INSPECTION REPORT

Report no.	70550460-TDT 06-59781A
Client	Wenzhou Cantor H.V. Electric Manufacturing Co. Ltd Zhejing, China
Reference	-
Concerning	type testing
Date	March 21, 2006 to June 7, 2006
Place	Xi'an, China
Object	metal-oxide surge arrester without gaps
Type	Complete type series YH 5W-3-36 kV
Manufacturer	Wenzhou Cantor H.V. Electric Manufacturing Co. Ltd Zhejing, China

REQUIREMENTS
As per IEC 60099-4 Second Edition (2004-05).

INSPECTION PROGRAMME
The programme was specified by KEMA Nederland B.V.
For the programme we refer to page 3.

SUMMARY AND CONCLUSION

The results obtained relate only to the work ordered and to the material inspected.
The arrester withstood all type tests as per inspection program of page 3.

Author André W. van Boetzelaer

KEMA Nederland B.V.

P.G.A. Bus
KEMA T&D Testing Services
Managing Director

This B-report consists of:
10 pages
2 annexes (35 pages)

Arnhem, August 28, 2006

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MATERIAL DATA		**Metal-oxide surge arrester without gaps**
Type		Series YH 5W-3-36 kV
Manufacturer		Wenzhou Cantor H.V. Electric Manufacturing Co. Ltd Zhejing, China
Housing material		polymer
Rated voltage U_r	kV	3-36
Reference voltage (1 mA)	kV	≥ 3-36
Rated frequency	Hz	50
Nominal discharge current	kA	5
Continuous operating voltage U_{cov}	kV	2,4-28,8
Residual voltage at		
- nominal discharge current 8/20 µs	kV	≤ 8,5-102
- switching current 30/60 µs	kV	≤ 7,3-87,7
- steep current 1/10 µs	kV	≤ 9,8-117,6
Line discharge class		-
Housing insulation level		
- lightning impulse	kV	12-150
- power frequency	kV	7-70
Arrester mechanical load		
- torsional	Nm	50
- cantilever	N	147
Block dimensions		
- diameter	mm	42
- height	mm	22
Number of metal-oxide blocks		1-12
Rated short-circuit withstand current	kA	-

The exact data of each type of arrester from this series as well the drawings are summarized in annex A, page 1 to 15.

INSPECTION PROGRAM

The inspection program was specified by KEMA. All measurements and tests are in accordance with IEC 60099-4 (2004-05).

	Kind of test	Standard	Clause
1	**COMPLETE ARRESTER**		
1.1	Reference voltage measurement	IEC 60099-4	7.2
1.2	Internal partial discharge test	IEC 60099-4	8.8
1.3	Mechanical tests	IEC 60099-4	
1.3.1	Moisture ingress test	IEC 60099-4	10.8.13
1.3.2	Weather ageing test	IEC 60099-4	10.8.14
2	**ARRESTER HOUSING**		
2.1	Lightning impulse voltage test	IEC 60099-4	8.2.6
2.2	Power frequency voltage test, wet	IEC 60099-4	8.2.8
3	**ARRESTER SECTION**		
3.1	Residual voltage test	IEC 60099-4	
3.1.1	Lightning impulse	IEC 60099-4	8.3.2
3.1.2	Steep current	IEC 60099-4	8.3.1
3.2	Long duration current impulse withstand test	IEC 60099-4	8.4.3
3.3	Operating duty test	IEC 60099-4	
3.3.1	Accelerated ageing test	IEC 60099-4	8.5.2
3.3.2	Conditioning	IEC 60099-4	8.5.4.1
3.3.3	High current impulse surge operating duty test, application of impulses	IEC 60099-4	8.5.4.2

PERSONS ATTENDING THE INSPECTION

Mr Xiao'ou Zheng	Wenzhou Cantor H.V. Electric Manufacturing Co. Ltd

THE INSPECTION WAS CARRIED OUT BY

Mr André W. van Boetzelaer	KEMA Nederland B.V.

PURPOSE OF THE INSPECTION

Purpose of the inspection was to verify whether the arrester complies with the specified requirements.

DESCRIPTION AND RESULTS OF THE TEST

0 INSPECTION OF THE TEST SET-UP

The tests were carried out in the laboratory of China National Centre for Quality Supervision and Test of Insulators and Surge Arresters in Xi'an, China, who is therefore jointly responsible for the correctness of the results obtained. The measuring devices and the test set-up were checked by KEMA and where necessary calibrated.

Result

The inspection results did not give rise to remarks.

1 COMPLETE ARRESTER

1.1 Reference voltage measurement

The reference voltage of the arrester is defined as the power frequency voltage applied to the arrester when the resistive component of the current flowing through the arrester is 1 mApeak.
The reference voltage should be greater than the value as stated in the material data.
The reference voltage measurement was carried out on three complete arresters of the 36 kV type, which is representative for the whole series
The results of this measurement are summarised in annex B.

Result

The test results fulfilled the requirements.

1.2 Internal partial discharge test

The internal partial discharges were measured when applying a power frequency voltage to the arrester. The voltage was first raised to the rated voltage, held for 10 s and then decreased to 1,05 times the continuous operating voltage at which level the partial discharges were measured.
The partial discharge level should be below 10 pC.
The reference voltage measurement was carried out on three complete arresters of the 36 kV type, which is representative for the whole series.
The results of this measurement are summarised in annex B.

Result

The test results fulfilled the requirements.

1.3 Mechanical tests

1.3.1 MOISTURE INGRESS TEST

One sample of a complete arrester of the 36 kV type, which is representative for the whole series, was submitted to the following test sequence:

- initial measurements: partial discharge-, watt losses-and residual voltage measurement
- terminal torque test at rated torque
- thermo mechanical test in four directions with rated cantilever load at temperatures of respectively +60 °C, -25 °C, +45 °C and -40 °C
- water immersion test in boiling water with NaCl for 42 hours
- visual inspection of the sample
- verification tests: partial discharge-, watt losses-and residual voltage measurement.

The results of this test are summarised in annex B.
The acceptance criteria are:

- no mechanical change
- increase of watt losses should be less than 20%
- partial discharges < 10 pC at 1,05 U_{cov}
- change of residual voltage should be less than 5%.

Result

The test results fulfilled the requirements.

1.3.2 WEATHER AGEING TEST

One ratio arrester with an U_r of 15 kV and an equivalent creep age distance was specially prepared for this test. This sample was submitted to the following test sequence:

- initial measurements: reference voltage- and partial discharge measurement
- test series A: 1000 hours at a constant power frequency voltage of U_{cov} (12 kV) in a climate room sprayed with salt water and a flow rate of 0,4 ± 0,1 l/h/m^3
- verification tests: reference voltage- and partial discharge measurement.

The results of this test are summarised in annex B.
The acceptance criteria are:
- change of reference voltage should be less than 5%
- partial discharges < 10 pC at 1,05 U_{cov}.

Result

The test results fulfilled the requirements.

2 ARRESTER HOUSING

2.1 Lightning impulse voltage test

One empty housing of the 36 kV type which is representative for the whole series was subjected to a standard lightning impulse voltage dry test with 15 impulses of positive polarity and 15 impulses of negative polarity and a crest value of 150 kV.
The results of this test are summarised in annex B.
The acceptance criterion is:
- not more than two external disruptive discharges per 15 impulses.

Result

The test results fulfilled the requirements.

2.2 Power frequency voltage test, wet

One empty housing of the 36 kV type, which is representative for the whole series, was tested with a power frequency of 70 kV, 50 Hz during 1 minute under artificial rain in accordance with IEC 60060-1 (1989).
The results of this test are summarised in annex B.
The acceptance criterion is:
- no external disruptive discharge during the test

Result

The test results fulfilled the requirements.

3 ARRESTER SECTION

3.1 Residual voltage test

All residual voltage tests were carried out on the same three-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.

3.1.1 LIGHTNING IMPULSE

Three lightning current impulses with a waveform of 8/20 µs with a peak value of respectively 2,5, 5 and 10 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.
The results of this test are summarised in annex B.
The acceptance criterion is:

- the equivalent residual voltage of the arrester at nominal discharge current (5 kA) should be below the specified residual voltage in kV.

Result

The test results fulfilled the requirements.

3.1.2 STEEP CURRENT

One steep current impulse with a waveform of 1/10 µs and a peak value of 5 kA was applied to each of the three sections. The maximum value of the residual voltage was recorded.
The results of this test are summarised in annex B.
The acceptance criterion is:

- the equivalent residual voltage of the arrester at nominal discharge current should be below the specified steep current impulse residual voltage in kV.

Result

The test results fulfilled the requirements.

3.2 Long duration current impulse withstand test

The long duration current impulse withstand test was carried out on three-arrester sections. The rated voltage of one section is 3 kV and consisted of one metal-oxide block.
Before this test the lightning impulse residual voltage at nominal discharge current was measured. The peak current was 100 A and the virtual duration of the impulse 1000 μs. Each sample was tested with 18 long duration impulses divided in 6 groups. Between each impulse there is a pause of 50 to 60 s and between each group the samples are cooled down to ambient.
Following the test and after the samples are cooled down to ambient the lightning impulse residual voltage at nominal discharge current was measured.
The results of this test are summarized in Annex B.
The acceptance criterium is:

- no evidence of puncture, flashover or other significant damage
- change of residual voltage should be less than 5%

Result

The test results fulfilled the requirements

3.3 Operating duty test

The operating duty test was carried out on three-arrester sections. The rated voltage of one section is 3 kV and consisted of one metal-oxide block. Successively the following three tests were carried out.

3.3.1 ACCELERATED AGEING TEST

This test is designed to determine the elevated test voltages and to decide whether new or aged samples shall be used in the operating duty test.
The three samples were subjected to a long duration test with a corrected U_{cov} of 2,55 kV during 1000 hours. During the whole test duration the resistor power losses are measured. Taken into account the results of these loss measurements and using the calculation method described in the IEC standard the choice between aged and new samples for the following tests has to be made.

3.3.2 CONDITIONING

The conditioning test was made on three new samples. Before the conditioning tests the lightning impulse residual voltage at nominal discharge current was determined. Following this the three samples were exposed to 20 lightning current impulses of 8/20 μs with nominal discharge current. The impulses were applied while the sample was energized at 1,2 x U_{cov}. The 20 impulses are applied in four groups of 5 impulses. The interval between each impulse was 50-60 s and between each group 25-30 min.

3.3.3 HIGH CURRENT IMPULSE OPERATING DUTY TEST, APPLICATION OF IMPULSES

The operating duty test is made on the same samples as during conditioning, above. The samples were placed in a housing, which is thermal equivalent to the housing of a complete arrester.

All three samples were tested with two high current impulses of 65 kA, 4/10 μs. Before the application of the second impulse the samples were pre heated to a temperature of 60 °C.

Immediately after the second application of the high current impulse, a power frequency of U_r during 10 s and U_{cov} 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 the lightning impulse residual voltage at nominal discharge current was measured.

The results of this test are summarised in annex B.

The acceptance criteria is:

- 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 test results fulfilled the requirements.

Technical Data of Metal Oxide Surge Arrester (Type: YH5W-3~18kV)

	Manufacturer	生产商		Wenzhou Cantor H.V. Electric Manufacturing Co., LTD.					
	Rated Voltage	额定电压	kV	3	6	9	12	15	18
	Nominal discharge current	标称放电电流	kA	5	5	5	5	5	5
1	General Feature	一般特征	Unit						
1.1	Applicable standard	适用标准		IEC60099-4(2004)					
1.2	Type designation	型号		YH5W-3/8.5	YH5W-6/17	YH5W-9/25.5	YH5W-12/34	YH5W-15/42.5	YH5W-18/51
1.3	Housing material	外套材料		Silicone rubber	Silicone rubber	Silicone rubber	Silicone rubber	Silicone rubber	Silicone rubber
1.4	With(out) gqps	结构类型（有无间隙）		Without	Without	Without	Without	Without	Without
2	Ratings & characteristics	技术参数							
2.1	Rated frequency	额定频率	Hz	50	50	50	50	50	50
2.2	Residual voltage at	残压							
	-lightning impule 8/20μs	-雷电	kV	8.5	17	25.5	34	42.5	51
	-steep current impulse 1/10μs	-陡坡	kV	9.8	19.6	29.4	39.2	49	58.8
	-switching impulse 30/60μs(10kA&up)	-操作	kV	7.3	14.6	21.9	29.4	36.6	43.9
	-switching surge(class 2&up)	-操作波	kA	0.25	0.25	0.25	0.25	0.25	0.25
2.3	Continuous operating voltage	持续运行电压	kV	2.4	4.8	7.2	9.6	12	14.4
2.4	Power freqncy reference voltage	工频参考电压	kV	≥3	≥6	≥9	≥12	≥15	≥18
2.5	Long duration current impulse withstand	持续冲击耐受							
	-line discharge chass(10kA&up)	-线路放电等级							
	-2ms rectangular current withstand	-方波耐受电流	A	100	100	100	100	100	100
2.6	Operating duty	动作负载							
	-4/10μs high current impulse withstand	-大电流冲击耐受	kA	65	65	65	65	65	65
2.7	Housing insulation level	外套绝缘水平							
	-lightning impulse	-雷电冲击	kV	12	25	35	45	60	70
	-power frequency,wet 1 min	-工频，湿	kV	7	10	20	25	30	35
2.8	Partial discharge	局放	pC	<10					
2.9	Rated short-circuit withstand current	额定短路耐受电流	kA						

Annex A page 1

	Manufacturer	生产商		Wenzhou Cantor H.V. Electric Manufacturing Co., LTD.					
	Rated Voltage	额定电压	kV	3	6	9	12	15	18
	Nominal discharge current	标称放电电流	kA	5	5	5	5	5	5
2.10	Power frequency voltage versus time	工频电压时间特性		$1.15U_R$-0.1s $1.10U_R$-1s $1.05U_R$-1s $1U_R$-1200s					
2.11	Other ratings & characteristics	其他参数							
	-Reference voltage(1 mA DC)	-参考电压（1mA DC）	kV	4.4	8.8	13.2	17.6	22.0	26.4
	-Energy absorption capability	-能量吸收能力	kJ/kV						
3	Measurements & dimensions	尺寸/机械强度							
3.1	Creepage distance	爬距	mm	120	240	369	432	510	576
	-creepage distance/rated voltage ratio	-爬电比距	mm/kV	40	40	41	36	34	32
3.2	Mechnical section length	本体高度（不含螺栓）	mm	90	113	157	175	198	215
3.3	Insuation distance/electrical section length	绝缘距离	mm	68	91	135	153	176	193
3.4	Mechanical strength	机械强度							
	-torsional	-抗扭（水平）	Nm	50	50	50	50	50	50
	-cantilever	-抗弯（垂直）	N	147	147	147	147	147	147
	-bending moment (10kA up &based mounted)	抗弯强度 （水平）	kg						
3.5	Blocks	电阻片							
	-diameter	-直径	mm	φ42	φ42	φ42	φ42	φ42	φ42
	-height	-高度	mm	22	22	22	22	22	22
	-number of blocks	-数量		1	2	3	4	5	6
3.6	Arrester dimension	避雷器尺寸							
	-diameter (big shed)	-直径（大伞径）	mm	125	125	125	125	125	125
	-diameter (small shed)	-小伞径	mm	/	107	107	107	107	107
	-number of sheds	-伞数		1	3	5	6	7	8
	-core diameter	-芯径	mm	59	59	59	59	59	59
	-arrester height (with fittings)	-总高度	mm	153	177	219	238	261	280
3.7	Rated voltage/Insuation distance Ratio	额定电压/绝缘距离	kV/mm	0.044	0.066	0.067	0.078	0.085	0.093

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Technical Data of Metal Oxide Surge Arrester (Type: YH5W-21~36kV)

	Manufacturer	生产商		Wenzhou Cantor H.V. Electric Manufacturing Co., LTD.					
	Rated Voltage	额定电压	kV	21	24	27	30	33	36
	Nominal discharge current	标称放电电流	kA	5	5	5	5	5	5
1	General Feature	一般特征	Unit						
1.1	Applicable standard	适用标准		IEC60099-4(2004)					
1.2	Type designation	型号		YH5W-21/59.5	YH5W-24/68	YH5W-27/76.5	YH5W-30/85	YH5W-33/93.5	YH5W-36/102
1.3	Housing material	外套材料		rubber	rubber	rubber	rubber	rubber	rubber
1.4	With(out) gqps	结构类型（有无间隙）		Without	Without	Without	Without	Without	Without
2	Ratings & characteristics	技术参数							
2.1	Rated frequency	额定频率	Hz	50	50	50	50	50	50
2.2	Residual voltage at	残压							
	-lightning impule 8/20μs	-雷电	kV	59.5	68	76.5	85	93.5	102
	-steep current impulse 1/10μs	-陡坡	kV	68.6	78.4	88.2	98	107.8	117.6
	-switching impulse 30/60μs(10kA&up)	-操作	kV	51.2	58.5	65.8	73.1	80.4	87.7
	-switching surge(class 2&up)	-操作波	kA	0.25	0.25	0.25	0.25	0.25	0.25
2.3	Continuous operating voltage	持续运行电压	kV	16.8	19.2	21.6	24.0	26.4	28.8
2.4	Power freqncy reference voltage	工频参考电压	kV	≥21	≥24	≥27	≥30	≥33	≥36
2.5	Long duration current impulse withstand	长线冲击耐受							
	-line discharge chass(10kA&up)	-线路放电等级							
	-2ms rectangular current withstand	-方波耐受电流	A	100	100	100	100	100	100
2.6	Operating duty	动作负载							
	-4/10μs high current impulse withstand	-大电流冲击耐受	kA	65	65	65	65	65	65
2.7	Housing insulation level	外套绝缘水平							
	-lightning impulse	-雷电冲击	kV	80	95	110	120	135	150
	-power frequency,wet 1 min	-工频，湿	kV	40	50	55	60	65	70
2.8	Partial discharge	局放	pC	<10					
2.9	Rated short-circuit withstand current	额定短路耐受电流	kA						
2.10	Power frequency voltage versus time	工频电压时间特性		$1.15U_R$-0.1s $1.10U_R$-1s $1.05U_R$-1s $1U_R$-1200s					

