM1033
Product type	YH10W-33	Revision	A
Factory	Nanyang jinniu electric co., LTD		



Surge arrester structure data			
No	Item	Data	Noted
1	Structure height	400	mm
2	Small shed diameter	92	mm
3	Big shed diameter	112	mm
4	Housing inner diameter	46	mm
5	Housing external diameter	52	mm
6	Creepage distance	1340	mm
7	Dry arcing distance	428	mm
8	Size of ZnO block Quantity	ø42x22.5 12	mm piece

Surge arrester performance data				
No	Item	Data	Unit	Noted
1	Arrester class	Distribution		
2	Designation	DH		
3	Rated voltage	36	kV	
4	Continuous operating voltage	29	kV	
5	Nominal discharge current	10	kA	
6	Partial discharge	≤10	pc	
7	Power frequence reference voltage	≥38.4	kV	1mA
8	1/5μS residual voltage of steep impulse current	≤115.0	kV	peak
9	8/20μS residual voltage of lightning impulse current	≤102.0	kV	peak
10	Repetitive charge transfer rating Q_{rs}	≥0.4	C	
11	High current impulse of 4/10μS	100	kA	peak
12	Short-circuit / pressure relief capability	20 600±200	kA A	
13	The power-frequency voltage-versus-time characteristics	0.1s/1.18Ur 1.1s/1.05Ur 10.1s/1.00Ur 1000s/0.95Ur		
14	Thermal charge transfer rating Q_{th}	1.1	C	
15	Lightning impulse withstand of housing	185	kV	peak
16	Power frenquce withstand of housing	90	kV	peak
17	Specified short-term load(SSL)	400	N	

Product	36kV polymer-housed suger arresters	Drawing No.	JNKM1036
Product type	YH10W-36	Revision	A
Factory	Nanyang jinniu electric co., LTD		


Iron spacer
epoxy
silicone rubber
zinc oxide varistor
bolt
conductor
φ52
φ46
φ112
φ92
φ42
120
195±5
Mark
Signature
Date
Designed by
Date
Checked by
Standardized by
Technology
Approved by
Audit
Date
The internal components of 3~36kV surge arrester for test to the dielectric withstand
Assembly drawing
Assembly Drawing code
Item
Pattern Mark
Qty
Weight
Scale
1:1
Page of
Nanyang jinniu electric co., LTD

Appendix A Test report (CEPRI)

180008250711

中国认可
国际互认
检测
TESTING
CNAS L0699

CEPRI

TEST REPORT

CEPRI-EETC02-2018-0066

Client: Nanyang jinniu electric co.,LTD

Object: Polymer-housed metal oxide surge arresters without gaps for a.c. system

Type: YH10W-3, YH10W-6, YH10W-9, YH10W-12, YH10W-15, YH10W-18, YH10W-21, YH10W-24, YH10W-27, YH10W-30, YH10W-33, YH10W-36 (Φ42mm×22.5mm)

Test Category: Type Test

POWER INDUSTRY QUALITY INSPECTION AND TEST CENTER FOR ELECTRIC EQUIPMENT

Catalogue

Test Report	Power Industry Quality Inspection and Test Center for Electric Equipment		CEPRI-EETC02-2018-0066 Total 60 Page 2
Client	Nanyang jinniu electric co.,LTD	Manufacturer	Nanyang jinniu electric co.,LTD
Object	Polymer-housed metal oxide surge arresters without gaps for a.c. system	Type	YH10W-3, YH10W-6, YH10W-9, YH10W-12, YH10W-15, YH10W-18, YH10W-21, YH10W-24, YH10W-27, YH10W-30, YH10W-33, YH10W-36 (Φ42mm×22.5mm)
Sampling procedure	By the client delivery	Serial No.	5 arrester (001~005) 10 thermally prorated sections (201～210) 16 resistors (301～316) 12 housings (401~412) 1 dielectrically prorated section(501) 3 specimens of shed and housing materials (601～603)
Test Category	Type Test	Date	2018.12.03~2019.03.03
Requirements	IEC60099-4 Edition 3.0 (2014-06) Metal-oxide surge arresters without gaps for a.c. systems		
Conclusion	Polymer-housed metal oxide surge arresters without gaps for a.c. system of YH10W-3, YH10W-6, YH10W-9, YH10W-12, YH10W-15, YH10W-18, YH10W-21, YH10W-24, YH10W-27, YH10W-30, YH10W-33 and YH10W-36 have passed the type tests specified in IEC60099-4 Edition 3.0 (2014-06).		
Note	Note :See appendix A for sample instruction.		

Compiled by: 王陆璐 黄佳瑞

Checked by: 左中秋 **Verified by:** 熊易

Approved by: 王保山 **Date of issue:** 2019.06.17

Test Results

No.	Item		Requirements		Results	Evaluation
1	Insulation withstand tests on the arrester housing		Power-frequency voltage: (wet) ≥28kV$_p$~90kV$_p$, for 1min. Lightning impulse voltage : 60kV$_p$~185kV$_p$, Positive and negative 15 times each.		The dry arcing distance is larger than the value given by the equation, so the tests were not required.	Pass
2	Residual voltage test	Lightning impulse current	YH10W-3	≤8.5kV$_p$	8.16 kV$_p$	Pass
			YH10W-6	≤17.0kV$_p$	16.32 kV$_p$	
			YH10W-9	≤25.5kV$_p$	24.48 kV$_p$	
			YH10W-12	≤34.0kV$_p$	32.64 kV$_p$	
			YH10W-15	≤42.5kV$_p$	40.80 kV$_p$	
			YH10W-18	≤51.0kV$_p$	48.96 kV$_p$	
			YH10W-21	≤59.5kV$_p$	57.12 kV$_p$	
			YH10W-24	≤68.0kV$_p$	65.28 kV$_p$	
			YH10W-27	≤76.5kV$_p$	73.44 kV$_p$	
			YH10W-30	≤85.0kV$_p$	81.60 kV$_p$	
			YH10W-33	≤93.5kV$_p$	89.76 kV$_p$	
			YH10W-36	≤102.0kV$_p$	97.92 kV$_p$	
		Steep impulse current	YH10W-3	≤10.5kV$_p$	10.28 kV$_p$	
			YH10W-6	≤20.0kV$_p$	19.36 kV$_p$	
			YH10W-9	≤29.5kV$_p$	28.79 kV$_p$	
			YH10W-12	≤39.0kV$_p$	38.22 kV$_p$	
			YH10W-15	≤48.5kV$_p$	47.65 kV$_p$	
			YH10W-18	≤58.0kV$_p$	56.73 kV$_p$	
			YH10W-21	≤67.5kV$_p$	66.16 kV$_p$	
			YH10W-24	≤77.0kV$_p$	75.59 kV$_p$	
			YH10W-27	≤86.5kV$_p$	85.02 kV$_p$	
			YH10W-30	≤96.0kV$_p$	94.45 kV$_p$	
			YH10W-33	≤105.5kV$_p$	103.88 kV$_p$	
			YH10W-36	≤115.0kV$_p$	112.96 kV$_p$	
3	Repetitive charge transfer withstand test		10 samples should withstand 20 times 8/20μs lightning impulses and the charge value and the current should not less than 0.4C.		Q_{rs}: 0.440C~0.454C	Pass
4	Test to verify long term stability under continuous operating voltage		The accelerated ageing test of resistors should be carried out according to the specified procedure.		P_{max}-P_{min} <1.3P_{min}, P_{max} <1.1 P_{start}, the samples fulfilled the requirements.	Pass

No.	Items	Requirements	Results	Evaluation
5	Heat dissipation behavior verification test	The test section is for all instants during the cooling period have a temperature higher than the complete arrester.	Fulfilled the requirements. See fig 5.	Pass
6	Operating duty test	The switching surge operating duty test should be carried out according to the specified procedure. The residual voltage shall not have changed by more than 5%.	The three samples are carried out according to the specified procedure. The residual voltage changed ratio is from +1.90% to+2.41%.	Pass
7	Power-frequency voltage-versus-time characteristics	Supply the Power frequency voltage-versus-time characteristics for the range of voltage from $1.18U_r^*$ to $0.95U_r^*$, the range of time from 0.1s to 1000s for with prior duty, $1.20U_r^*$ to $0.98U_r^*$, the range of time from 0.1s to 1000s for without prior duty.	With prior duty $1.18U_r^*$ 0.1s $1.05U_r^*$ 1.1s $1.00U_r^*$ 10.1s $0.95U_r^*$ 1000s Without prior duty $1.20U_r^*$ 0.1s $0.98U_r^*$ 1000s	Pass
8	Test to verify the dielectric withstand of the internal components of an arrester	1 time 100kA-4/10μs	98.4kA, no puncture, flashover, cracking or other significant damage.	Pass
9	Bending moment	Bending load of SLL:80.0N, Bending load of SSL=400N for 60s～90s,and meet the evaluation requirements.	Bending load of SLL:80.0N, Bending load of SSL=400N for 63s, fulfilled the requirements.	Pass
10	Weather aging test	Samples should pass salt fog test, and meet the evaluation requirements. Samples should pass UV light test, and meet the evaluation requirements.	Fulfilled the requirements. Fulfilled the requirements.	Pass
11	Water immersion test	Put the samples into the boiling water with 0.1%NaCl for42 h: The change rate of power loss should not exceed 20%; the change rate of residual voltage should not exceed 5%; The partial discharge≤10pC	ΔPower loss =-10.90%~-5.24% ΔResidual voltage =-0.37%~+4.38% PD =2.40pC ΔU_{1mAAC}=-1.75%~+0.25%	Pass

Content:

1 Insulation withstand tests on the arrester housing

Samples: 12 housings of arrester (401~412)

Requirements of standards:

1.1 Power-frequency voltage withstand test

Test data: the dry arcing distance value is large than the value given by the equation, so the tests were not required, the test data were listed in table 1.

Table 1 Power-frequency voltage withstand value calculation

sample	401/402	403	404	405/406	407	408	409	410	411/412
Rated voltage，kV	3/6	9	12	15/18	21	24	27	30	33/36
IEC standard, kV_p	7.48/14.96	22.44	29.92	37.4/44.88	52.36	59.84	67.32	74.8	82.28/89.76
Manufacturer claimed, kV_p	28	35	40	50	55	65	70	80	90
$d = [1.82 \times (e^{(U/859)} - 1)]^{0.813}$, m	0.096	0.116	0.130	0.158	0.171	0.198	0.211	0.237	0.263
Dry arcing distance actual, m	0.146	0.178	0.214	0.250	0.284	0.318	0.356	0.392	0.428

1.2 Lightning impulse voltage withstand test

Test data: The dry arcing distance value is large than the value given by the equation, so the tests were not required, the test data were listed in table 2.

Table 2 Lightning impulse voltage withstand value calculation

sample	401/402	403	404	405/406	407	408	409	410	411/412
Rated voltage，kV	3/6	9	12	15/18	21	24	27	30	33/36
IEC standard, kV_p	11.05/22.1	33.15	44.2	55.25/66.3	77.35	88.4	99.45	110.5	121.5/132.6
Manufacturer claimed, kV_p	60	75	90	110	125	140	155	170	185
d=U/500, m	0.120	0.150	0.180	0.220	0.250	0.280	0.310	0.340	0.370
Dry arcing distance actual, m	0.146	0.178	0.214	0.250	0.284	0.318	0.356	0.392	0.428

2 Residual voltage test

Samples:3 resistors（301~303）

Residual voltage tests were performed on three sections of arrester, consisting of one ϕ 42mm ×22.5mm non-linear metal-oxide resistors.

Requirements of standards:

a. The residual voltages of sections are measured at 5kA, 10kA, 20kA by 8/20μs. The maximum values of the determined residual voltages shall be drawn in a residual voltage versus discharge current curve. The residual voltage read on the curve corresponding to the 10kA is defined as the lightning impulse protection level of the arrester.

b. The residual voltage of sections and metal blocks are measured at 10kA by 1/5μs used inductive effect checking the residual voltages of sections and then multiply a factor , ① Matrix to the residual voltages of arrester,② Use Inductive voltage time function to ensure the inductive voltage drop of the arrester terminal. Defined ①+② as the impulse shape of the residual voltage.

Test data: Fulfilled the requirements, the test data were listed in table 3～5， the residual voltage versus rate of rise were shown in fig 1 , the test waveforms were shown in appendix A fig A.1.

Table 3 Sample residual voltage data summary

Impulse Current , kA	Wave Shape, μs	Residual voltage (peak), kV			Residual voltage Ratio		
		Sample 301	Sample 302	Sample 303	Sample 301	Sample 302	Sample 303
5	8/20	7.30	7.46	7.54	0.91	0.93	0.92
10	8/20	8.00	8.04	8.16	1.00	1.00	1.00
20	8/20	8.99	8.99	9.23	1.12	1.12	1.13
10	1/5	8.96	8.96	9.08	1.12	1.11	1.11

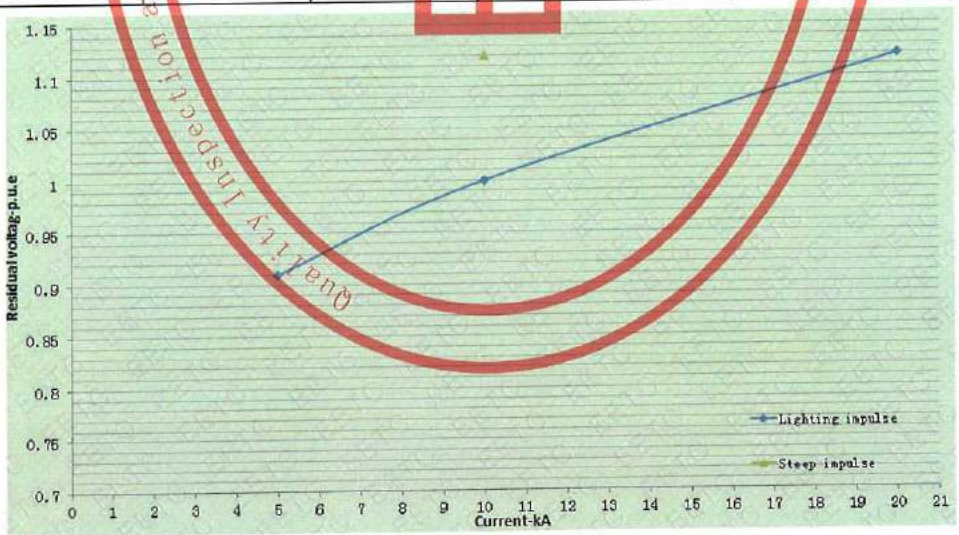


Fig 1 Residual voltage versus rate of rise

Table 4 Lightning impulse residual voltage test kV (peak)

Samples			301	302	303
Residual voltage of the sections		U_{1mAAC}	3.32	3.25	3.25
		8/20μs, 5 kA_p	7.30	7.46	7.54
		8/20μs, 10 kA_p	8.00	8.04	8.16
		8/20μs, 20 kA_p	8.99	8.99	9.23
Residual voltage of the arresters	YH10W-3	Ratio, n	1		
		U_{5kAp}	7.30	7.46	7.54
		U_{10kAp}	8.00	8.04	8.16
		U_{20kAp}	8.99	8.99	9.23
		Equivalent U_{10kAp}	8.16		
		U_{10kAp} R quired	≤8.5		
	YH10W-6	Ratio, n	2		
		U_{5kAp}	14.60	14.92	15.08
		U_{10kAp}	16.00	16.08	16.32
		U_{20kAp}	17.98	17.98	18.46
		Equivalent U_{10kAp}	16.32		
		U_{10kAp} Required	≤17.0		
	YH10W-9	Ratio, n	3		
		U_{5kAp}	21.90	22.38	22.62
		U_{10kAp}	24.00	24.12	24.48
		U_{20kAp}	26.97	26.97	27.69
		Equivalent U_{10kAp}	24.48		
		U_{10kAp} Required	≤25.5		
	YH10W-12	Ratio, n	4		
		U_{5kAp}	29.20	29.84	30.16
		U_{10kAp}	32.00	32.16	32.64
		U_{20kAp}	35.96	35.96	36.92
		Equivalent U_{10kAp}	32.64		
		U_{10kAp} Required	≤34.0		
	YH10W-15	Ratio, n	5		
		U_{5kAp}	36.50	37.30	37.70
		U_{10kAp}	40.00	40.20	40.80
		U_{20kAp}	44.95	44.95	46.15
		Equivalent U_{10kAp}	40.80		
		U_{10kAp} Required	≤42.5		
	YH10W-18	Ratio, n	6		
		U_{5kAp}	43.80	44.76	45.24
		U_{10kAp}	48.00	48.24	48.96
		U_{20kAp}	53.94	53.94	55.38
		Equivalent U_{10kAp}	48.96		
		U_{10kAp} Required	≤51.0		

Samples			301	302	303
Residual voltage of the arresters	YH10W-21	Ratio, n	7		
		U_{5kAp}	51.10	52.22	52.78
		U_{10kAp}	56.00	56.28	57.12
		U_{20kAp}	62.93	62.93	64.61
		Equivalent U_{10kAp}	57.12		
		U_{10kAp} Required	≤59.5		
	YH10W-24	Ratio, n	8		
		U_{5kAp}	58.40	59.68	60.32
		U_{10kAp}	64.00	64.32	65.28
		U_{20kAp}	71.92	71.92	73.84
		Equivalent U_{10kAp}	65.28		
		U_{10kAp} Required	≤68.0		
	YH10W-27	Ratio, n	9		
		U_{5kAp}	65.70	67.14	67.86
		U_{10kAp}	72.00	72.36	73.44
		U_{20kAp}	80.91	80.91	83.07
		Equivalent U_{10kAp}	73.44		
		U_{10kAp} Required	≤76.5		
	YH10W-30	Ratio, n	10		
		U_{5kAp}	73.00	74.60	75.40
		U_{10kAp}	80.00	80.40	81.60
		U_{20kAp}	89.90	89.90	92.30
		Equivalent U_{10kAp}	81.60		
		U_{10kAp} Required	≤85.0		
	YH10W-33	Ratio, n	11		
		U_{5kAp}	80.30	82.06	82.94
		U_{10kAp}	88.00	88.44	89.76
		U_{20kAp}	98.89	98.89	101.53
		Equivalent U_{10kAp}	89.76		
		U_{10kAp} Required	≤93.5		
	YH10W-36	Ratio, n	12		
		U_{5kAp}	87.60	89.52	90.48
		U_{10kAp}	96.00	96.48	97.92
		U_{20kAp}	107.88	107.88	110.76
		Equivalent U_{10kAp}	97.92		
		U_{10kAp} Required	≤102.0		

Table 5 Steep current impulse residual voltage test kV (peak)

Samples			301	302	303
U_{1mAAC}			3.32	3.25	3.25
Residual voltage of the sections		1/5μs, U_{10kAp}	8.96	8.96	9.08
Residual voltage of metal block		1/5μs 10kA$_p$	0.10		
Residual voltage after correction		1/5μs 10kA$_p$	8.96	8.96	9.08
Residual voltage of the arresters	YH10W-3	Ratio, n	1		
		① U_{10kAp}	8.96	8.96	9.08
		②inductive voltage drop	10kV/m×0.120m=1.20kV		
		①+②:Residual voltage of arrester	10.16	10.16	10.28
		Equivalent U_{10kAp}	10.28		
		U_{10kAp} Required	≤10.5		
	YH10W-6	Ratio, n	2		
		① U_{10kAp}	17.92	17.92	18.16
		②inductive voltage drop	10kV/m×0.120m=1.20kV		
		①+②:Residual voltage of arrester	19.12	19.12	19.36
		Equivalent U_{10kAp}	19.36		
		U_{10kAp} Required	≤20.0		
	YH10W-9	Ratio, n	3		
		① U_{10kAp}	26.88	26.88	27.24
		②inductive voltage drop	10kV/m×0.155m=1.55kV		
		①+②:Residual voltage of arrester	28.43	28.43	28.79
		Equivalent U_{10kAp}	28.79		
		U_{10kAp} Required	≤29.5		
	YH10W-12	Ratio, n	4		
		① U_{10kAp}	35.84	35.84	36.32
		②inductive voltage drop	10kV/m×0.190m=1.90kV		
		①+②:Residual voltage of arrester	37.74	37.74	38.22
		Equivalent U_{10kAp}	38.22		
		U_{10kAp} Required	≤39.0		
	YH10W-15	Ratio, n	5		
		① U_{10kAp}	44.80	44.80	45.40
		②inductive voltage drop	10kV/m×0.225m=2.25kV		
		①+②:Residual voltage of arrester	47.05	47.05	47.65
		Equivalent U_{10kAp}	47.65		
		U_{10kAp} Required	≤48.5		
	YH10W-18	Ratio, n	6		
		① U_{10kAp}	53.76	53.76	54.48
		②inductive voltage drop	10kV/m×0.225m=2.25kV		
		①+②:Residual voltage of arrester	56.01	56.01	56.73
		Equivalent U_{10kAp}	56.73		
		U_{10kAp} Required	≤58.0		

Samples			301	302	303
Residual voltage of the arresters	YH10W-21	Ratio, n	7		
		① U_{10kAp}	62.72	62.72	63.56
		②inductive voltage drop	10kV/m×0.260m=2.60kV		
		①+②:Residual voltage of arrester	65.32	65.32	66.16
		Equivalent U_{10kAp}	66.16		
		U_{10kAp} Required	≤67.5		
	YH10W-24	Ratio, n	8		
		① U_{10kAp}	71.68	71.68	72.64
		②inductive voltage drop	10kV/m×0.295m=2.95kV		
		①+②:Residual voltage of arrester	74.63	74.63	75.59
		Equivalent U_{10kAp}	75.59		
		U_{10kAp} Required	≤77.0		
	YH10W-27	Ratio, n	9		
		① U_{10kAp}	80.64	80.64	81.72
		②inductive voltage drop	10kV/m×0.330m=3.30kV		
		①+②:Residual voltage of arrester	83.94	83.94	85.02
		Equivalent U_{10kAp}	85.02		
		U_{10kAp} Required	≤86.5		
	YH10W-30	Ratio, n	10		
		① U_{10kAp}	89.60	89.60	90.80
		②inductive voltage drop	10kV/m×0.365m=3.65kV		
		①+②:Residual voltage of arrester	93.25	93.25	94.45
		Equivalent U_{10kAp}	94.45		
		U_{10kAp} Required	≤96.0		
	YH10W-33	Ratio, n	11		
		① U_{10kAp}	98.56	98.56	99.88
		②inductive voltage drop	10kV/m×0.400m=4.00kV		
		①+②:Residual voltage of arrester	102.56	102.56	103.88
		Equivalent U_{10kAp}	103.8		
		U_{10kAp} Required	≤105.5		
	YH10W-36	Ratio, n	12		
		① U_{10kAp}	107.52	107.52	108.96
		②inductive voltage drop	10kV/m×0.400m=4.00kV		
		①+②:Residual voltage of arrester	111.52	111.52	112.96
		Equivalent U_{10kAp}	112.96		
		U_{10kAp} Required	≤115.0		

3 Repetitive charge transfer withstand

Samples:10 resistors（304～313）

Requirements of standards: The samples should withstand more than 0.40C by 8/20μs lightning impulses for 20 times, and after test, have no breakdown or flashover or breakage, the change of residual voltage within ±5%, the change of reference voltage within ±5%，also should withstand capability to one 8/20 current impulse of at least 0.5 kA/cm^2 peak current density or 2 times I_n, whichever is lower.

Test data: Fulfilled the requirements , the test data were listed in the table 6, the test waveforms were shown in appendix A fig A.2～fig A.3.

