



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 mA peak. 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 42 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 42 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 42 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_i of 15 kV and an equivalent creepage 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/m³
- 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 42 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 160 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 42 kV type which is representative for the whole series was tested with a power frequency of 80 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 5, 10 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. 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 (10 kA) should be below the specified residual voltage in kV.

Result

The test results fulfilled the requirements.

3.1.2 SWITCHING IMPULSE

One switching impulse with a waveform of 30/60 µs and a peak value of 500 A 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 should be below the specified switching impulse residual voltage in kV.

Result

The test results fulfilled the requirements

3.1.3 STEEP CURRENT

One steep current impulse with a waveform of 1/10 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.

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. The line discharge class is 1.

Before this test the lightning impulse residual voltage at nominal discharge current and the switching impulse residual voltage at 125 A was measured. The latter was used for calculating the energy, which should be injected into the sample during every long duration impulse. This energy was determined as 2,98 kJ. The duration of the impulse is 2000 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 summarised in annex B.

The acceptance criteria are:

- 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.

3.3.4 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 2,56 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.

3.3.5 CONDITIONING

The conditioning test was made on three new samples. Before the conditioning test 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 μ s with nominal discharge current. The impulses were applied while the sample was energized at $1,2 \times U_{cov}$. 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 100 kA, 4/10 μ s. 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_1 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: YH10W-3~27kV)

CAUTOR
(12mm)

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

Manufacturer		Wenzhou Cantor H.V. Electric Manufacturing Co., LTD.										
Rated Voltage	生产商	额定电压	IEC60099-4(2004)									
Nominal discharge current	标称放电电流	KA	3	6	9	12	15	18	21	24	27	
General Feature		一般特征	Unit									
Applicable standard	适用标准	型号	YH10W-3/8.5	YH10W-6/17	YH10W-9/25.5	YH10W-12/34	YH10W-15/42.5	YH10W-18/51	YH10W-21/59.5	YH10W-24/68	YH10W-27/76.5	
Type designation	型号	YH10W-3/8.5	YH10W-6/17	YH10W-9/25.5	YH10W-12/34	YH10W-15/42.5	YH10W-18/51	YH10W-21/59.5	YH10W-24/68	YH10W-27/76.5		
Housing material	外套材料	Silicone rubber	Silicone rubber	Silicone rubber	Silicone rubber	Silicone rubber	Silicone rubber	Silicone rubber	Silicone rubber	Silicone rubber		
With(out) gpps	结构类型 (有无间隙)	Without	Without	Without	Without	Without	Without	Without	Without	Without		
Ratings & characteristics		技术参数										
Rated frequency	额定频率	Hz	50	50	50	50	50	50	50	50	50	
Residual voltage at	残压											
lightning impulse 8/20µs	-雷电	kV	8.5	17	25.5	34	42.5	51	59.5	68	76.5	
steep current impulse 1/10µs	-陡坡	kV	9.8	19.6	29.4	39.2	49	58.8	68.6	78.4	88.2	
switching impulse 30/60µs(10kA&up)	-操作	kV	7.3	14.6	21.9	29.2	36.5	43.8	51.1	58.4	65.7	
switching surge(class 1)	-操作波	kA	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Continuous operating voltage	持续运行电压	kV	2.4	4.8	7.2	9.6	12	14.4	16.8	19.2	21.6	
Power frequency reference voltage	工频参考电压	kV	≥3	≥6	≥9	≥12	≥15	≥18	≥21	≥24	≥27	
Long duration current impulse withstand	长线冲击耐受											
line discharge chass(10kA& up)	-线路放电等级		I	I	I	I	I	I	I	I	I	
2ms rectangular current withstand	-方波耐受电流	A										
Operating duty	动作负载											
4/10µs high current impulse withstand	-大电流冲击耐受	KA	100	100	100	100	100	100	100	100	100	
Housing insulation level	外套绝缘水平											
lightning impulse	-雷电冲击	kV	12	25	35	45	60	70	80	95	110	
power frequency, wet 1 min	-工频, 湿	kV	7	10	20	25	30	35	40	50	55	

Manufacturer		Wenzhou Cantor H.V. Electric Manufacturing Co., LTD.									
Rated Voltage	额定电压	KV	3	6	9	12	15	18	21	24	27
Nominal discharge current	标称放电电流	KA	10	10	10	10	10	10	10	10	10
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 withstand 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	4.45	8.9	13.35	17.8	22.25	26.7	31.15	35.6	40.05
-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	261	414	480	570	630	788	888	945
-creepage distance/rated voltage ratio	-爬电比距	mm/kV	40	43.5	46	40	38	35	37.5	37	35
3.2 Mechanical section length	本体高度 (不含螺栓)	mm	93	113	155	174	198	217	258	281	304
3.3 Insulation distance/electrical section length	绝缘距离	mm	61	81	123	142	166	185	226	249	272
3.4 Mechanical strength	机械强度										
-torsional	-抗扭 (水平)	Nm	50	50	50	50	50	50	50	50	50
-cantilever	-抗弯 (垂直)	N	147	147	147	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	φ53	φ53	φ53	φ53	φ53	φ53	φ53	φ53	φ53
-height	-高度	mm	22	22	22	22	22	22	22	22	22
-number of blocks	-数量		1	2	3	4	5	6	7	8	9
3.6 Arrestor dimension	避雷器尺寸										
-diameter (big shed)	-直径 (大伞径)	mm	155	155	155	155	155	155	155	155	155
-diameter (small shed)	-小伞径	mm	/	134	134	134	134	134	134	134	134
-number of sheds	-伞数		1	3	5	6	7	8	10	11	12
-core diameter	-芯径	mm	77	77	77	77	77	77	77	77	77
-arrestor height (with fittings)	-总高度	mm	160	178	220	239	262	281	323	346	365
3.7 Rated voltage/insulation distance Ratio	额定电压/绝缘距离	KV/mm	0.049	0.074	0.073	0.085	0.090	0.097	0.093	0.096	0.099

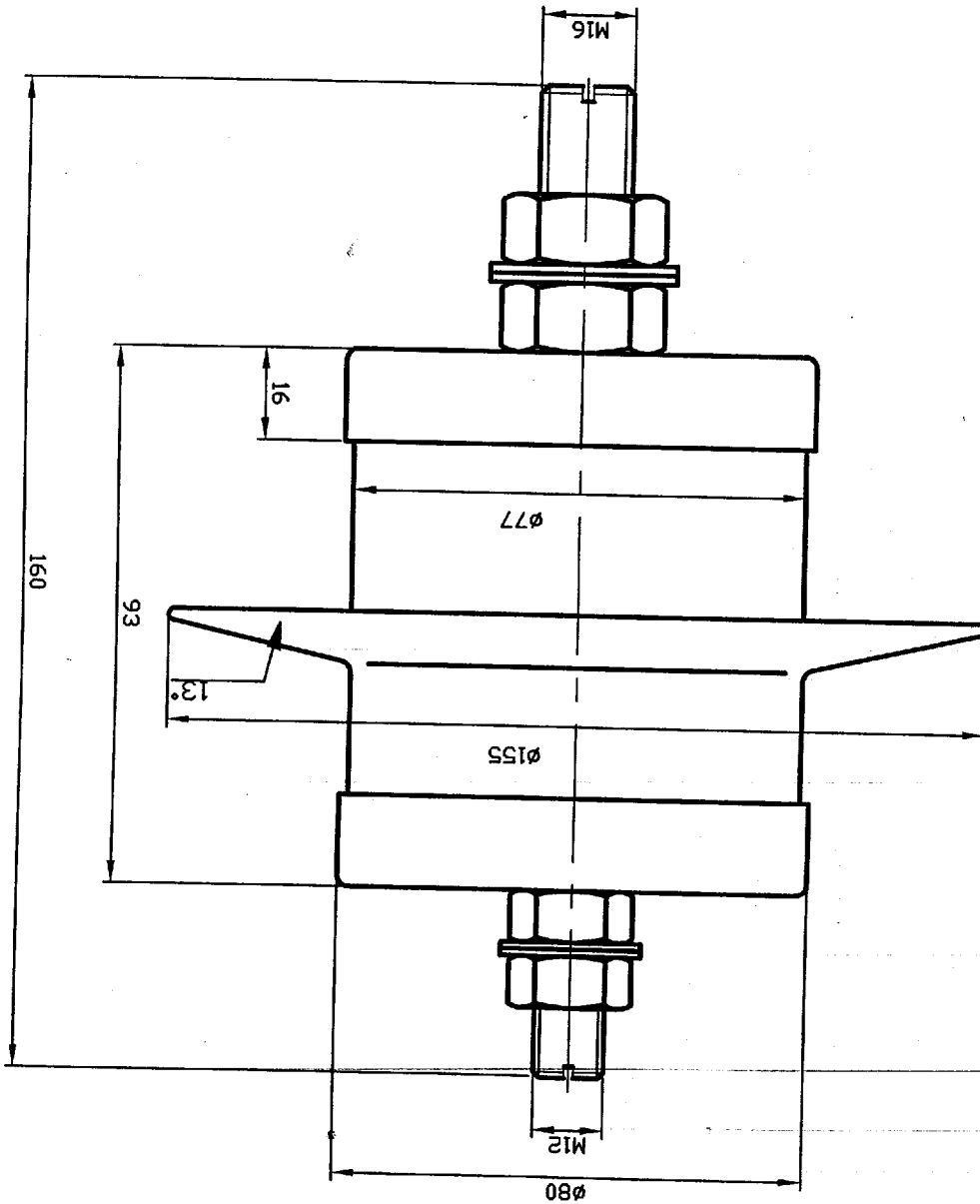
Technical Data of Metal Oxide Surge Arrester (Type: YH10W-30~42kV)