Annex A page 3

	Manufacturer	生产商		Wenzhou Cantor H.V. Electric Manufacturing Co., LTD.					
	Rated Voltage	额定电压	kV	21	24	27	30	33	36
	Nominal discharge current	标称放电电流	kA	5	5	5	5	5	5
2.11	Other ratings & characteristics	其他参数							
	-Reference voltage(1 mA DC)	-参考电压（1mA DC）	kV	30.8	35.2	39.6	44.0	48.4	52.8
	-Energy absorption capability	-能量吸收能力	kJ/kV						
3	Measurements & dimensions	尺寸/机械强度							
3.1	Creepage distance	爬距	mm	693	780	837	975	1122	1188
	-creepage distance/rated voltage ratio	-爬电比距	mm/kV	33	32.5	31	32.5	34	33
3.2	Mechnical section length	本体高度（不含螺栓）	mm	259	281	312	343	386	406
3.3	Insuation distance/electrical section length	绝缘距离	mm	237	269	290	321	364	384
3.4	Mechanical strength	机械强度							
	-torsional	-抗扭（水平）	Nm	50	50	50	50	50	50
	-cantilever	-抗弯（垂直）	N	147	147	147	147	147	147
	-bending moment (10kA up &based mounted)	抗弯强度 （水平）	kg						
3.5	Blocks	电阻片							
	-diameter	-直径	mm	Φ42	Φ42	Φ42	Φ42	Φ42	Φ42
	-height	-高度	mm	22	22	22	22	22	22
	-number of blocks	-数量		7	8	9	10	11	12
3.6	Arrester dimension	避雷器尺寸							
	-diameter (big shed)	-直径（大伞径）	mm	125	125	125	125	125	125
	-diameter (small shed)	-小伞径	mm	107	107	107	107	107	107
	-number of sheds	-伞数		10	11	12	14	16	17
	-core diameter	-芯径	mm	59	59	59	59	59	59
	-arrester height (with fittings)	-总高度	mm	322	345	364	406	448	471
3.7	Rated voltage/Insuation distance Ratio	额定电压/绝缘距离	kV/mm	0.089	0.089	0.093	0.093	0.091	0.094

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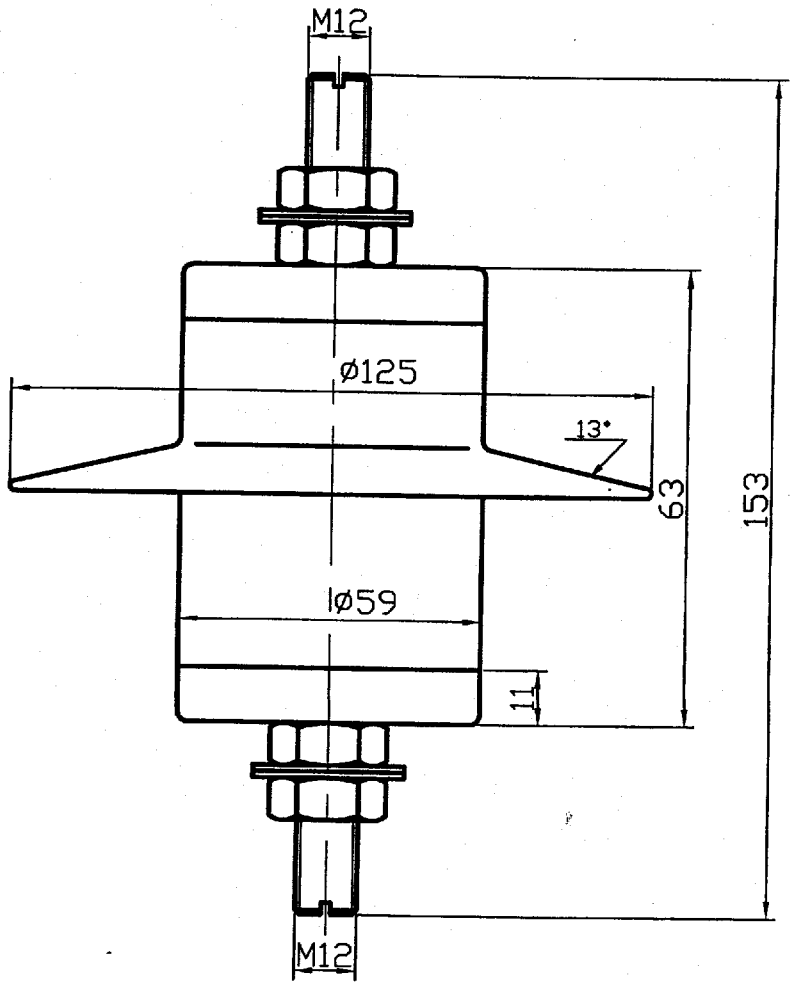
CTY1.01.03-1

Technial Data

1. Applicable standard IEC60099-4(2004)
2. Rated voltage 3kV.
3. Continuous operating voltage 2.4kV.
4. Power frequency reference voltage ≥3kV.
5. Residual voltage at lightning impulse 8/20 μs ≤8.5kV.
6. Housing insulation level lightning impulse ≥12kV.

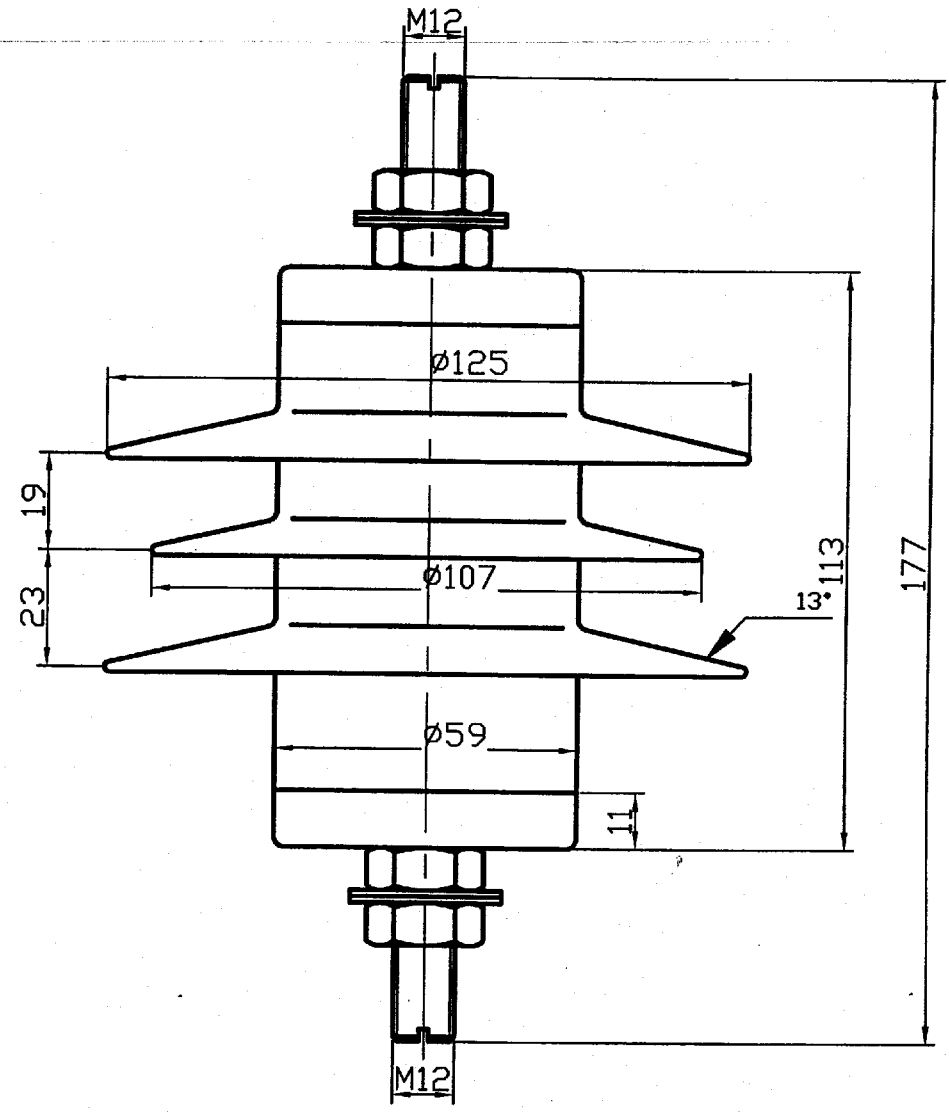


					Metal Oxide Surge Arrester without gaps		Wenzhou CANTOR H.V.Electric Manufacturing Co.,LTD.
rk	QTY	Change File No.	Sig.	Date	**YH5W-3/8.5**		
sign	Jianhua Hou	Check					Exterior drawing
wing	Yong Zheng				Fig.No. / QTY / Scale / Wight		
nics		Sanction	Xiao'ou Zheng			1:1	
ting	Shunyue Zhao	Date	2006-03-31		No. / Page / Total / Page		CTY1.01.03-1

CTY1.01.06-1

Technial Data

1. Applicable standard IEC60099-4(2004)
2. Rated voltage 6kV.
3. Continuous operating voltage 4.8kV.
4. Power frequency reference voltage ≥6kV.
5. Residual voltage at lightning impulse 8/20 μs ≤17kV.
6. Housing insulation level lightning impulse ≥25kV.

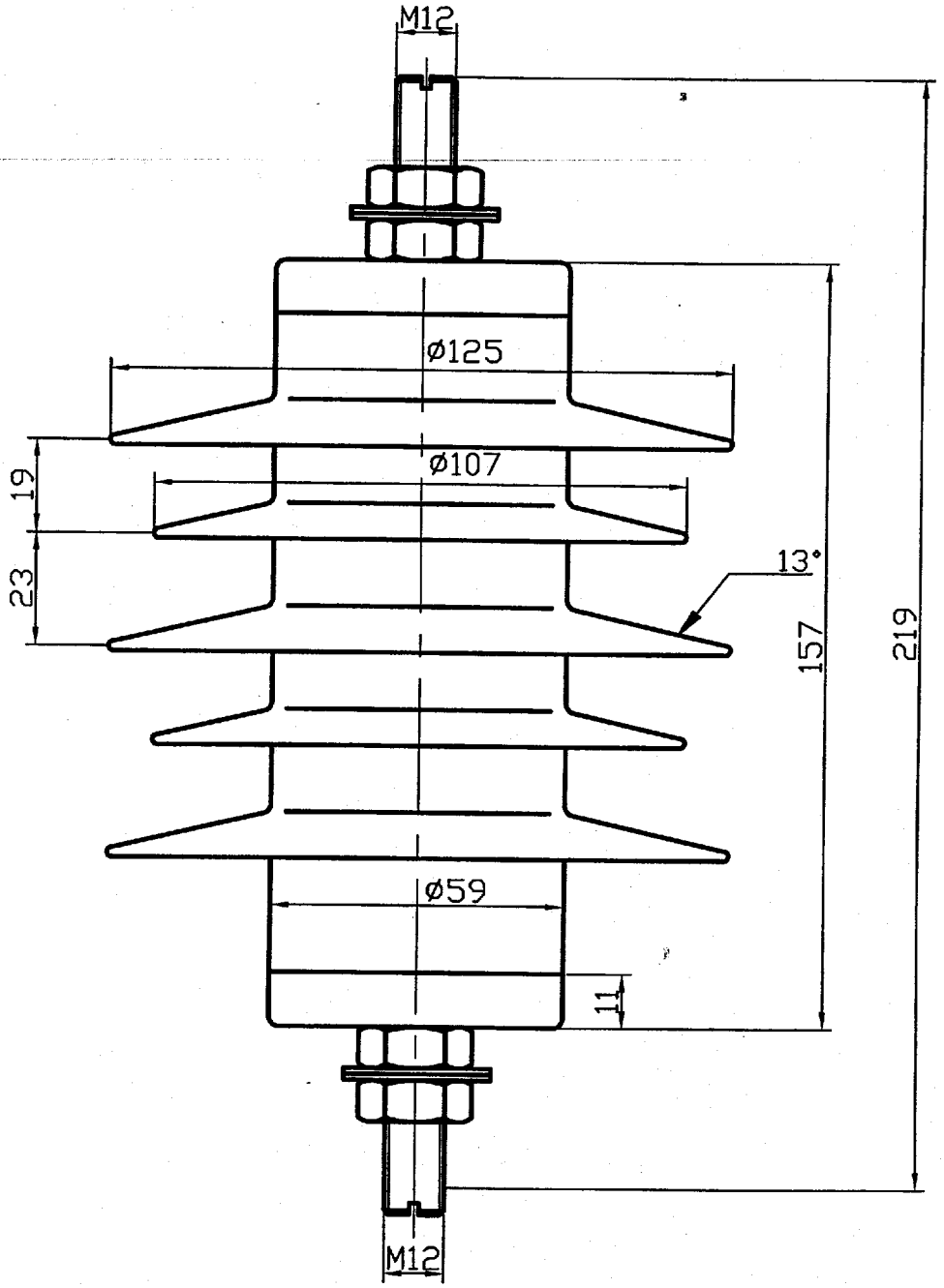


					Metal Oxide Surge Arrester without gaps		Wenzhou CANTOR H.V.Electric Manufacturing Co.,LTD.
					YH5W-6/17		
k	QTY	Change File No.	Sig.	Date			Exterior drawing
sign	Jianhua Hou	Check			Fig.No.	QTY	Scale	Wight
wing	Yong Zheng							
nics		Sanction	Xiao'ou Zheng				1:1	
ting	Shunyue Zhao	Date	2006-03-31		No.	Page	Total	Page	CTY1.01.06-1

CTY1.01.09-1

Technial Data

1. Applicable standard IEC60099-4(2004)
2. Rated voltage 9kV.
3. Continuous operating voltage 7.2kV.
4. Power frequency reference voltage >9kV.
5. Residual voltage at lightning impulse 8/20 μs ≤25.5kV.
6. Housing insulation level lightning impulse >35kV.



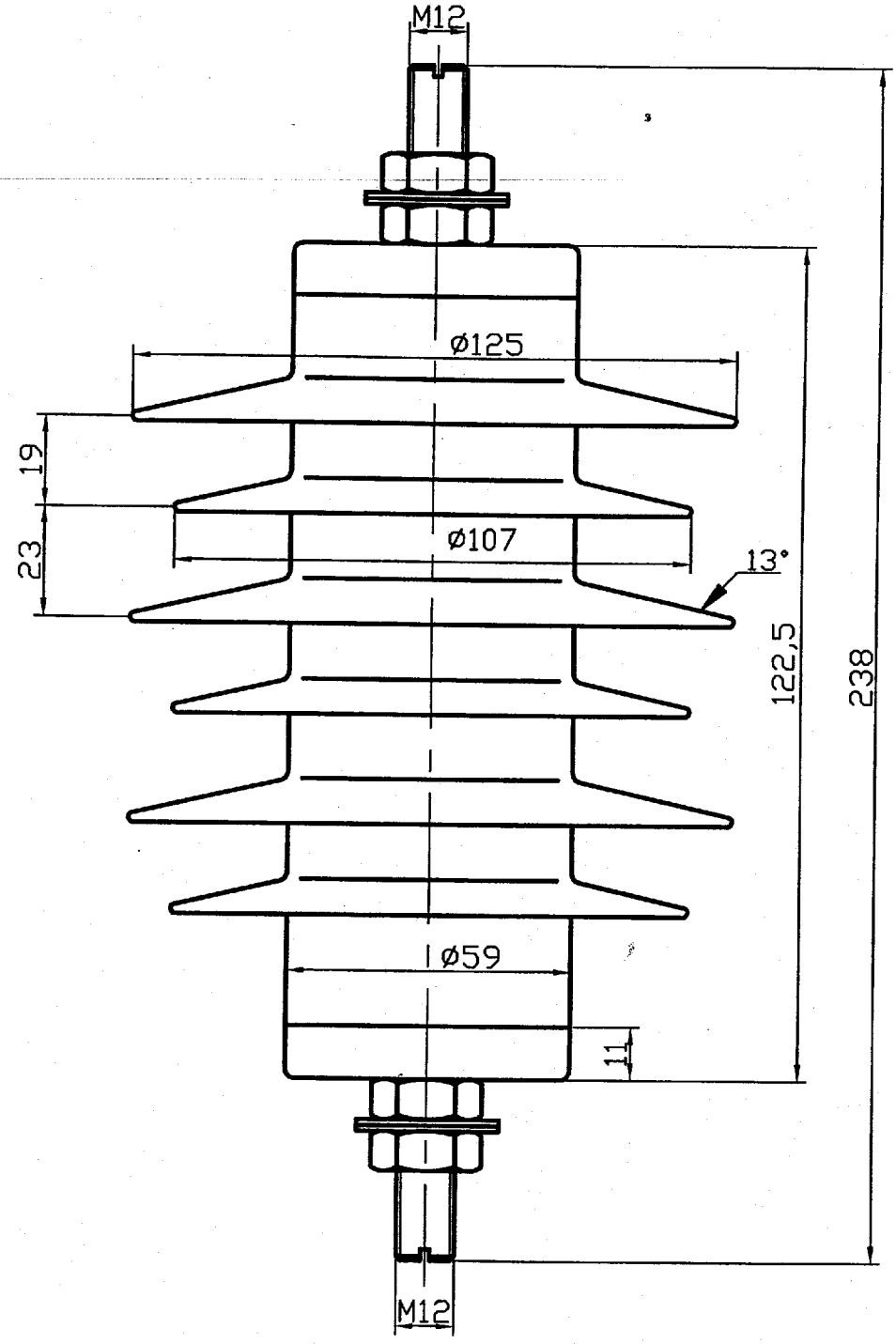
					Metal Oxide Surge Arrester without gaps			Wenzhou CANTOR H.V.Electric Manufacturing Co.,LTD.
k	QTY	Change File No.	Sig.	Date	**YH5W-9/25.5**			
ign	Jianhua Hou	Check						Exterior drawing
wing	Yong Zheng				Fig.No.	QTY	Scale	Wight
nics		Sanction	Xiao'ou Zheng				1:1	
ting	Shunyue Zhao	Date	2006-03-31		No.	Page	Total	Page
								CTY1.01.09-1

Annex A page 8

CTY1.01.12-1

Technial Data

1. Applicable standard IEC60099-4(2004)
2. Rated voltage 12kV.
3. Continuous operating voltage 9.6kV.
4. Power frequency reference voltage >12kV.
5. Residual voltage at lightning impulse 8/20 μs <42.5kV.
6. Housing insulation level lightning impulse >45kV.