Table 6 Repetitive charge transfer withstand

Samples		304	305	306	307	308	309	310	311	312	313
Before test	U_{1mAAC}, kV	3.51	3.49	3.54	3.49	3.49	3.48	3.50	3.48	3.48	3.49
	8/20μs U_{10kA}, kV	8.33	8.29	8.33	8.33	8.29	8.20	8.41	8.33	8.29	8.20
Q_{rs}, C		Q_{rs} (Claimed repetitive charge transfer rating) * 1.1=0.44									
1st	Q_{rs}, C	0.452	0.451	0.450	0.454	0.452	0.453	0.446	0.443	0.453	0.452
2nd	Q_{rs}, C	0.446	0.443	0.443	0.443	0.446	0.443	0.444	0.443	0.443	0.451
3rd	Q_{rs}, C	0.443	0.443	0.443	0.443	0.444	0.443	0.452	0.443	0.443	0.443
4th	Q_{rs}, C	0.446	0.446	0.445	0.443	0.443	0.443	0.443	0.445	0.443	0.443
5th	Q_{rs}, C	0.445	0.445	0.443	0.445	0.446	0.444	0.451	0.443	0.443	0.443
6th	Q_{rs}, C	0.443	0.440	0.446	0.440	0.446	0.443	0.443	0.443	0.443	0.443
7th	Q_{rs}, C	0.443	0.447	0.447	0.443	0.443	0.454	0.445	0.443	0.443	0.452
8th	Q_{rs}, C	0.446	0.445	0.444	0.443	0.446	0.443	0.440	0.443	0.443	0.443
9th	Q_{rs}, C	0.447	0.447	0.447	0.452	0.443	0.446	0.447	0.440	0.443	0.443
10th	Q_{rs}, C	0.445	0.445	0.444	0.443	0.445	0.444	0.444	0.440	0.447	0.443
11th	Q_{rs}, C	0.445	0.443	0.444	0.447	0.446	0.446	0.443	0.446	0.443	0.447
12th	Q_{rs}, C	0.443	0.443	0.440	0.446	0.444	0.443	0.443	0.445	0.443	0.446
13th	Q_{rs}, C	0.445	0.445	0.444	0.447	0.446	0.443	0.444	0.447	0.443	0.444
14th	Q_{rs}, C	0.440	0.445	0.444	0.446	0.444	0.443	0.440	0.446	0.444	0.444
15th	Q_{rs}, C	0.444	0.443	0.444	0.446	0.445	0.444	0.446	0.440	0.446	0.444
16th	Q_{rs}, C	0.444	0.444	0.440	0.445	0.440	0.443	0.446	0.444	0.444	0.444
17th	Q_{rs}, C	0.445	0.446	0.447	0.444	0.444	0.443	0.440	0.446	0.447	0.443
18th	Q_{rs}, C	0.445	0.445	0.445	0.445	0.443	0.443	0.445	0.447	0.443	0.443
19th	Q_{rs}, C	0.440	0.440	0.444	0.443	0.446	0.440	0.440	0.440	0.440	0.450
20th	Q_{rs}, C	0.440	0.440	0.443	0.442	0.443	0.440	0.440	0.440	0.440	0.440

Test evaluation	One 8/20 current impulse, kA	0.5kA/cm^2=0.5*3.14*(4.2/2)^2=6.92kA which is higher than 2 times I_n								
		9.37	7.36	7.04	7.12	7.20	7.28	7.12	7.16	7.08	10.12
	U_{1mAAC}, kV	3.64	3.62	3.66	3.61	3.63	3.57	3.62	3.57	3.59	3.59
	Change rate, %	+3.70	+3.72	+3.39	+3.44	+4.01	+2.59	+3.43	+2.59	+3.16	+2.87
	8/20μs U_{10kA}, kV	8.70	8.67	8.70	8.70	8.67	8.57	8.66	8.61	8.66	8.66
	Change rate, %	+4.44	+4.58	+4.44	+4.44	+4.58	+4.51	+2.97	+3.36	+4.46	+5.61
	Visual inspection	All the samples have no puncture, flashover or cracking. The change of residual voltage of sample 313 is higher than + 5%, the change of residual voltage and the change of reference voltage for the other 9 samples within ±5%.									

4 Test to verify long term stability under continuous operating voltage

Samples: 3 resistors（314~316）

Requirements of standards: 3 resistors should pass the accelerated ageing test.

Test data: Fulfilled the requirements, the test data were listed in table 7～8, the accelerated ageing curves were shown in fig 2～4.

Table 7 Accelerated ageing test

Time/Sample	Power losses ,W		
	φ42×22.5mm, $U_{cl}=2.55\times(1+0.15\times0.4)=2.70$kV ,115℃		
	314	315	316
04/12/2018 08:40	0.32	0.24	0.30
04/12/2018 11:40	0.27	0.21	0.25
05/12/2018 11:40	0.24	0.20	0.23
06/12/2018 11:40	0.24	0.19	0.22
07/12/2018 11:40	0.23	0.19	0.22
08/12/2018 11:40	0.23	0.19	0.21
09/12/2018 11:40	0.23	0.19	0.22
10/12/2018 11:40	0.23	0.19	0.21
11/12/2018 11:40	0.23	0.19	0.21
12/12/2018 11:40	0.23	0.19	0.21
13/12/2018 11:40	0.23	0.19	0.21
14/12/2018 11:40	0.23	0.19	0.21
15/12/2018 11:40	0.22	0.19	0.21
16/12/2018 11:40	0.22	0.19	0.21
17/12/2018 11:40	0.22	0.19	0.21
18/12/2018 11:40	0.22	0.19	0.20
19/12/2018 11:40	0.22	0.19	0.20
20/12/2018 11:40	0.22	0.19	0.20

21/12/2018 11:40	0.22	0.19	0.20
22/12/2018 11:40	0.22	0.19	0.20
23/12/2018 11:40	0.22	0.19	0.20
24/12/2018 11:40	0.22	0.19	0.20
25/12/2018 11:40	0.22	0.19	0.20
26/12/2018 11:40	0.22	0.19	0.20
27/12/2018 11:40	0.22	0.19	0.20
28/12/2018 11:40	0.22	0.19	0.20
29/12/2018 11:40	0.22	0.19	0.20
30/12/2018 11:40	0.22	0.18	0.20
31/12/2018 11:40	0.22	0.19	0.20
01/01/2019 11:40	0.22	0.18	0.20
02/01/2019 11:40	0.22	0.18	0.20
03/01/2019 11:40	0.22	0.18	0.20
04/01/2019 11:40	0.22	0.18	0.20
05/01/2019 11:40	0.21	0.18	0.20
06/01/2019 11:40	0.21	0.18	0.20
07/01/2019 11:40	0.21	0.18	0.19
08/01/2019 11:40	0.22	0.18	0.20
09/01/2019 11:40	0.21	0.18	0.19
10/01/2019 11:40	0.21	0.18	0.19
11/01/2019 11:40	0.21	0.18	0.20
12/01/2019 11:40	0.21	0.18	0.20
13/01/2019 11:40	0.21	0.18	0.19
14/01/2019 11:40	0.21	0.18	0.19
15/01/2019 11:40	0.21	0.18	0.19

Table 8 Power losses relationship

Samples	314	315	316
U_{1mAAC}, kV	3.26	3.24	3.20
U_c, kV_{rms}	2.70	2.70	2.70
Power losses P_{start}, 3h, W	0.27	0.21	0.25
Power losses P_{end}, 1000+11 h,W	0.21	0.18	0.19
P_{max}, W	0.27	0.21	0.25
P_{min}, W	0.21	0.18	0.19
$(P_{max} - P_{min}) / 1.3P_{min}$	0.22	0.13	0.24
P_{max} /1.1 P_{start}	0.91	0.91	0.91

Note: (1) Because$(P_{max} - P_{min}) < 1.3P_{min}$, $P_{max} < 1.1\ P_{start}$, the samples fulfilled the requirements.

(2) The temperature of blocks:115±4℃.

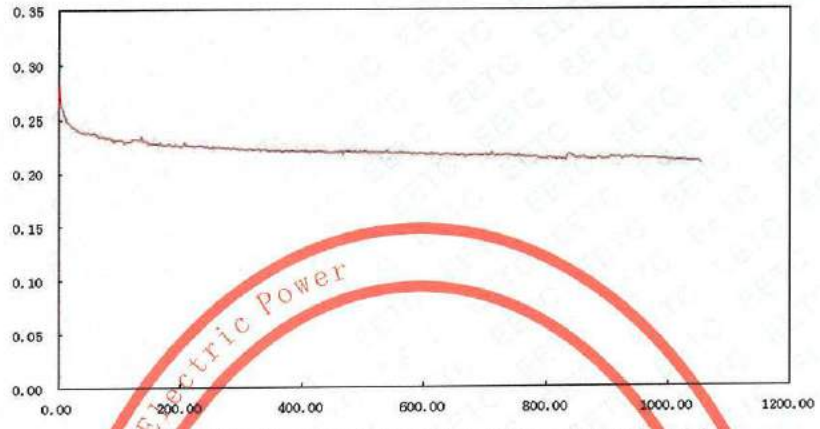


Fig 2 The Accelerated ageing curve of sample 314

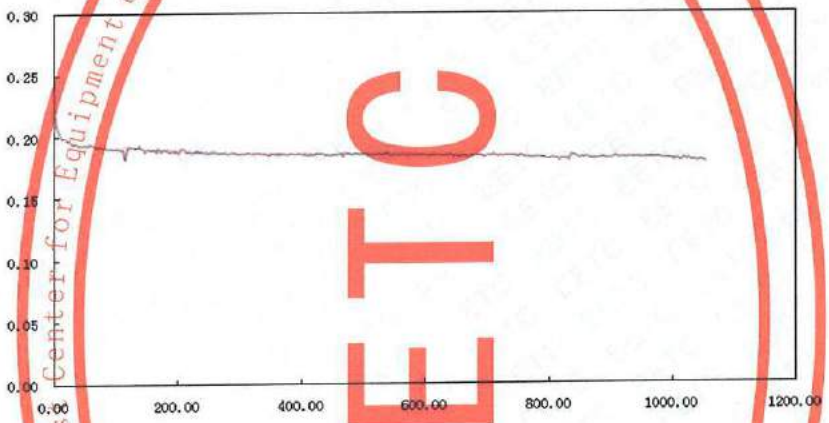


Fig 3 The Accelerated ageing curve of sample 315

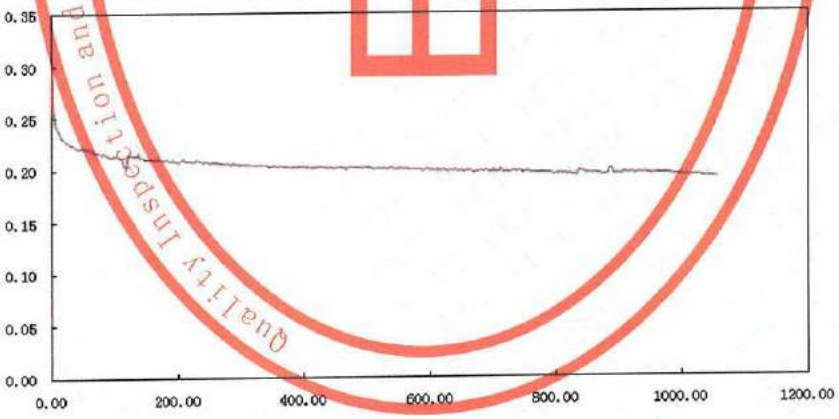


Fig 4 The Accelerated ageing curve of sample 316

5 Heat dissipation behavior verification of test sample

Samples: 1 thermally prorated section (210) 1 arrester (005)

Requirements of standards: the MO resistors in the sample shall be heated to 140℃ by the application of power-frequency voltage. When the temperature is reached, the voltage source shall be disconnected and the cooling time curve shall be determined. At any time, the measured cooling curve of section falls shall above the measured cooling curve of the arrester.

Test data: Fulfilled the requirements, the test waveform was shown in fig 5.

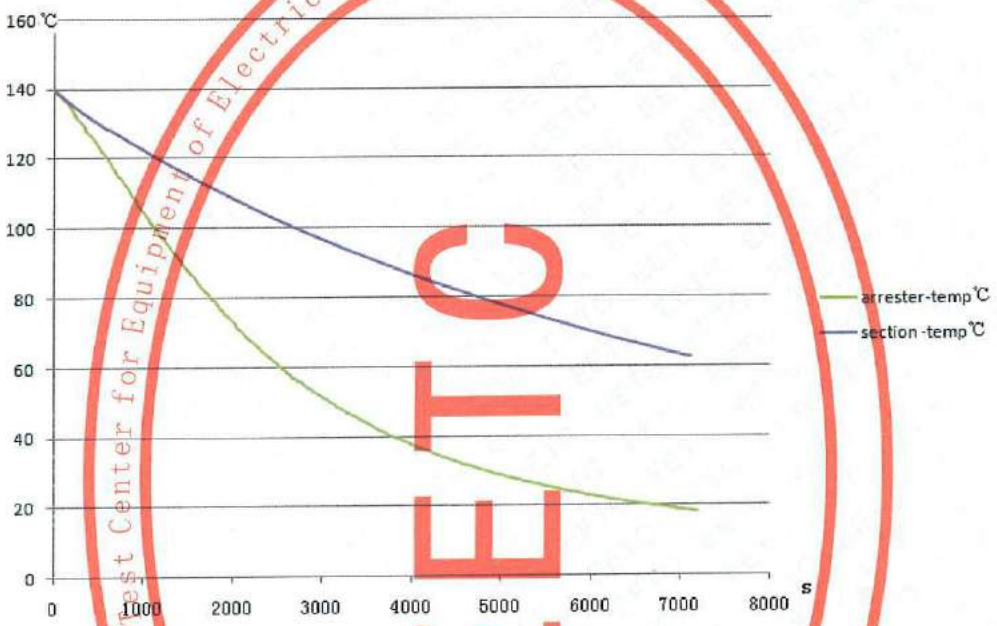


Fig 5 The cooling curve for the section and arrester

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6 Operating duty test

Samples: 3 thermally prorated sections（201~203）

Requirements of standards: 3 thermally prorated sections should pass the high current impulse operating duty test.

Test data: Fulfilled the requirements, the test data were listed in table 9,the test waveforms were shown in appendix A fig A.4～fig A.6.

Table 9 operating duty test

Samples			201	202	203
U_{1mAAC}, kV			3.39	3.44	3.46
U_{sr}, kV_{rms}			3.18	3.23	3.24
U_{sc}, kV_{rms}			2.54	2.58	2.59
8/20μs, U_{10kA} ,before, kV			8.41	8.41	8.29
Conditioning test	One high current impulse, kA		98.8	100.4	99.2
preheated samples			preheated samples to 60.0℃±3℃		
Rated thermal charge transfer,Q_{th}	Lightning current impulse	1st Q_{th} ,C	0.558	0.562	0.566
		2nd Q_{th},C	0.568	0.568	0.594
	Q_{th} rating (2 times), C		1.126	1.130	1.160
Applied voltage after the 2nd impulse	Time	Req.	as short as possible (within 100ms)		
		Actual	85.6	86.0	95.6
	Applied voltage and duration	U_{sr}^*, kV_{rms}	3.18	3.25	3.25
		Duration, s	10	10	10
		U_{sc}^*, kV_{rms}	2.61	2.63	2.64
		Duration, min	30	30	30
Power loss, W	1 s		1.16	1.25	1.18
	5 min		1.07	1.11	1.14
	10 min		1.03	1.10	1.12
	15 min		1.04	1.09	1.09
	20 min		1.04	1.08	1.09
	25 min		1.01	1.07	1.06
	30 min		1.02	1.07	1.06
Samples cooled to			cooled to ambient 20℃±15℃		
8/20μs, U_{10kA} ,after, kV			8.57	8.57	8.49
Variability of the residual voltage, %			+1.90	+1.90	+2.41
Visual inspection			No puncture, flashover, cracking or other significant damage		

7 Power-frequency voltage-versus-time test

Samples: 6 thermally prorated sections（204~209）

Requirements of standards: The 4 sections of arrester should pass the power-frequency voltage-versus-time test.

Test data: Fulfilled the requirements, the test data were listed in table 10～11,and the Power-frequency voltage-versus-time curve was shown in fig 6, the test waveforms were shown in appendix A fig A.7～A.8.

Table 10 Power-frequency voltage-versus-time test data (with prior duty)

Samples			204	205	206	207
U_{1mAAC}, kV			3.47	3.38	3.30	3.33
U_{sr}, kV_{rms}			3.29	3.17	3.09	3.12
U_{sc}, kV_{rms}			2.63	2.54	2.48	2.50
8/20μs, U_{10kA} ,before, kV			8.16	8.12	8.20	8.12
preheated samples			preheated samples to 60.0℃±3℃			
Lightning current impulse	1st impulse	Q_{th} ,C	0.576	0.567	0.565	0.565
	2nd impulse	Q_{th},C	0.575	0.587	0.572	0.579
	Q_{th} rating (2 times) , C		1.151	1.154	1.136	1.144
Applied voltage after the 2nd impulse	Time	Req.	as short as possible (within 100ms)			
		Actual	96.0	86.4	88.4	87.2
	Applied voltage and duration	U_{sr}^*, kV_{rms}	3.14	3.18	3.25	3.68
		TOV scale	0.95	1.00	1.05	1.18
		Duration, s	1000	10.1	1.1	0.1
		U_{sc}^*, kV_{rms}	2.63	2.63	2.61	2.59
		Duration,	30	30	30	30
Power loss, W	1 s		1.19	0.87	1.14	1.28
	5 min		1.17	0.85	0.87	0.88
	10 min		1.17	0.84	0.86	0.88
	15 min		1.15	0.83	0.87	0.88
	20 min		1.14	0.83	0.88	0.86
	25 min		1.14	0.82	0.84	0.85
	30 min		1.14	0.82	0.84	0.84
Samples cooled to			cooled to ambient 20℃±15℃			
8/20μs, U_{10kA} ,after, kV			8.41	8.33	8.37	8.37
Variability of the residual voltage, %			+3.06	+2.59	+2.07	+3.08
Visual inspection			No puncture, flashover, cracking or other significant damage			

Table 11 Power-frequency voltage-versus-time test data (without prior duty)

Samples			208	209
U_{1mAAC}, kV			3.33	3.33
U_{sr}, kV_{rms}			3.12	3.12
U_{sc}, kV_{rms}			2.50	2.50
8/20μs, U_{10kA} ,before, kV			8.12	8.12
preheated samples			preheated samples to 60.0℃±3℃	
Applied voltage	Applied voltage and duration	U_{sr}^*, kV_{rms}	3.74	3.09
		TOV scale	1.20	0.98
		Duration, s	0.1	1000
		U_{sc}^*, kV_{rms}	2.54	2.55
		Duration,	30	30
Power loss, W	1 s		0.85	0.86
	5 min		0.83	0.83
	10 min		0.83	0.78
	15 min		0.84	0.79
	20 min		0.83	0.79
	25 min		0.83	0.78
	30 min		0.83	0.78
Samples cooled to			cooled to ambient 20℃±15℃	
8/20μs, U_{10kA} ,after, kV			8.33	8.24
Variability of the residual voltage, %			+2.59	+1.48
Visual inspection			No puncture, flashover, cracking or other significant damage	

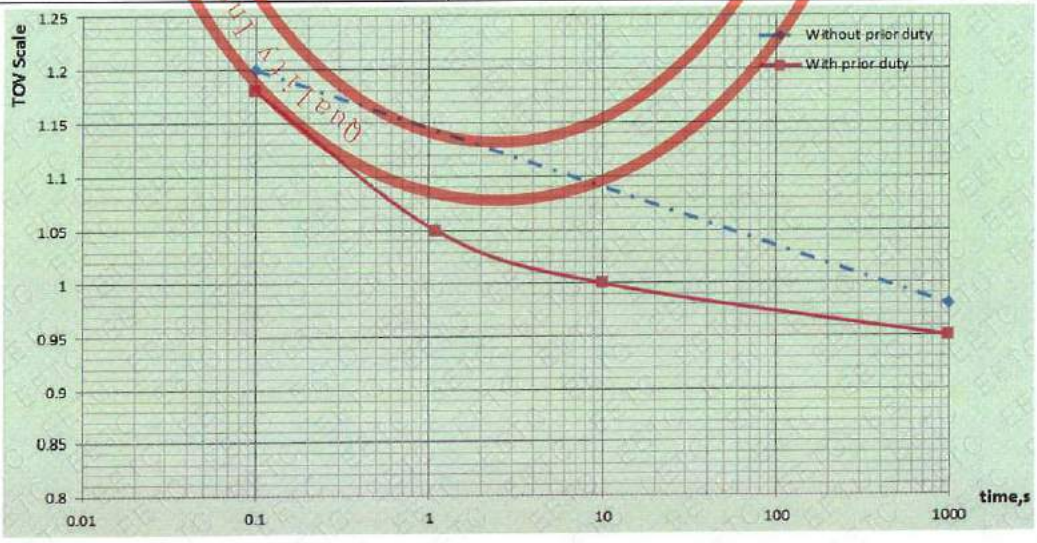

Fig 6 Power-frequency voltage-versus-time curve

8 Test to verify the dielectric withstand of the internal components of an arrester

Samples: 1 dielectrically prorated section（501）

Requirements of standards: preheat the sample to 60℃, consists of one application of a 100kA high-current impulse. There should be no evidence of a dielectric breakdown. the test data were listed in table 12,and the test waveforms were shown in appendix A fig A.9.

Table 12 Test to verify the dielectric withstand of the internal components of an arrester

Sample	501
U_{1mAAC}, kV	3.30
8/20μs, U_{10kA} ,before, kV	8.08
preheated samples	preheated samples to 60℃±3℃
high-current impulse，kA	98.4
Samples cooled to	cooled to ambient 20℃±15℃
8/20μs, U_{10kA} ,after，kV	8.24
Variability of the residual voltage，%	+1.98
Visual inspection	No puncture, flashover, cracking or other significant damage

9 Bending moment

Samples: 3 arresters(001~003)

Requirements of standards: the test of bending moment shall be performed one after the other on three samples as follows: Step 1.1: subject two of the samples to a bending moment test. The bending load shall be increased smoothly to specified short-term load (SSL) within 30s to 90s. When the test load is reached, it shall be maintained for 60s to 90s.Step 1.2: subject the third sample to mechanical/thermal preconditioning test. Step 2: subject all three samples to the water immersion test.

9.1 Bending moment (part 1: on sample 001)

(1) Measure the power loss, partial discharge, residual voltage before the thermo-mechanical preconditioning test;

(2)After terminal torque preconditioning of established procedure, the sample should withstand the cold-heat cycling test at +60℃±5K to -25℃±5K, and +45℃±5K to -40℃±5K. Each cycling time is 48 hours. The temperature of the hot and cold periods shall be maintained for at least 16h. During the test, the continuous static mechanical load of 50% F_s should be applied, its direction change rates every 24 hours, the interruption time should not exceed 1h.

(3)The test samples shall be kept immersed in a vessel, in boiling deionized water with 1kg/m3 of NaCl for 42h.

(4)Measure the power loss and partial discharge ,and then put two successive impulses at nominal discharge current in 50 to 60s, which the wave shape shall be in the range of T1/T2=(4 to 10)/(10 to 25)μs.

(5)After test, there should be no visible mechanical damage. The change rate of power loss should not exceed 20%, the change rate of U_{1mAAC} should not exceed 2%, the change rate of residual voltage should not exceed 5%, the

change of leakage current should not exceed 20μA, the partial discharge should not exceed 10pC.

Test data: Fulfilled the requirements, the test data were listed in table 13.