Manufacturer		生产商		Wenzhou Cantor H.V. Electric Manufacturing Co., LTD.							
	Rated Voltage	额定电压	kV	30	33	36	39	42			
	Nominal discharge current	标称放电电流	KA	10	10	10	10	10			
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		YH10W-30/85	YH10W-33/93.5	YH10W-36/102	YH10W-39/110.5	YH10W-42/119			
1.3	Housing material	外套材料		Silicone rubber	Silicone rubber	Silicone rubber	Silicone rubber	Silicone rubber	Silicone rubber		
1.4	With(out) gaps	结构类型 (有无间隙)		Without	Without	Without	Without	Without	Without		
2	Rated frequency	额定频率	Hz	50	50	50	50	50	50		
2.1	Rated frequency	额定频率	Hz	50	50	50	50	50	50		
2.2	Residual voltage at lightning impulse 8/20μs	残压	kV	85	93.5	102	110.5	119			
	sleep current impulse 1/10μs	-陡坡	kV	98	107.8	117.6	127.4	137.2			
	-switching impulse 30/60μs(10kA& up)	-操作	kV	73	80.3	87.6	94.9	102.2			
	-switching surge(class 1)	-操作波	KA	0.5	0.5	0.5	0.5	0.5			
2.3	Continuous operating voltage	持续运行电压	kV	24	26.4	28.8	31.2	33.6			
2.4	Power frequency reference voltage	工频参考电压	kV	≥30	≥33	≥36	≥39	≥42			
2.5	Long duration current impulse withstand	长线冲击耐受									
	-line discharge chass(10kA& up)	-线路放电等级		I	I	I	I	I			
	-2ms rectangular current withstand	-方波耐受电流	A								
2.6	Operating duty	动作负载									
	-4/10μs high current impulse withstand	-大电流冲击耐受	KA	100	100	100	100	100			
2.7	Housing insulation level	外套绝缘水平									
	-lightning impulse	-雷电冲击	kV	120	135	150	155	160			
	-power frequency,wet 1 min	-工频, 湿	kV	60	65	70	75	80			

Manufacturer		Wenzhou Cantor H.V. Electric Manufacturing Co., LTD.							
Rated Voltage	生产商	额定电压	KV	30	33	36	39	42	
Nominal discharge current	标称放电电流	KA	10	10	10	10	10	10	
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	
2.11 Other ratings & characteristics	其他参数								
-Reference voltage(1 mA DC)	-参考电压 (1mA DC)	KV	44.5	48.95	53.4	57.85	62.3		
-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	1095	1254	1350	1404	1512		
-creepage distance/rated voltage ratio	-爬电比距	mm/kV	36.5	38	37.5	36	36		
3.2 Mechanical section length	本体高度 (不含螺栓)	mm	343	384	408	426	449		
Insulation distance/electrical section length	绝缘距离	mm	311	352	376	394	417		
3.4 Mechanical strength	机械强度								
-torsional	-抗扭 (水平)	Nm	50	50	50	50	50		
-cantilever	-抗弯 (垂直)	N	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	φ53	φ53	φ53	φ53	φ53		
-height	-高度	mm	22	22	22	22	22		
-number of blocks	-数量		10	11	12	13	14		
3.6 Arrester dimension	避雷器尺寸								
-diameter (big shed)	-直径 (大伞径)	mm	155	155	155	155	155		
-diameter (small shed)	-小伞径	mm	134	134	134	134	134		
-number of sheds	-伞数		14	16	17	18	19		
-core diameter	-芯径	mm	77	77	77	77	77		
-arrester height (with fittings)	-总高度	mm	407	449	472	491	514		
3.7 Rated voltage/Insulation distance Ratio	额定电压/绝缘距离	kV/mm	0.096	0.094	0.096	0.099	0.100		

Auditing	Shunyu Zhao	Date	2006-03-31	No.	Page	Total	Page	CTY1.02.03-1
	Technics	Sanction	Xiao'ou Zheng			1:1		
Drawing	Yong Zheng			Fig.No.	QTY	Scale	Wight	Exterior drawing
Design	Jianhua Hou	Check						
Mark	QTY	Change file No.	Sig.	Date				Wenzhou CANTOR H.V.Electric Manufacturing Co.,LTD.

Metal Oxide Surge Arrester
without gaps
YH10W-3/8.5

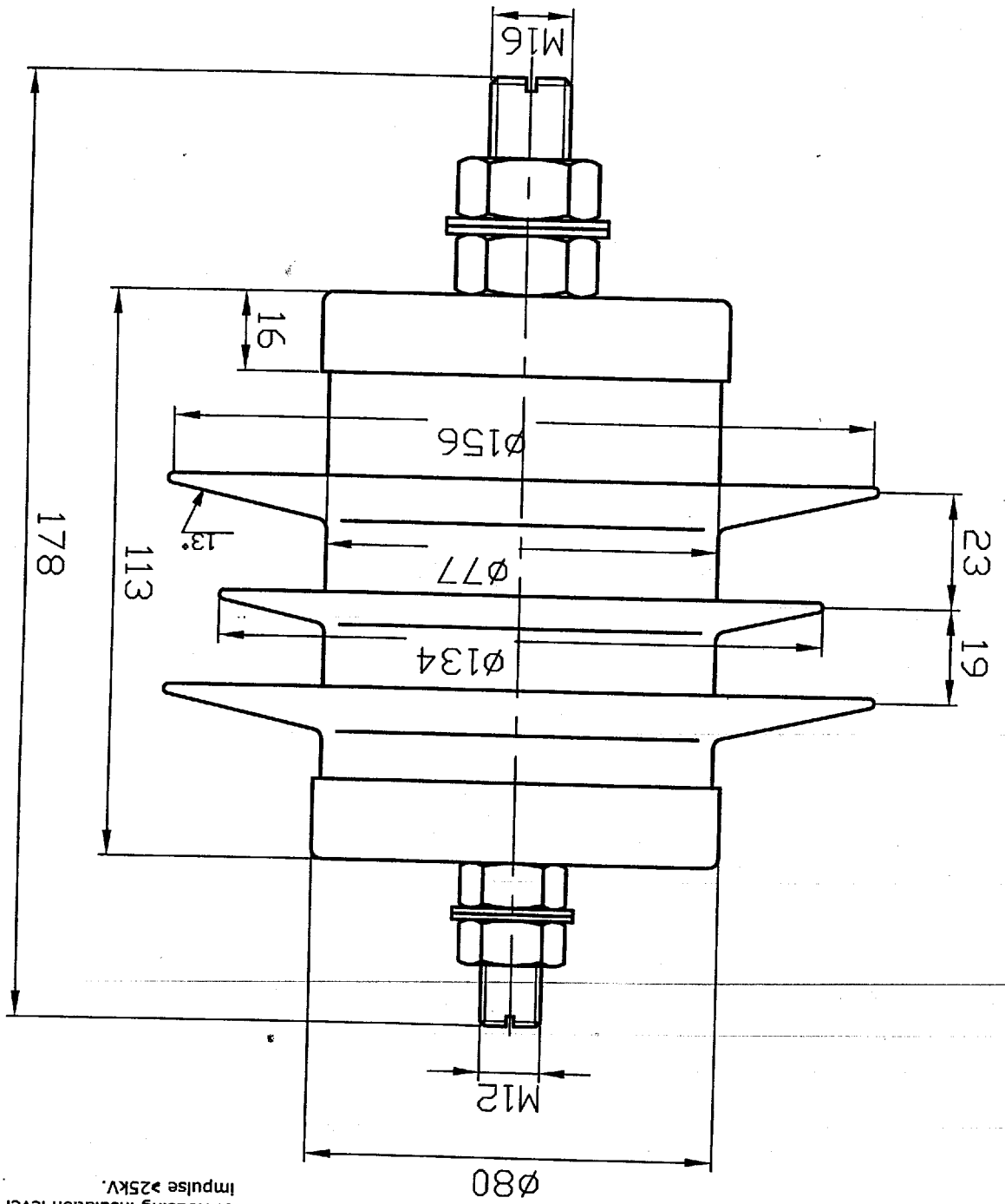


- Technical Data**
1. Applicable standard IEC60099-4(2004)
 2. Rated voltage 3kV.
 3. Continuous operating voltage 2.4kV.
 4. Power frequency reference voltage $\geq 3kV$.
 5. Residual voltage at lightning impulse $8/20 \mu s \leq 8.5kV$.
 6. Housing insulation level lightning impulse $\geq 12kV$.

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Inner A pages

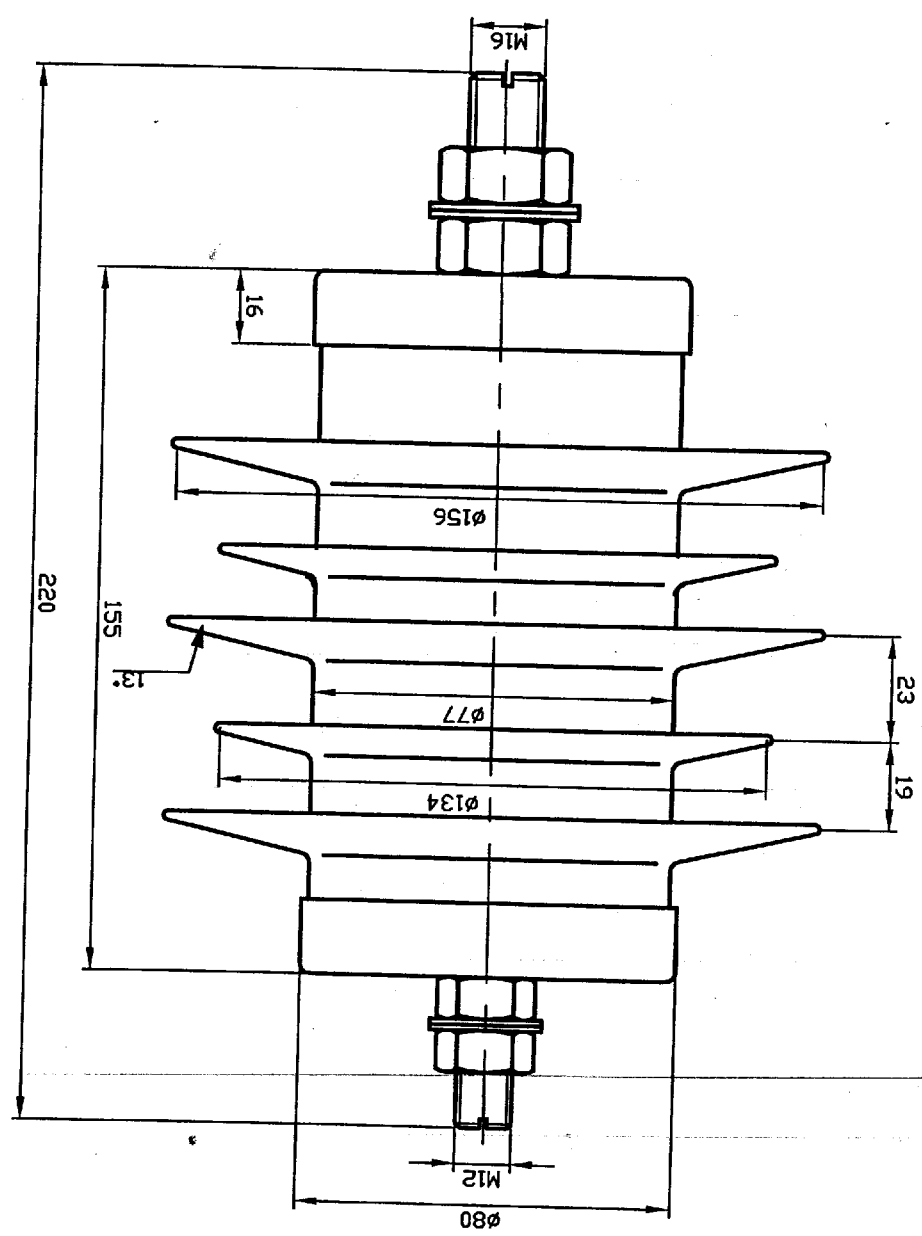
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Drawing		Yong Zheng		Check		Jianhua Hou		Fig.No.		QTY		Scale		Wight	
Design		Yong Zheng		Jianhua Hou		Check		Metal Oxide Surge Arrester without gaps YH10W-6/17		Wenzhou CANTOR H.V.Electric Manufacturing Co.,LTD.		Exterior drawing		CTY1.02.06-1	
Mark		QTY		Change File No.		Sig.		Date							



- Technical 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.