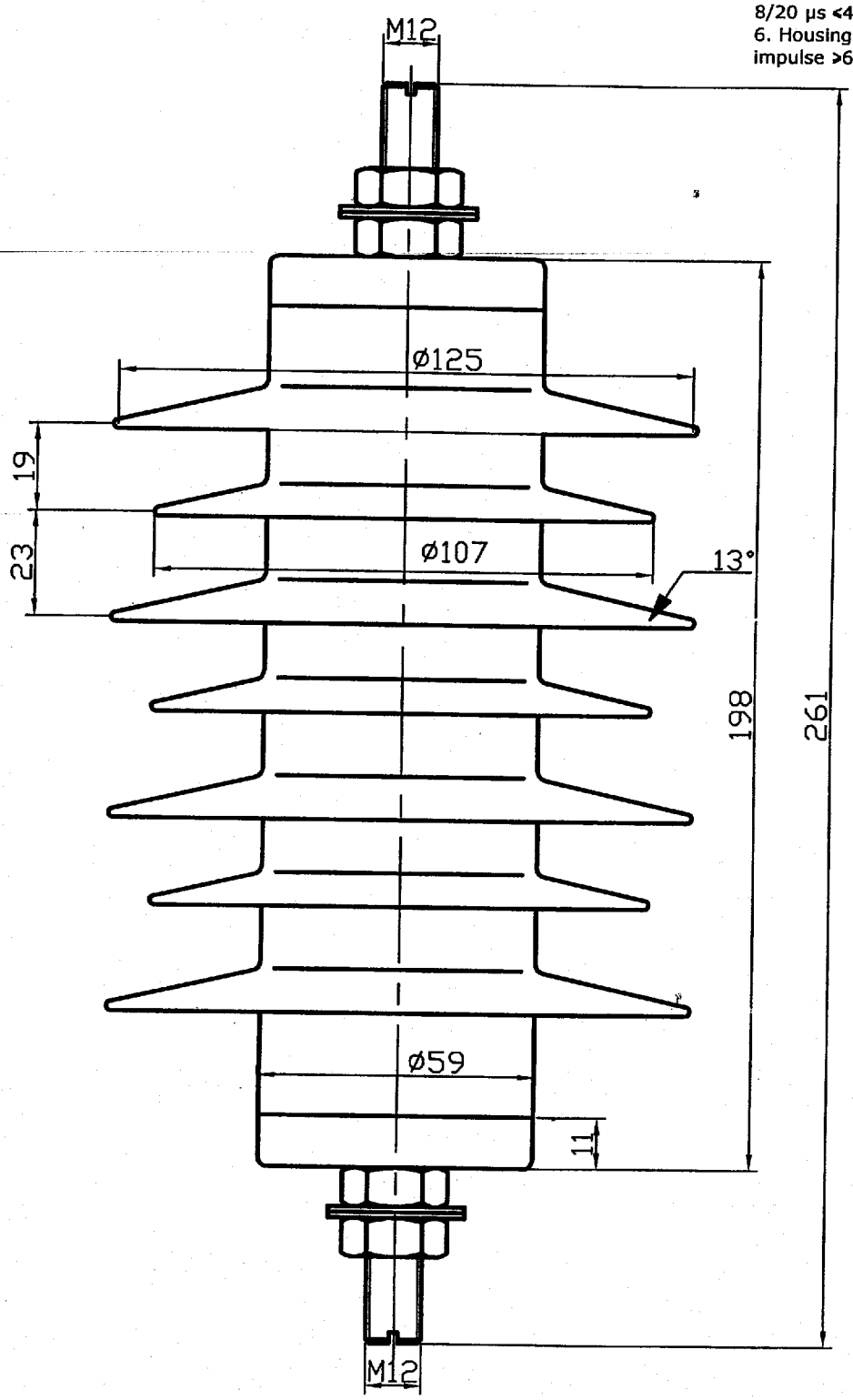


					Metal Oxide Surge Arrester without gaps		Wenzhou CANTOR H.V.Electric Manufacturing Co.,LTD.
k	QTY	Change File No.	Sig.	Date	**YH5W-12/34**		
ign	Jianhua Hou	Check					Exterior drawing
ving	Yong Zheng				Fig.No. QTY Scale Wight		
nics		Sanction	Xiao'ou Zheng			1:1	
ting	Shunyue Zhao	Date	2006-03-31		No. Page Total Page		CTY1.01.12-1

CTY1.01.15-1

Technial Data

1. Applicable standard IEC60099-4(2004)
2. Rated voltage 15kV.
3. Continuous operating voltage 12kV.
4. Power frequency reference voltage >15kV.
5. Residual voltage at lightning impulse 8/20 μs ≤42.5kV.
6. Housing insulation level lightning impulse ≥60kV.

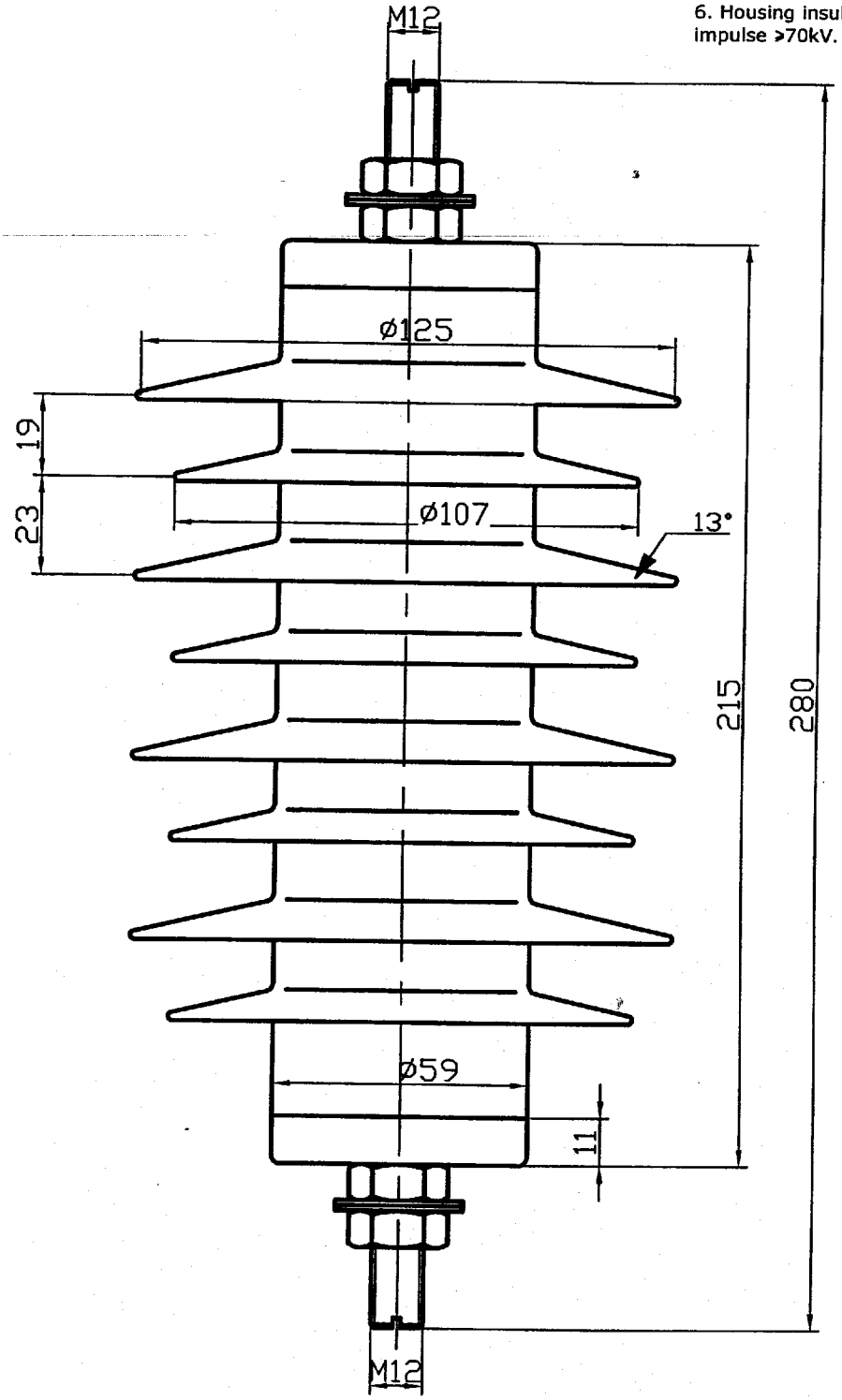


				Metal Oxide Surge Arrester without gaps			Wenzhou CANTOR H.V.Electric Manufacturing Co.,LTD.
QTY	Change File No.	Sig.	Date	**YH5W-15/42.5**			
gn Jianhua Hou	Check			Fig.No.	QTY	Scale	Wight	Exterior drawing
ing Yong Zheng							
pics	Sanction	Xiao'ou Zheng				1:1		
ing Shunyue Zhao	Date	2006-03-31		No.	Page	Total	Page	CTY1.01.15-1

CTY1.01.18-1

Technial Data

1. Applicable standard IEC60099-4(2004)
2. Rated voltage 18kV.
3. Continuous operating voltage 14.4kV.
4. Power frequency reference voltage ≥18kV.
5. Residual voltage at lightning impulse 8/20 μs ≤51kV.
6. Housing insulation level lightning impulse ≥70kV.



					Metal Oxide Surge Arrester without gaps			Wenzhou CANTOR H.V.Electric Manufacturing Co.,LTD.
QTY	Change File No.		Sig.	Date	**YH5W-18/51**			
gn	Jianhua Hou	Check			Fig.No.	QTY	Scale	Wight	Exterior drawing
ing	Yong Zheng							
ics		Sanction	Xiao'ou Zheng				1:1		
ing	Shunyue Zhao	Date	2006-03-31		No.	Page	Total	Page	CTY1.01.18-1

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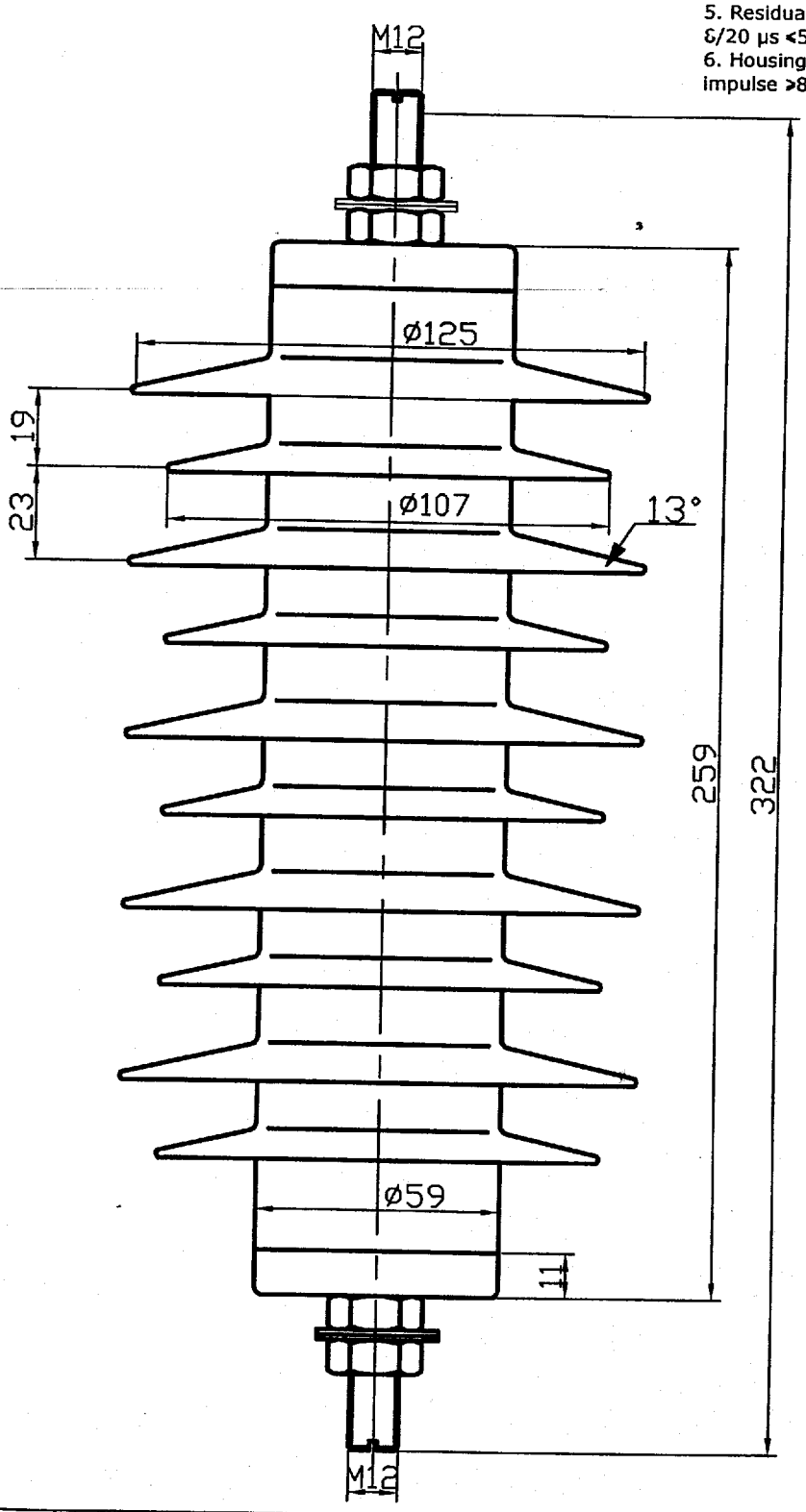
CTY1.01.21-1

Technial Data

1. Applicable standard IEC60099-4(2004)
2. Rated voltage 21kV.
3. Continuous operating voltage 16.8kV.
4. Power frequency reference voltage ≥21kV.
5. Residual voltage at lightning impulse 8/20 μs ≤59.5kV.
6. Housing insulation level lightning impulse ≥80kV.



QTY	Change File No.		Sig.	Date			
Jianhua Hou		Check					
Yong Zheng							
		Sanction	Xiao'ou Zheng				
Shunyue Zhao		Date	2006-03-31				

Metal Oxide Surge Arrester without gaps

YH5W-21/59.5

Fig.No.	QTY	Scale	Wight
		1:1	
No.	Page	Total	Page

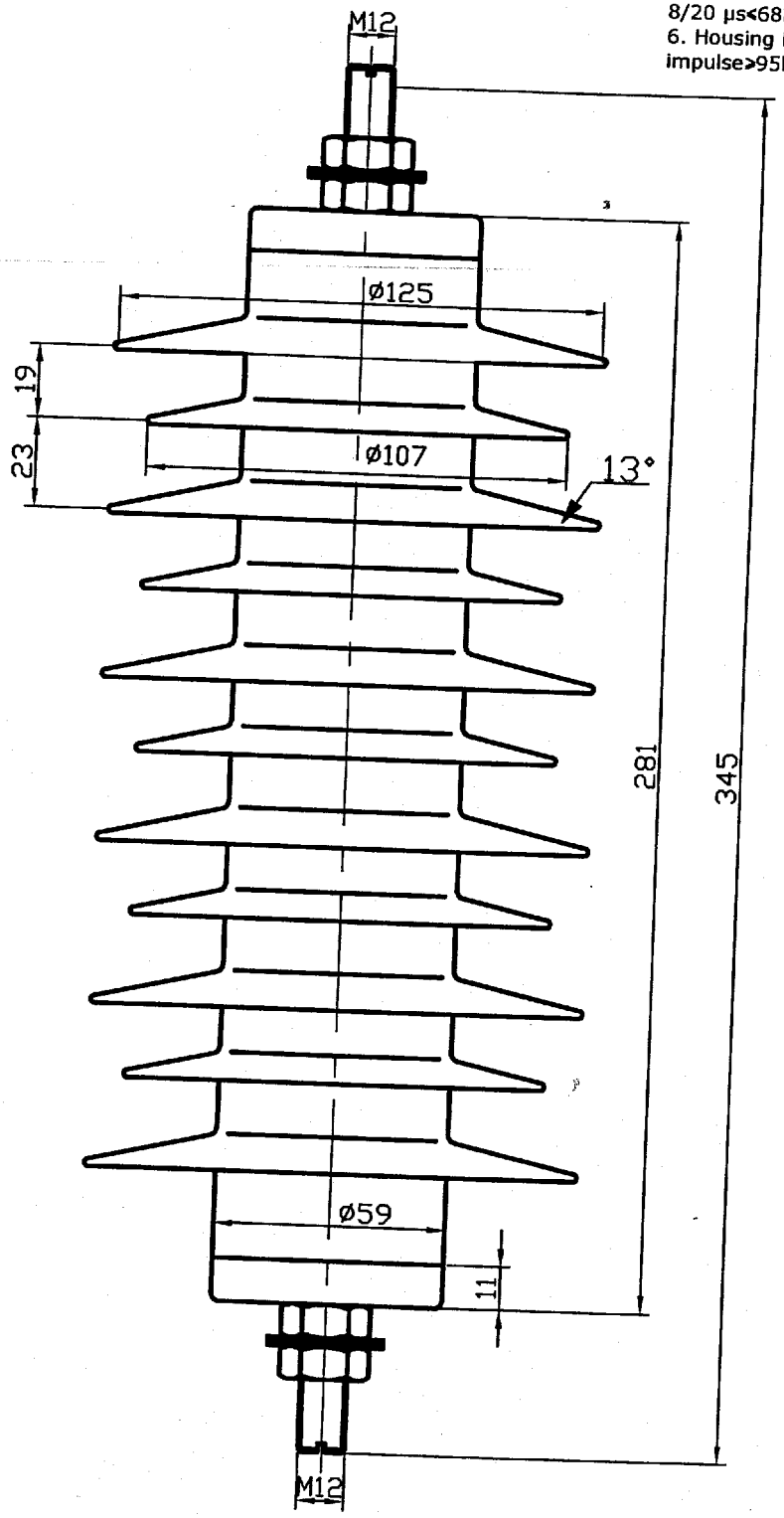
Wenzhou CANTOR H.V.Electric Manufacturing Co.,LTD.

Exterior drawing

CTY1.01.21-1

CTY1.01.24-1

Technial Data
1. Applicable standard IEC60099-4(2004)
2. Rated voltage 24kV.
3. Continuous operating voltage 19.2kV.
4. Power frequency reference voltage>24kV.
5. Residual voltage at lightning impulse 8/20 μs<68kV.
6. Housing insulation level lightning impulse>95kV.



QTY	Change File No.	Sig.	Date

Design	Jianhua Hou	Check	
Drawing	Yong Zheng		
Standardization		Sanction	Xiao'ou Zheng
Engineering	Shunyue Zhao	Date	2006-03-31

Metal Oxide Surge Arrester without gaps

YH5W-24/68

Fig.No.	QTY	Scale	Wight
		1:1	
No.	Page	Total	Page

Wenzhou CANTOR H.V.Electric Manufacturing Co.,LTD.