Table 13 Bending moment test part 1

Sample			001
Before test	Power loss, mW		1031
	Partial discharge, pC		5.40
	Residual voltage, 10kA, 8/20μs, kV		98.49
	U_{1mAAC}, kV		39.9
Terminal torque preconditioning	Torque applied to arrester, N·m		30.0
	Duration, s		30
Thermo-mechanical preconditioning	Specified short-term load(SLL), N		80.0
	Actual applied, N		80.0
	Load angle, temperature and duration		Time:03/12/2018,14:30~04/12/2018, Temperature: +58~+62°C, Load angle:0°
			Time: 04/12/2018,14:30~05/12/2018,14:30 Temperature: -26~-23°C, Load angle:180°
			Time: 05/12/2018,14:30~06/12/2018,14:30 Temperature: +43~+46°C, Load angle:270°
			Time: 06/12/2018,14:30~07/12/2018,14:30 Temperature: -41~-38°C, Load angle:90°
			Maintained time of highest and lowest temperature > 16 h Interruption time < 0.5 h
Boiling water immersion test	The test samples shall be kept immersed in a vessel, in boiling deionized water with 1kg/m^3 of NaCl for 42h.		Time: 07/12/2018, 17:00~09/12/2018, 11:00. Put the sample into the boiling water with 0.1%NaCl, then remove the sample placed under ambient temperature, dry 5h after the sample has cooled to ambient temperature then finish the verification test in 1h
Verification test	Power loss	Value, mW	977.0
		Change rate, %	-5.24
	Partial discharge, pC		2.40
	2 times impulses at nominal discharge current	1st impulse, kV	98.13
		2nd impulse, kV	98.49
		Residual voltage	+0.37
	Residual voltage 10kA, 8/20μs	Value, kV	98.13
		Change rate %	-0.37
	U_{1mAAC}	Value, kV	39.2
		Change rate,%	-1.75
Sample check	No visible mechanical damage		

9.2 Bending moment (part 2: on sample002 and 003)

(1) Measure the power loss, partial discharge, residual voltage before the bending moment test.

(2) The arresters were mounted to the horizontal base of the test equipment and loading was applied at a rate necessary to reach the desired bending moment in 30s to 90 s. After reaching the target load, the load should maintained 60s to 90s and the deflection shall be measured. After release of load, the residual deflection shall be measured.

(3) After the bending moment test, there is no visible mechanical damage and no mutating at the deflection-load, the remaining permanent deflection should not exceed 5% of the length of the housing.

(4) The samples shall pass water immersion test. The change rate of power loss should not exceed 20%, the change rate of residual voltage should not exceed 5%, the partial discharge should not exceed 10pC.

Test data: Fulfilled the requirements, the test data were listed in table 14, the waveforms were shown in appendix A fig A.10.

Table 14 Bending moment test part 2

Samples			002	003
Before bending moment test	Power loss, mW		981.6	1050
	Partial discharge, pC		5.8	3.1
	Residual voltage, 10kA, 8/20μs, kV		95.80	94.76
	U_{1mAAC}, kV		40.0	39.5
Bending moment test	Specified short-term load(SSL), N		400	
	Actual applied, N		400	400
	Time, s		63	63
After bending moment test	Sample check		No visible mechanical damage	
	Residual deflection	Housing height, mm	420	420
		Maximum deflection, mm	6.61	11.69
		Residual deflection, mm	1.20	6.26
	Seal inspection	Hot water immersion test	No continuous bubbles	
Boiling water	Boiling water with 0.1%NaCl for 42 h		Time: 07/12/2018,16:30~09/12/2018,10:30.	
Verification test	Power loss	Value, mW	875.0	938.0
		Change rate, %	-10.9	-10.7
	Partial discharge, pC		2.40	2.40
	2 times impulses at nominal discharge current	1st impulse, kV	100.0	98.2
		2nd impulse, kV	99.7	98.7
		Residual voltage change	-0.30	+0.51
	Residual voltage, 10kA, 8/20μs	Value, kV	100.0	98.2
		Change rate, %	+4.38	+3.63
	U_{1mAAC}	Value, kV	40.1	39.5
		Change rate, %	+0.25	0
Sample check	No visible mechanical damage.			

10 Weather ageing test

10.1 Salt fog test

Sample: 1 arrester(004)

Requirements of standards: The sample should pass salt fog test of established procedure.

Test data: Fulfilled the requirements, the test data were listed in table 15. The test sample successfully withstood the 1000h salt fog test with no evidence of surface tracking, erosion, or puncturing.

Table 15 Weather ageing test

Sample			004
Before test	U_{1mAAC}, kV		39.4
	Partial discharge, pC		5.4
Test condition	Test time: 1008h Water flow rate: 0.4L/m^3·h Size of droplets: 5~10μm		
	Temperature: 21~25 °C NaCl content of water: 1.0kg/m^3		
Test procedure	The sample should withstand salt fog test for 1000h while the continuous operating voltage is applied. It is allowed to have 6 times power supply interruptions during the test, every interruption may not exceed 15min.		①Applied voltage U_c = 28.8kV$_{rms}$
			②Begin time: 05/12/2018, 15:00 End time: 16/01/2019, 15:00
			③Power supply interruption times: 0; salt-frog interruption times: 0.
Test estimate	Corrosion tests without tracking, not through the entire thickness of the outer layer until the next layer of material, the shed and housing should be no breakdown.		Arrester over current a time, no leakage and trial traces of corrosion is not through the entire thickness of the outer layer until the next layer of material, the shed is not breakdown.
After test	U_{1mAAC}	value, kV	39.8
		change rate, %	+1.01
	Partial discharge, pC		2.0

10.2 UV light test

Samples: 3 specimens of shed and housing materials(601~603)

Requirements of standards: The samples should pass UV light test of established procedure, the roughness Rz should not exceed 0.1mm.

Test data: Fulfilled the requirements, the test data were listed in table 16. The test specimens successfully withstood the 1000 hours UV light test, the surface of specimens had no cracks and raised areas.

Table 16 UV light test

Samples		601	602	603
Test condition		Test time: 1000 h Irradiance of around: 0.76W/m^2		
		Temperature: 60～63℃ for 8h UV light 49～52 ℃ for 4h condensation		
Test procedure		The sample should withstand UV light test for 1000 hours. 4 hours condensation after 8 hours UV light test, circular 1000 hours.	Begin time: 05/12/2018, 15:30 End time: 16/01/2019, 15:30	
Rz, μm	Surface NO.1	0.417	0.423	0.436
	Surface NO.2	0.451	0.422	0.358
Rz≤0.01mm, Fulfilled the requirements				
Sample check		No visible cracks and raised areas		

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11 Water immersion test

Samples:3 arresters(001～003)

Requirements of standards: Before test, measure the power loss, partial discharge, residual voltage, then immerse the samples into the boiling water of 0.1% NaCl for 42h, then cooled to normal temperature in air for 8 hours; After the test, measure the power loss, partial discharge, residual voltage. The requirements as following:

a. The change rate of power loss should not exceed 20%;

b. the change rate of residual voltage should not exceed 5%;

c. The partial discharge≤10pC;

d. The change rate of U_{1mAAC} should not exceed 2%;

Test data: Fulfilled the requirements, the test data were listed in table 17.

Table 17 Water immersion test

Samples			001	002	003
Before test	Power loss, mW		1031	981.6	1050
	Partial discharge, pC		5.4	5.8	3.1
	Residual voltage,10kA, kV		98.49	95.80	94.76
	U_{1mAAC}, kV		39.9	40.0	39.5
Water immersion test	Put into boiling water with 0.1%NaCl for 42 h				
After test	Power loss	Value, mW	977.0	875.0	938.0
		Change rate, %	-5.24	-10.9	-10.7
	Partial discharge, pC		2.40	2.40	2.40
	Residual voltage, 10kA	Value, kV	98.13	100.0	98.2
		Change rate, %	-0.37	+4.38	+3.63
	U_{1mAAC}	Value，kV	39.2	40.1	39.5
		Change rate, %	-1.75	+0.25	0

Appendix A The typical test waveform

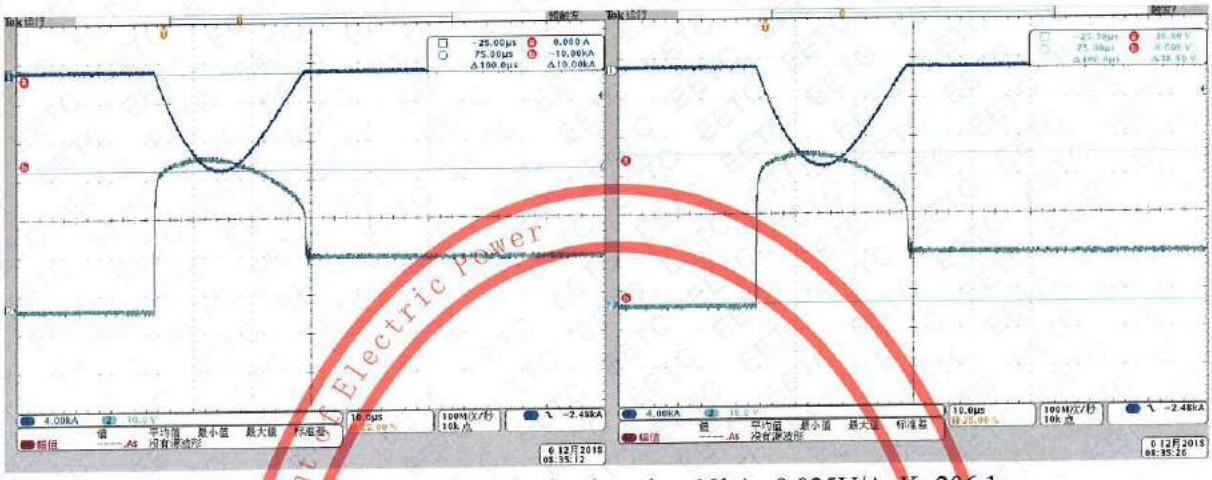

Fig A.1.1 Sample 301, Lightning impulse, 10kA , 0.025V/A K=206.1

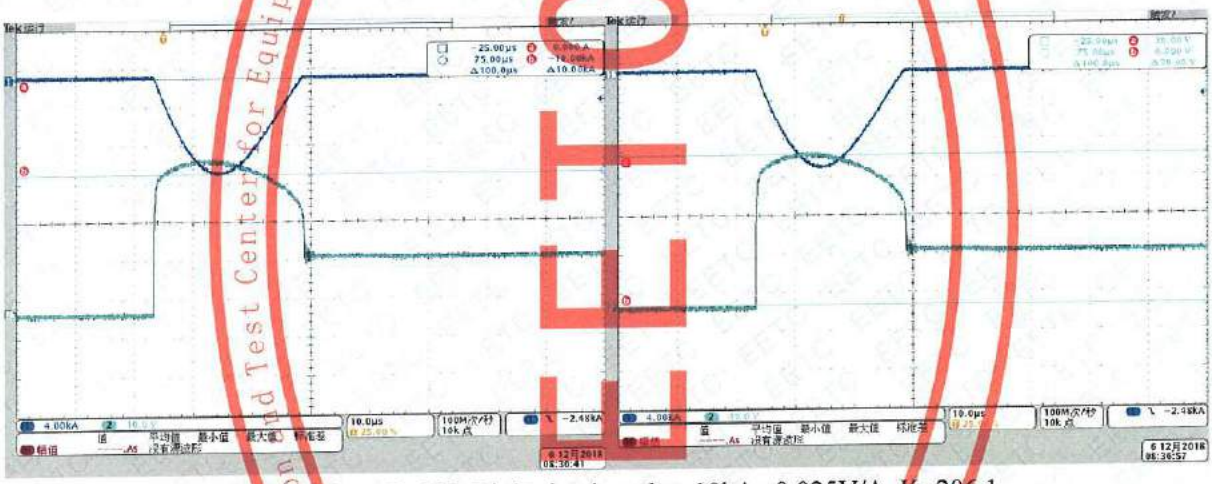

Fig A.1.2 Sample 302, Lightning impulse, 10kA , 0.025V/A K=206.1

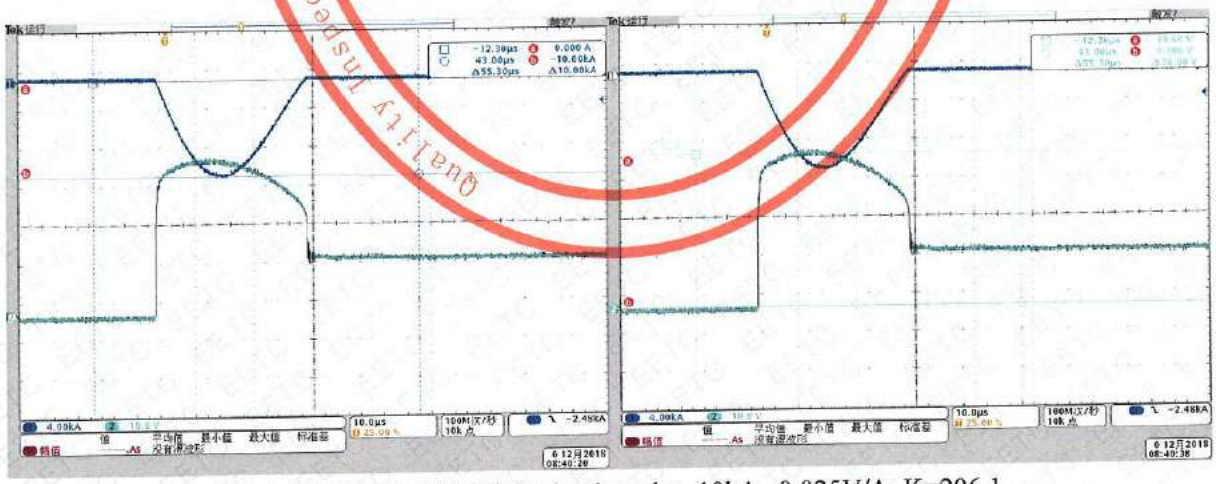

Fig A.1.3 Sample 303, Lightning impulse, 10kA , 0.025V/A K=206.1

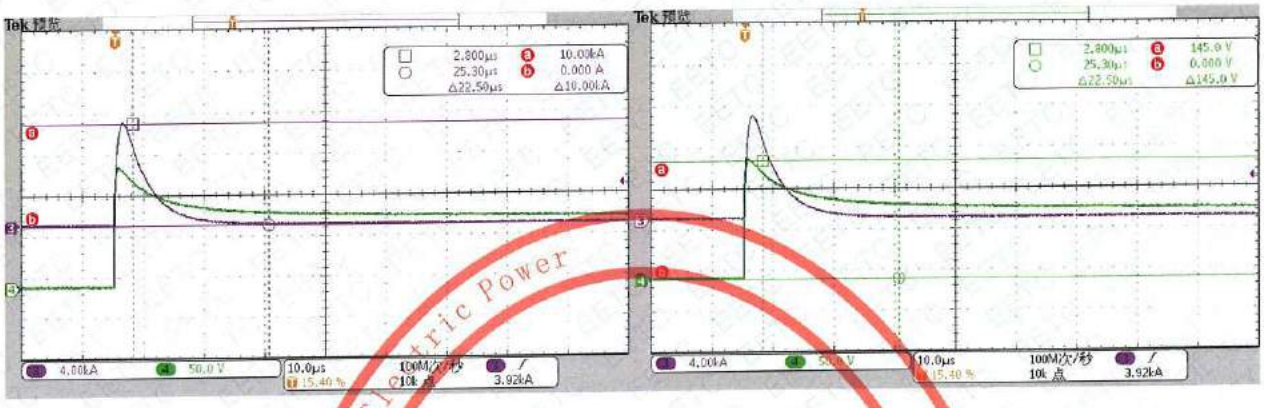

Fig A.1.4 Sample 301, Steep current impulse, 10kA ,0.025 V/A K= 61.8

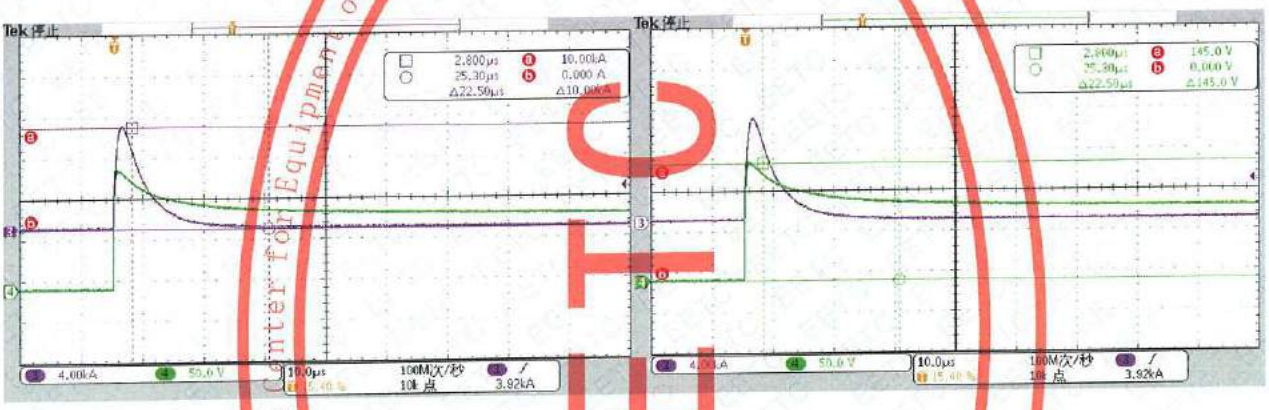

Fig A.1.5 Sample 302, Steep current impulse, 10kA ,0.025 V/A K= 61.8

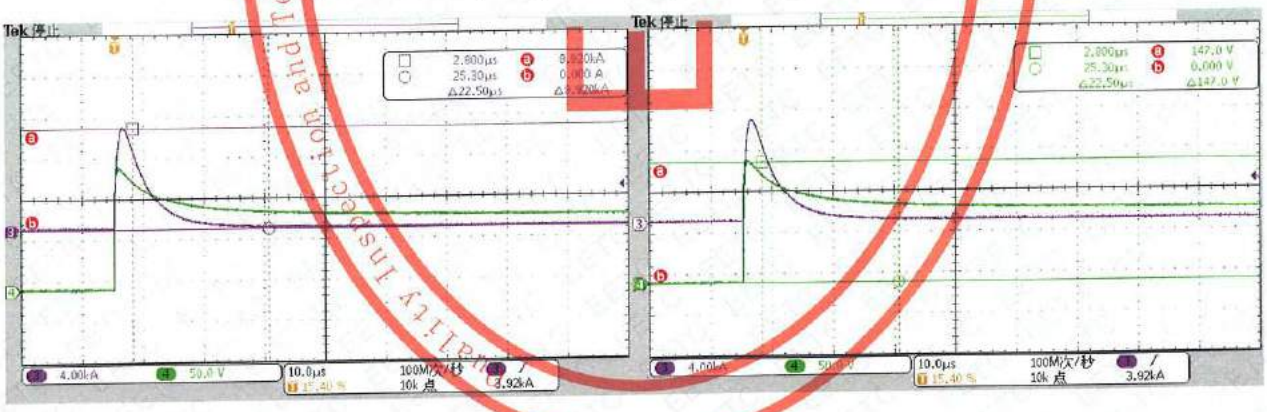

Fig A.1.6 Sample 303, Steep current impulse, 10kA ,0.025 V/A K= 61.8

Fig A.1 Residual voltage waveform

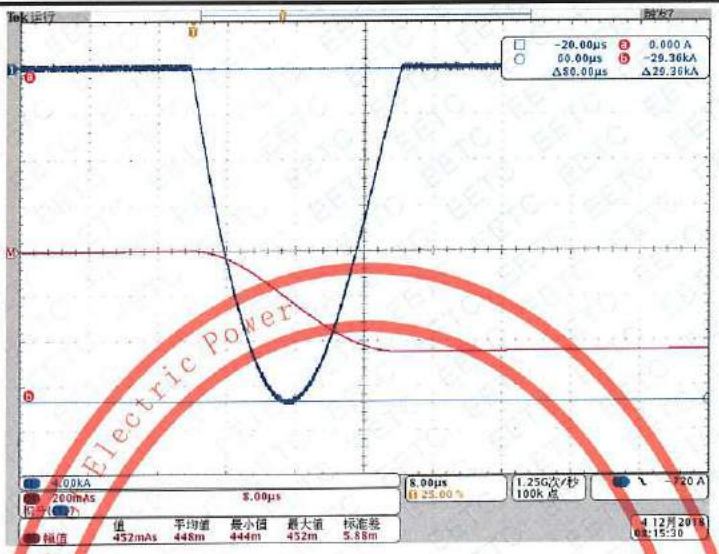

Fig A.2.1 The 1st time of sample 304, Repetitive charge transfer withstand, 0.01V/A

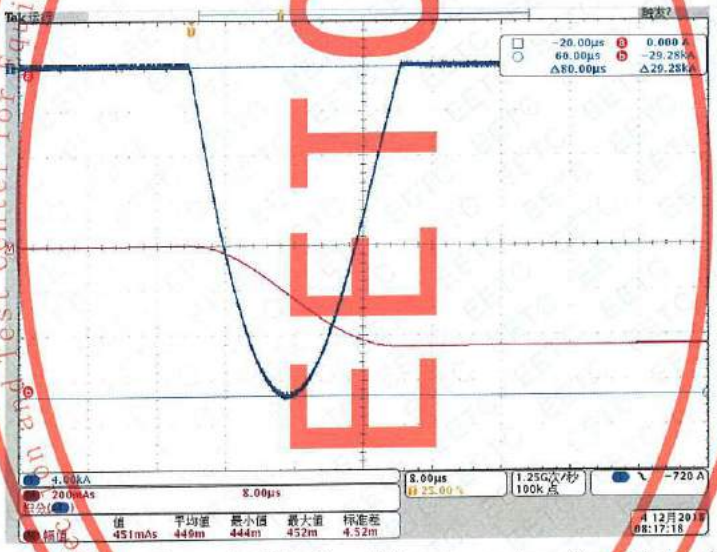

Fig A.2.2 The 1st time of sample 305, Repetitive charge transfer withstand, 0.01V/A

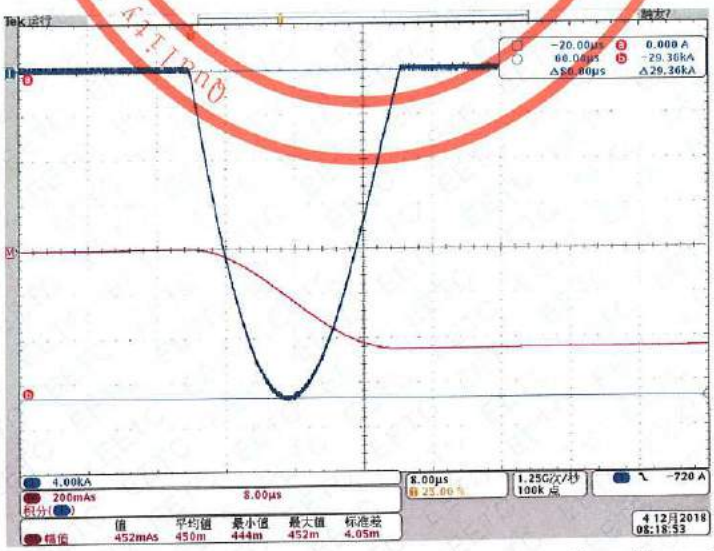

Fig A.2.3 The 1st time of sample 306, Repetitive charge transfer withstand, 0.01V/A

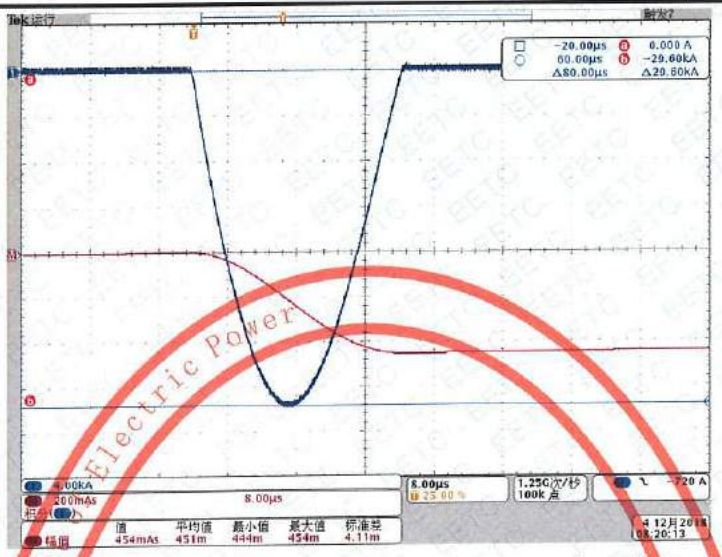

Fig A.2.4 The 1st time of sample 307, Repetitive charge transfer withstand, 0.01V/A