CTY1.02.06-1

Auditing	Shunyu Zhao	Date	2006-03-31	No.	Page	Total	Page
Technics		Sanction	Xiao'ou Zheng	Fig.No.	QTY	Scale	1:1
Drawing	Yong Zheng	Check				Wight	
Design	Jianhua Hou	Change File No.		Metal Oxide Surge Arrester without gaps YH10W-9/25.5			
Mark	QTY	Sig.	Date				
Wenzhou CANTOR H.V.Electric Manufacturing Co.,LTD. Exterior drawing CTY1.02.09-1							

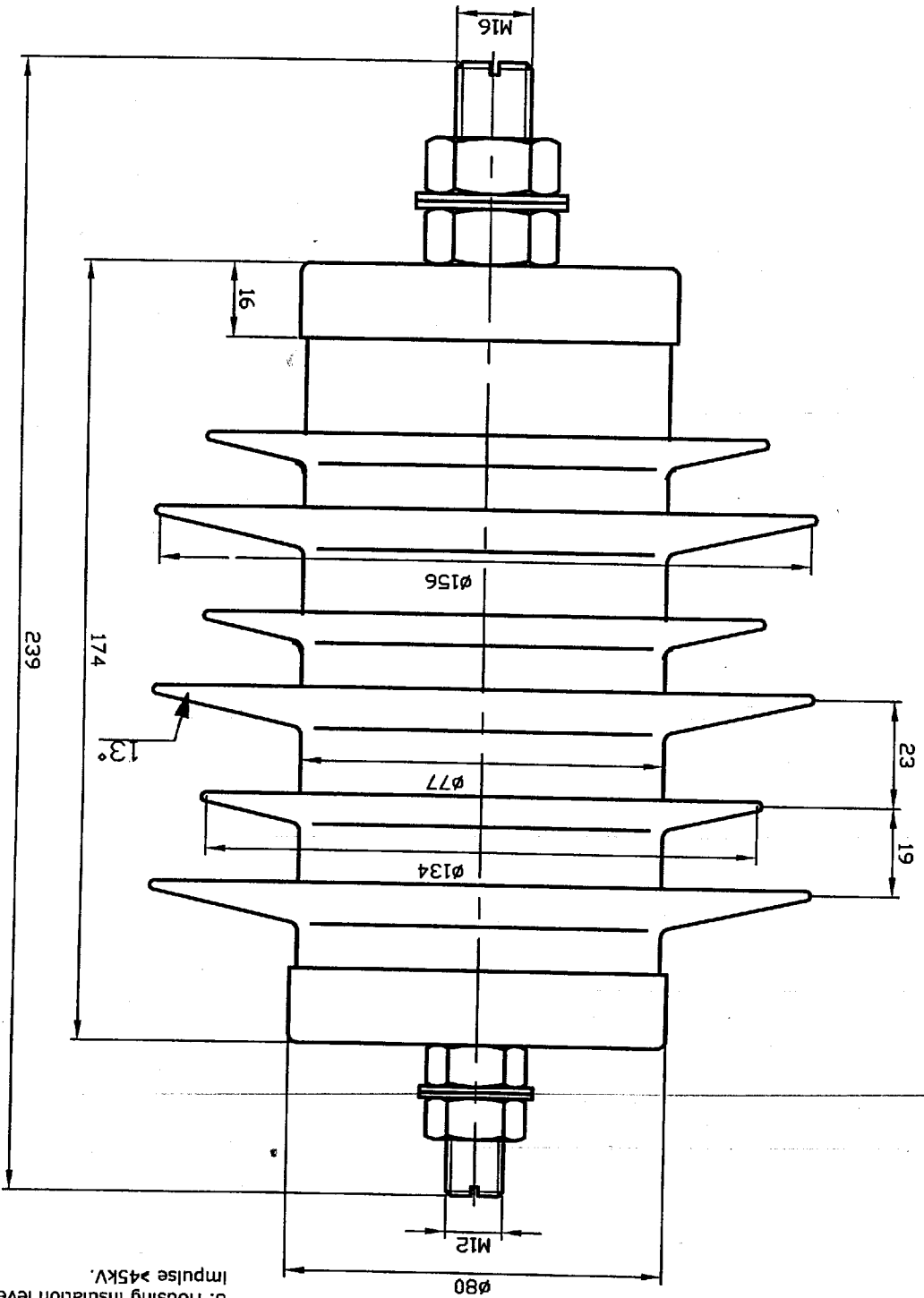


- Technical Data**
1. Applicable standard IEC60099-4(2004)
 2. Rated voltage 9kV.
 3. Continuous operating voltage 7.2kV.
 4. Power frequency reference voltage >9kV.
 5. Residual voltage at lightning impulse 8/20 μs <25.5kV.
 6. Housing insulation level lightning impulse >35kV.

CTY1.02.09-1

Annex A page 1

Wenzhou CANTOR H.V. Electric Manufacturing Co., LTD.	Metal Oxide Surge Arrester without gaps YH10W-12/34	Fig. No.	QTY	Scale	Wight	Date		Change File No.	Sig.	Date	
						2006-03-31					
Exterior drawing	CTY1.02.12-1	No.	Page	Total	Page	Sanction		Xiao'ou Zheng	Shunyu Zhao	Date	
						2006-03-31					
Wenzhou CANTOR H.V. Electric Manufacturing Co., LTD.		Metal Oxide Surge Arrester without gaps YH10W-12/34		Scale		Sanction		Shunyu Zhao		Date	
Exterior drawing		CTY1.02.12-1		1:1		Xiao'ou Zheng		Shunyu Zhao		Date	



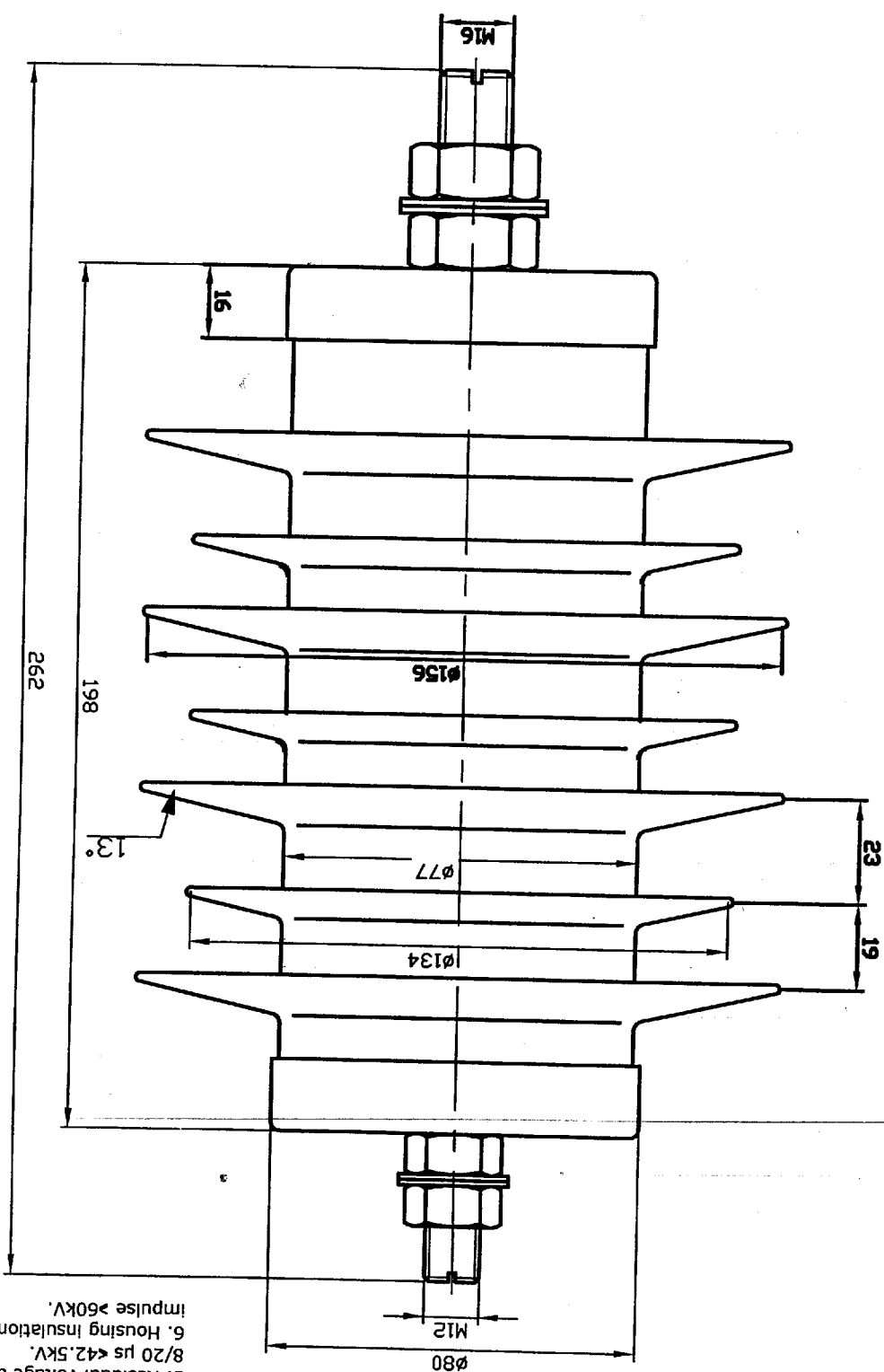
Technical Data

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 6/20 μs <34kV.
6. Housing insulation level lightning impulse >45kV.