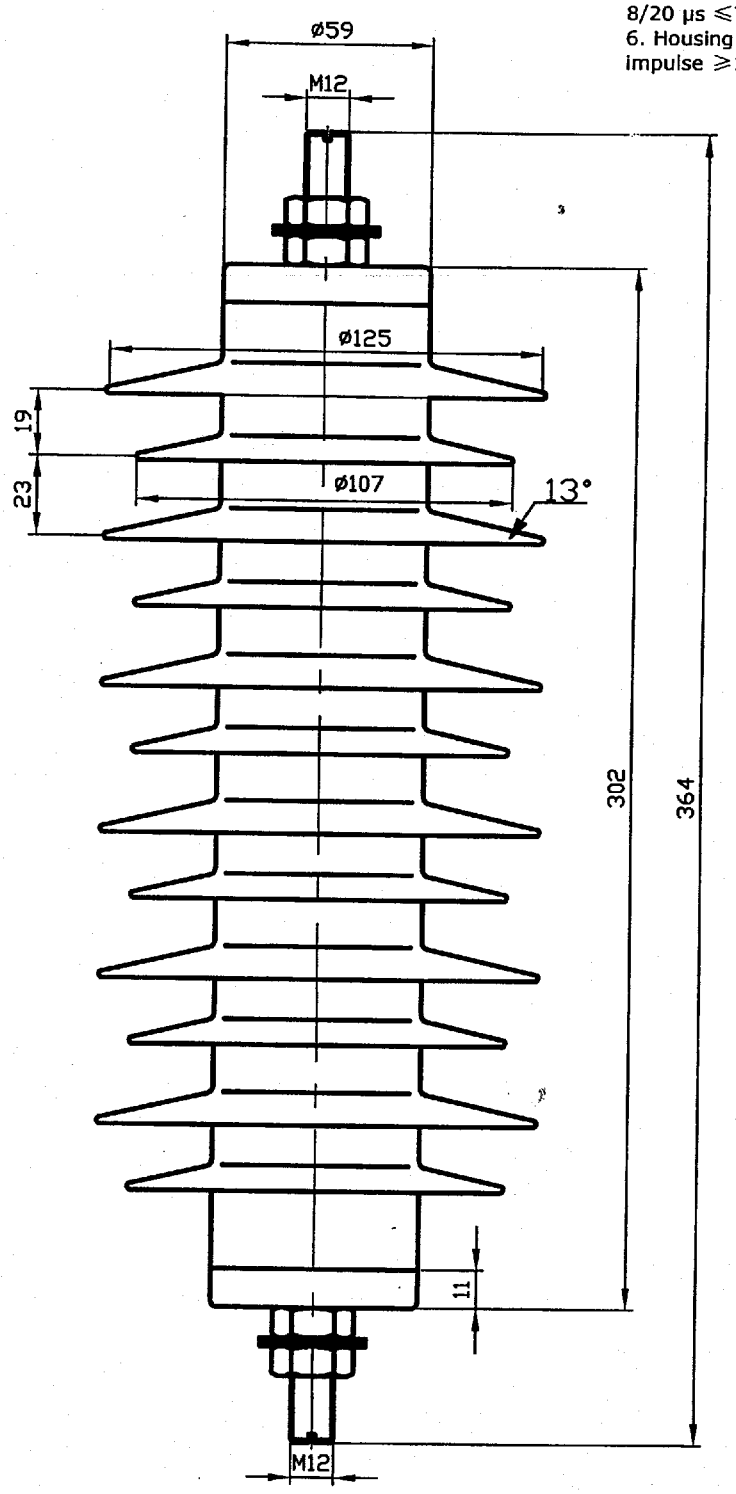
Exterior drawing

CTY1.01.24-1

CTY1.01.27-1

Technial Data

1. Applicable standard IEC60099-4(2004)
2. Rated voltage 27kV.
3. Continuous operating voltage 21.6kV.
4. Power frequency reference voltage ⩾27kV.
5. Residual voltage at lightning impulse 8/20 μs ⩽76.5kV.
6. Housing insulation level lightning impulse ⩾110kV.

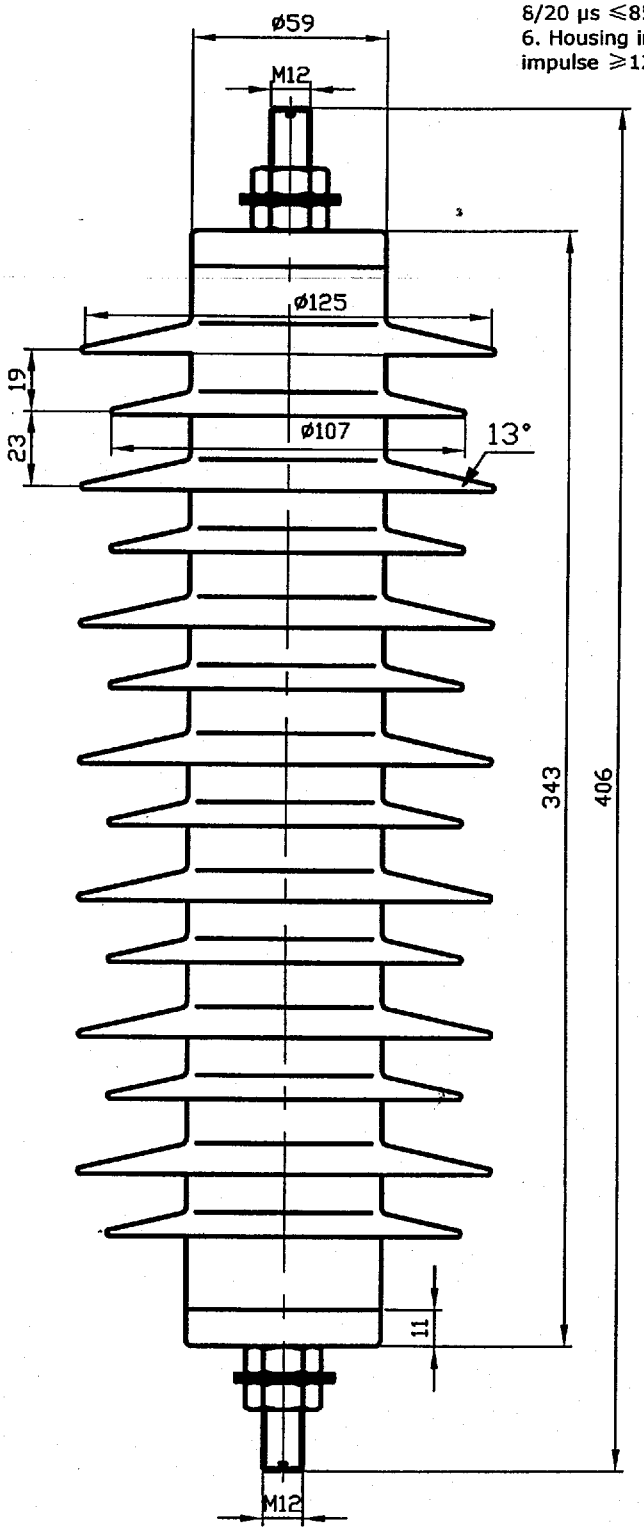


					Metal Oxide Surge Arrester without gaps				Wenzhou CANTOR H.V.Electric Manufacturing Co.,LTD.
k	QTY	Change File No.	Sig.	Date	**YH5W-27/76.5**				
ign	Jianhua Hou	Check							Exterior drawing
wing	Yong Zheng				Fig.No.	QTY	Scale	Wight	
nics		Sanction	Xiao'ou Zheng				1:1		
ting	Shunyue Zhao	Date	2006-03-31		No.	Page	Total	Page	CTY1.01.27-1

CTY1.01.30-1

Technial Data

1. Applicable standard IEC60099-4(2004)
2. Rated voltage 30kV.
3. Continuous operating voltage 24kV.
4. Power frequency reference voltage ⩾30kV.
5. Residual voltage at lightning impulse 8/20 μs ⩽85kV.
6. Housing insulation level lightning impulse ⩾120kV.



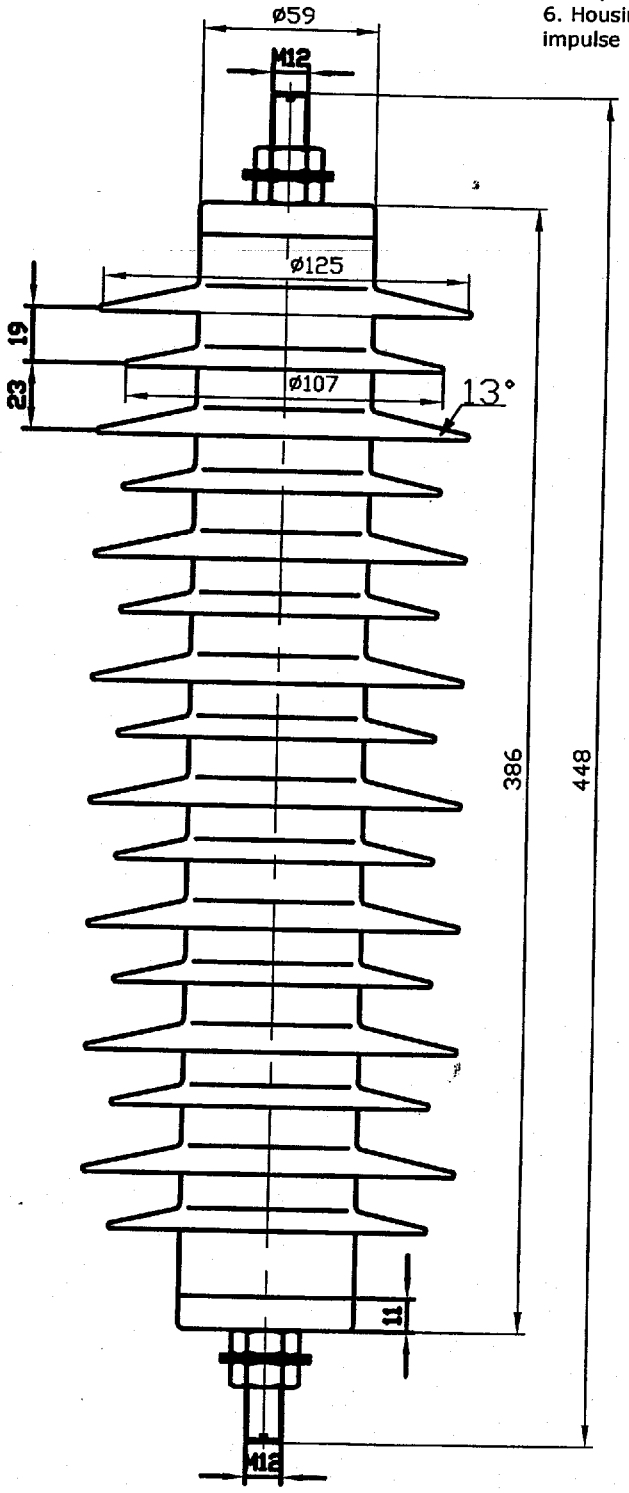
					Metal Oxide Surge Arrester without gaps		Wenzhou CANTOR H.V.Electric Manufacturing Co.,LTD.
					YH5W-30/85		Exterior drawing
					Fig.No. / QTY / Scale / Wight		
						1:1	CTY1.01.30-1
					No. / Page / Total / Page		

	QTY	Change File No.	Sig.	Date
ign	Jianhua Hou	Check		
wing	Yong Zheng			
nics		Sanction	Xiao'ou Zheng	
ting	Shunyue Zhao	Date	2006-03-31	

CTY1.01.33-1

Technial Data

1. Applicable standard IEC60099-4(2004)
2. Rated voltage 33kV.
3. Continuous operating voltage 26.4kV.
4. Power frequency reference voltage ⩾33kV.
5. Residual voltage at lightning impulse 8/20 μs ⩽93.5kV.
6. Housing insulation level lightning impulse ⩾135kV.

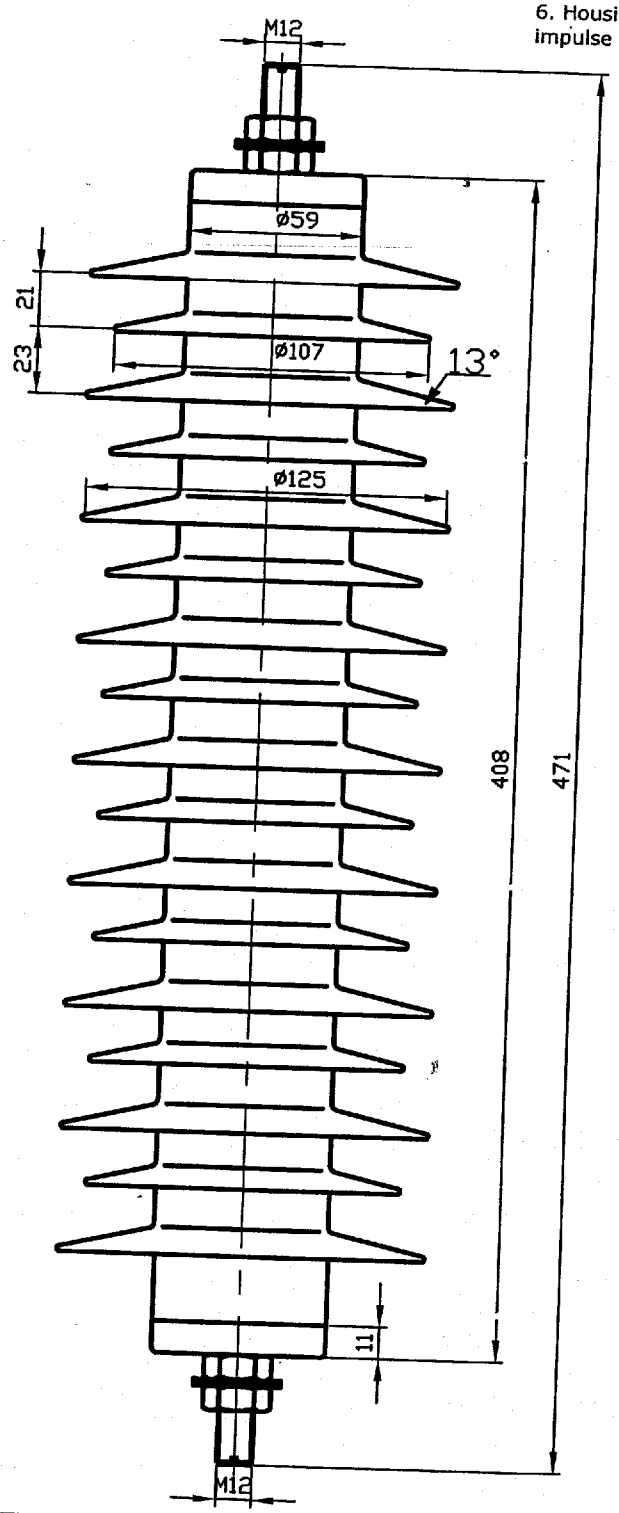


					Metal Oxide Surge Arrester without gaps			Wenzhou CANTOR H.V.Electric Manufacturing Co.,LTD.
					YH5W-33/93.5			Exterior drawing
k	QTY	Change File No.	Sig.	Date	Fig.No.	QTY	Scale / Wight	
ign	Jianhua Hou	Check					1:1	CTY1.01.33-1
ying	Yong Zheng							
nics		Sanction	Xiao'ou Zheng					
ing	Shunyue Zhao	Date	2006-03-31		No.	Page	Total / Page	

CTY1.01.36-1

Technial Data

1. Applicable standard IEC60099-4(2004)
2. Rated voltage 36kV.
3. Continuous operating voltage 28.8kV.
4. Power frequency reference voltage ⩾36kV.
5. Residual voltage at lightning impulse 8/20 μs ⩽102kV.
6. Housing insulation level lightning impulse ⩾150kV.



					Metal Oxide Surge Arrester without gaps		Wenzhou CANTOR H.V.Electric Manufacturing Co.,LTD.
					YH5W-36/102		Exterior drawing
QTY	Change File No.	Sig.	Date				
Jianhua Hou	Check			Fig.No.	QTY	Scale	Wight
Yong Zheng						1:1	
	Sanction	Xiao'ou Zheng					
Shunyue Zhao	Date	2006-03-31		No.	Page	Total	Page
							CTY1.01.36-1

No. L0222 (2004)国认监认字(059)号 (2004)量认(国)字(A0196)号

No. WB-016(1)-2006

国家绝缘子避雷器质量监督检验中心

CHINA NATIONAL CENTRE FOR QUALITY SUPERVISION AND TEST OF INSULATORS AND SURGE ARRESTERS

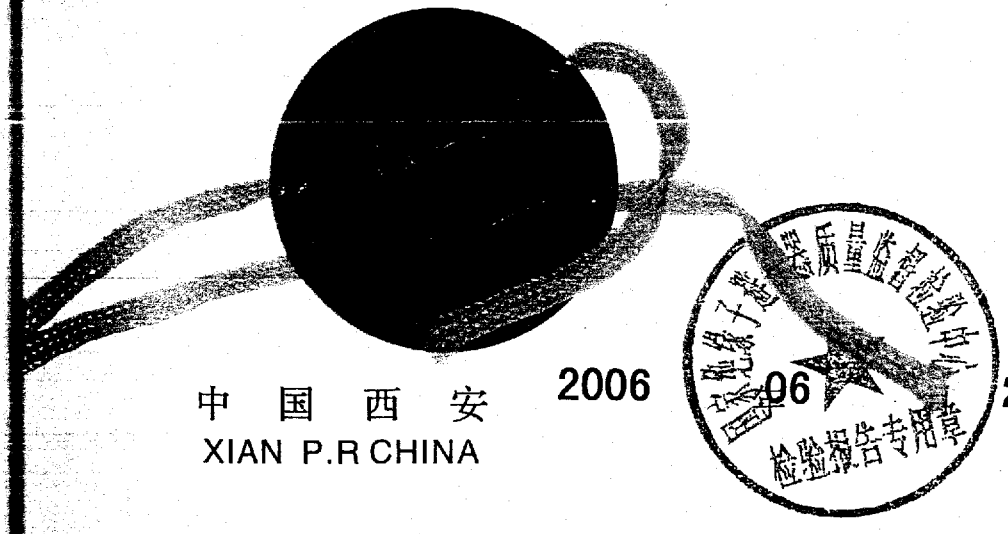
检 验 报 告

TEST REPORT

Object 产品名称: YH5W—36/102 Polymeric Housed Metal Oxide Surge Arrester Without Gaps

Client 顾客名称: Wenzhou Cantor H.V.Electric Manufacturing Co.,Ltd.