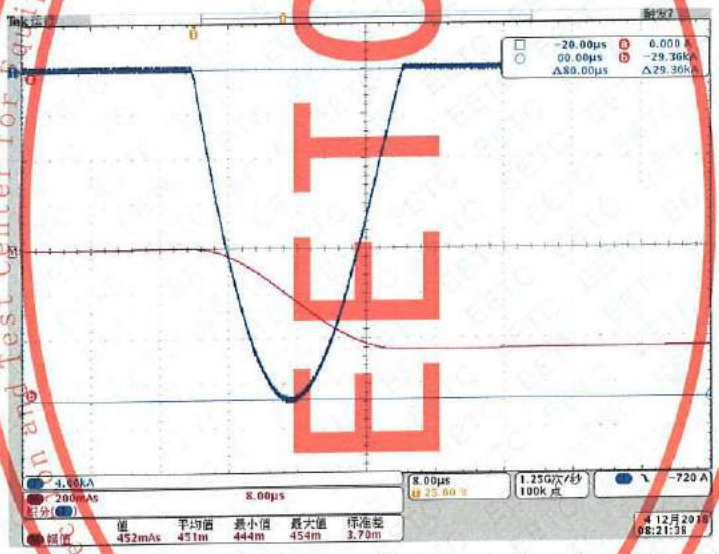

Fig A.2.5 The 1st time of sample 308, Repetitive charge transfer withstand, 0.01V/A

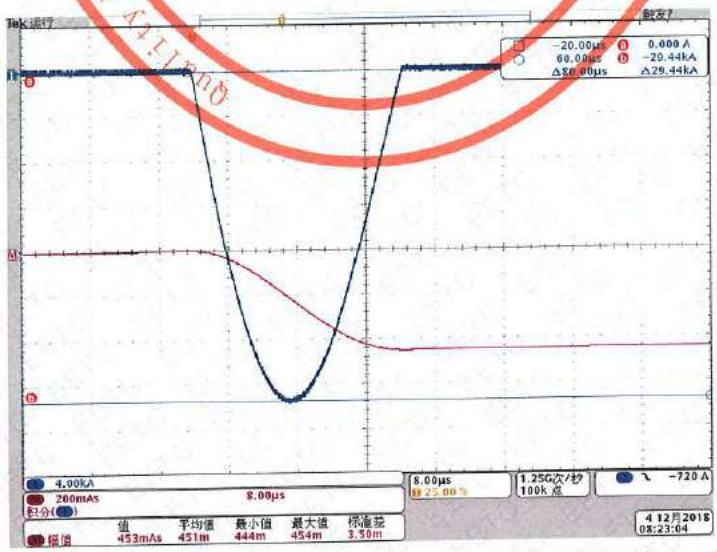

Fig A.2.6 The 1st time of sample 309, Repetitive charge transfer withstand, 0.01V/A

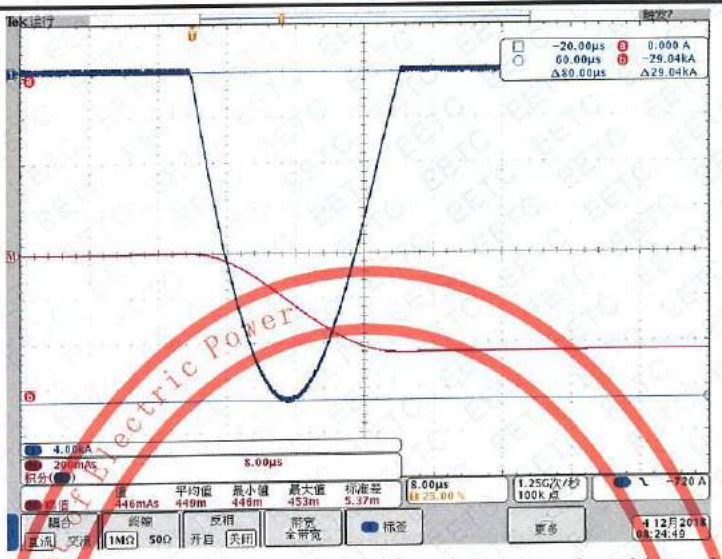

Fig A.2.7 The 1st time of sample 310, Repetitive charge transfer withstand, 0.01V/A

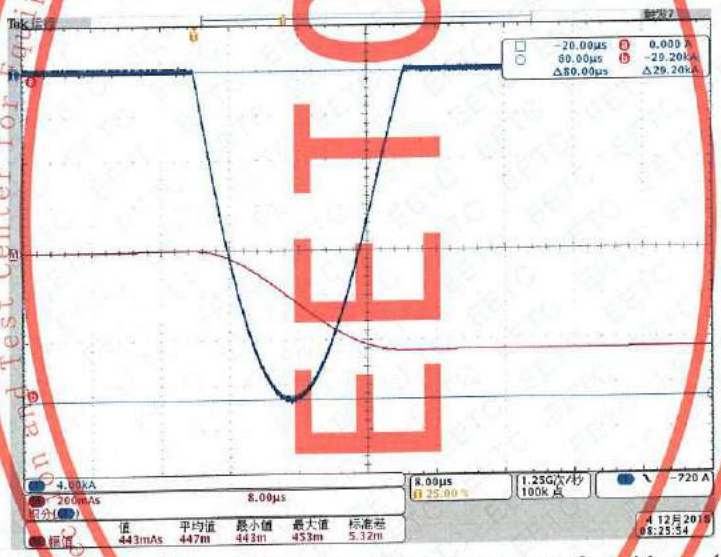

Fig A.2.8 The 1st time of sample 311, Repetitive charge transfer withstand, 0.01V/A

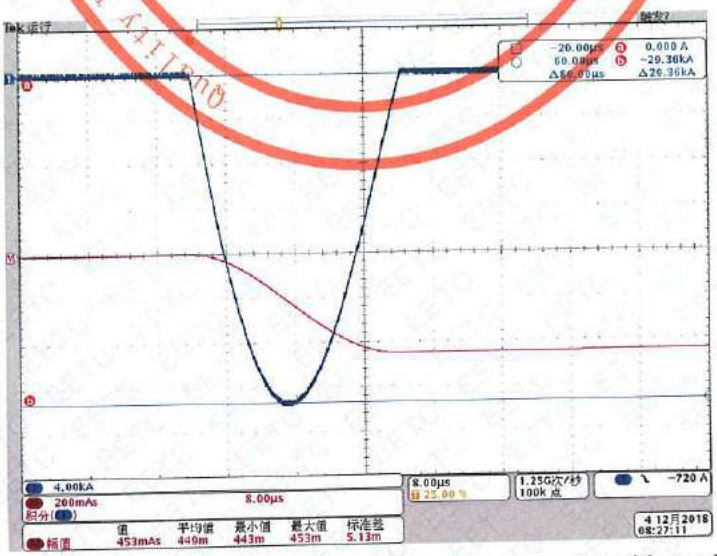

Fig A.2.9 The 1st time of sample 312, Repetitive charge transfer withstand, 0.01V/A

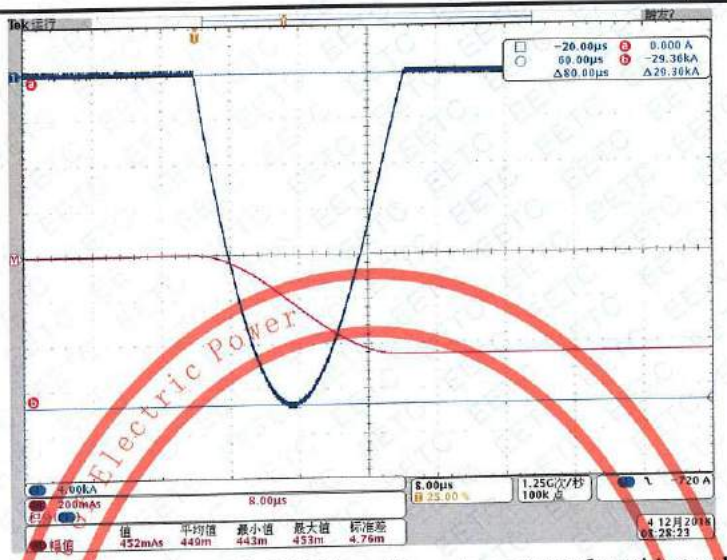

Fig A.2.10 The 1st time of sample 313, Repetitive charge transfer withstand, 0.01V/A

Fig A.2 Repetitive charge transfer withstand waveform of 1st time

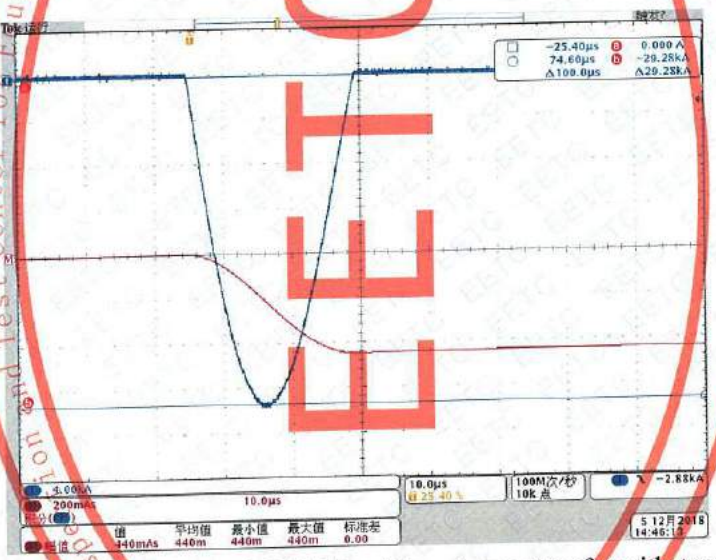

Fig A.3.1 The 20th time of sample 304, Repetitive charge transfer withstand, 0.01V/A

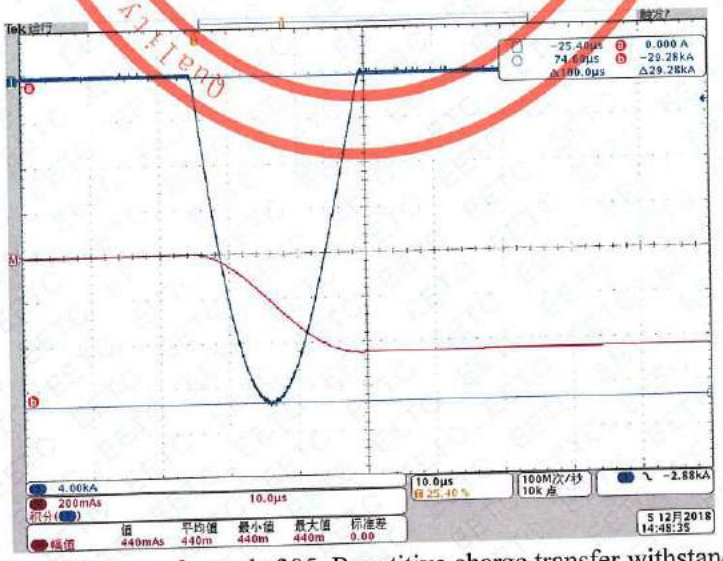

Fig A.3.2 The 20th time of sample 305, Repetitive charge transfer withstand, 0.01V/A

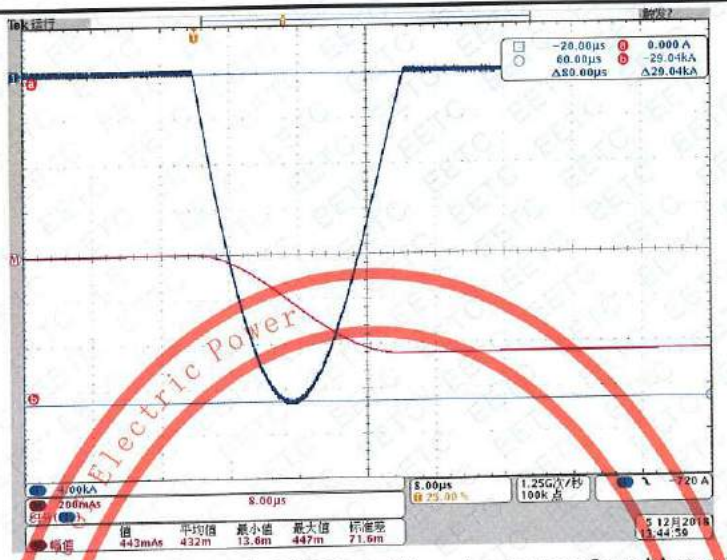

Fig A.3.3 The 20th time of sample 306, Repetitive charge transfer withstand, 0.01V/A

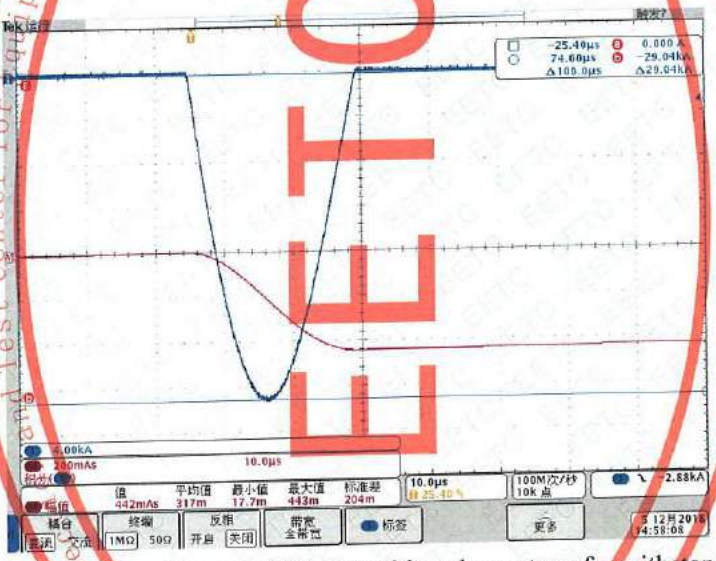

Fig A.3.4 The 20th time of sample 307, Repetitive charge transfer withstand, 0.01V/A

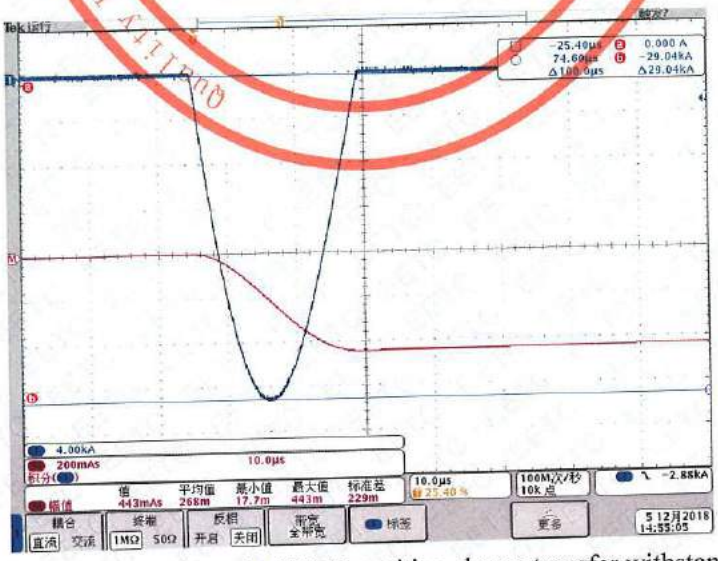

Fig A.3.5 The 20th time of sample 308, Repetitive charge transfer withstand, 0.01V/A

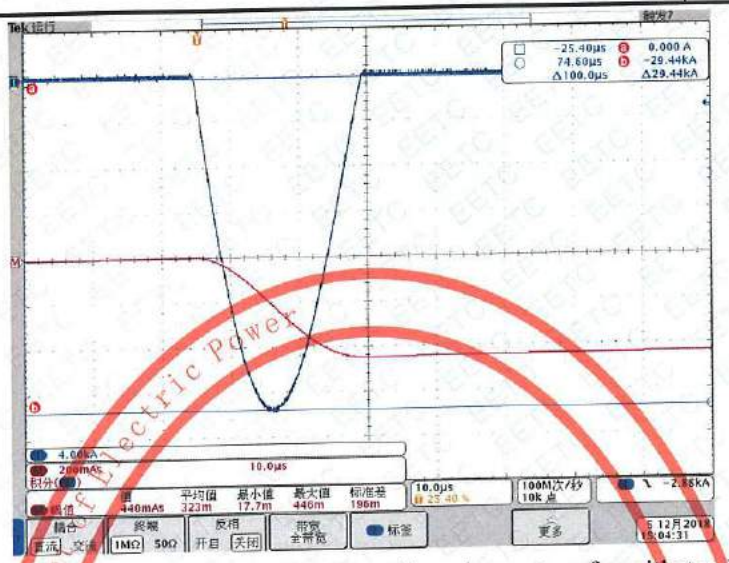

Fig A.3.6 The 20th time of sample 309, Repetitive charge transfer withstand, 0.01V/A

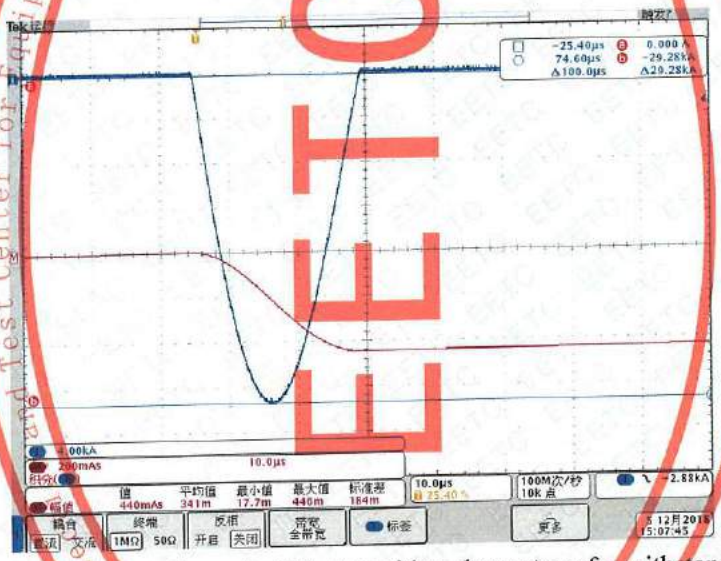

Fig A.3.7 The 20th time of sample 310, Repetitive charge transfer withstand, 0.01V/A

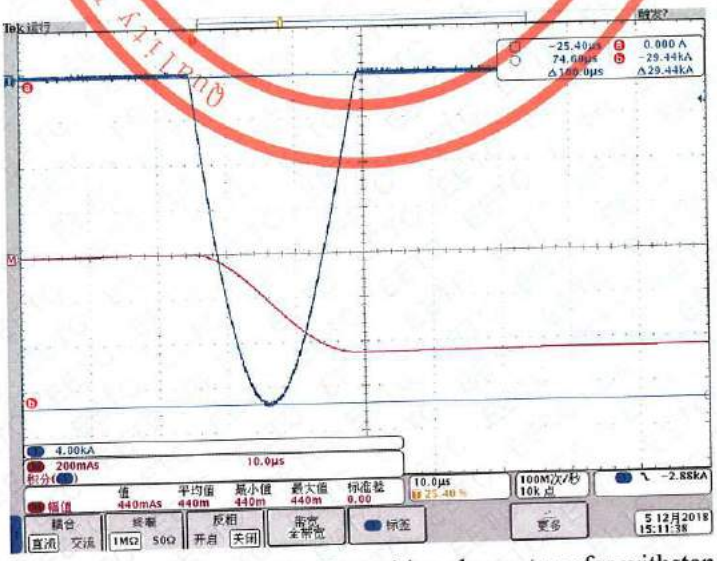

Fig A.3.8The 20th time of sample 311, Repetitive charge transfer withstand, 0.01V/A

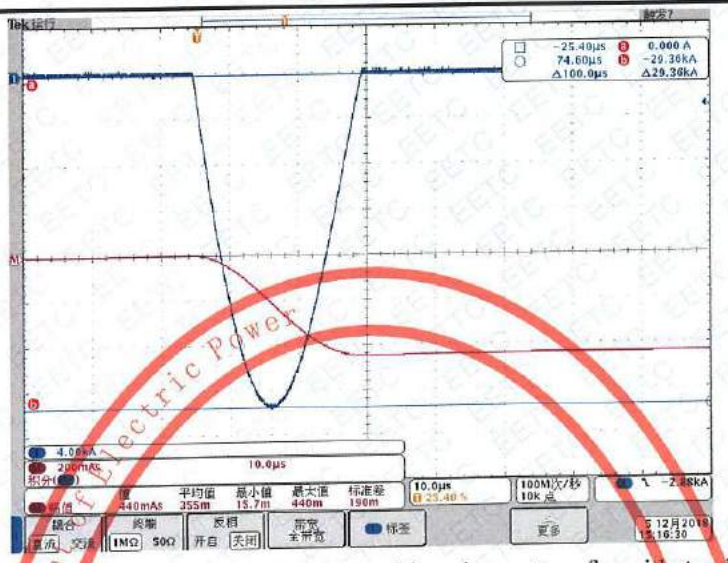

Fig A.3.9 The 20th time of sample 312, Repetitive charge transfer withstand, 0.01V/A

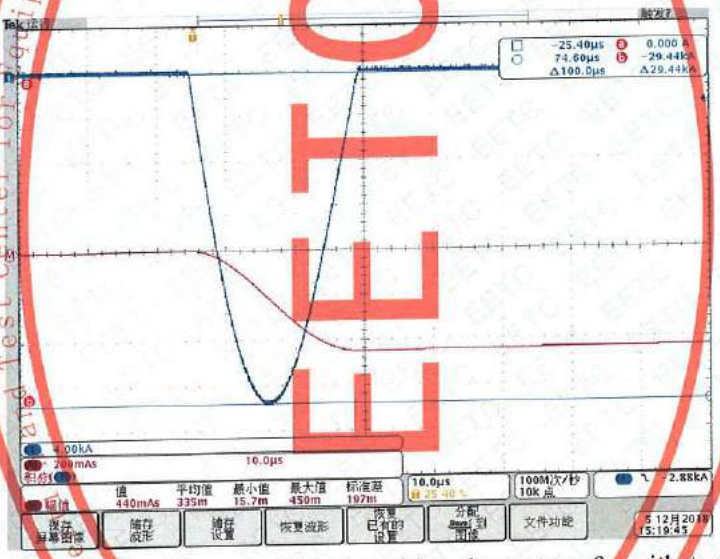

Fig A.3.10 The 20th time of sample 313, Repetitive charge transfer withstand, 0.01V/A