CTY1.02.12-1

Annex A page 8

Auditing	Shunyue Zhao	Date	2006-03-31	No.	Page		Page
	Technics	Sanction	Xiao'ou Zheng			Total	
Drawing	Yong Zheng	Fig.No.	QTY	Scale	Wight		Exterior drawing
Design	Jianhua Hou	Check	Metal Oxide Surge Arrester without gaps YH10W-15/42.5				
Mark	QTY	Change File No.	Sig.	Date	Wenzhou CANTOR H.V.Electric Manufacturing Co.,LTD.		



- Technical 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 μ s <42.5kV.
 6. Housing insulation level lightning impulse 260kV.

CTY1.02.15-1

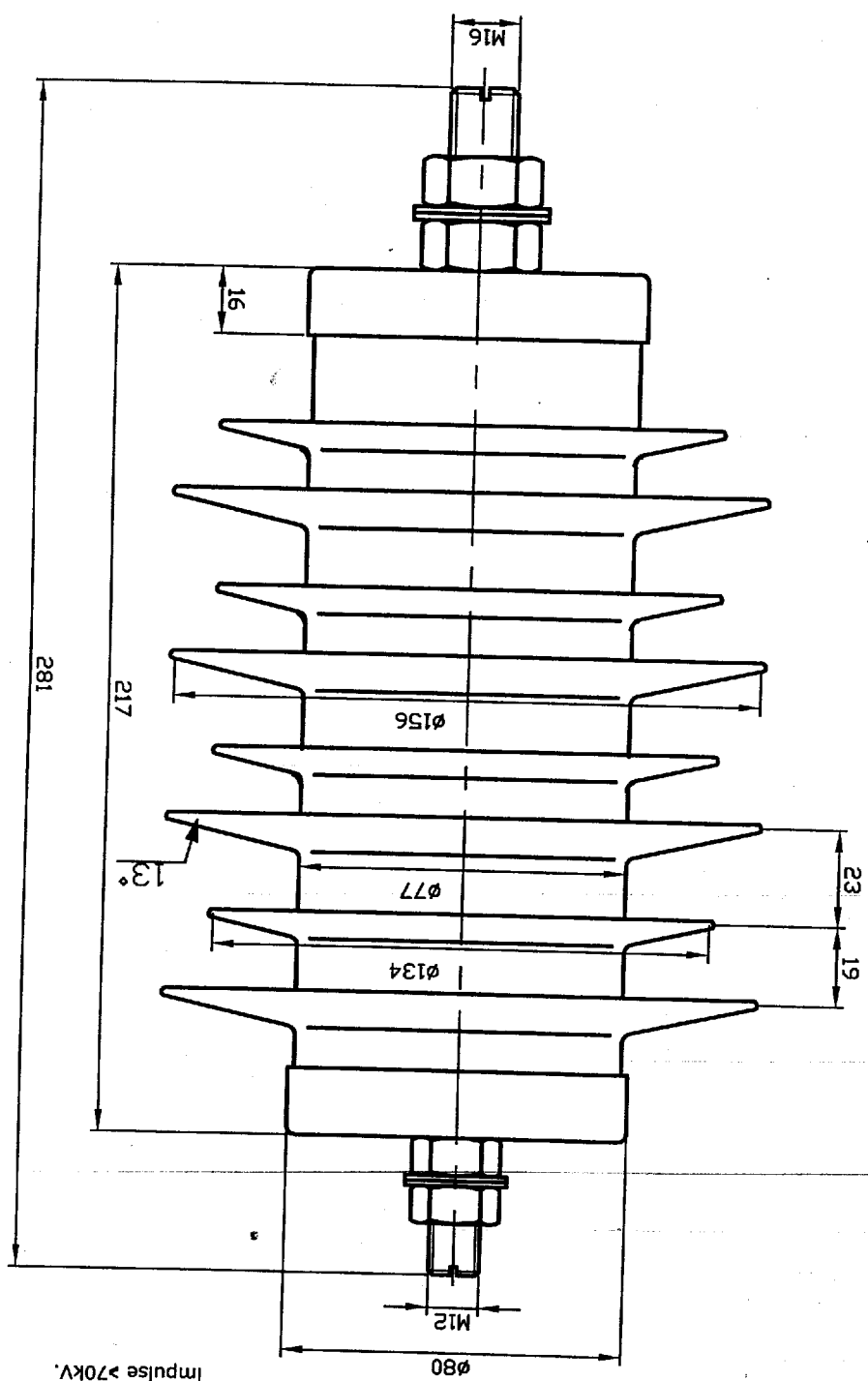
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					Drawing	Yong Zheng												
					Technics	Xiao'ou Zheng	Sanction											
					Auditing	Shunyu Zhao	Date	2006-03-31	No.	Page	Total	Page						

**Metal Oxide Surge Arrester
without gaps
YH10W-18/51**

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

Exterior drawing

CTY1.02.18-1

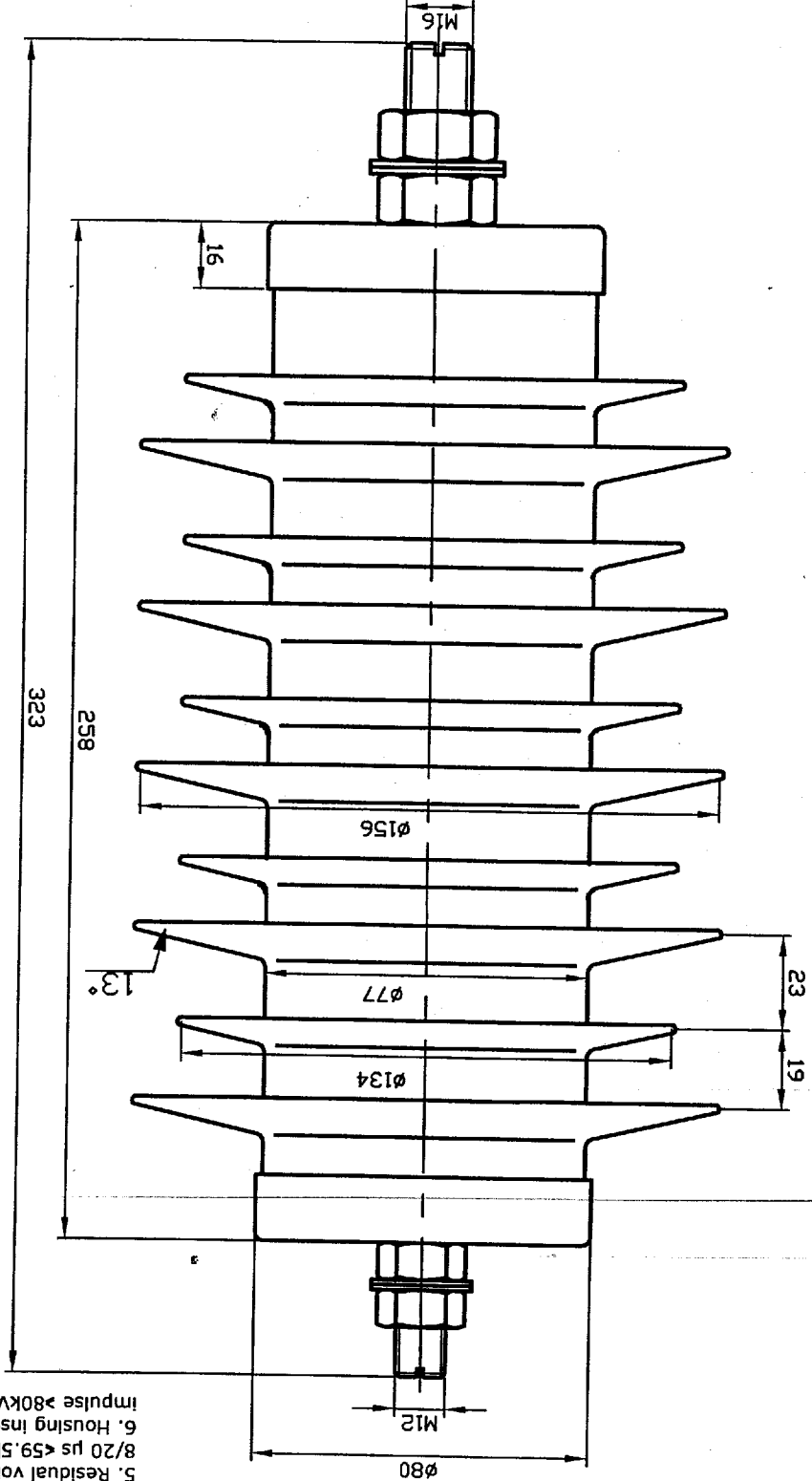


- Technical Data**
1. Applicable standard IEC60099-4(2004)
 2. Rated voltage 18kV.
 3. Continuous operating voltage 14.4kV.
 4. Power frequency reference voltage >18kV.
 5. Residual voltage at lightning impulse 8/20 μs <51kV.
 6. Housing insulation level lightning impulse >70kV.