Classification 检验类别: Type Test



中国西安 XIAN P.R CHINA

2006 06 29 日

Annex B

CHINA NATIONAL CENTRE FOR QUALITY SUPERVISION AND TEST OF INSULATORS AND SURGE ARRESTERS

TEST REPORT

NO.WB—016(1)—2006

Name	Polymeric Housed Metal Oxide Surge Arrester Without Gaps	Type	YH5W—36/102
		Trade Mark	CANTOR
Consignor	Wenzhou Cantor H.V.Electric Manufacturing Co.,Ltd.	Manufacturer	Wenzhou Cantor H.V.Electric Manufacturing Co.,Ltd.
Representative	Xiao'ou Zheng	Classification	Type Test
Address And Post Code	NO.8-88 Xingye North Rd.Liushi,YueQing, Zhejiang,China	Telephone	0086-577-62767809
		Fax.	0086-557-62767819
Quantity of Samples	Arrester:6,Ratio arrester:1, Section:30,Housing:1.	Samples Received Date	2006.3.21
		Test Date	2006.3.21～2006.06.08
Serial Number	Arrester:1～3、M; Section:R1～R3, O1～O3,L1～L3,A1～A3; Ratio arrester:M; Housing :H.		
Test Judge	IEC 60099-4:2004-05 Metal-oxide surge arresters without gaps for a.c. systems		
Test Items	All test items see page 2 of this report.		
Test Conclusion	This surge arrester pass all 8 items of type test and is deemed satisfactory to meet standards-specifications. (2004)国认监认字(059)号 (Official sign) Confirmed on: 2006.06.29		
Remarks	1. The arrester height is: 408 mm,housing is gray,its diameter is 59.5 mm;diameter of 9 big sheds is 125 mm,diameter of 8 small sheds is 106 mm. 2. The size of resistors is Φ42 ×24 mm; 3. The arrester has 12 piecese of resistors.		

Approved: 李 **Checked:** 张 **Editor:** **Test-leader:**

Anner B

CHINA NATIONAL CENTRE FOR QUALITY SUPERVISION AND TEST OF INSULATORS AND SURGE ARRESTERS TEST REPORT

Type Test Items

No.	Test Items	Req.	Test Data	Result
1	Power frequency reference voltage test	Voltage at1mA≥36 kV (peak/$\sqrt{2}$)	38 kV	passed
2	Partial discharge test	≤10 pC	1 pC	passed
3	Residual voltage test	8/20μs U_{5kA}≤102 kV 1/10μs U_{5kA}≤117.6 kV	89 kV 91.8 kV	passed
4	Long duration current impulse withstand test	2ms 100A, 18times	passed	passed
5	Operating duty test	4/10μs, 65 kA	passed	passed
6	Insulation withstand test	Lightning impulse withstand 150kV, 15 times positive and negative; Power frequence voltage (wet) withstand 70 kV, 1 min	passed	passed
7	Moisture ingress test	Withstand 60℃→-25℃→45℃→-40℃ heat-cool ,boiling 42h in boiled 0.1%Nacl water;immering 50℃	passed	passed
8	Weather ageing test	Applied Uc 1000 hours in salt fog	passed	passed

Test Conclusion: Satisfied.

(2004)国认监认字(059)号

Annex B

CHINA NATIONAL CENTRE FOR QUALITY SUPERVISION AND TEST OF INSULATORS AND SURGE ARRESTERS TEST REPORT

1 Power Frequency Reference Voltage Test

No.	1	2	3	Req.
A.C. Reference voltage at 1mA (kV, peak/ $\sqrt{2}$)	38	38	38	⩾ 36

Test Conclusion: Satisfied.

2 Partial Discharge Test

No.	Applied voltage kV(r.m.s)	P.D. Value pC
1	30.2	1.0
2	30.2	1.0
3	30.2	1.1
Req.	30.2	⩽10

Test Conclusion: Satisfied.

3 Residual Voltage Test (wave shape see Fig1~Fig6)

n=12

3.1 8/20μs lightning impulse current residual voltage

No.	Residual voltage of sections kV			Equivalent residual voltage of arresters at 10 kA kV	Req. kV
	2.5 kA	5 kA	10 kA		
R1	6.90	7.34	8.00	89	⩽ 102
R2	6.96	7.40	8.09		
R3	6.94	7.37	8.11		

3.2 1/10μs steep impulse current residual voltage

No.	Residual voltage of sections at 5kA kV	Residual voltage of arresters at 5kA kV	Req. kV
R1	7.50	91.8	⩽ 117.6
R2	7.65		
R3	7.55		

Test Conclusion: Satisfied.

4 Long Duration Current Impulse Withstand Test

(wave shape see Fig.7~Fig.9)

No.	Ur kV	Current A	Times	8/20μs,U_{5kA} kV			Result
				Before	After	Varity %	
L1	3.00	100	18	7.48	7.43	0.7	passed
L2	3.00	100	18	7.43	7.45	0.3	passed
L3	3.00	100	18	7.40	7.40	0	passed
Req.	3~6	100	18	/		⩽5	passed

Test Conclusion: Satisfied.

5 Operating duty Test

5.1 Accelerated ageing test

5.1.1 Parameter of complete arresters

Ur=36 kV; Uc=28.8kV; $U_{5kA} \leqslant 102$kV; H=0.408m.

5.1.2 Parameter of sections

Uc=2.4kV; Uct=Uc(1+0.15H)=2.55kV; test time 1000h。

The data of test

Power losses / No. / Time	A1	A2	A3	Temperature ℃
2006.3.24 19:05	1.393	1.168	0.998	114.0
2006.3.24 19:36	1.380	1.149	0.983	115.0
2006.3.24 20:06	1.427	1.168	0.982	115.0
2006.3.24 20:36	1.413	1.149	0.966	114.0
2006.3.24 21:06	1.403	1.137	0.959	113.0
2006.3.25 09:06	1.368	1.082	0.927	114.0
2006.3.25 18:30	1.370	1.090	0.930	115.0
2006.3.26 09:07	1.562	1.214	1.046	114.0
2006.3.27 17:10	1.324	1.021	0.881	115.0
2006.3.28 17:10	1.354	1.040	0.903	115.0
2006.3.29 17:10	1.361	1.042	0.908	115.0
2006.3.30 17:11	1.408	1.072	0.935	114.0
2006.3.31 17:11	1.394	1.062	0.924	114.5
2006.4.1 17:12	1.378	1.048	0.915	114.5
2006.4.2 17:12	1.409	1.059	0.925	114.5
2006.4.3 17:12	1.442	1.084	0.945	114.5
2006.4.4 17:13	1.412	1.063	0.932	114.5
2006.4.5 17:13	1.451	1.089	0.956	114.5
2006.4.6 17:14	1.422	1.067	0.937	114.3
2006.4.7 17:14	1.410	1.057	0.929	114.4

CHINA NATIONAL CENTRE FOR QUALITY SUPERVISION AND TEST OF INSULATORS AND SURGE ARRESTERS TEST REPORT

Power losses w NO. / time	A1	A2	A3	试验温度 ℃
2006.4.8 17:56	1.514	1.122	0.981	114.4
2006.4.9 21:57	1.470	1.088	0.953	114.6
2006.4.10 04:57	1.396	1.034	0.906	114.5
2006.4.11 01:29	1.491	1.103	0.966	114.5
2006.4.12 09:30	1.502	1.109	0.974	114.5
2006.4.13 09:30	1.499	1.109	0.975	114.5
2006.4.14 02:50	1.471	1.092	0.961	114.5
2006.4.15 10:50	1.488	1.103	0.973	114.5
2006.4.16 10:51	1.459	1.083	0.956	114.5
2006.4.17 02:51	1.479	1.095	0.965	114.5
2006.4.18 10:52	1.470	1.088	0.959	114.5
2006.4.19 02:52	1.463	1.082	0.956	114.5
2006.4.20 10:53	1.481	1.093	0.965	114.4
2006.4.21 18:54	1.473	1.085	0.958	114.6
2006.4.22 10:54	1.471	1.084	0.959	114.6
2006.4.23 02:55	1.512	1.115	0.987	114.5
2006.4.24 18:56	1.516	1.112	0.982	114.5
2006.4.25 02:56	1.491	1.096	0.970	114.6
2006.4.26 02:57	1.500	1.104	0.979	114.6
2006.4.27 02:57	1.426	1.055	0.939	114.5
2006.4.28 02:58	1.484	1.096	0.974	114.6
2006.4.29 02:59	1.452	1.070	0.952	114.5
2006.4.30 10:59	1.504	1.106	0.983	114.5
2006.5.1 10:00	1.487	1.091	0.967	114.6
2006.5.2 11:01	1.493	1.095	0.972	114.6
2006.5.3 11:01	1.501	1.101	0.979	114.7
2006.5.4 11:02	1.515	1.109	0.987	114.6
2006.5.5 11:05	1.500	1.101	0.981	114.6
stop test				
P_{1ct}	1.427	1.168	0.982	/
P_{2ct}	1.500	1.101	0.981	
P_{3ct}	1.396	1.034	0.906	
Result	$P_{2ct}<1.1\times P_{3ct}$ $P_{2ct}>P_{1ct}$	$P_{2ct}<1.1\times P_{3ct}$ $P_{1ct}>P_{2ct}$		kct=1.051

CHINA NATIONAL CENTRE FOR QUALITY SUPERVISION AND TEST OF INSULATORS AND SURGE ARRESTERS TEST REPORT

5.2 High current impulse operating duty test (wave shape see Fig10~Fig18)

No.			O1	O2	O3
8/20μs, U_{5kA}, before		kV	7.40	7.40	7.41
Ur		kV	3.00	3.00	3.00
Uc		kV	2.40	2.40	2.40
P_{1c}		W	0.048	0.052	0.050
P_{2c}		W	0.050	0.055	0.053
Uc*		kV	2.41	2.41	2.42
p_{1r}		W	0.342	0.355	0.337
p_{2r}		W	0.359	0.373	0.354
Ur*		kV	3.02	3.01	3.01
Condition test	Applied 1.2Uc=2.88kV, 8/20μs, In =5 kA , 45 ° before peak				
4/10μs high current impulse	Times		20	20	20
	1st. current	kA	69.6	69.6	69.6
	Heated to 60 ℃				
	2nd. Current	kA	68.0	69.6	68.0
Applied power frenquency voltage within 48 ms					
Ur*		kV	3.02	3.02	3.02
Power losses (max) at Ur*		W	2.58	2.90	2.90
Applied Uc*		kV	2.42	2.42	2.42
Power losses at Uc W	1 min		0.74	1.02	0.89
	10 min		0.37	0.50	0.45
	15 min		0.31	0.40	0.37
	25 min		0.25	0.31	0.30
	30 min		0.22	0.280	0.26
Checking samples			all right	all right	all right
8/20μs, U_{5kA}, after		kV	7.33/7.34	7.37/7.40	7.37/7.40
Varity of U_{5kA}		%	0.9/0.8	0.4/0	0.5/0.1

Test Conclusion: Satisfied.

6 Housing Insulation Withstand Test

6.1 Lightning impulse voltage withstand test (wave shape see Fig18~Fig20)

P=973×10² Pa, t_{dry}=15.5℃, t_{wet}=11.5 ℃;

K=0.9755

No.	Req. kV		Test Value kV	Adj. kV	Withstand Times	Result
H	(+)	150	150~153	154~157	15	passed
	(−)	150	153	157	15	passed

6.2 Power frequency insulation withstand test

P=964 ×10² Pa, t_{dry}=25.0 ℃, t_{wet}=22.5 ℃; t_{water}=22.5 ℃.

specific resistance of rain ρ_{20}=104.1 Ω · m.

rainfall: horizon=1.13 mm/min , verticality=1.39 mm/min.

K=0.9970

No.	Req. kV	Test Value kV	Adj. kV	Keeping time min	Result
H	70	76	76	1	passed

Test Conclusion: Satisfied.

7 Moisture ingress test

7.1 Terminal torque test

M =50 N · m , withstand 30 s

7.2 Thermomechanical test

F1=147 N, F2 =11.9 N, F =(F1+F2) =158.9 N

No.	Test time	Temprature ℃	Applied angle degrees °	Times h	Bend load N
M	2006.04.10 16:10~2006.04.11 08:20(keeping)	60.0~61.0	0	16	159
	2006.04.11 16:20~2006.04.12 08:30(keeping)	-25.0~-26.0	180	16	
	2006.04.12 16:30~2006.04.13 08:40(keeping)	45.0~46.0	270	16	
	2006.04.13 16:50~2006.04.14 09:00(keeping)	-40.0~-41.0	90	16	
Req.	24h×4	60℃→-25℃ 45℃→-40℃	0~360	≥16	158.9

CNAL No. L6222

7.3 Water immersion test (wave shape see Fig21~Fig22)

No.	Boiling time (h)	Partial discharge value pC			Power losses W			Residual voltage of complete arrester at 5 kA kV		
		before	after	var.	before	after	var. %	before	after	var. %
M	42	1	7	6	2.04	2.04	0	78.6	78.6	0
Req.	42	≤10		≤10	/		≤20	/		≤5

Test Conclusion: Satisfied.

8 Weather ageing test

fog room: 10.83 m^3 temperature of fog room : 23.0℃~25.5℃

water speed: (0.41~0.49)L/m^3 · h NaCl in water : 5 kg/m^3

date of test:2006.3.24~2006.5.5

No.	Uc kV	Creep distance mm	Time h	Power frenquency reference voltage kV (peak/$\sqrt{2}$)			Partial discharge pC		
				before	after	var. %	before	after	var.
W	12	502	1007	15.6	15.4	1.3	2	2	0
Req.	12	/	≥1000	/		≤5	≤10		≤10

Test Conclusion: Satisfied.