Fig A.3 Repetitive charge transfer withstand waveform of the last time

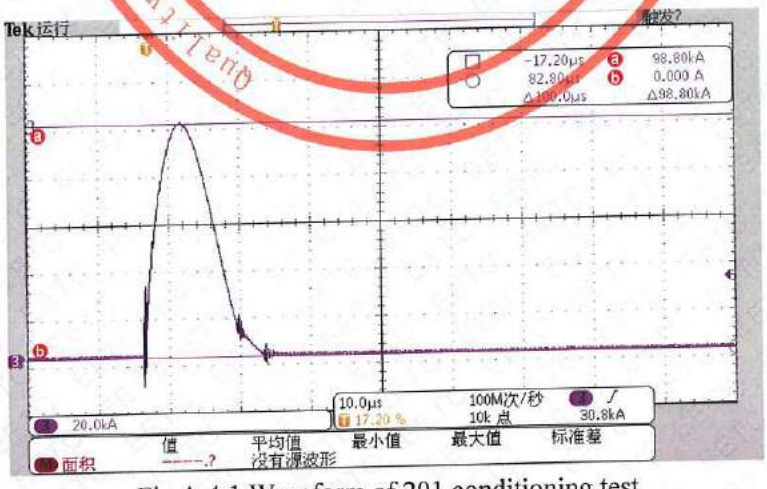

Fig A.4.1 Waveform of 201 conditioning test

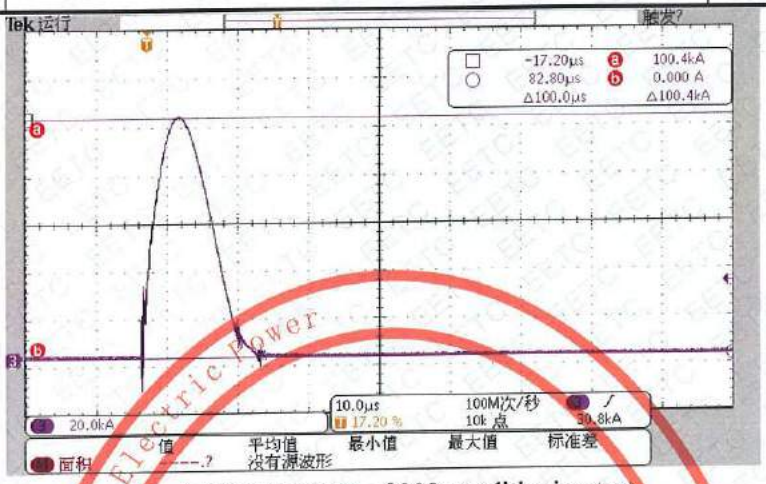

Fig A.4.2 Waveform of 202 conditioning test

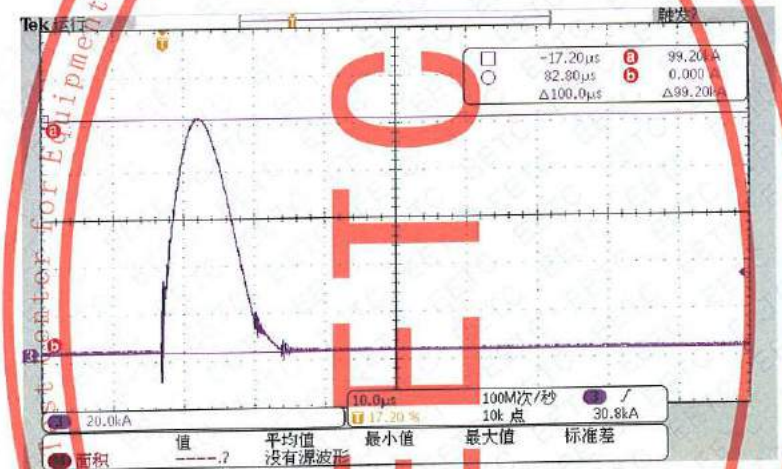

Fig A.4.3 Waveform of 203 conditioning test

Fig A.4 Waveform of conditioning test

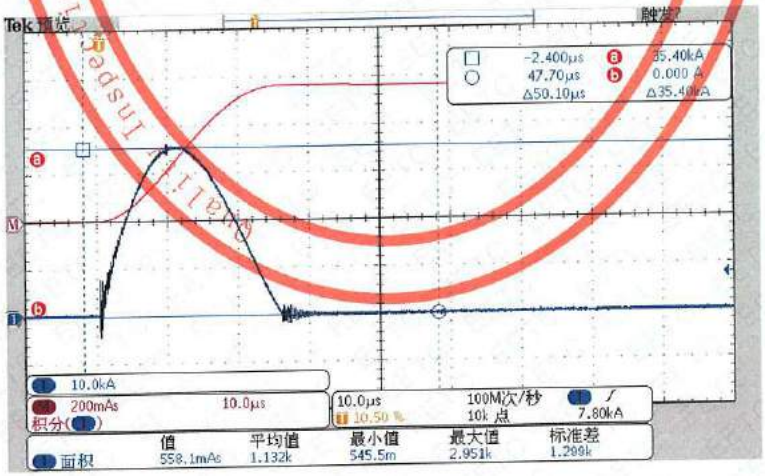

Fig A.5.1 The waveform of 201, Lightning current impulse, first impulse, 0.01V/A K_d=96.8

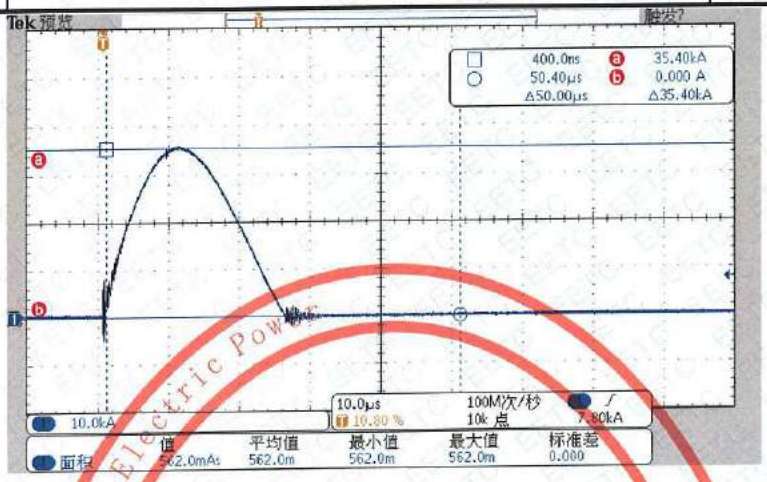

Fig A.5.2 The waveform of 202, Lightning current impulse, first impulse, 0.01V/A K_d=96.8

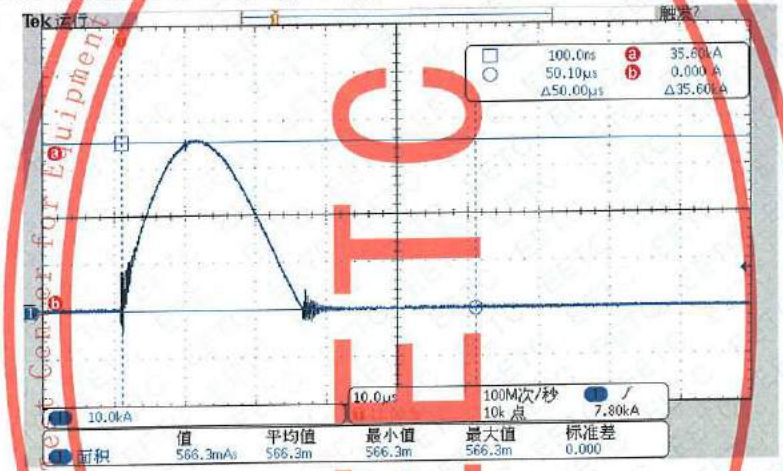

Fig A.5.2 The waveform of 203, Lightning current impulse, first impulse, 0.01V/A K_d=96.8

Fig A.5 The waveform of Lightning current impulse

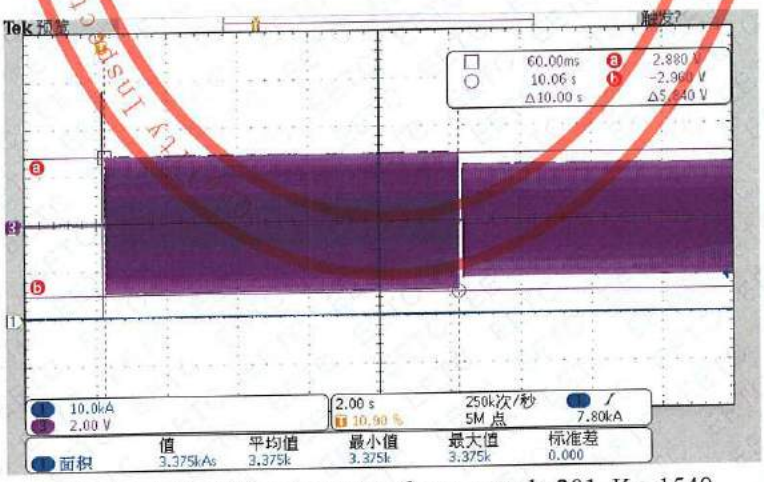

Fig A.6.1 Operating duty waveform, sample 201, K_d=1540

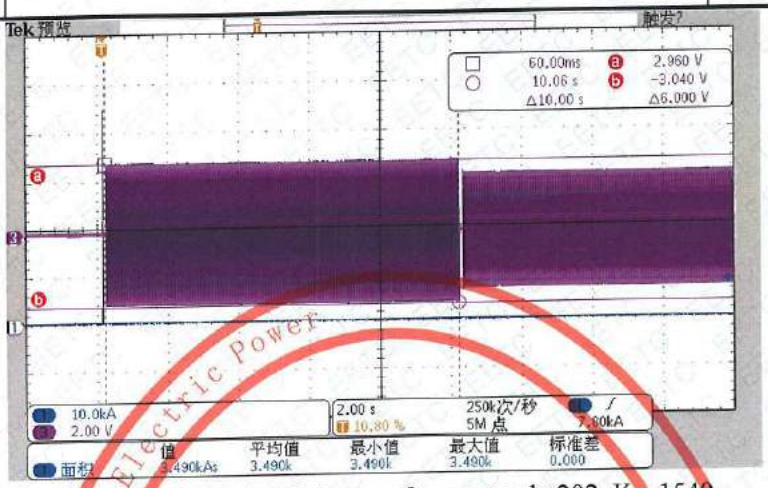

Fig A.6.2 Operating duty waveform, sample 202, K_d=1540

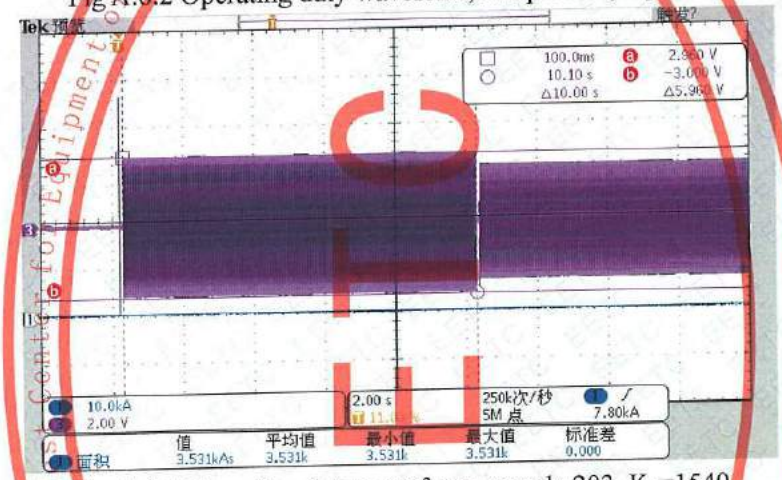

Fig A.6.3 Operating duty waveform, sample 203, K_d=1540

Fig A.6 Operating duty waveforms

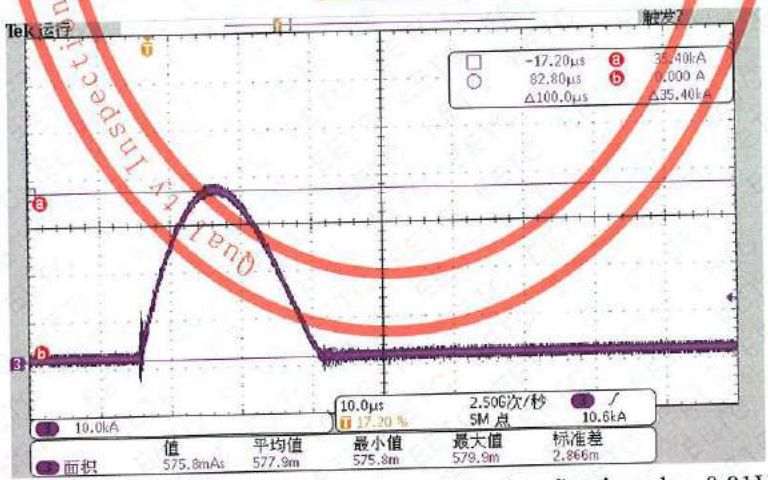

Fig A.7.1 The waveform of 204, Lightning current impulse, first impulse, 0.01V/A K_d=96.8

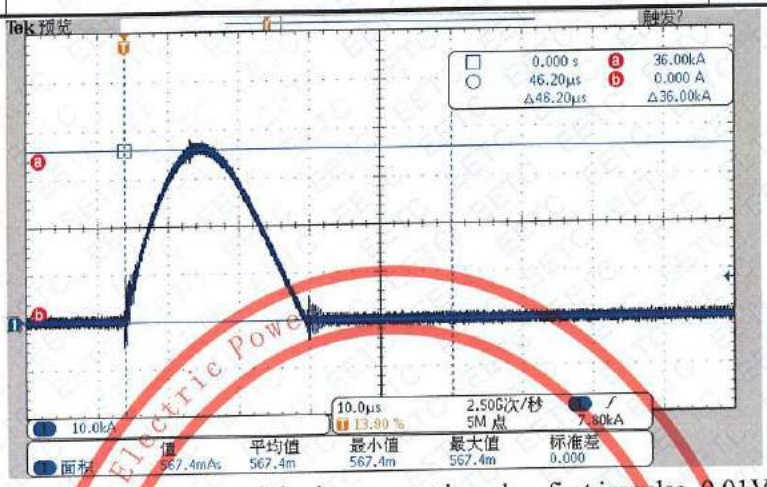

Fig A.7.2 The waveform of 205, Lightning current impulse, first impulse, 0.01V/A K_d=96.8

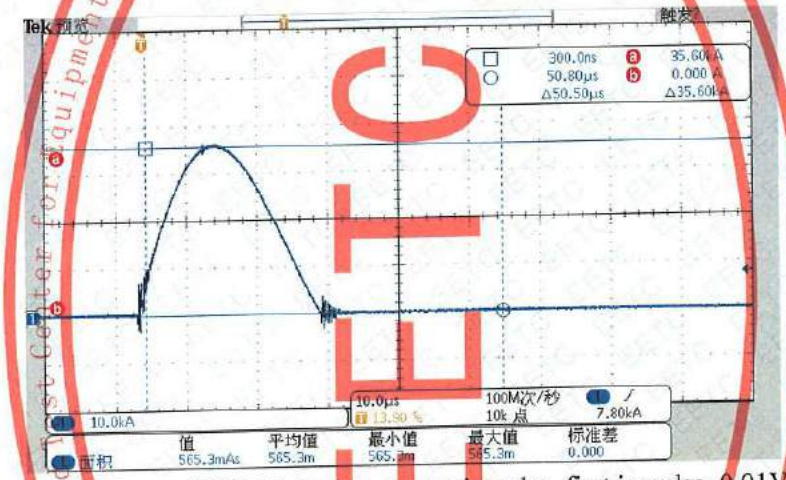

Fig A.7.3 The waveform of 206, Lightning current impulse, first impulse, 0.01V/A K_d=96.8

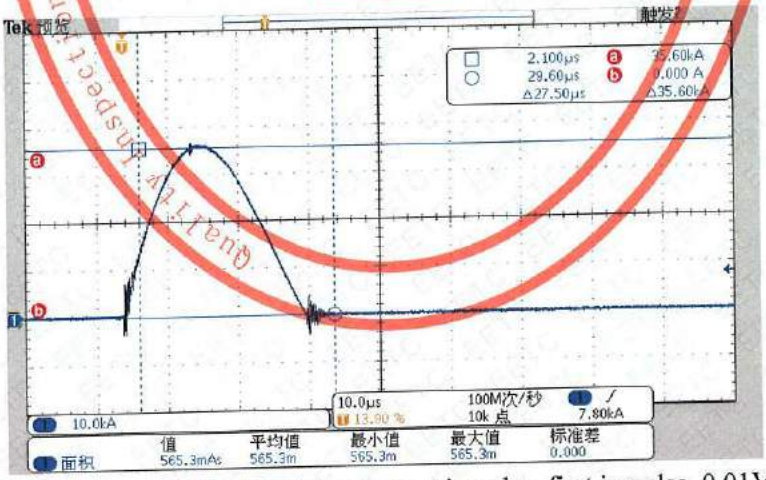

Fig A.7.4 The waveform of 207, Lightning current impulse, first impulse, 0.01V/A K_d=96.8

Fig A.7 The waveform of lightning current impulse for TOV test with prior duty

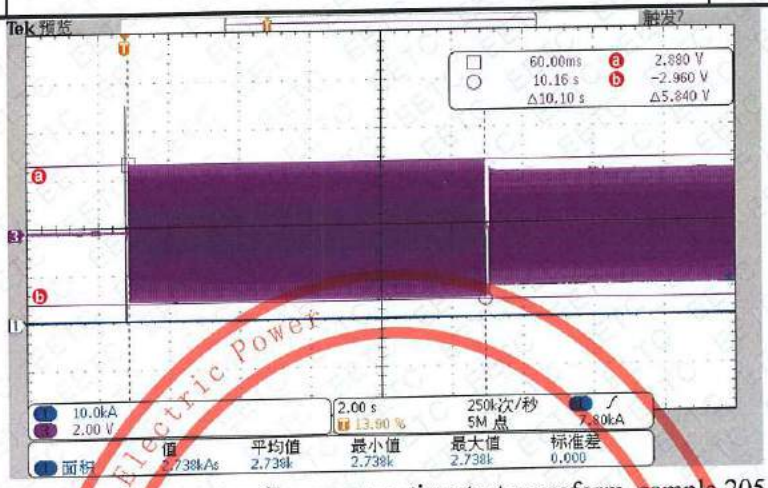

Fig A.8.1 Power-frequency voltage-versus-time test waveform, sample 205, K_d=1540

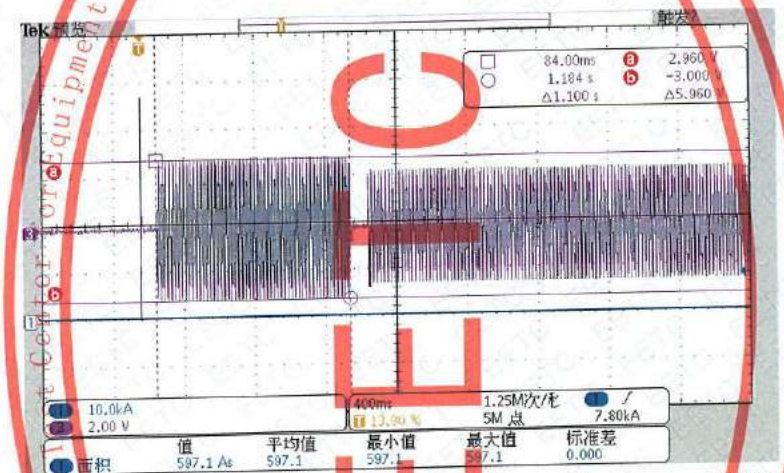

Fig A.8.2 Power-frequency voltage-versus-time test waveform, sample 206, K_d=1540

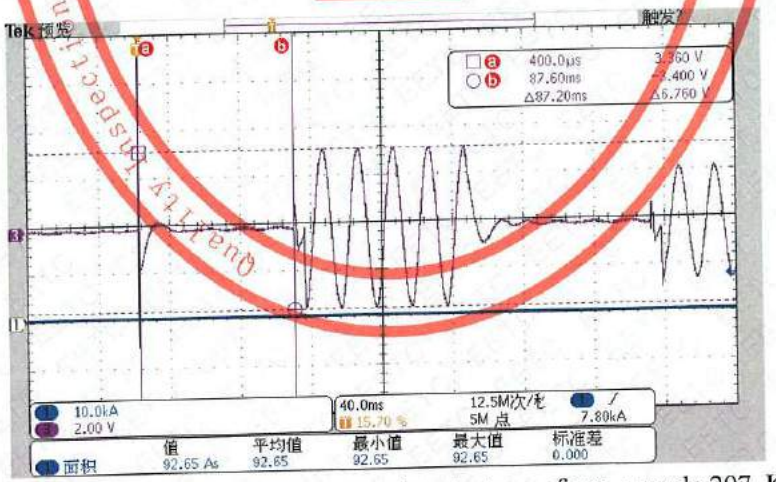

Fig A.8.3 Power-frequency voltage-versus-time test waveform, sample 207, K_d=1540

Fig A.8 The waveforms of power-frequency voltage-versus-time test

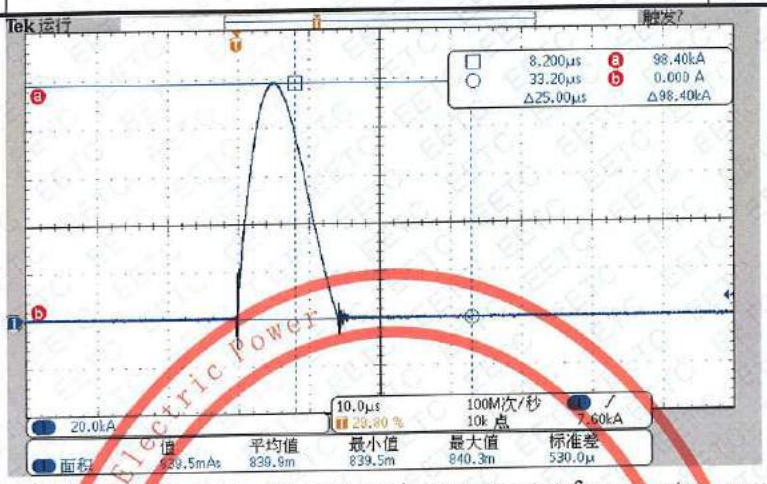

Fig A.9 Test to verify the dielectric withstand of the internal components of an arrester , sample 501, the waveforms of high current impulse.