CTY1.02.18-1

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Wenzhou CANTOR H.V. Electric Manufacturing Co., LTD.	Metal Oxide Surge Arrester without gaps YH10W-21/59.5	Mark	QTY	Change File No.	Sig.	Date
		Design	Jianhua Hou	Check		
Exterior drawing	Fig. No.	QTY	Scale	Wight	Technics	Sanction
					Xiao'ou Zheng	2006-03-31
CTY1.02.21-1	Page	Total	Page	No.	Date	Auditing
	1:1				Shunyu Zhao	

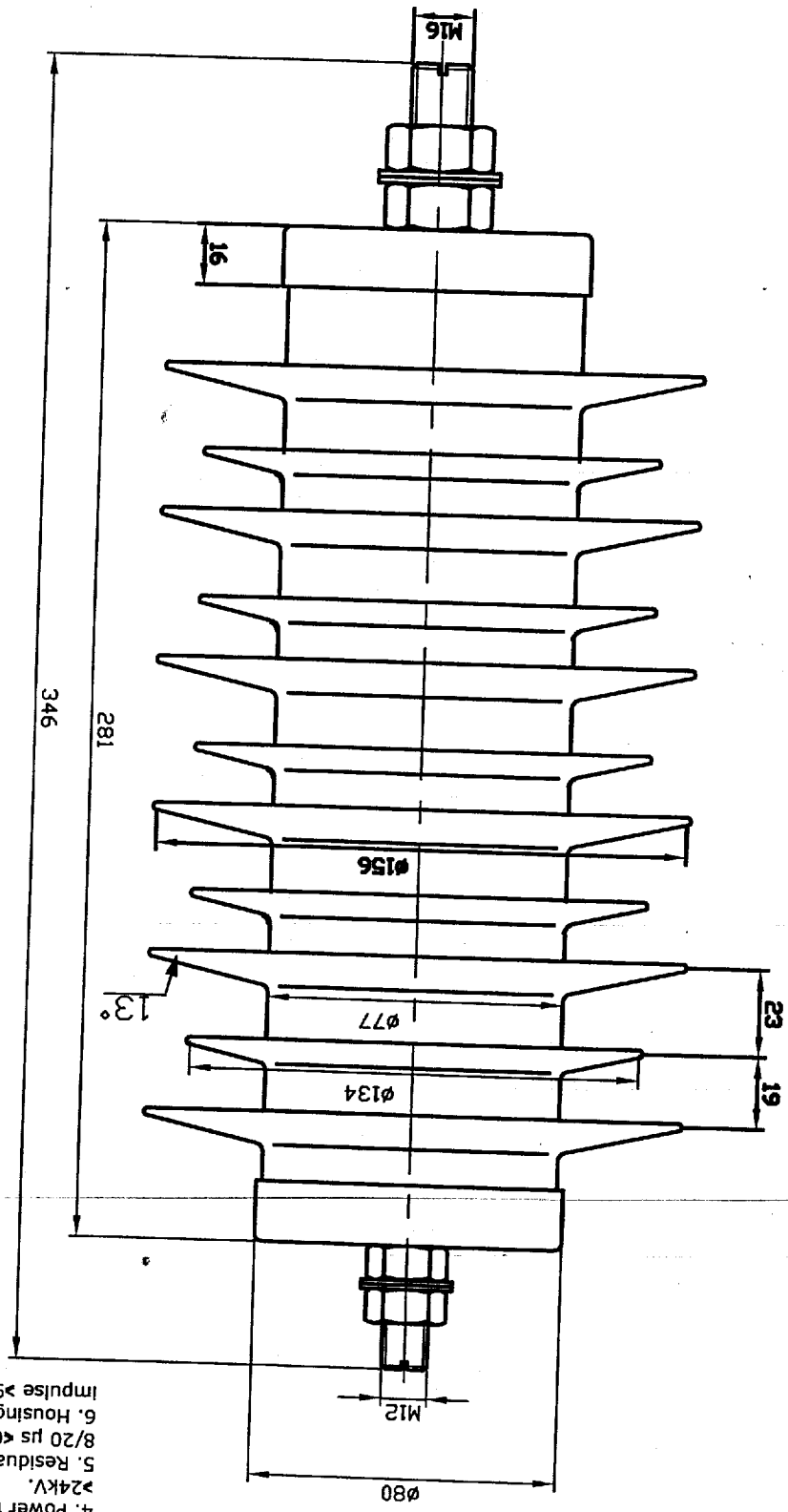


- Technical Data**
1. Applicable standard IEC60099-4(2004)
 2. Rated voltage 21kV.
 3. Continuous operating voltage 16.8kV.
 4. Power frequency reference voltage >21kV.
 5. Residual voltage at lightning impulse 8/20 μs <59.5kV.
 6. Housing insulation level lightning impulse >80kV.

CTY1.02.21-1

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Auditing		Shunyu Zhao		Date	2006-03-31		No.	Page		Total		Page	
Technics		Sanction		Xiao'ou Zheng		Fig.No.		QTY		Scale		Wight	
Drawing		Yong Zheng		Check		Jianhua Hou		Y10W-24/68		Metal Oxide Surge Arrester without gaps		Exterior drawing	
Design		Change File No.		Sig.		Date		Wenzhou CANTOR H.V.Electric Manufacturing Co.,LTD.		CTY1.02.24-1			



Technical 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.

CTY1.02.24-1

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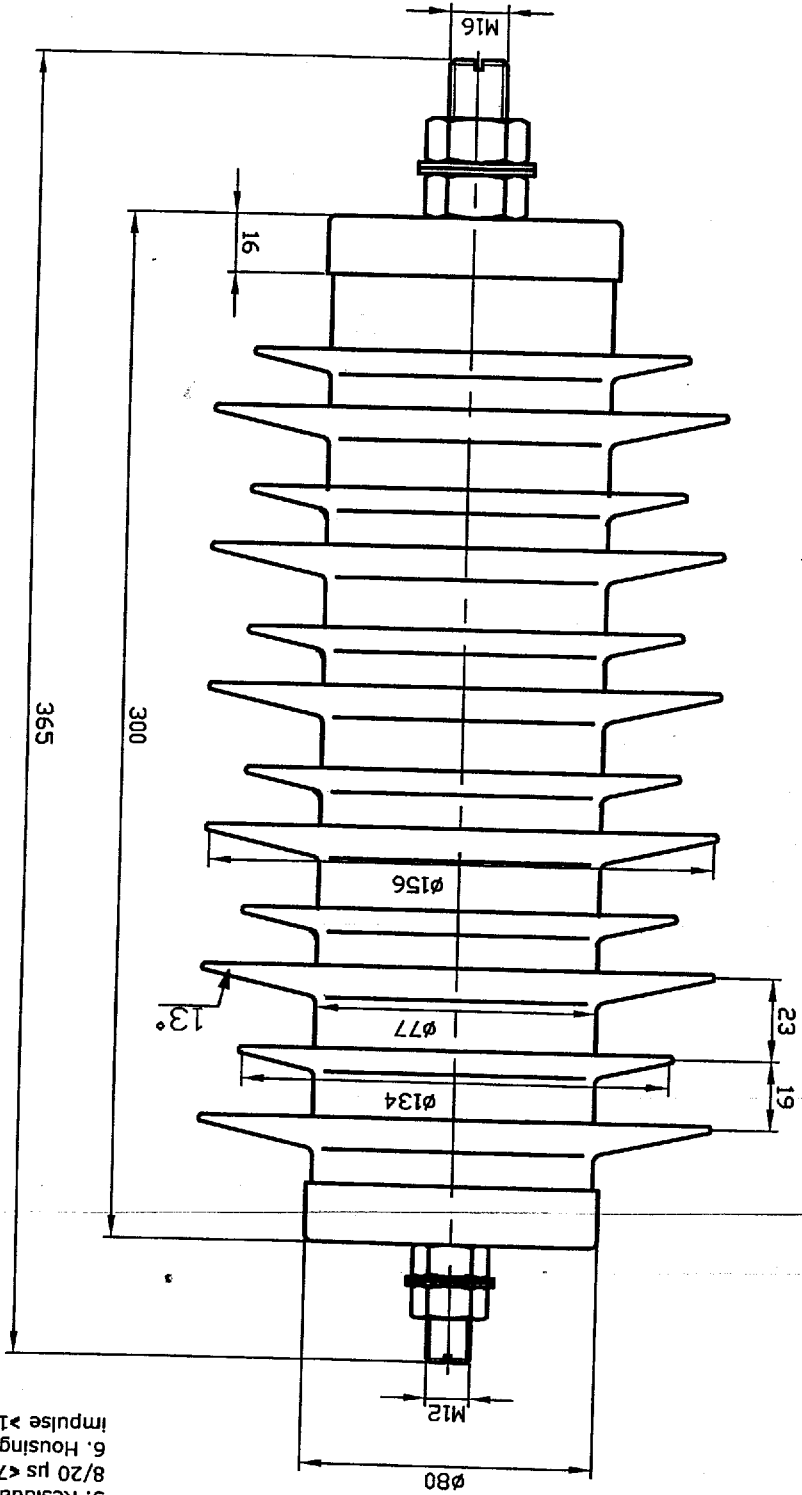
Auditing	Shunyu Zhao	Date	2006-03-31	No.	Page	Total	Page	Page
	Technics		Sanction	Xiao'ou Zheng				
Design	Jianhua Hou	Check		Fig.No.	QTY	Scale	Wight	Drawing
	Yong Zheng							
Mark	QTY	Change File No.	Sig.	Date				