Testor:Zhang Yi-ming, An li, Wu liang

Sang Jian-ping , Hu Wen-qi , Zhong Yan-dong ,

Su Miao, Meng Fan-sheng, Hou Yu-jun

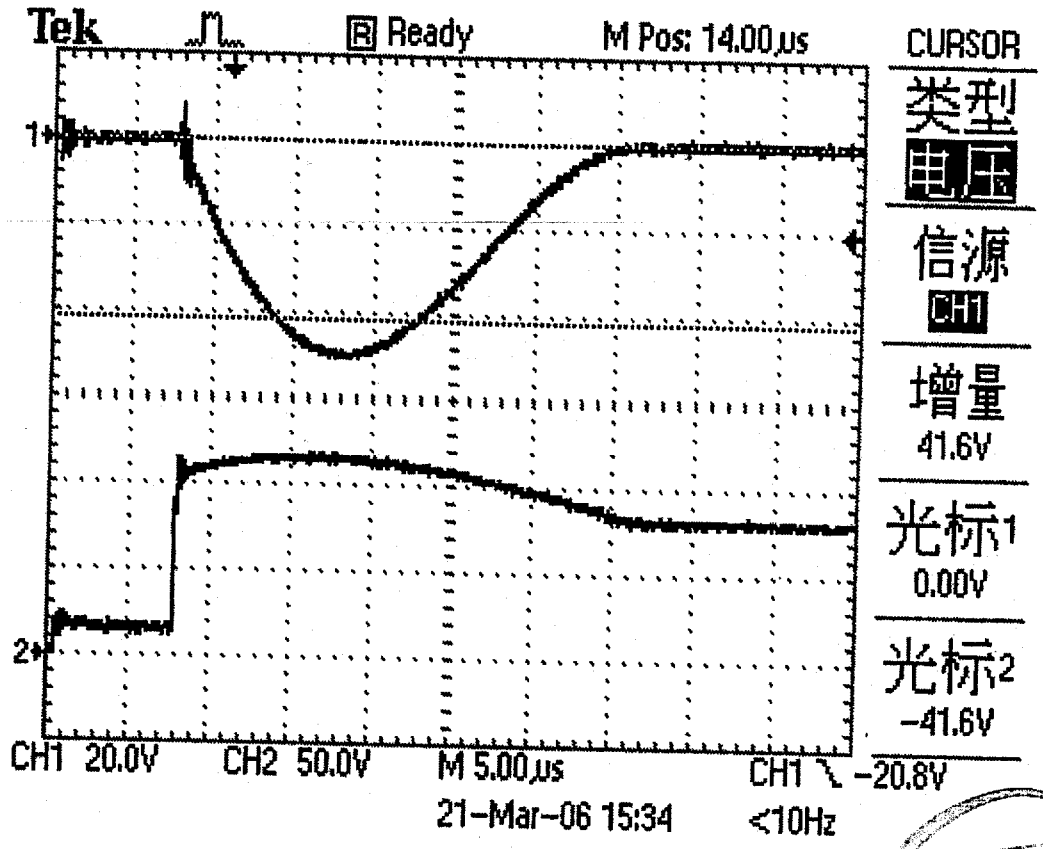


Fig. 1: R1 8/20µs 5kA

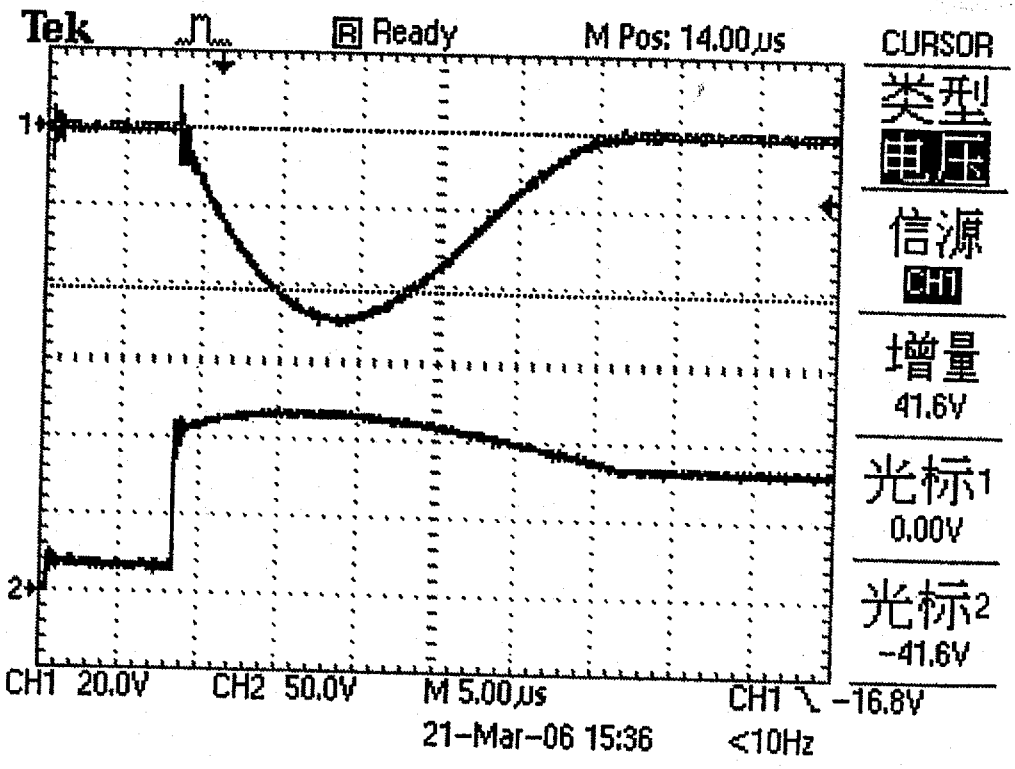


Fig. 2: R2 8/20µs 5kA

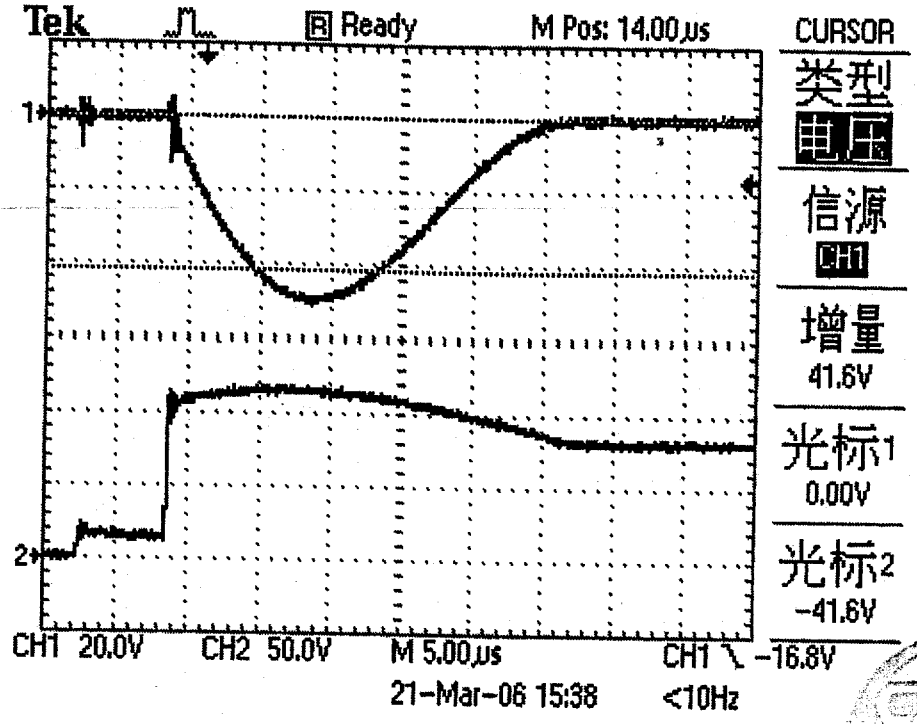


Fig. 3: R3 8/20µs 5kA

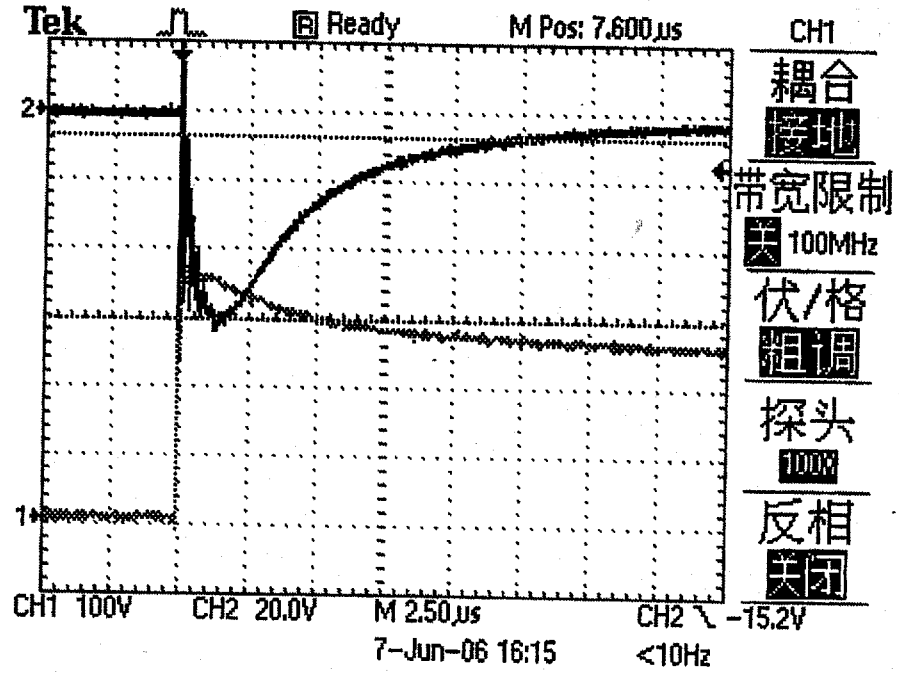


Fig. 4: R1 1/10µs 5kA

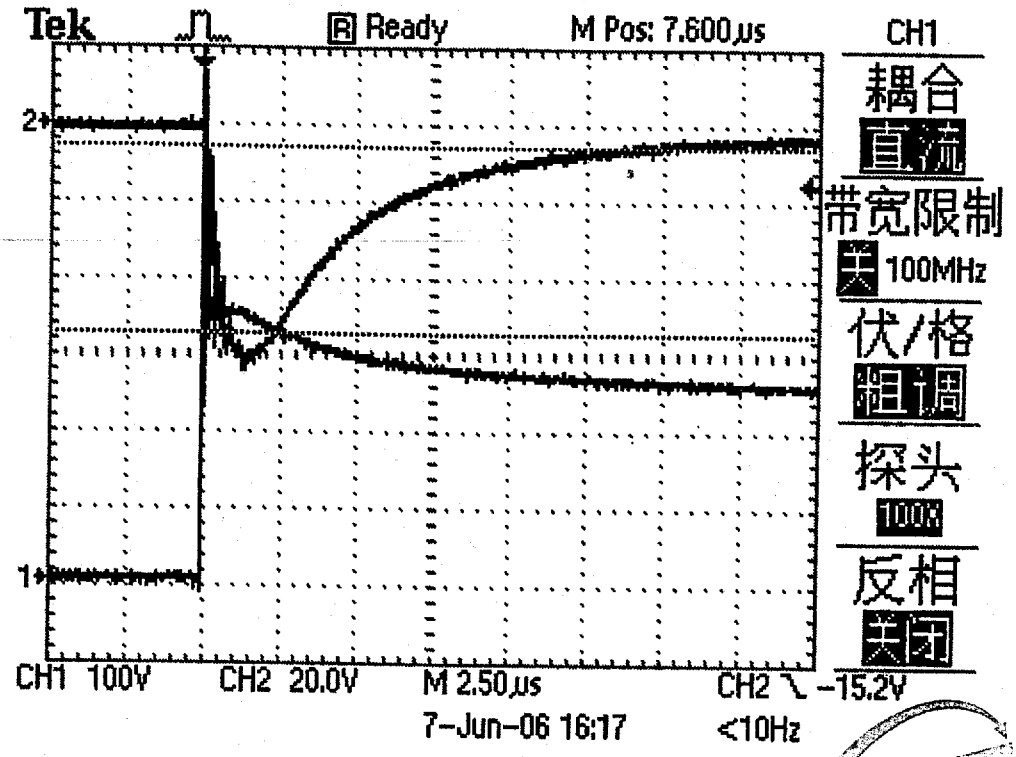


Fig. 5: R2 1/10µs 5kA

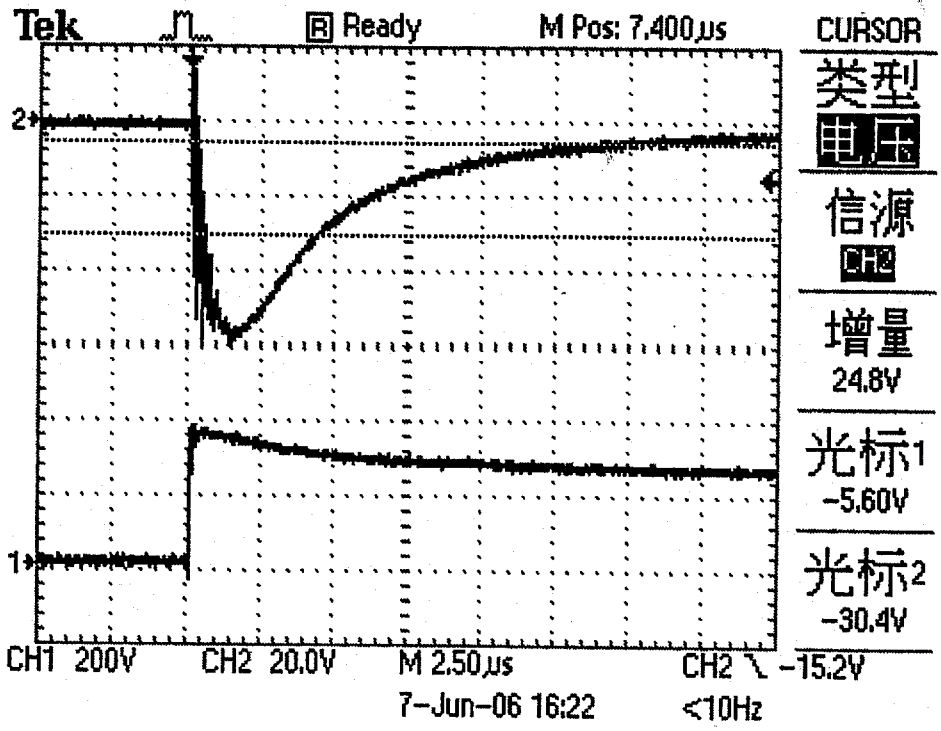


Fig. 6: R3 1/10µs 5kA

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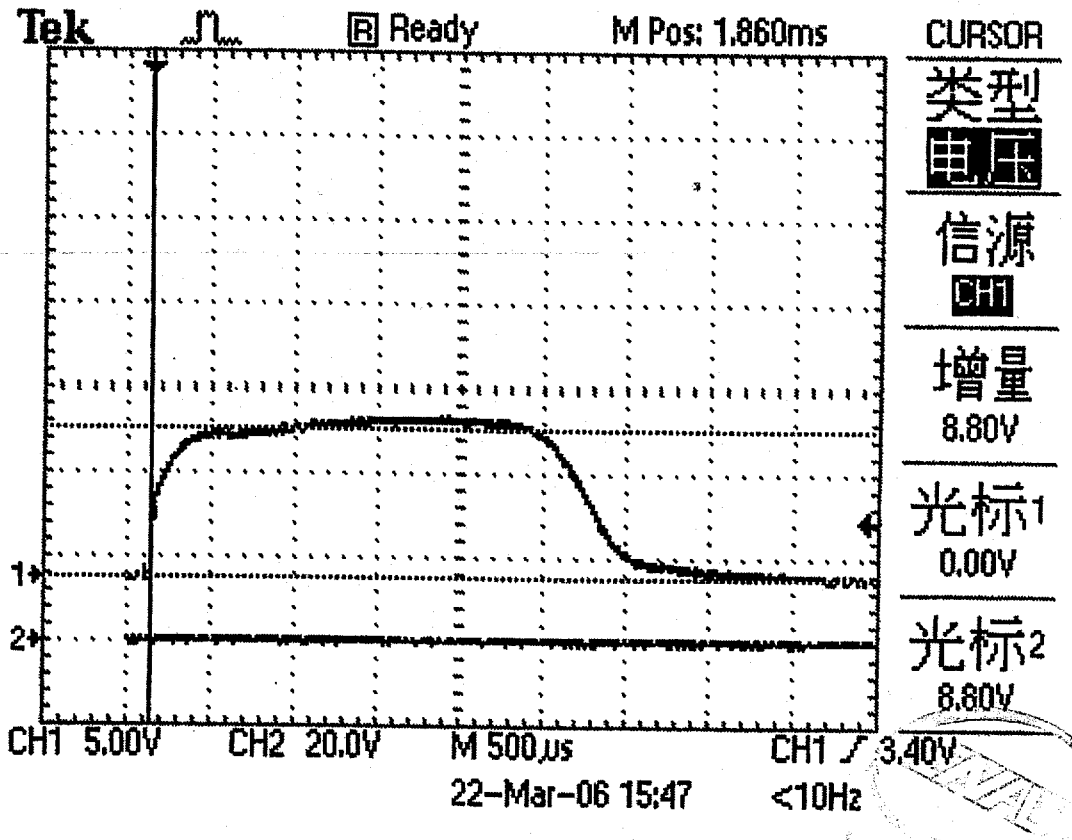