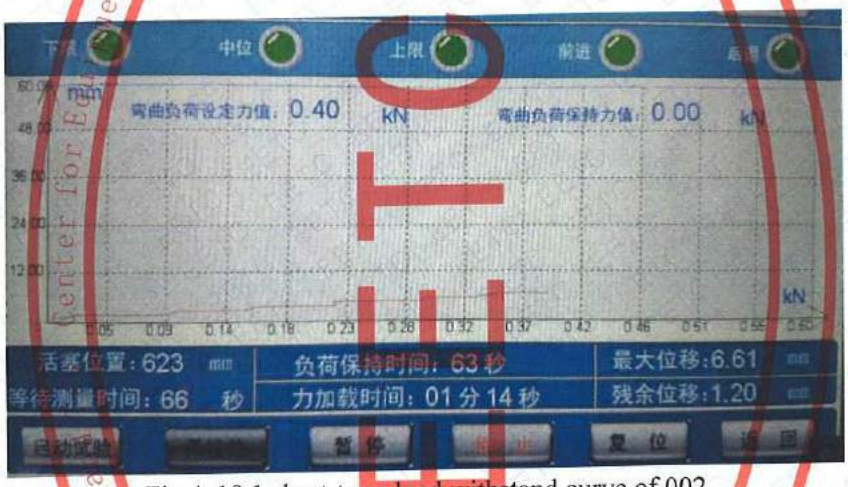

Fig A.10.1 short-term load withstand curve of 002

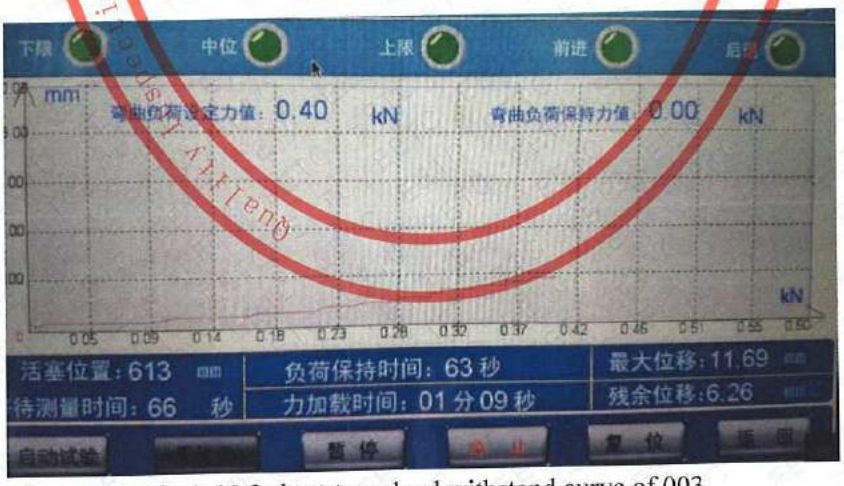

Fig A.10.2 short-term load withstand curve of 003

Fig A.10 Test curve of bending moment part 2

Appendix B: Sample instruction

The test sample number correspondence are as follows:

Category name	Quantity	Number of samples	Short number	Comment
Arrester	5	EETC02-18/11/02-0066-001	001	Type YH10W-36
		EETC02-18/11/02-0066-001	002	
		EETC02-18/11/02-0066-001	003	
		EETC02-18/11/02-0066-001	004	
		EETC02-18/11/02-0066-001	005	
Thermally prorated section	10	EETC02-18/11/02-0066-201	201	-
		EETC02-18/11/02-0066-202	202	-
		EETC02-18/11/02-0066-203	203	-
		EETC02-18/11/02-0066-204	204	-
		EETC02-18/11/02-0066-205	205	-
		EETC02-18/11/02-0066-206	206	-
		EETC02-18/11/02-0066-207	207	-
		EETC02-18/11/02-0066-208	208	-
		EETC02-18/11/02-0066-209	209	-
		EETC02-18/11/02-0066-210	210	-
Resistor	16	EETC02-18/11/02-0066-301	301	-
		EETC02-18/11/02-0066-302	302	-
		EETC02-18/11/02-0066-303	303	-
		EETC02-18/11/02-0066-304	304	-
		EETC02-18/11/02-0066-305	305	-
		EETC02-18/11/02-0066-306	306	-
		EETC02-18/11/02-0066-307	307	-
		EETC02-18/11/02-0066-308	308	-
		EETC02-18/11/02-0066-309	309	-
		EETC02-18/11/02-0066-310	310	-
		EETC02-18/11/02-0066-311	311	-
		EETC02-18/11/02-0066-312	312	-
		EETC02-18/11/02-0066-313	313	-
		EETC02-18/11/02-0066-314	314	-
		EETC02-18/11/02-0066-315	315	-
		EETC02-18/11/02-0066-316	316	-

Category name	Quantity	Number of samples	Short number	Comment
Housing	12	EETC02-18/11/02-0066-401	401	Type YH10W-3
		EETC02-18/11/02-0066-402	402	Type YH10W-6
		EETC02-18/11/02-0066-403	403	Type YH10W-9
		EETC02-18/11/02-0066-404	404	Type YH10W-12
		EETC02-18/11/02-0066-405	405	Type YH10W-15
		EETC02-18/11/02-0066-406	406	Type YH10W-18
		EETC02-18/11/02-0066-407	407	Type YH10W-21
		EETC02-18/11/02-0066-408	408	Type YH10W-24
		EETC02-18/11/02-0066-409	409	Type YH10W-27
		EETC02-18/11/02-0066-410	410	Type YH10W-30
		EETC02-18/11/02-0066-411	411	Type YH10W-33
		EETC02-18/11/02-0066-412	412	Type YH10W-36
Dielectrically prorated	1	EETC02-18/11/02-0066-501	501	-
specimens of shed and housing materials	3	EETC02-18/11/02-0066-601	601	-
		EETC02-18/11/02-0066-602	602	-
		EETC02-18/11/02-0066-603	603	-

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Appendix C: Main test device

NO.	Device name	Device NO.	Measurement	Uncertainty /Accuracy	Calibration institution	Expiration date
1	Long duration (rectangular) current impulse generator	EETC02-0001	2ms 10 kA , 30kV	U_{rel}=0.015 k=2 U_{rel}=0.014 k=2	National center for high voltage measurement	2019-06-04
2	impulse current generator	EETC02-0003	8/20 μs 100 kA, 20kV 4/10 μs 150 kA, 20kV 30/80 μs 50 kA, 20kV	U_{rel}=0.017 k=2 U_{rel}=0.014 k=2	National center for high voltage measurement	2019-06-04
3	Steep current impulse generator	EETC02-0004	1/5μs 20kA , 20kV	U_{rel}=0.015 k=2 U_{rel}=0.014 k=2	National center for high voltage measurement	2019-06-04
4	impulse current generator	EETC02-0005	8/20 μs 50 kA, 20kV 30/80 μs 10 kA, 20kV	U_{rel}=0.015 k=2 U_{rel}=0.014 k=2	National center for high voltage measurement	2019-06-04
5	Operating duty test system	EETC02-0009	0~10kV; 0~100A	U_{rel}=0.0058 k=2 U_{rel}=0.009 k=2	National center for high voltage measurement	2019-10-25
6	Accelerated aging test system	EETC02-0036	115℃; 0-6kV	U_{rel}=0.3℃ k=2 U_{rel}=0.0058 k=2	Hubei province meteorological metrological verification station	2019-10-24
7	Partial discharge test system	EETC09-1046	0-500 pC	Class 10	National center for high voltage measurement	2019-11-02
8	Series resonance measurement system	EETC09-1029	(40-1100) kV	Class 3	National center for high voltage measurement	2020-02-01
9	Impulse voltage measurement system	EETC09-1030	(200-3000)kV	Class 3	National center for high voltage measurement	2019-04-27

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Appendix D: Photos of the arrester

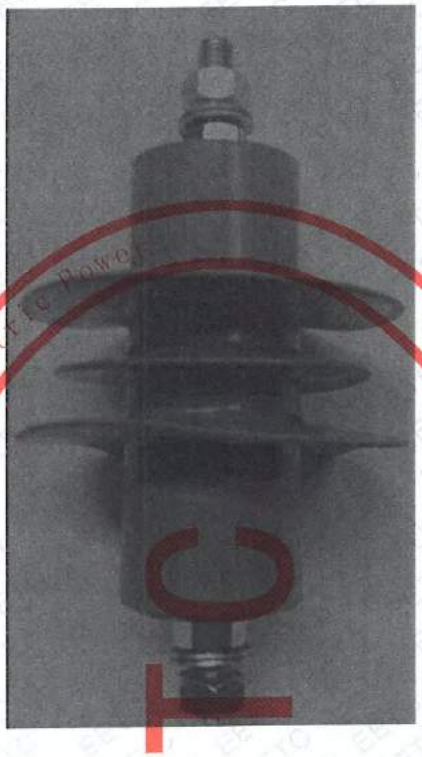


Fig D1: Outside view of YH10W-3 and YH10W-6

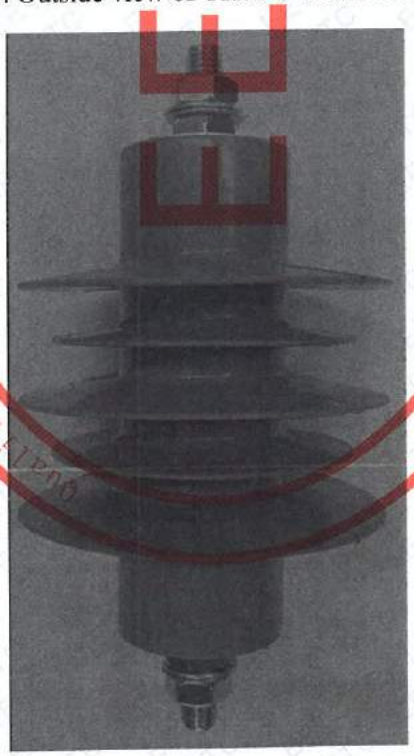


Fig D2: Outside view of YH10W-9

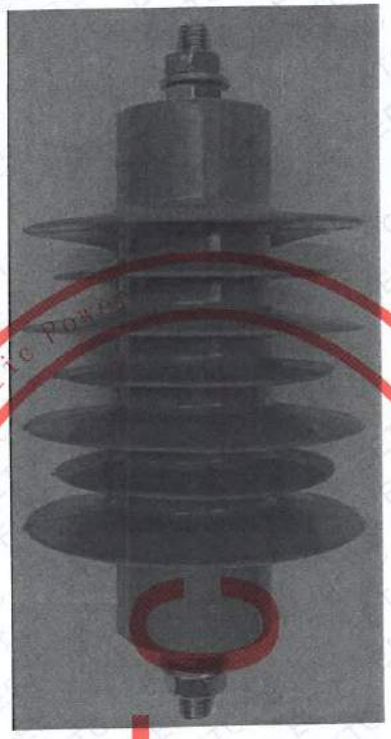


Fig D3: Outside view of YH10W-12

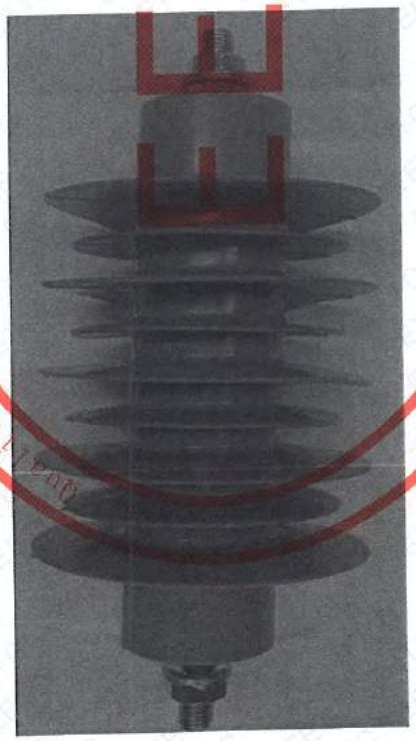


Fig D4: Outside view of YH10W-15 and YH10W-18

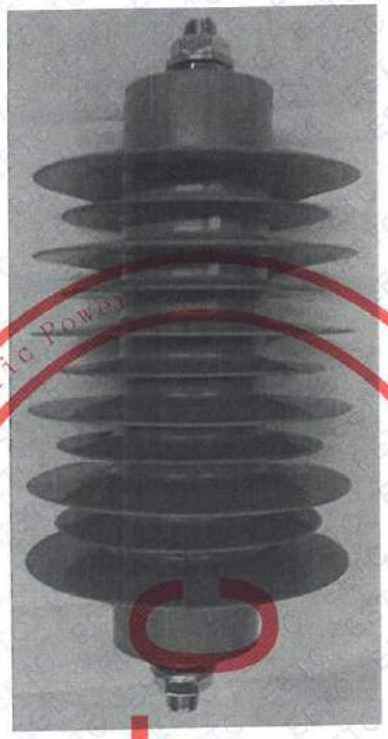


Fig D5: Outside view of YH10W-21

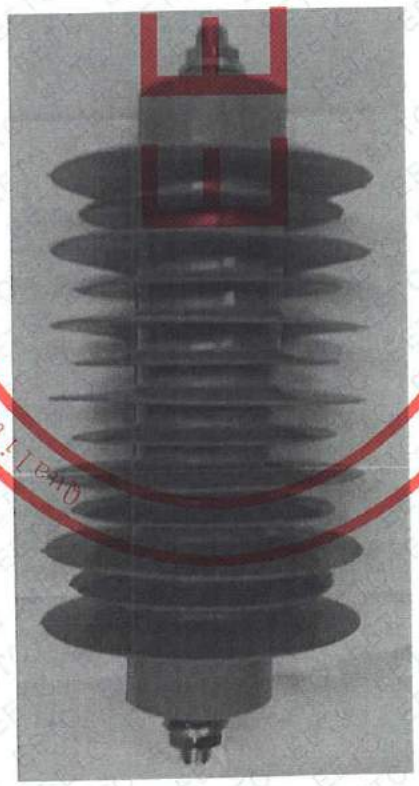


Fig D6: Outside view of YH10W-24

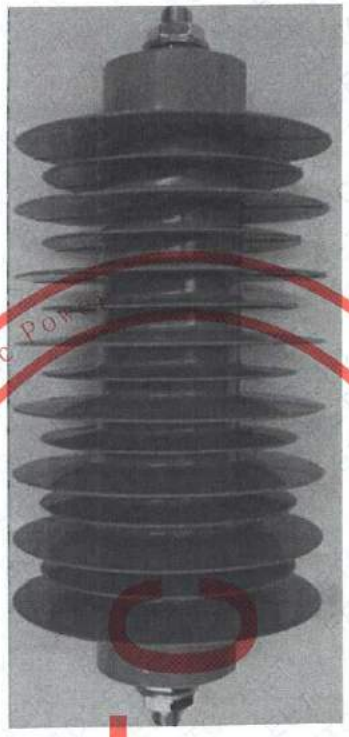


Fig D7: Outside view of YH10W-27

Fig D8: Outside view of YH10W-30

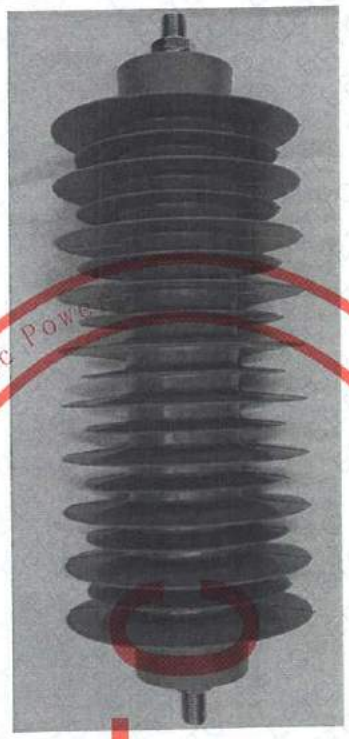


Fig D9: Outside view of YH10W-33 and YH10W-36

(No content in this page below)

Appendix E Visual and dimensional check of the arresters

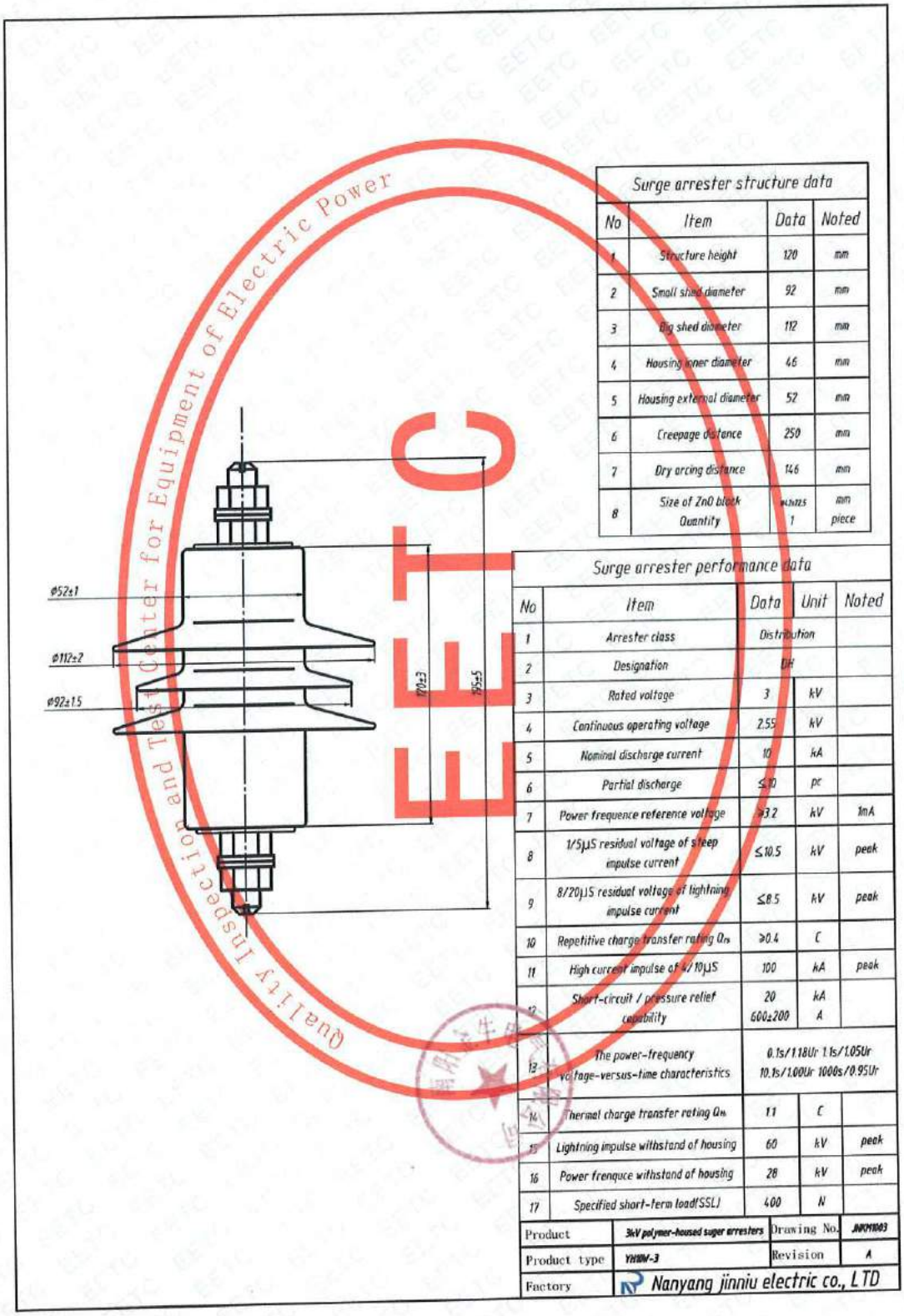
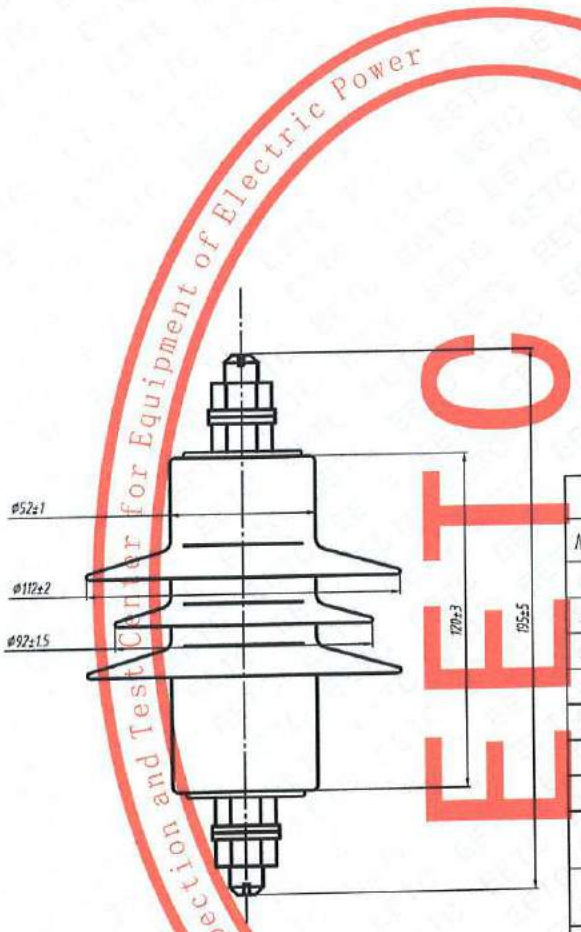


Fig E1: Dimensional drawing of YH10W-3



Surge arrester structure data

No	Item	Data	Noted
1	Structure height	120	mm
2	Small shed diameter	92	mm
3	Big shed diameter	112	mm
4	Housing inner diameter	46	mm
5	Housing external diameter	52	mm
6	Creepage distance	250	mm
7	Dry arcing distance	146	mm
8	Size of ZnO block Quantity	Φ42x25 7	mm piece

Surge arrester performance data

No	Item	Data	Unit	Noted
1	Arrester class	Distribution		
2	Designation	DH		
3	Rated voltage	6	kV	
4	Continuous operating voltage	5.10	kV	
5	Nominal discharge current	10	kA	
6	Partial discharge	≤10	pc	
7	Power frequence reference voltage	≥8.4	kV	1mA
8	1/5μS residual voltage of steep impulse current	≤20.0	kV	peak
9	8/20μS residual voltage of lightning impulse current	≤17.0	kV	peak
10	Repetitive charge transfer rating Q_{rs}	≥0.4	C	
11	High current impulse of 4/10μS	100	kA	peak
12	Short-circuit / pressure relief capability	20 600±200	kA A	
13	The power-frequency voltage-versus-time characteristics	0.1s/1.18Ur 1.1s/1.05Ur 10.1s/1.00Ur 1000s/0.95Ur		
14	Thermal charge transfer rating Q_{th}	1.1	C	
15	Lightning impulse withstand of housing	60	kV	peak
16	Power frenquce withstand of housing	28	kV	peak
17	Specified short-term load(SSL)	4.00	N	

Product	6kV polymer-housed suger arresters	Drawing No.	JNQY1006
Product type	YH10W-6	Revision	A
Factory	Nanyang jinniu electric co., LTD		