**Metal Oxide Surge Arrester
without gaps
YH10W-27/76.5**

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

Exterior drawing

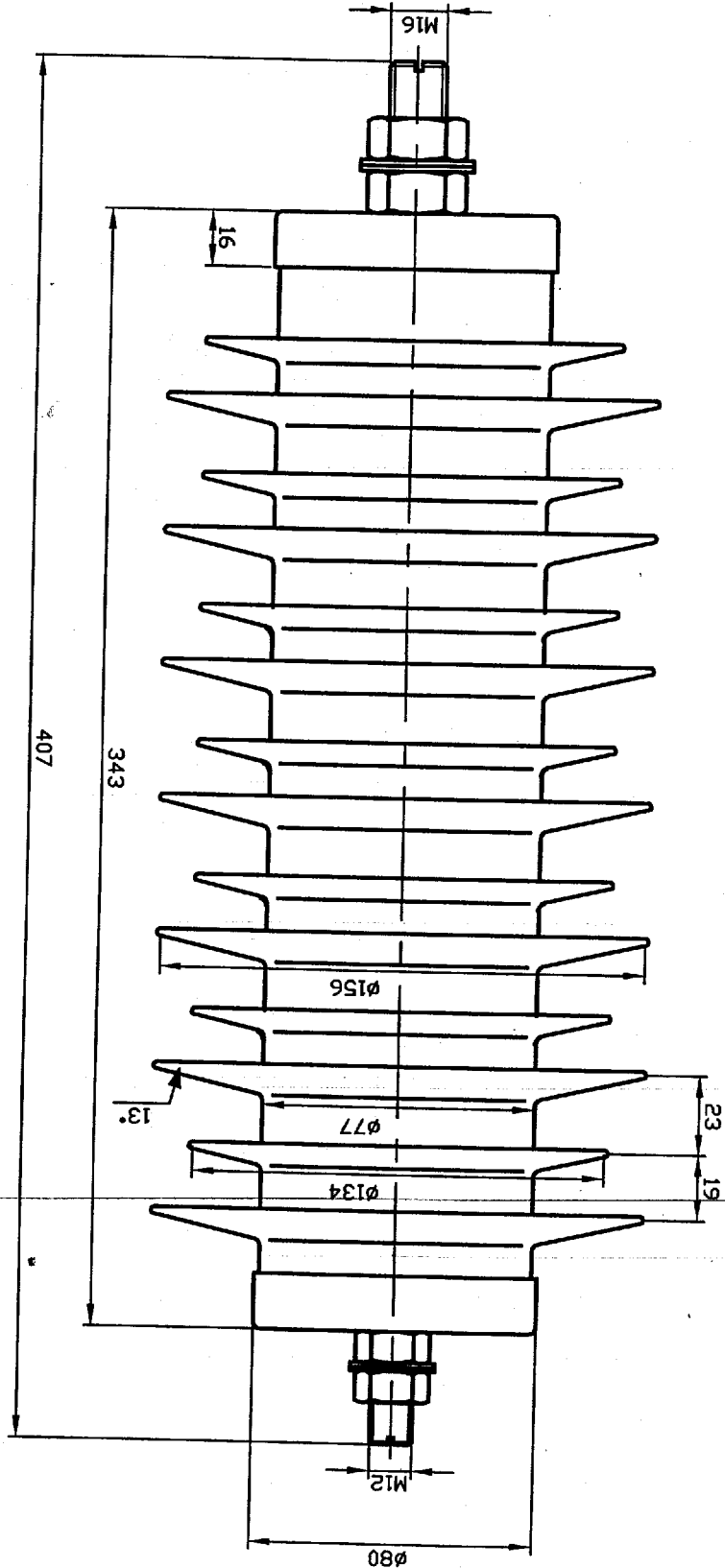
CTY1.02.27-1



- Technical Data**
1. Applicable standard IEC60099-4(2004)
 2. Rated voltage 27KV.
 3. Continuous operating voltage 21.6KV.
 4. Power frequency reference voltage $\geq 27KV$.
 5. Residual voltage at lightning impulse 8/20 μs $\leq 76.5KV$.
 6. Housing insulation level lightning impulse $\geq 110KV$.

CTY1.02.27-1

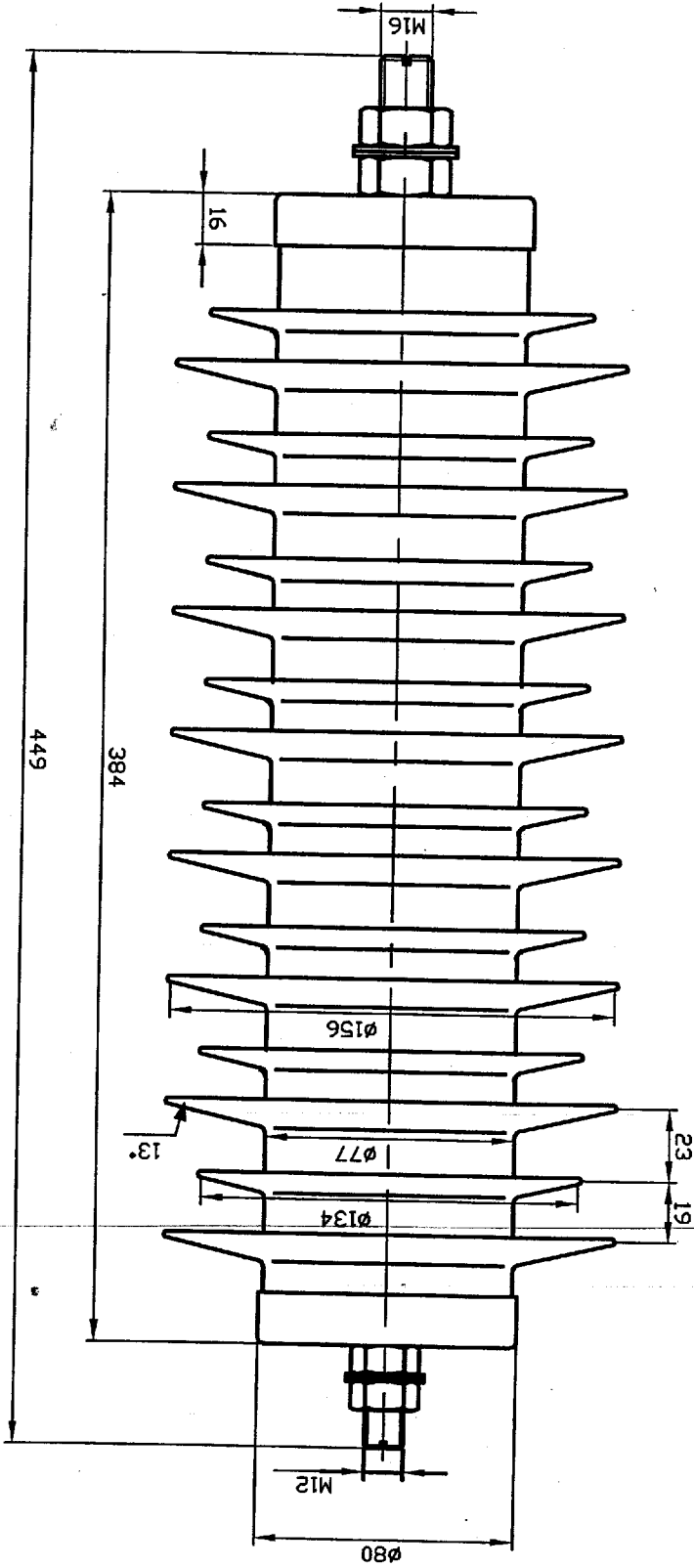
Mark	QTY	Change File No.	Sig.	Date	Check	Design	Jianhua Hou			
						Drawing	Yong Zheng			
Technics	Date	Sanction	Xiao'ou Zheng	2006-03-31	No.	Page	Total	Page	Auditing	Shunyu Zhao
									Fig.No.	QTY
Metal Oxide Surge Arrester without gaps YH10W-30/85										
Wenzhou CANTOR H.V.Electric Manufacturing Co.,LTD.										
Exterior drawing										
CTY1.02.30-1										



- Technical 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 μ s <85kV.
 6. Housing insulation level lightning impulse >120kV.

CTY1.02.30-1

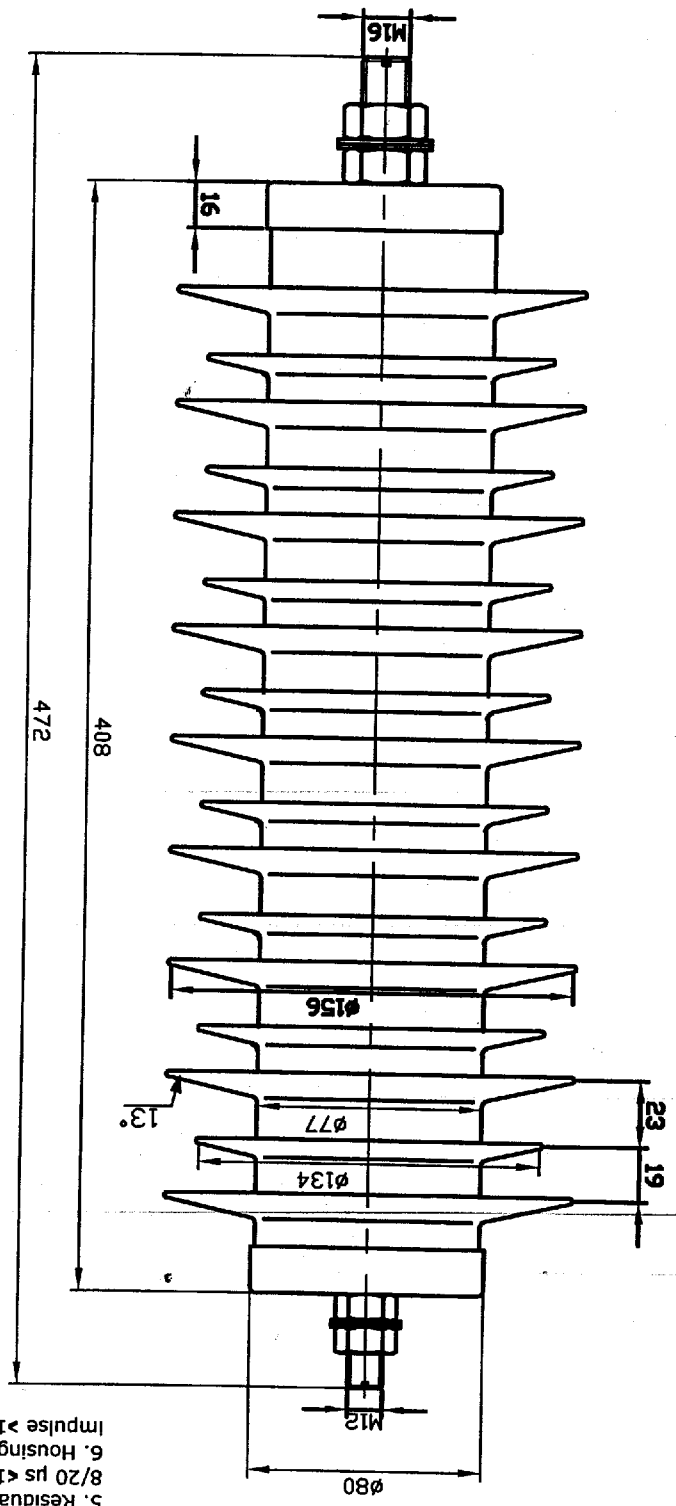
Mark	QTY	Change File No.	Sig.	Date	Check	Design	Jianhua Hou	Drawing	Yong Zheng	Technics	Shun Yue Zhao	Auditing	
							Xiao'ou Zheng		Sanction		Date		2006-03-31
Page		Total	Page		Page		Page		Page		Page		
1:1		1:1	1:1		1:1		1:1		1:1		1:1		
Wight		Scale	QTY		Fig.No.		Fig.No.		Fig.No.		Fig.No.		
Metal Oxide Surge Arrester		YH10W-33/93.5		without gaps		YH10W-33/93.5		YH10W-33/93.5		YH10W-33/93.5		YH10W-33/93.5	
Wenzhou CANTOR H.V. Electric Manufacturing Co., LTD.		Wenzhou CANTOR H.V. Electric Manufacturing Co., LTD.		Wenzhou CANTOR H.V. Electric Manufacturing Co., LTD.		Wenzhou CANTOR H.V. Electric Manufacturing Co., LTD.		Wenzhou CANTOR H.V. Electric Manufacturing Co., LTD.		Wenzhou CANTOR H.V. Electric Manufacturing Co., LTD.		Wenzhou CANTOR H.V. Electric Manufacturing Co., LTD.	
Exterior drawing		Exterior drawing		Exterior drawing		Exterior drawing		Exterior drawing		Exterior drawing		Exterior drawing	
CTY1.02.33-1		CTY1.02.33-1		CTY1.02.33-1		CTY1.02.33-1		CTY1.02.33-1		CTY1.02.33-1		CTY1.02.33-1	



- Technical 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.