Fig. 7: L1 2ms 100A 1st

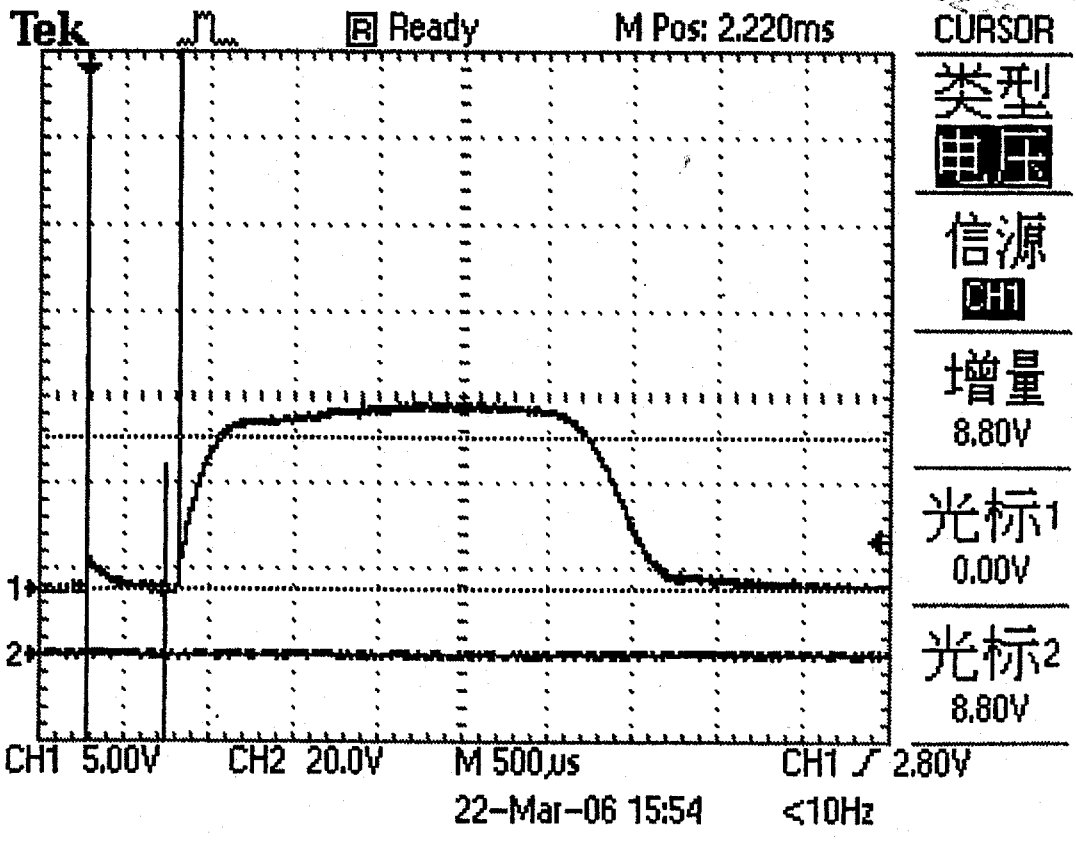

Fig. 8: L2 2ms 100A 1st

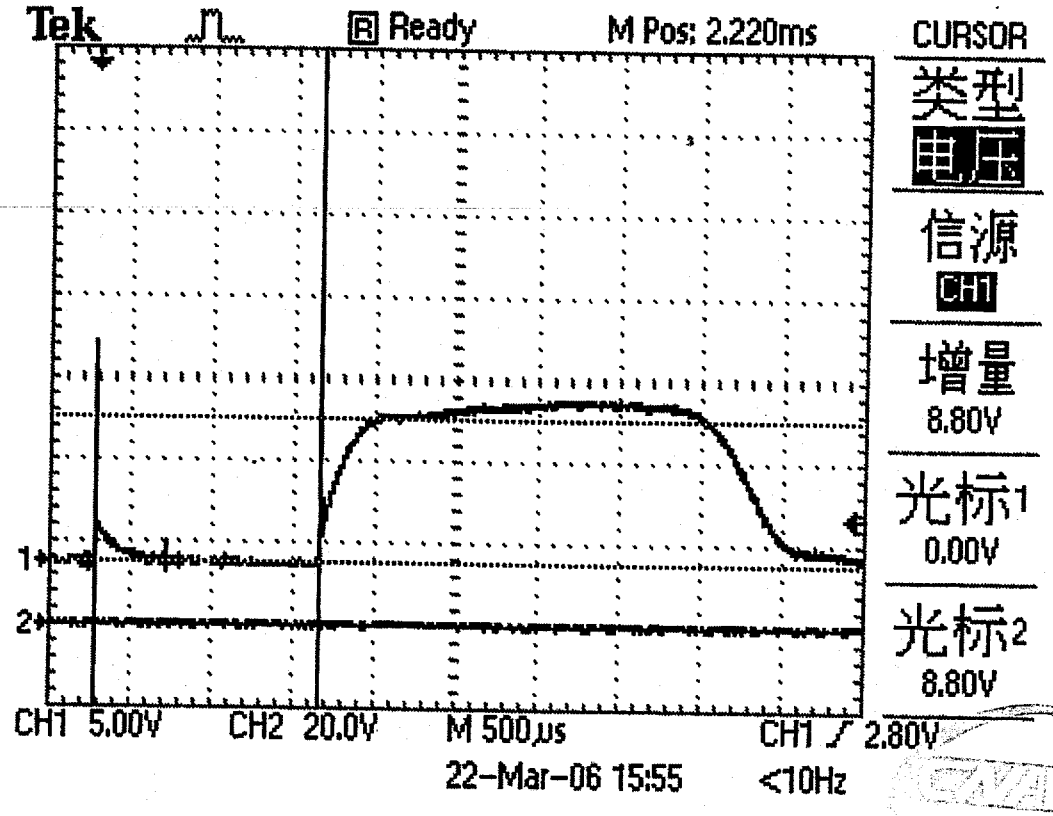

Fig. 9: L3 2ms 100A 1st

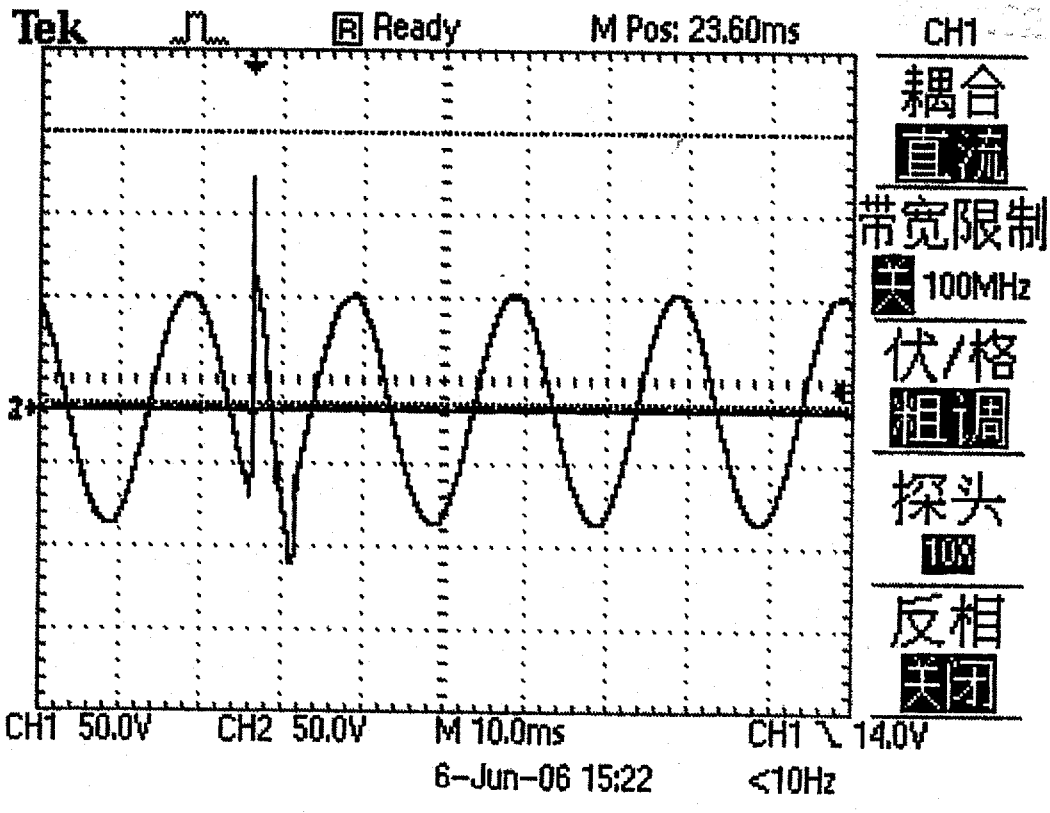

Fig. 10: 01 conditioning test 5kA

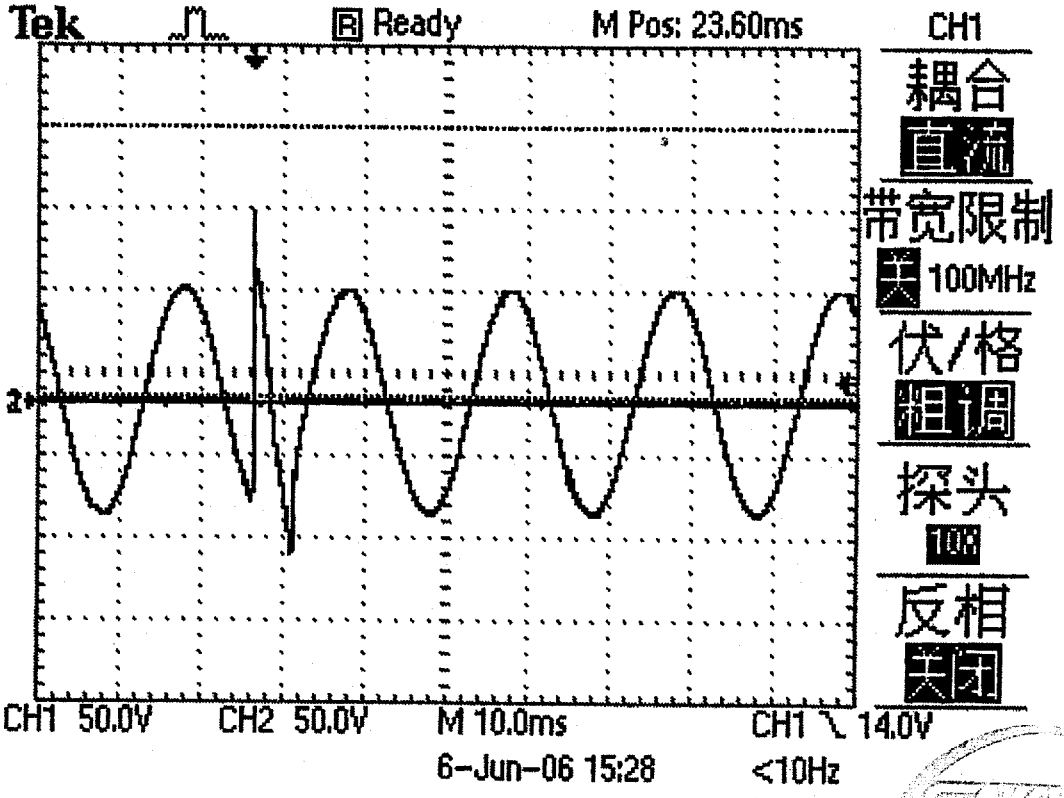

Fig. 11: 02 conditioning test 5kA

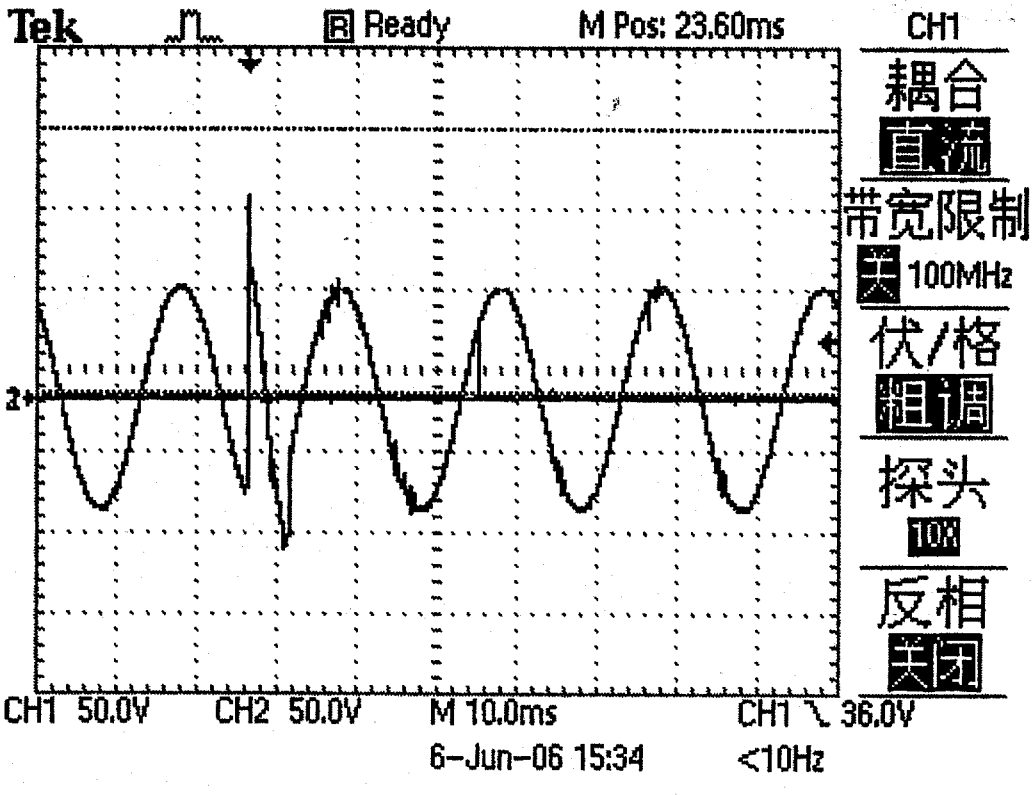

Fig. 12: 03 conditioning test 5kA

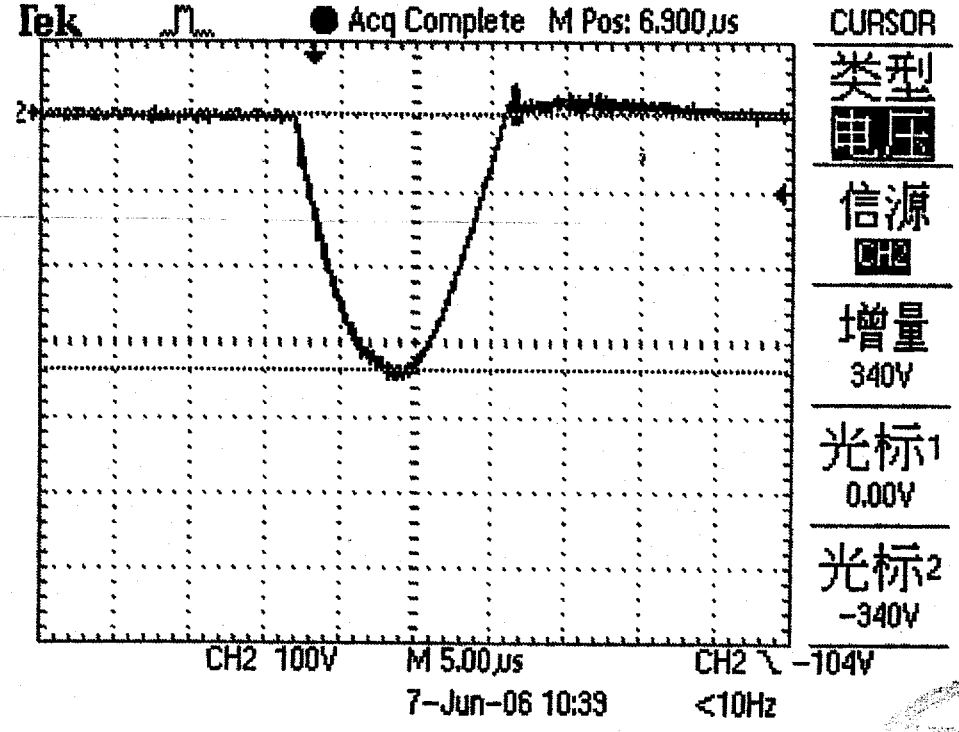

Fig. 13: 01 4/10µs 65kA 1st

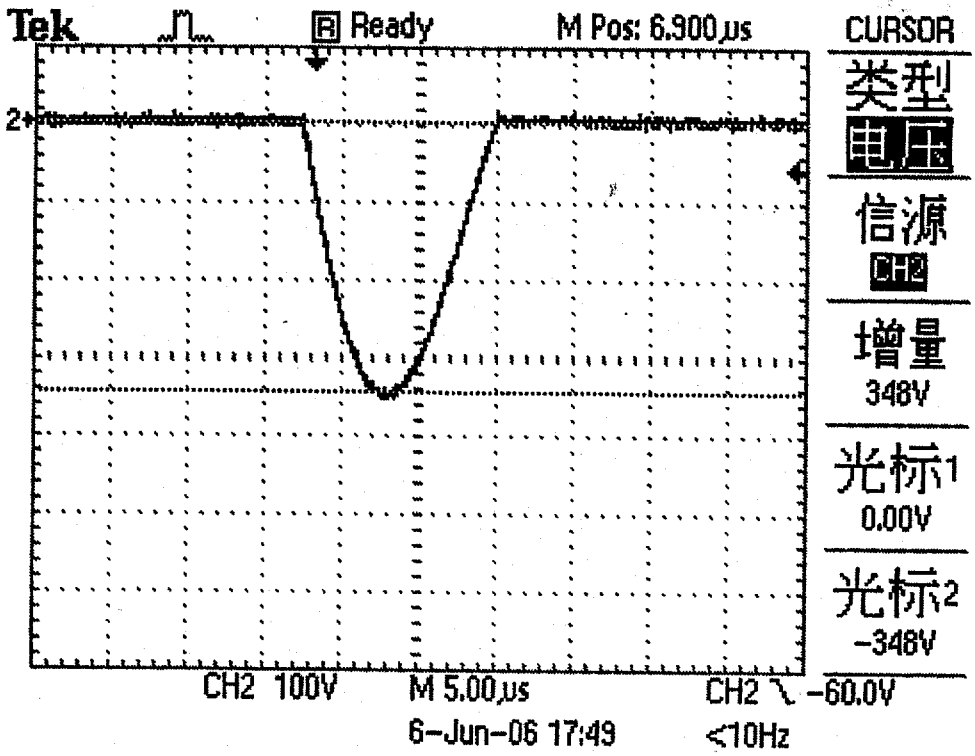

Fig. 14: 01 4/10µs 65kA 2nd

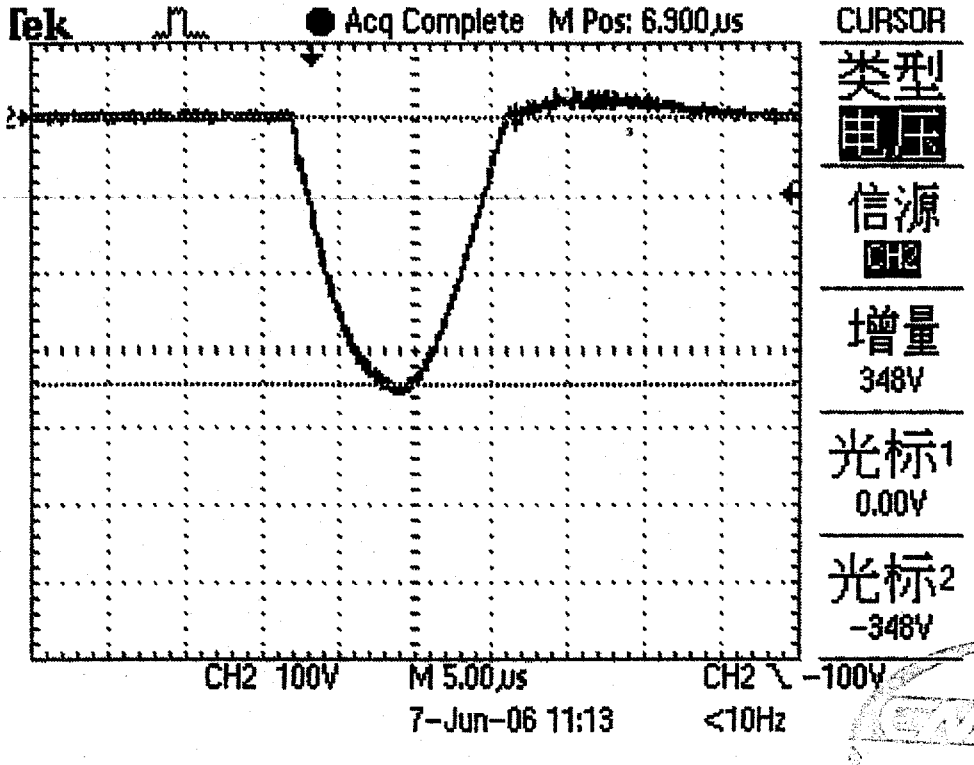

Fig. 15: 02 4/10μs 65kA 1st

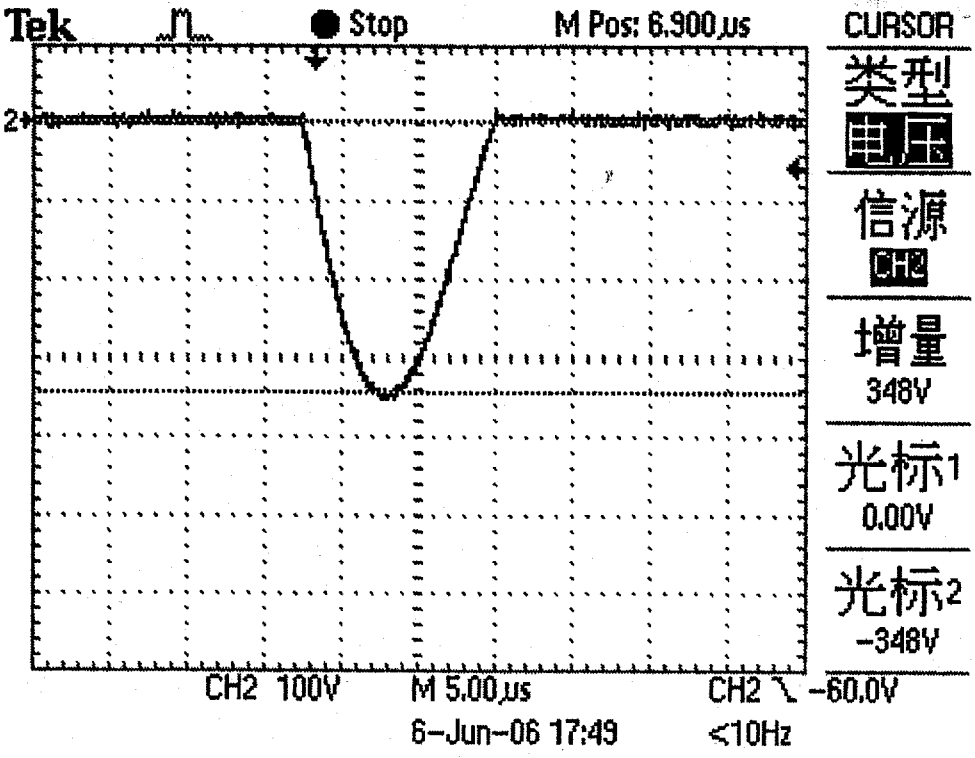

Fig. 16: 02 4/10μs 65kA 2nd

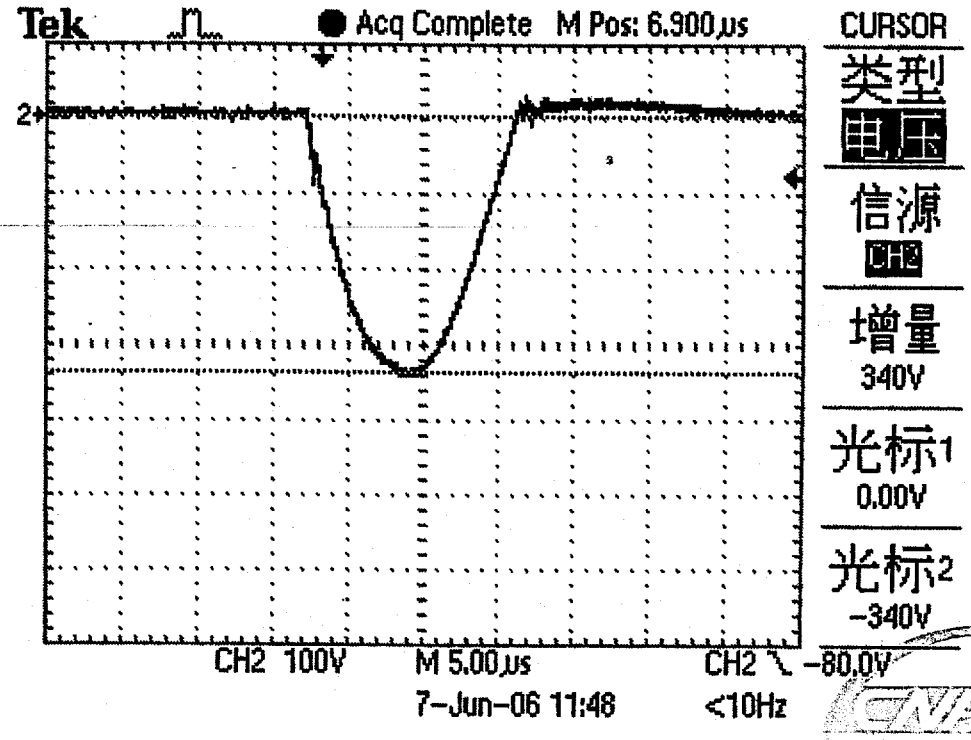