Fig E2: Dimensional drawing of YH10W-6

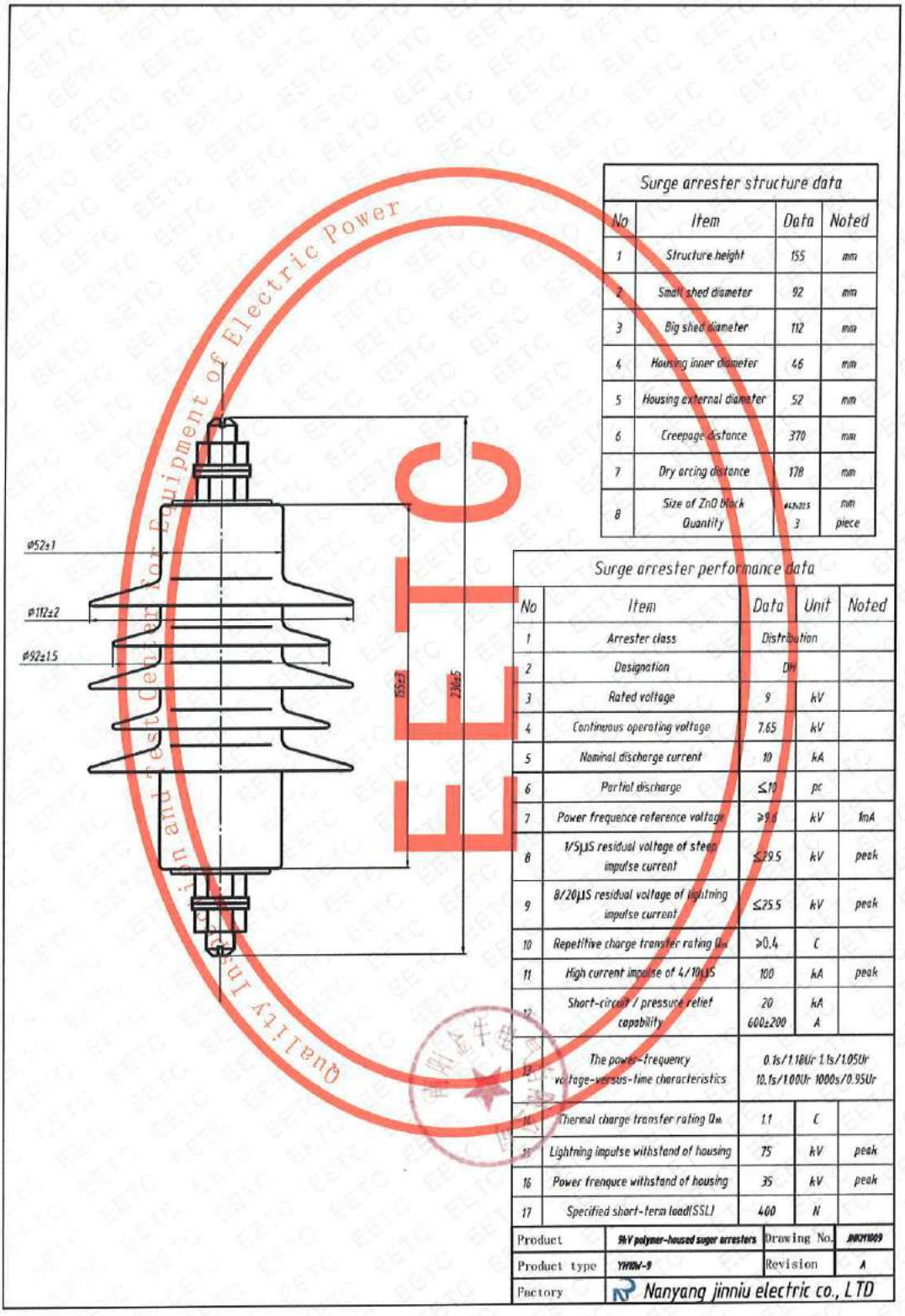


Fig E3: Dimensional drawing of YH10W-9

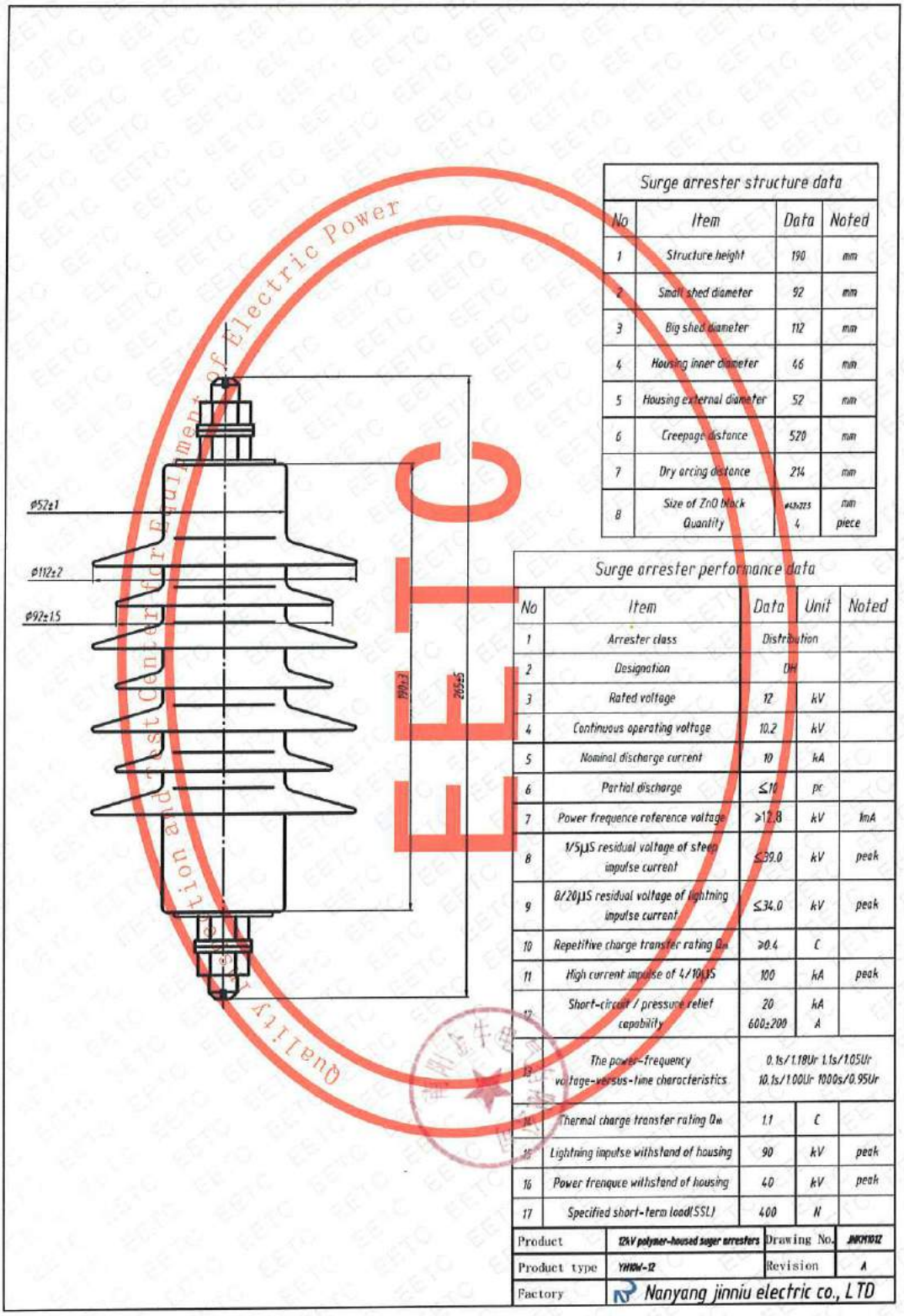
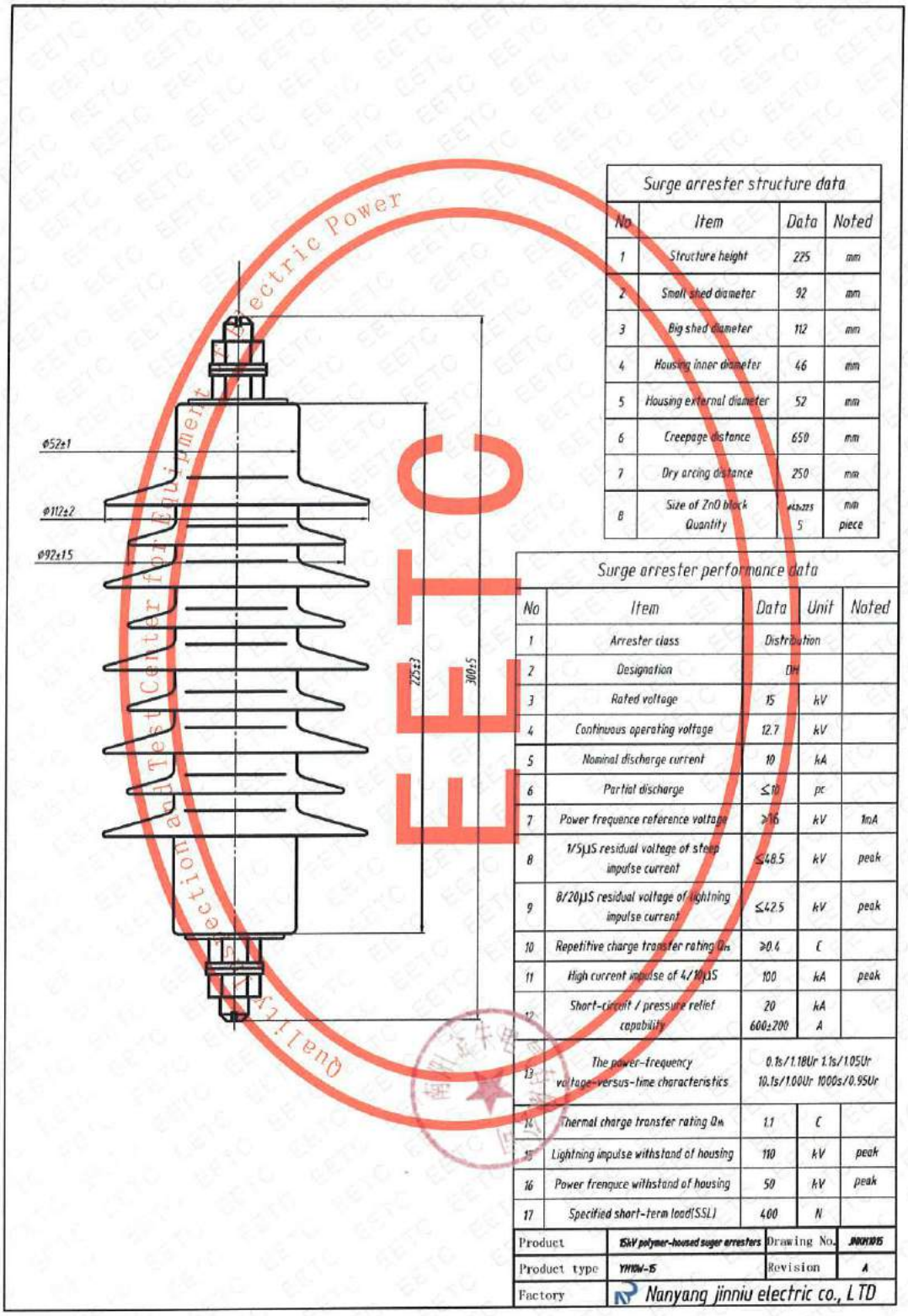


Fig E4: Dimensional drawing of YH10W-12



Surge arrester structure data

No	Item	Data	Noted
1	Structure height	225	mm
2	Small shed diameter	92	mm
3	Big shed diameter	112	mm
4	Housing inner diameter	46	mm
5	Housing external diameter	52	mm
6	Creepage distance	650	mm
7	Dry arcing distance	250	mm
8	Size of ZnO block Quantity	Φ43×25 5	mm piece

Surge arrester performance data

No	Item	Data	Unit	Noted
1	Arrester class	Distribution		
2	Designation	DH		
3	Rated voltage	15	kV	
4	Continuous operating voltage	12.7	kV	
5	Nominal discharge current	10	kA	
6	Partial discharge	≤10	pc	
7	Power frequence reference voltage	≥16	kV	1mA
8	1/5μS residual voltage of steep impulse current	≤48.5	kV	peak
9	8/20μS residual voltage of lightning impulse current	≤42.5	kV	peak
10	Repetitive charge transfer rating Q_{rs}	≥0.4	C	
11	High current impulse of 4/10μS	100	kA	peak
12	Short-circuit / pressure relief capability	20 600±200	kA A	
13	The power-frequency voltage-versus-time characteristics	0.1s/1.18Ur 1.1s/1.05Ur 10.1s/1.00Ur 1000s/0.95Ur		
14	Thermal charge transfer rating Q_{th}	1.1	C	
15	Lightning impulse withstand of housing	110	kV	peak
16	Power frenquce withstand of housing	50	kV	peak
17	Specified short-term load(SSL)	400	N	

Product	15kV polymer-housed suger arresters	Drawing No.	JNXY015
Product type	YH10W-15	Revision	A
Factory	Nanyang jinniu electric co., LTD		

Fig E5: Dimensional drawing of YH10W-15

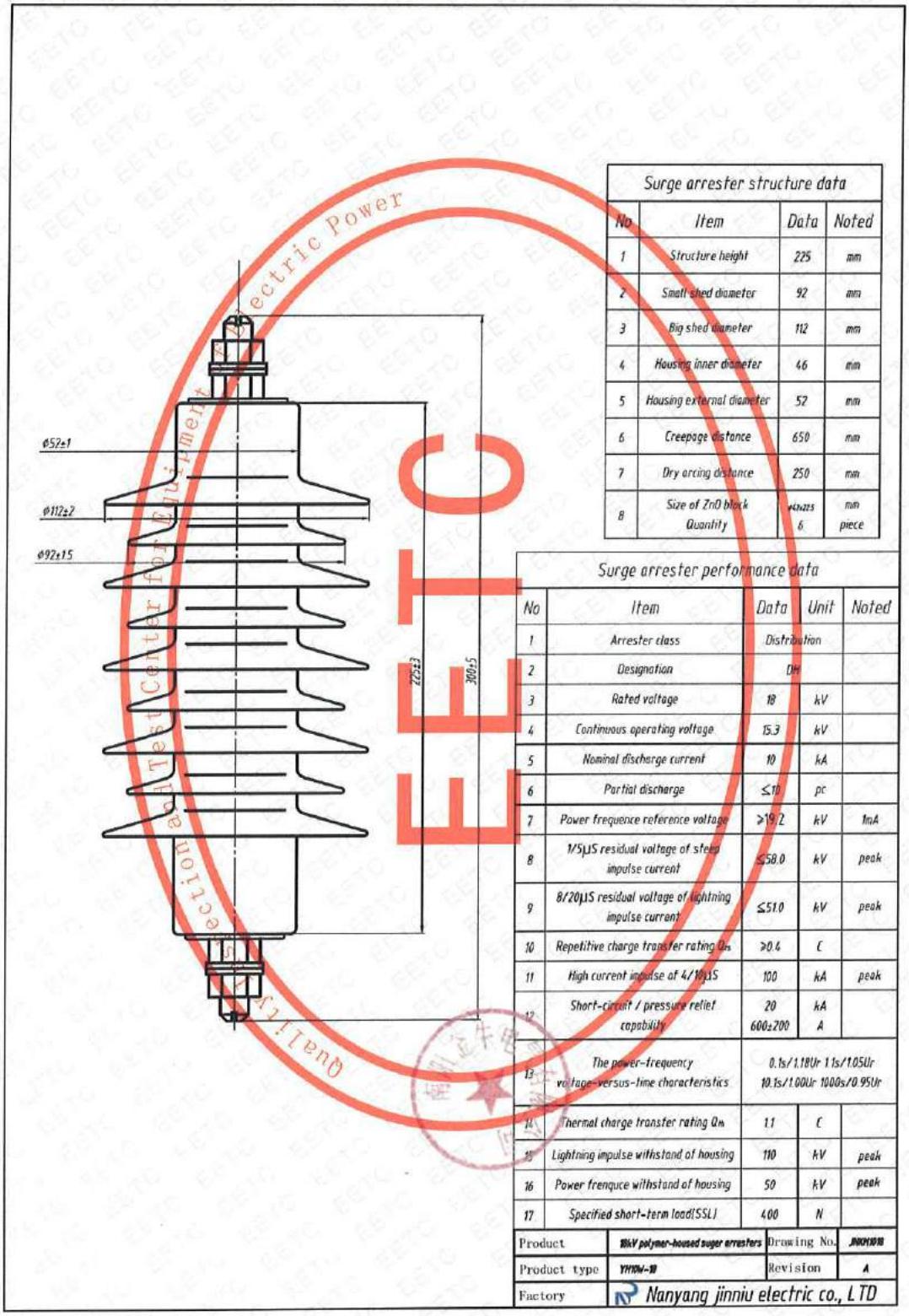
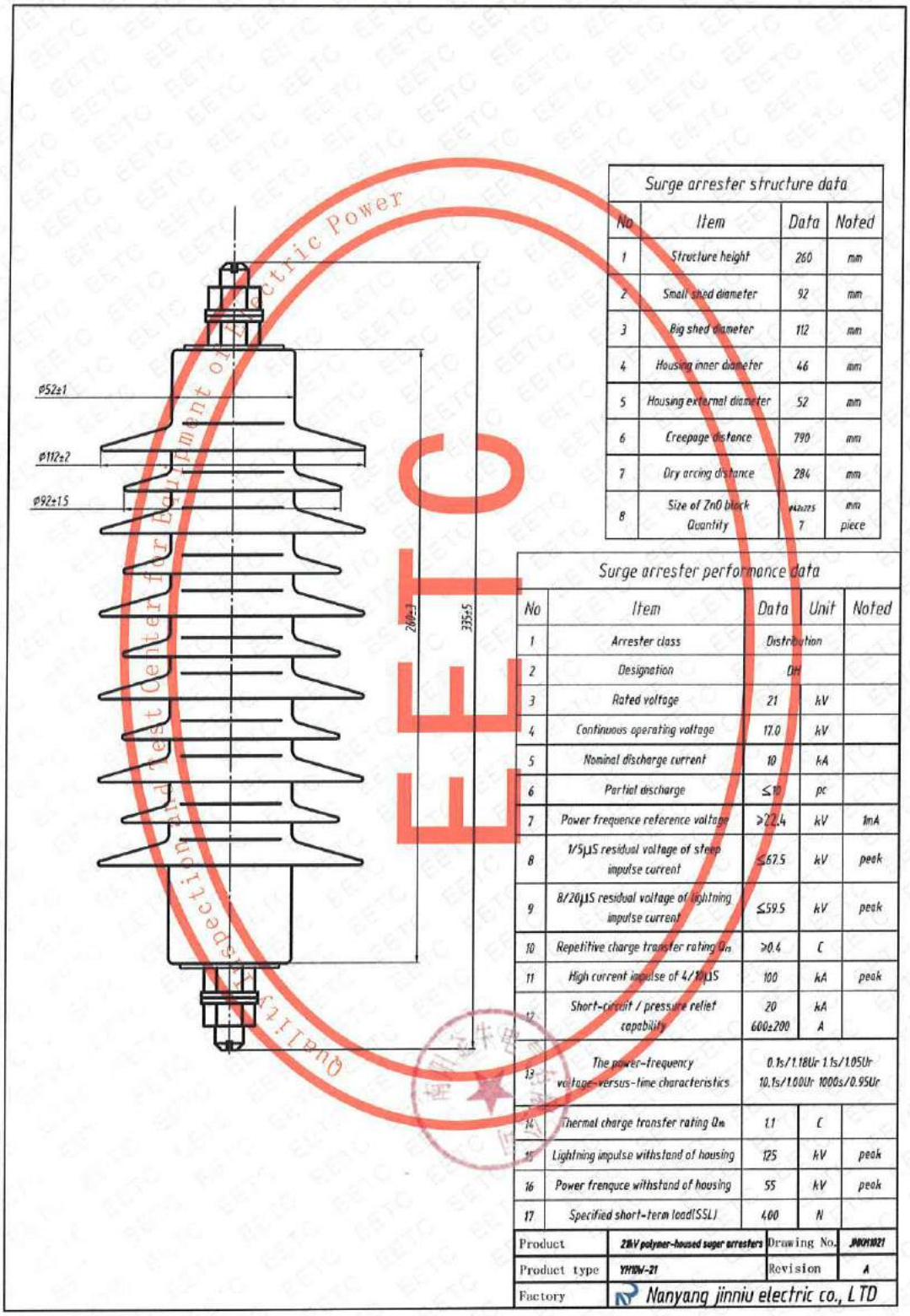


Fig E6: Dimensional drawing of YH10W-18



Surge arrester structure data

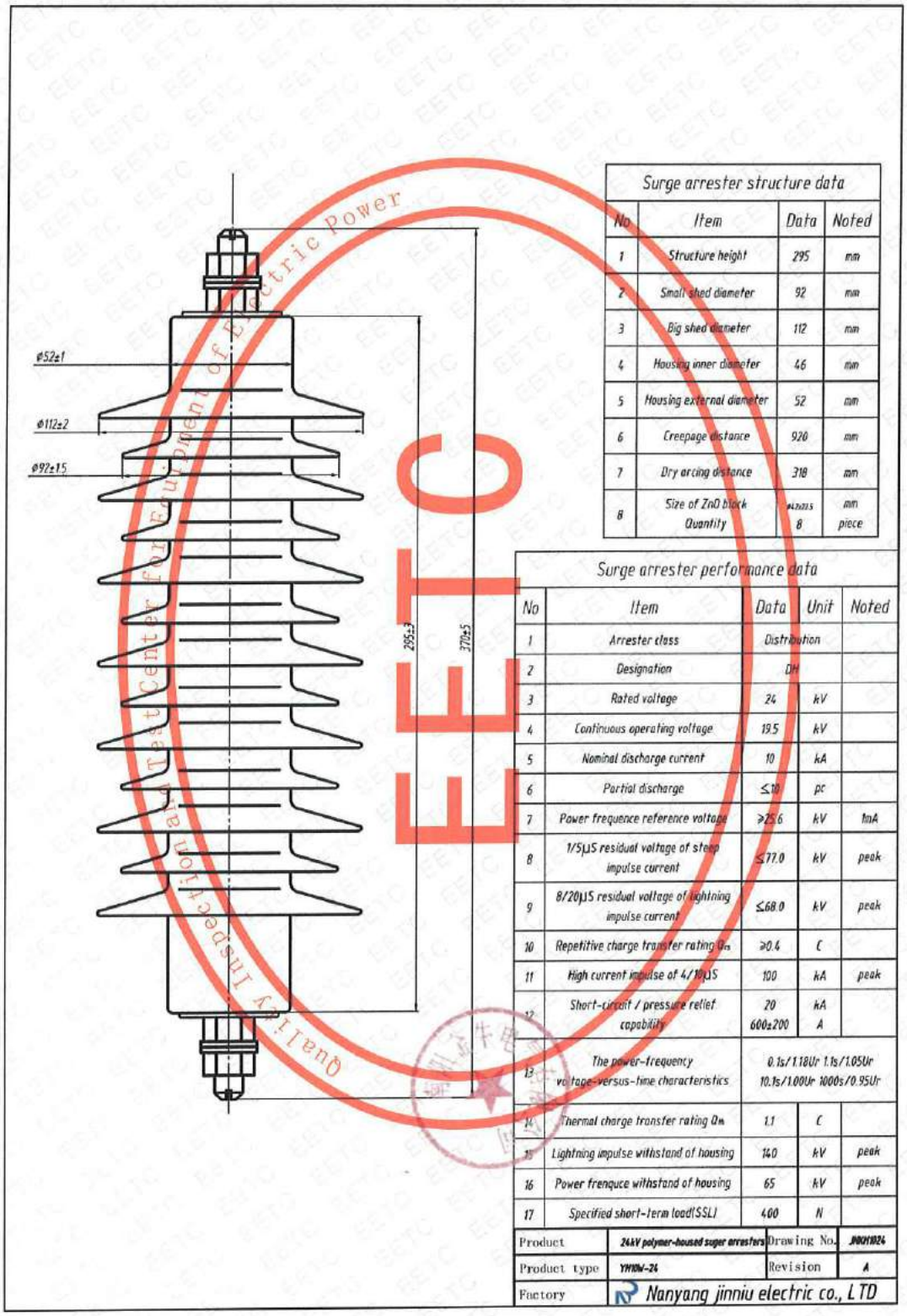
No	Item	Data	Noted
1	Structure height	260	mm
2	Small shed diameter	92	mm
3	Big shed diameter	112	mm
4	Housing inner diameter	46	mm
5	Housing external diameter	52	mm
6	Creepage distance	790	mm
7	Dry arcing distance	284	mm
8	Size of ZnO block Quantity	Φ42x25 7	mm piece

Surge arrester performance data

No	Item	Data	Unit	Noted
1	Arrester class	Distribution		
2	Designation	DH		
3	Rated voltage	21	kV	
4	Continuous operating voltage	17.0	kV	
5	Nominal discharge current	10	kA	
6	Partial discharge	≤10	pc	
7	Power frequence reference voltage	≥22.4	kV	1mA
8	1/5μS residual voltage of steep impulse current	≤67.5	kV	peak
9	8/20μS residual voltage of lightning impulse current	≤59.5	kV	peak
10	Repetitive charge transfer rating Q_{rs}	≥0.4	C	
11	High current impulse of 4/10μS	100	kA	peak
12	Short-circuit / pressure relief capability	20 600±200	kA A	
13	The power-frequency voltage-versus-time characteristics	0.1s/1.18Ur 1.1s/1.05Ur 10.1s/1.00Ur 1000s/0.95Ur		
14	Thermal charge transfer rating Q_{th}	1.1	C	
15	Lightning impulse withstand of housing	125	kV	peak
16	Power frenquce withstand of housing	55	kV	peak
17	Specified short-term load(SSL)	400	N	

Product	21kV polymer-housed surge arresters	Drawing No.	JBKH1021
Product type	YH10W-21	Revision	A
Factory	Nanyang jinniu electric co., LTD		