CTY1.02.33-1

Auditing	Shun Yue Zhao	Date	2006-03-31	No.	Page	Total	Page
	Technics	Xiao'ou Zheng	Sanction				
Drawing	Yong Zheng	Check	Fig.No.	QTY	Scale	Wight	Page
	Design						
Mark	QTY	Change File No.	Sig.	Date	Metal Oxide Surge Arrester without gaps YH10W-36/102		
Wenzhou CANTOR H.V.Electric Manufacturing Co.,LTD. Exterior drawing CTY1.02.36-1							

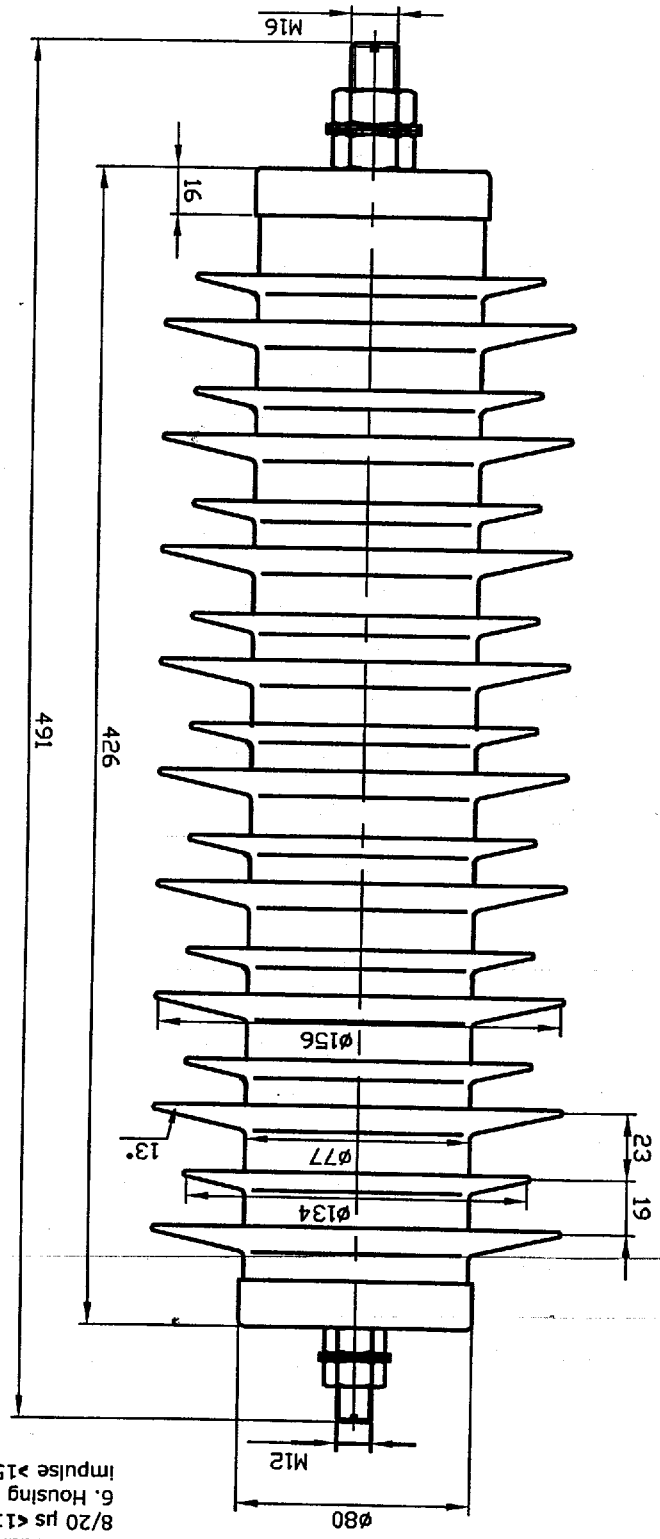


- Technical Data**
1. Applicable standard IEC60099-4(2004)
 2. Rated voltage 36KV.
 3. Continuous operating voltage 28.8KV.
 4. Power frequency reference voltage >36KV.
 5. Residual voltage at lightning impulse 8/20 μs <102KV.
 6. Housing insulation level lightning impulse >150KV.

CTY1.02.36-1

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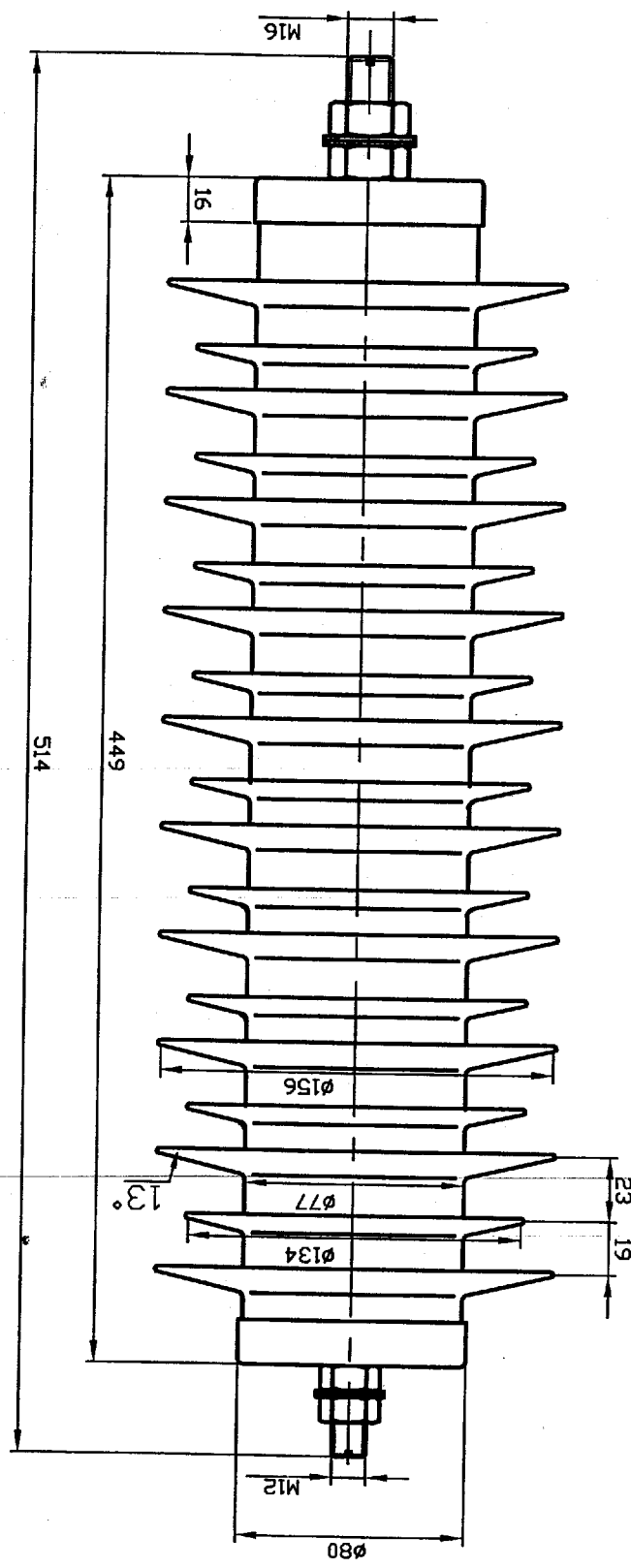
Auditing	Shunyu Zhao	Date	2006-03-31	No.	Page	Total	Page	CTY1.02.39-1
Drawing	Yong Zheng	Check	Jianhua Hou	Fig.No.	QTY	Scale	Wight	Exterior drawing
Mark	QTY	Change File No.	Sig.	Date	Metal Oxide Surge Arrester without gaps YH10W-39/110.5			



- Technical Data**
1. Applicable standard IEC60099-4(2004)
 2. Rated voltage 39KV.
 3. Continuous operating voltage 31.2KV.
 4. Power frequency reference voltage >39KV.
 5. Residual voltage at lightning impulse 8/20 μs <110.5KV.
 6. Housing insulation level lightning impulse >155KV.

CTY1.02.39-1

Auditing	Shunyu Zhao	Date	2006-03-31	No.	Page	Total	Page	Page
	Technics	Sancton	Xiao'ou Zheng					
Design	Jianhua Hou	Check	Fig.No.	QTY	Scale	Wight	Wight	Page
	Drawing							
Mark	QTY	Change File No.	Sig.	Date	Metal Oxide Surge Arrester without gaps YHSW-42/119			
Wenzhou CANTOR H.V.Electric Manufacturing Co.,LTD. Exterior drawing CTY1.02.42-1								



- Technical Data**
1. Applicable standard IEC60099-4(2004)
 2. Rated voltage 42kV.
 3. Continuous operating voltage 33.6kV.
 4. Power frequency reference voltage >42kV.
 5. Residual voltage at lightning impulse 8/20 μs <119kV.
 6. Housing insulation level lightning impulse >160kV.