Fig. 17: 03 4/10μs 65kA 1st

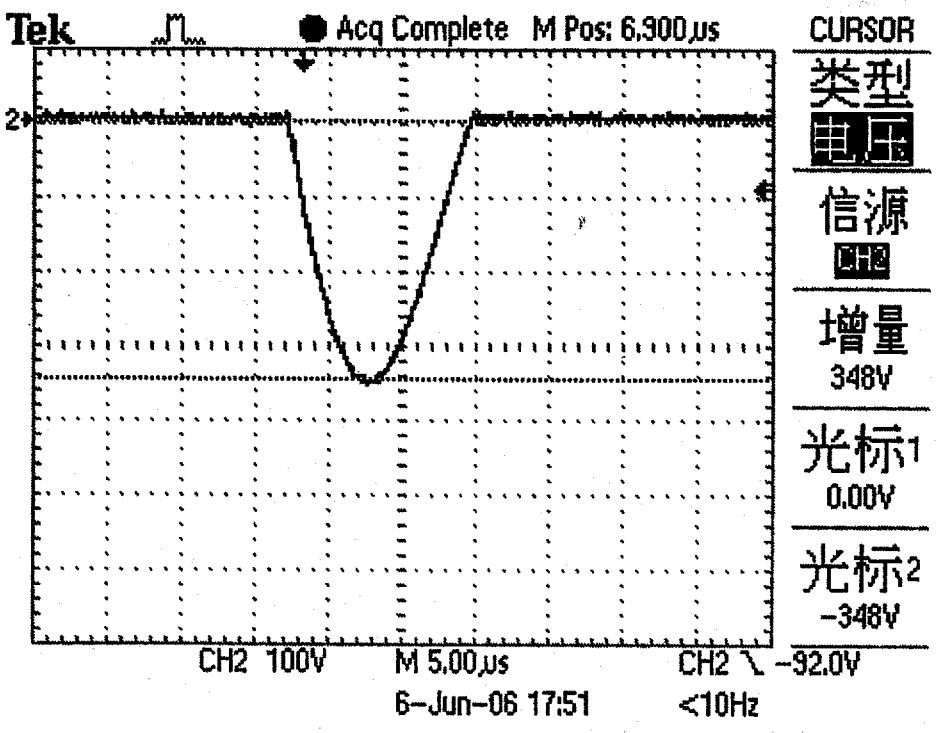

Fig. 18: 03 4/10μs 65kA 2nd

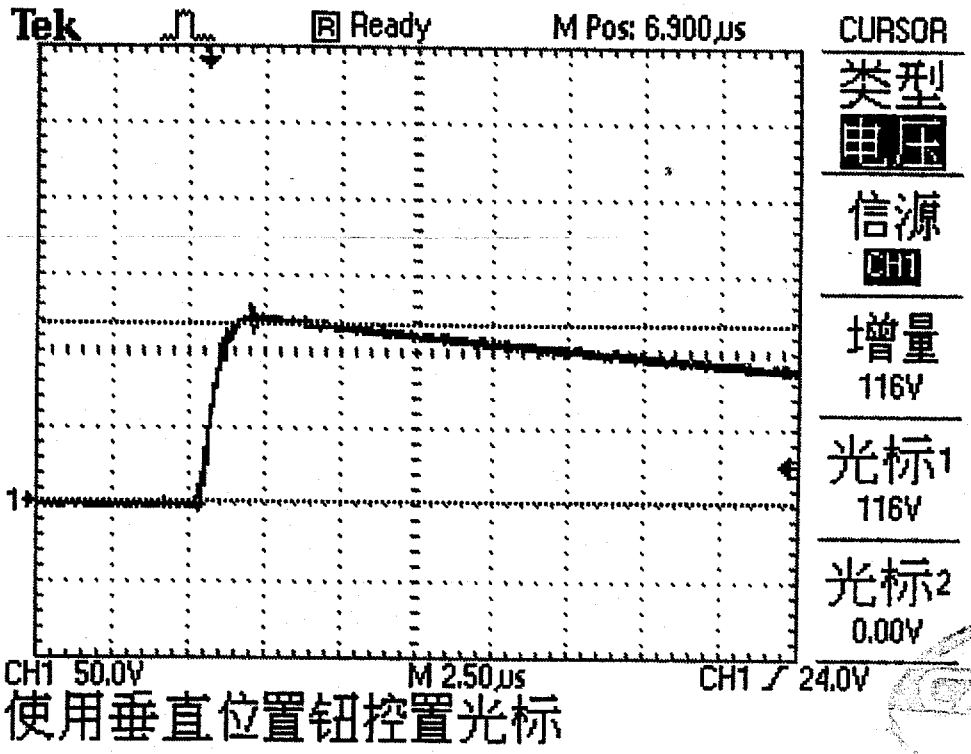

Fig. 19: wave of 1.2/50μs impluse voltage, positive

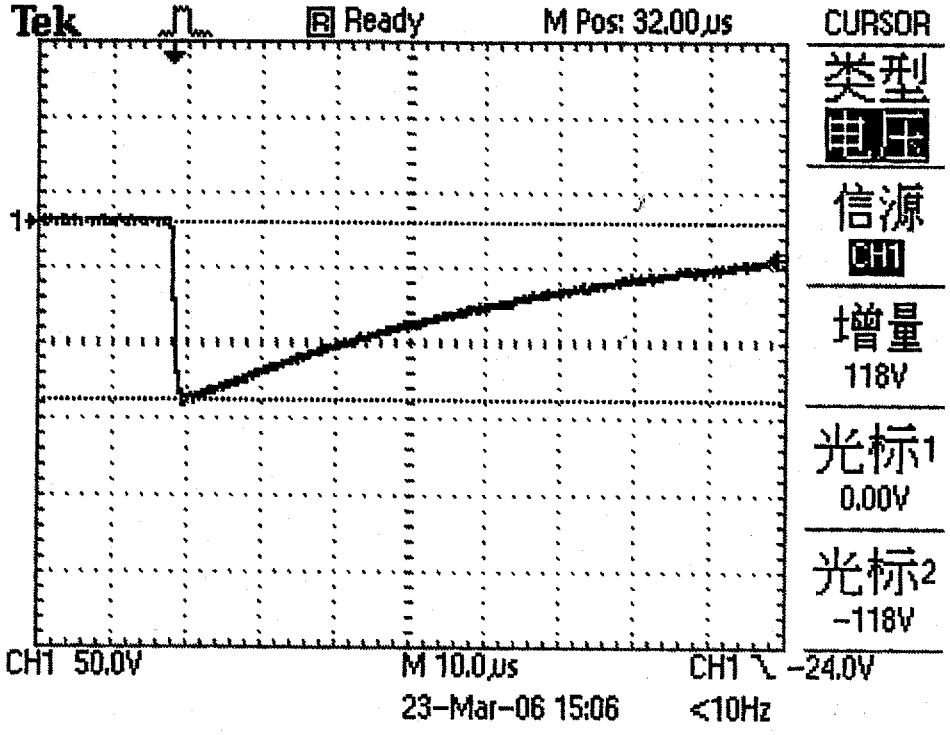

Fig. 20: wave of 1.2/50μs impluse voltage, negative

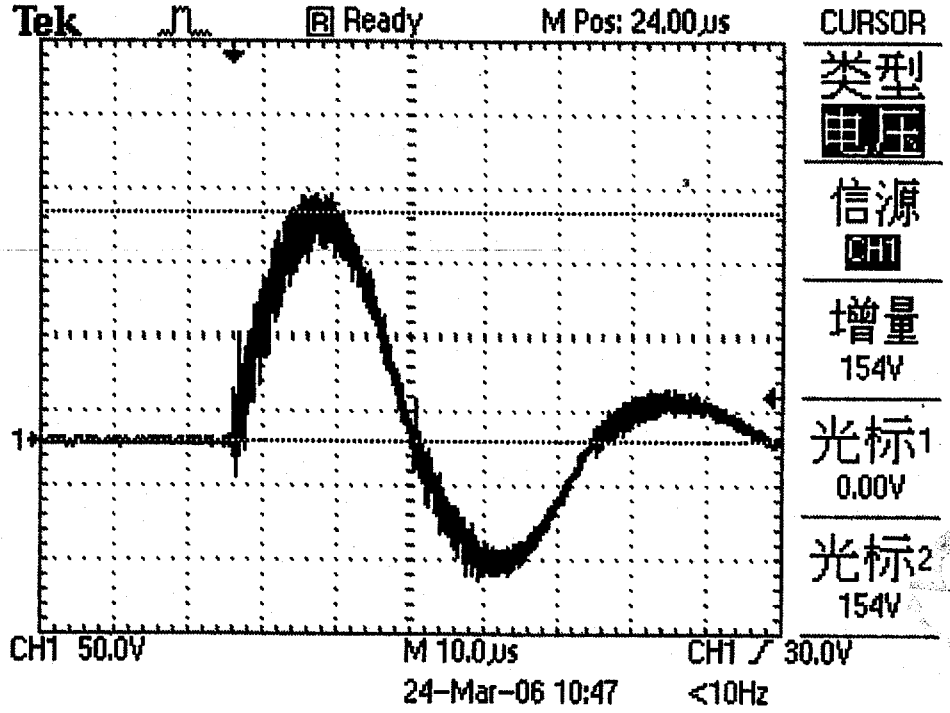

Fig. 21: the current wave before moisture ingress test

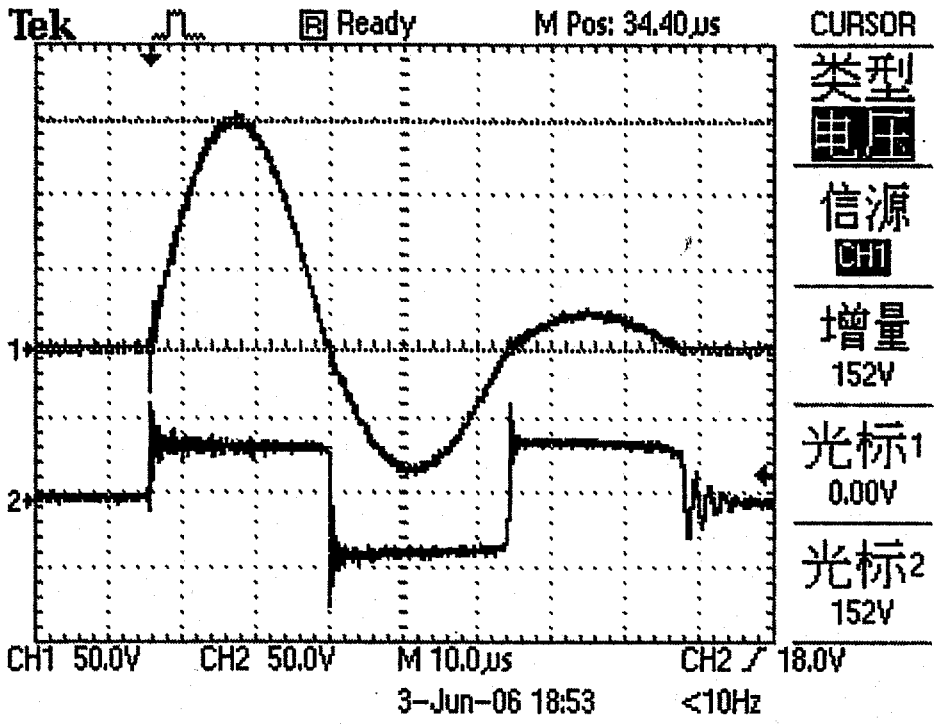

Fig. 22: the current wave after moisture ingress test

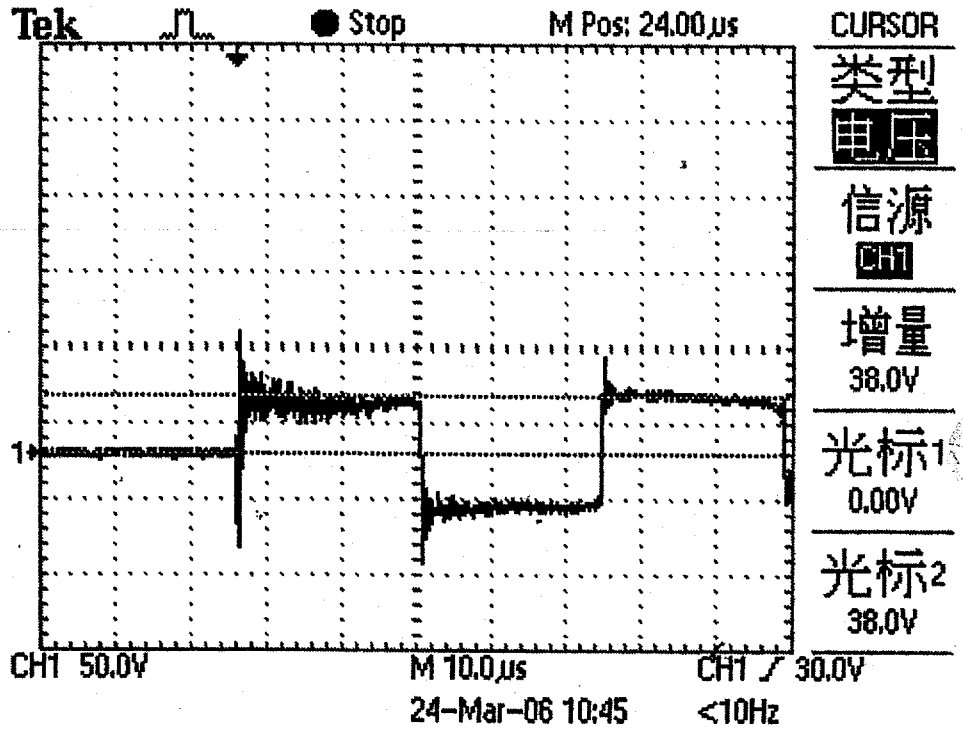

Fig. 23: the voltage wave before moisture ingress test

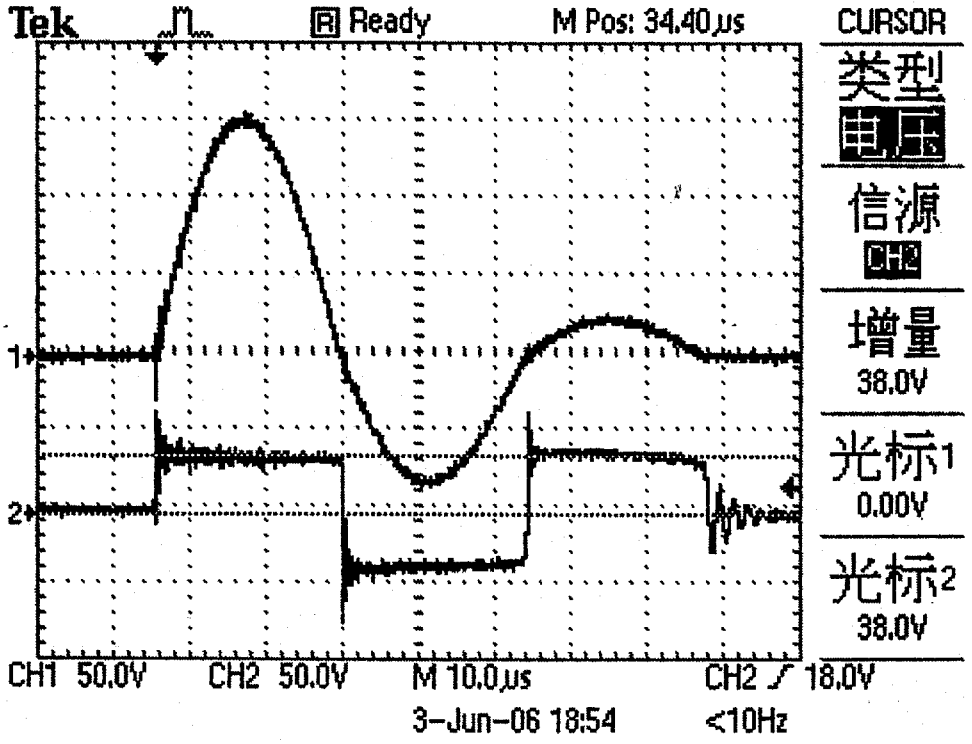

Fig. 24: the voltage wave after moisture ingress test