Fig E7: Dimensional drawing of YH10W-21



Surge arrester structure data

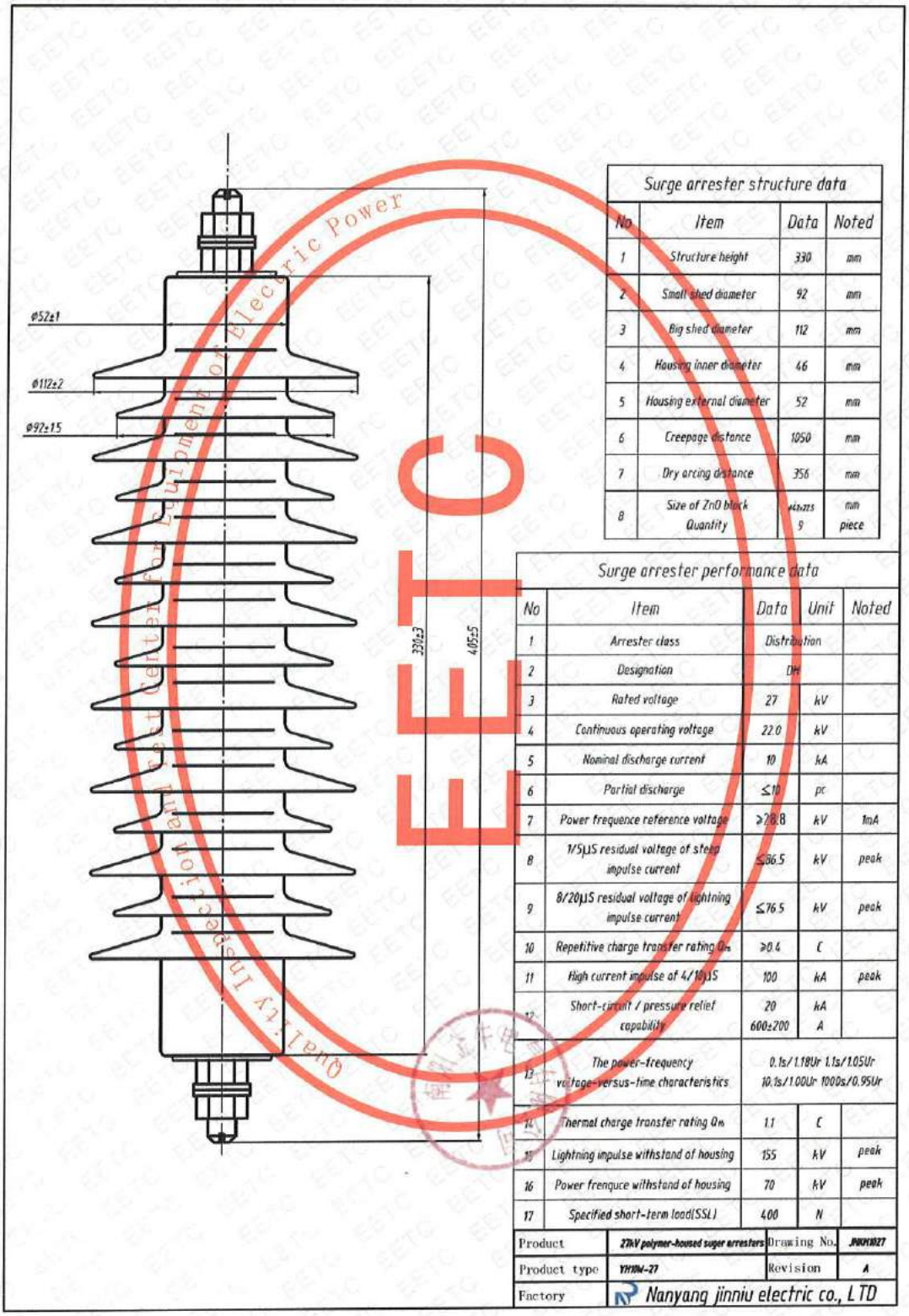
No	Item	Data	Noted
1	Structure height	295	mm
2	Small shed diameter	92	mm
3	Big shed diameter	112	mm
4	Housing inner diameter	46	mm
5	Housing external diameter	52	mm
6	Creepage distance	920	mm
7	Dry arcing distance	318	mm
8	Size of ZnO block Quantity	ø42x35 8	mm piece

Surge arrester performance data

No	Item	Data	Unit	Noted
1	Arrester class	Distribution		
2	Designation	DH		
3	Rated voltage	24	kV	
4	Continuous operating voltage	19.5	kV	
5	Nominal discharge current	10	kA	
6	Partial discharge	≤10	pc	
7	Power frequence reference voltage	≥25.6	kV	1mA
8	1/5μS residual voltage of steep impulse current	≤77.0	kV	peak
9	8/20μS residual voltage of lightning impulse current	≤68.0	kV	peak
10	Repetitive charge transfer rating Qrs	≥0.4	C	
11	High current impulse of 4/10μS	100	kA	peak
12	Short-circuit / pressure relief capability	20 600±200	kA A	
13	The power-frequency voltage-versus-time characteristics	0.1s/1.18Ur 1.1s/1.05Ur 10.1s/1.00Ur 1000s/0.95Ur		
14	Thermal charge transfer rating Qth	1.1	C	
15	Lightning impulse withstand of housing	140	kV	peak
16	Power frenquce withstand of housing	65	kV	peak
17	Specified short-term load(SSL)	400	N	

Product	24kV polymer-housed super arresters	Drawing No.	JB011024
Product type	YH10W-24	Revision	A
Factory	Nanyang jinniu electric co., LTD		

Fig E8: Dimensional drawing of YH10W-24



Surge arrester structure data

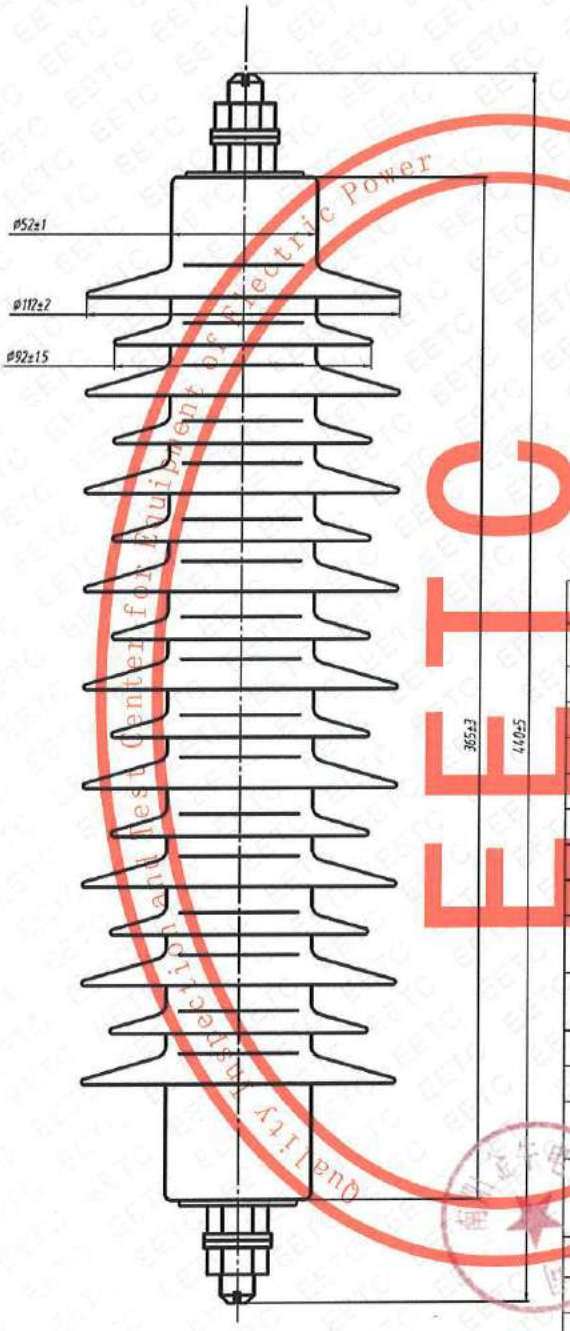
No	Item	Data	Noted
1	Structure height	330	mm
2	Small shed diameter	92	mm
3	Big shed diameter	112	mm
4	Housing inner diameter	46	mm
5	Housing external diameter	52	mm
6	Creepage distance	1050	mm
7	Dry arcing distance	356	mm
8	Size of ZnO block Quantity	46x225 9	mm piece

Surge arrester performance data

No	Item	Data	Unit	Noted
1	Arrester class	Distribution		
2	Designation	DH		
3	Rated voltage	27	kV	
4	Continuous operating voltage	22.0	kV	
5	Nominal discharge current	10	kA	
6	Partial discharge	≤10	pc	
7	Power frequence reference voltage	≥28.8	kV	1mA
8	1/5μS residual voltage of steep impulse current	≤36.5	kV	peak
9	8/20μS residual voltage of lightning impulse current	≤76.5	kV	peak
10	Repetitive charge transfer rating Q_{rs}	≥0.4	C	
11	High current impulse of 4/10μS	100	kA	peak
12	Short-circuit / pressure relief capability	20 600±200	kA A	
13	The power-frequency voltage-versus-time characteristics	0.1s/1.18Ur 1.1s/1.05Ur 10.1s/1.00Ur 1000s/0.95Ur		
14	Thermal charge transfer rating Q_{th}	1.1	C	
15	Lightning impulse withstand of housing	155	kV	peak
16	Power frenquce withstand of housing	70	kV	peak
17	Specified short-term load(SSL)	400	N	

Product	27kV polymer-housed suger arresters	Drawing No.	JNKH1027
Product type	YH10W-27	Revision	A
Factory	Nanyang jinniu electric co., LTD		

Fig E9: Dimensional drawing of YH10W-27

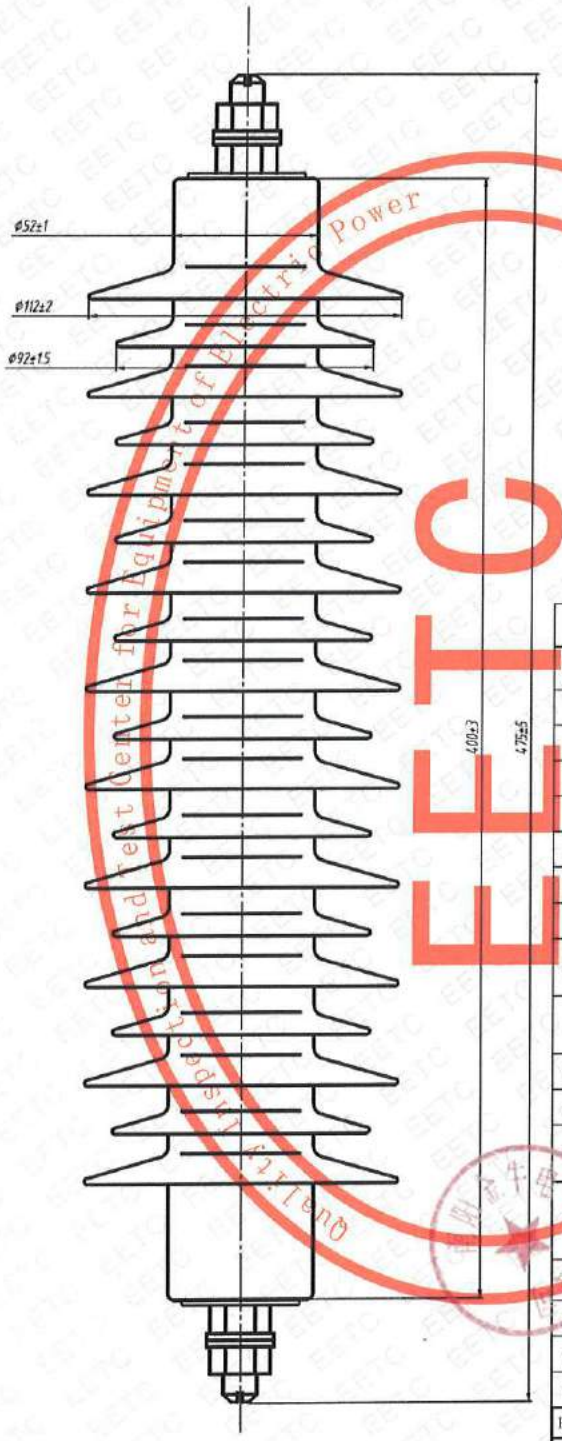


Surge arrester structure data			
No	Item	Data	Noted
1	Structure height	365	mm
2	Small shed diameter	92	mm
3	Big shed diameter	112	mm
4	Housing inner diameter	46	mm
5	Housing external diameter	52	mm
6	Creepage distance	1200	mm
7	Dry arcing distance	392	mm
8	Size of ZnO block Quantity	Φ42x27.5 10	mm piece

Surge arrester performance data				
No	Item	Data	Unit	Noted
1	Arrester class	Distribution		
2	Designation	DH		
3	Rated voltage	30	kV	
4	Continuous operating voltage	24.4	kV	
5	Nominal discharge current	10	kA	
6	Partial discharge	≤10	pc	
7	Power frequence reference voltage	≥32	kV	1mA
8	1/5μS residual voltage of steep impulse current	≤96.0	kV	peak
9	8/20μS residual voltage of lightning impulse current	≤85.0	kV	peak
10	Repetitive charge transfer rating Q_{rs}	≥0.4	C	
11	High current impulse of 4/10μS	100	kA	peak
12	Short-circuit / pressure relief capability	20 600±200	kA A	
13	The power-frequency voltage-versus-time characteristics	0.1s/1.18Ur 1.1s/1.05Ur 10.1s/1.00Ur 1000s/0.95Ur		
14	Thermal charge transfer rating Q_{th}	1.1	C	
15	Lightning impulse withstand of housing	170	kV	peak
16	Power frenquce withstand of housing	80	kV	peak
17	Specified short-term load(SSL)	400	N	

Product	30kV polymer-housed suger arresters	Drawing No.	J00X1330
Product type	YH10W-30	Revision	A
Factory	Nanyang jinniu electric co., LTD		

Fig E10: Dimensional drawing of YH10W-30



Surge arrester structure data

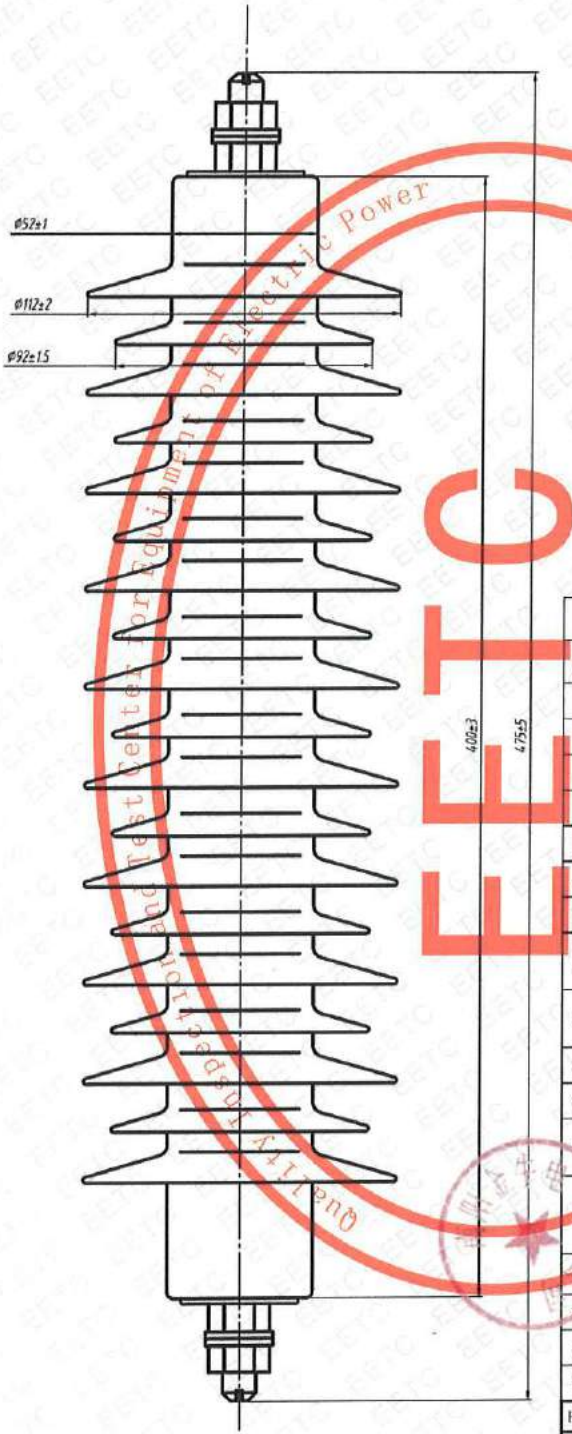
No	Item	Data	Noted
1	Structure height	400	mm
2	Small shed diameter	92	mm
3	Big shed diameter	112	mm
4	Housing inner diameter	46	mm
5	Housing external diameter	52	mm
6	Creepage distance	1340	mm
7	Dry arcing distance	428	mm
8	Size of ZnO block Quantity	Φ42×15 11	mm piece

Surge arrester performance data

No	Item	Data	Unit	Noted
1	Arrester class	Distribution		
2	Designation	DH		
3	Rated voltage	33	kV	
4	Continuous operating voltage	26.7	kV	
5	Nominal discharge current	10	kA	
6	Partial discharge	≤10	pc	
7	Power frequence reference voltage	≥35.2	kV	1mA
8	1/5μS residual voltage of steep impulse current	≤105.5	kV	peak
9	8/20μS residual voltage of lightning impulse current	≤93.5	kV	peak
10	Repetitive charge transfer rating Q_{rs}	≥0.4	C	
11	High current impulse of 4/10μS	100	kA	peak
12	Short-circuit / pressure relief capability	20 600±200	kA A	
13	The power-frequency voltage-versus-time characteristics	0.1s/1.18Ur 1.1s/1.05Ur 10.1s/1.00Ur 1000s/0.95Ur		
14	Thermal charge transfer rating Q_{th}	1.1	C	
15	Lightning impulse withstand of housing	185	kV	peak
16	Power frenquce withstand of housing	90	kV	peak
17	Specified short-term load(SSL)	400	N	

Product	33kV polymer-housed suger arresters	Drawing No.	JINYI033
Product type	YH10W-33	Revision	A
Factory	Nanyang jinniu electric co., LTD		

Fig E11: Dimensional drawing of YH10W-33



Surge arrester structure data			
No	Item	Data	Noted
1	Structure height	400	mm
2	Small shed diameter	92	mm
3	Big shed diameter	112	mm
4	Housing inner diameter	46	mm
5	Housing external diameter	52	mm
6	Creepage distance	1340	mm
7	Dry arcing distance	428	mm
8	Size of ZnO block Quantity	Ø42x27.5 17	mm piece

Surge arrester performance data				
No	Item	Data	Unit	Noted
1	Arrester class	Distribution		
2	Designation	DH		
3	Rated voltage	36	kV	
4	Continuous operating voltage	29	kV	
5	Nominal discharge current	10	kA	
6	Partial discharge	≤10	pc	
7	Power frequence reference voltage	≥38.4	kV	1mA
8	1/5μS residual voltage of steep impulse current	≤115.0	kV	peak
9	8/20μS residual voltage of lightning impulse current	≤102.0	kV	peak
10	Repetitive charge transfer rating Q_{rs}	≥0.4	C	
11	High current impulse of 4/10μS	100	kA	peak
12	Short-circuit / pressure relief capability	20 600±200	kA A	
13	The power-frequency voltage-versus-time characteristics	0.1s/1.18Ur 1.1s/1.05Ur 10.1s/1.00Ur 1000s/0.95Ur		
14	Thermal charge transfer rating Q_{th}	1.1	C	
15	Lightning impulse withstand of housing	185	kV	peak
16	Power frenquce withstand of housing	90	kV	peak
17	Specified short-term load(SSL)	400	N	

Product	36kV polymer-housed super arresters	Drawing No.	JINXIU36
Product type	YH10W-36	Revision	A
Factory	Nanyang jinniu electric co., LTD		

Fig E12: Dimensional drawing of YH10W-36

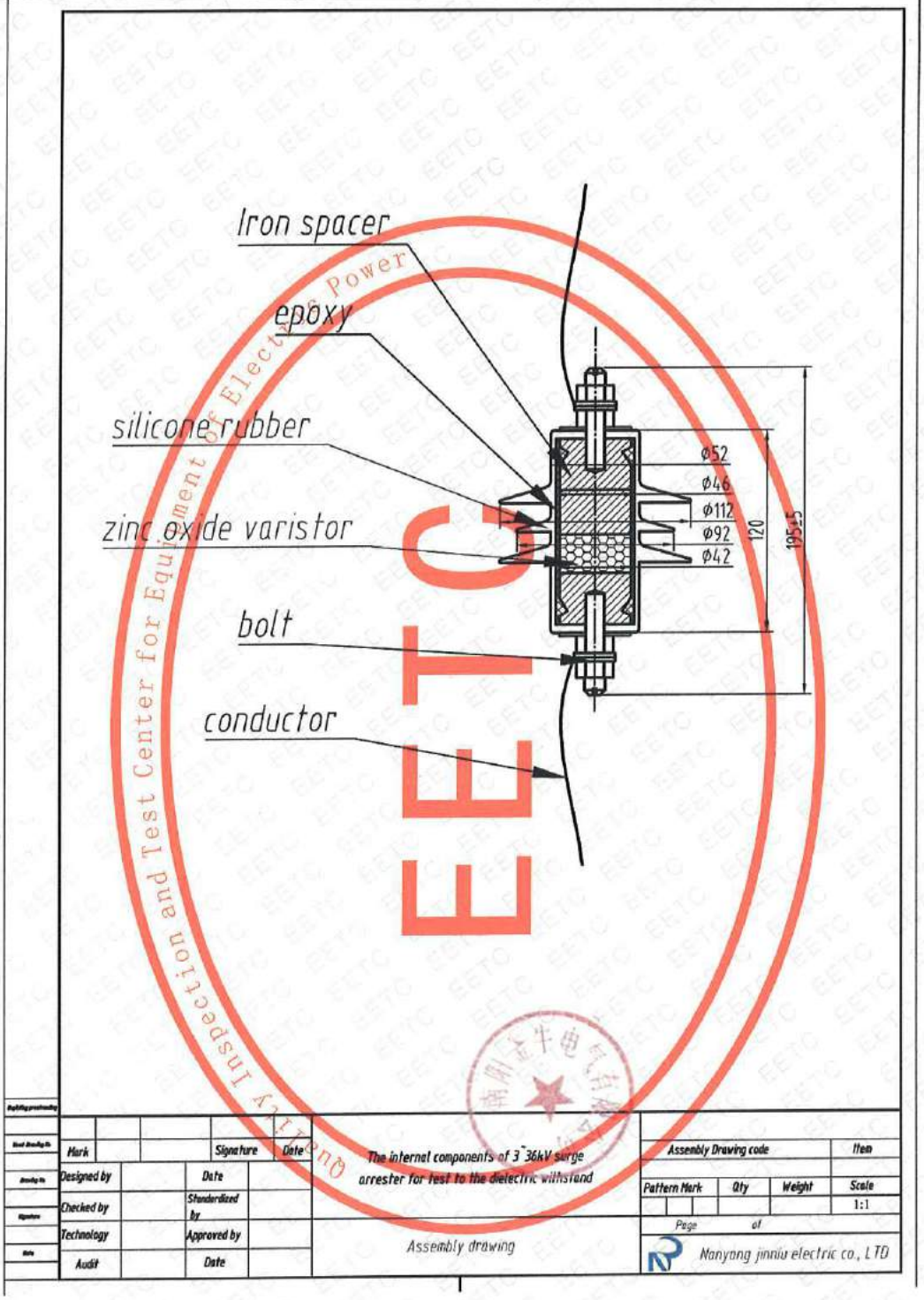


Fig E13: Dimensional drawing of dielectrically prorated section