CTY1.02.42-1

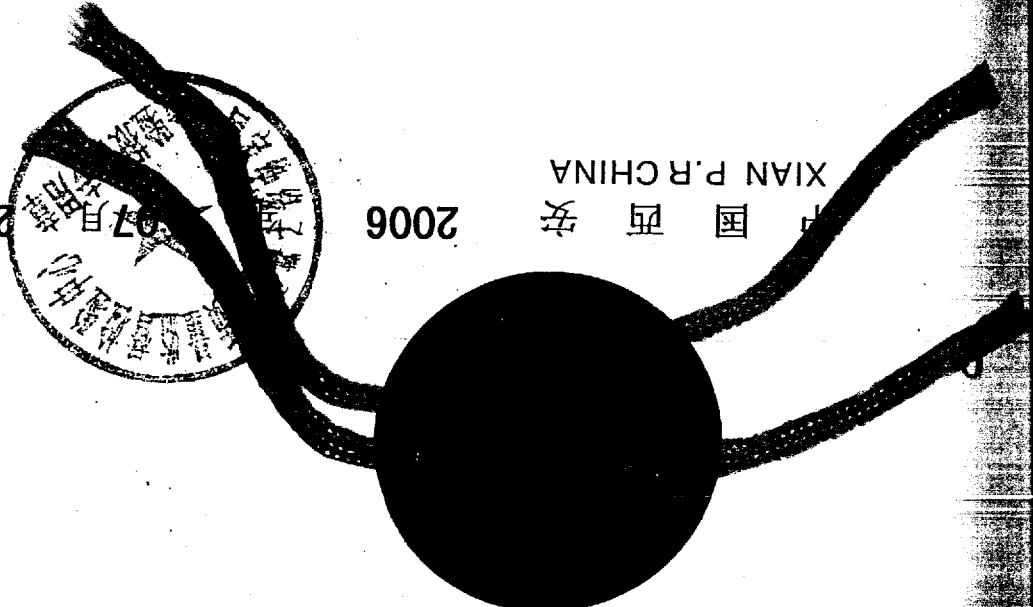
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国家绝缘子避雷器质量监督检验中心
 CHINA NATIONAL CENTRE FOR QUALITY SUPERVISION
 AND TEST OF INSULATORS AND SURGE ARRESTERS

检验报告 TEST REPORT

Object 产品名称 YH10W-42/119 Polymeric Housed Metal
 Client 顾客名称 Wenzhou Cantor H. V. Electric
 Classification 检验类别 Type Test

中国西安 2006 年 7 月 21 日
 XIAN P.R.CHINA




No. WB-015-2006

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

TEST REPORT

NO.WB-015-2006

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Name	Polymeric Housed Metal Oxide Surge Arrester		Trade Mark	CANTOR
	Without Gaps			
Consignor	Wenzhou Cantor H.V.Electric Manufacturing Co.,LTD.		Manufacturer	Wenzhou Cantor H.V.Electric Manufacturing Co.,LTD.
Representative	Zheng Xiao-ou		Classification	Type Test
Address And Post Code	8-88# Xin Ye North Road Liu Shi Town Yue Qing City Zhe Jiang P.R.China		Telephone	0577-62767809
	325604		Fax.	0577-62767819
Quantity of Samples	Arrester:6,Ratio arrester:1, Section:30, Housing:1.		Samples Received Date	2006.3.20
Serial Number	Arrester:14222, 14223, 14225, 14229; Section:R1~R3, O1~O3, L1~L3, A1~A3; Ratio arrester:11521; Housing:H.		Test Date	2006.3.21~2006.06.08
	IEC 60099-4:2004-05 Metal-oxide surge arresters without gaps for a.c. systems		All test items see page 2 of this report.	
Test Judge	Test Items			
Test Conclusion	This surge arrester pass all 8 items of type test and is deemed satisfactory to meet standards specifications.			
	 Confirmed on 2006.3.20 (Official sign)			
Remarks	1. The height of arrester is 451 mm, diameter of 89 mm, diameter of 9 small sheds is 132 mm.			
	2. The size of resistors is $\Phi 53 \times 22$ mm.			
3. The arrester has 14 resistors.				

Approved:  Checked:  Editor:  Test-leader: 

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Type Test Items

No.	Test Items	Req.	Test Data	Result
1	Power frequency reference voltage test	Voltage at $1mA \geq 42kV \cdot (\text{peak}/\sqrt{2})$	44kV	passed
2	Partial discharge test	≤ 10 pC	1 pC	passed
3	Residual voltage test	$8/20\mu s U_{10kA} \leq 119$ kV $1/10\mu s U_{10kA} \leq 137.2$ kV $30/60\mu s U_{10kA} \leq 102.2$ kV	112 kV 115.1 kV 87.5 kV	passed
4	Long duration current impulse withstand test	Should pass Class 1 line discharge, 18 times	passed	passed
5	Operating duty test	4/10 μs , 100 kA	passed	passed
6	Insulation withstand test	Lightning impulse withstand 160 kV, 15 times positive and negative; Power frequency voltage (wet) withstand 80 kV, 1 min	passed	passed
7	Moisture ingress test	Withstand 60°C \leftrightarrow -25°C \leftrightarrow 45°C \leftrightarrow -40°C heat-cool, boiling 42h in boiled 0.1%NaCl water; immersing 50°C water, test within 8 h after take out	passed	passed
8	Weather ageing test	Applied Uc 1000 hours in salt fog	passed	passed

Test Conclusion: Satisfied.

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1 Power Frequency Reference Voltage Test

No.	14225	14229	14223	Req.
A.C. reference voltage at 1mA (kV, peak/ $\sqrt{2}$)	44	44	44	≥ 42

Test Conclusion: Satisfied.

2 Partial Discharge Test

No.	14229	14225	14223	Req.
Applied voltage kV(r.m.s)	35.3	35.3	35.3	≤ 10
P.D. Value pC	1	1	1	

Test Conclusion: Satisfied.

3 Residual Voltage Test (wave shape see Fig1~Fig9) $n=14$

3.1 8/20 μ s lightning impulse current residual voltage

No.	Residual voltage of sections kV			Equivalent residual voltage of arresters at 10 kA kV	Req. kV
	5 kA	10 kA	20 kA		
R1	7.32	7.94	8.77	112	≤ 119
R2	7.29	7.93	8.72		
R3	7.33	7.97	8.75		

3.2 30/60 μ s switching impulse current residual voltage

No.	Residual voltage of sections at 500A kV			Residual voltage of arresters at 500 A kV	Req. kV
	R1	R2	R3		
R1	6.24	6.23	6.25	87.5	≤ 102.2
R2	6.23	6.23	6.25		
R3	6.24	6.23	6.25		

3.3 1/10 μ s steep impulse current residual voltage

No.	Residual voltage of sections at 10kA kV			Residual voltage of arresters at 10 kA kV	Req. kV
	R1	R2	R3		
R1	8.22	8.04	8.22	115.1	≤ 137.2
R2	8.04	8.04	8.22		
R3	8.22	8.04	8.22		

Test Conclusion: Satisfied.



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4 Long Duration Current Impulse Withstand Test

(Class 1 line discharge)

(wave shape see Fig10~Fig12)

No.	U _{10kA, before}		U _r		U _{125A}		Time
	kV	7.99	kV	3.00	kV	5.98	
L1	248	7.92	253	3.00	248	5.91	2080
	248	7.92	253	3.00	248	5.86	2080
	248	7.92	253	3.00	248	5.86	2080
1st.	Current	248	253	248	248	248	2.98
	Voltage	5.86	5.86	5.86	5.86	5.86	/
	Energy	3.02	3.08	3.02	3.02	3.02	/
2nd.	Current	248	248	248	248	248	2.98
	Voltage	5.86	5.86	5.86	5.86	5.86	/
	Energy	3.02	3.02	3.02	3.02	3.02	/
3th.	Current	248	248	248	248	248	2.98
	Voltage	5.86	5.86	5.86	5.86	5.86	/
	Energy	3.02	3.02	3.02	3.02	3.02	/
4th.	Current	248	248	248	248	248	2.98
	Voltage	5.86	5.86	5.86	5.86	5.86	/
	Energy	3.02	3.02	3.02	3.02	3.02	/
5th.	Current	248	248	248	248	248	2.98
	Voltage	5.86	5.86	5.86	5.86	5.86	/
	Energy	3.02	3.02	3.02	3.02	3.02	/
6th.	Current	248	248	248	248	248	2.98
	Voltage	5.86	5.86	5.86	5.86	5.86	/
	Energy	3.02	3.02	3.02	3.02	3.02	/
7th.	Current	248	248	248	248	248	2.98
	Voltage	5.86	5.86	5.86	5.86	5.86	/
	Energy	3.02	3.02	3.02	3.02	3.02	/
8th.	Current	248	248	248	248	248	2.98
	Voltage	5.86	5.86	5.86	5.86	5.86	/
	Energy	3.02	3.02	3.02	3.02	3.02	/
9th.	Current	248	248	248	248	248	2.98
	Voltage	5.86	5.86	5.86	5.86	5.86	/
	Energy	3.02	3.02	3.02	3.02	3.02	/
10th.	Current	248	248	248	248	248	2.98
	Voltage	5.86	5.86	5.86	5.86	5.86	/
	Energy	3.02	3.02	3.02	3.02	3.02	/
11th.	Current	248	248	248	248	248	2.98
	Voltage	5.86	5.86	5.86	5.86	5.86	/
	Energy	3.02	3.02	3.02	3.02	3.02	/
12th.	Current	248	248	248	248	248	2.98
	Voltage	5.86	5.86	5.86	5.86	5.86	/
	Energy	3.02	3.02	3.02	3.02	3.02	/

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No.	Checking samples				U _{10kA} , after		Varty of U _{10kA} %
	Current	Voltage	Energy	Current	Voltage	Energy	
13th.	A	248	248	248	5.86	3.02	1.0
	kV	5.86	5.86	5.86	5.86	3.02	1.0
	Energy	3.02	3.02	3.02	3.02	3.02	1.0
14th.	A	248	248	248	5.86	3.02	1.0
	kV	5.86	5.86	5.86	5.86	3.02	1.0
	Energy	3.02	3.02	3.02	3.02	3.02	1.0
15th.	A	248	248	248	5.86	3.02	1.0
	kV	5.86	5.86	5.86	5.86	3.02	1.0
	Energy	3.02	3.02	3.02	3.02	3.02	1.0
16th.	A	248	248	248	5.86	3.02	1.0
	kV	5.86	5.86	5.86	5.86	3.02	1.0
	Energy	3.02	3.02	3.02	3.02	3.02	1.0
17th.	A	248	248	248	5.86	3.02	1.0
	kV	5.86	5.86	5.86	5.86	3.02	1.0
	Energy	3.02	3.02	3.02	3.02	3.02	1.0
18th.	A	248	248	248	5.86	3.02	1.0
	kV	5.86	5.86	5.86	5.86	3.02	1.0
	Energy	3.02	3.02	3.02	3.02	3.02	1.0
	L1	L2	L3				

Test Conclusion: Satisfied.

5 Operating Duty Test

5.1 Accelerated ageing test

5.1.1 The parameters of arrester

U_r=42 kV(r.m.s); U_c=33.6 kV(r.m.s); U_{10kA} ≤ 119 kV; H=0.451m.

5.1.2 The parameters of test

U_c=2.4 kV; U_{ct}=U_c(1+0.15H)=2.56 kV; Testing time: 1000h.

No.	A1	A2	A3	Req.
U _{ct} kV(r.m.s)	2.56	2.56	2.56	2.56
Time h	1000	1000	1000	1000

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5.1.3 The data of test

Temperature °C	A3	A2	A1	Power losses	
				No.	Time
114.0	1.872	1.863	2.167	19:05	2006.3.24
115.0	1.828	1.853	2.160	19:36	2006.3.24
115.0	1.832	1.874	2.206	20:06	2006.3.24
114.0	1.887	1.932	2.285	20:36	2006.3.24
113.0	1.814	1.851	2.193	21:06	2006.3.24
114.0	1.620	1.588	1.921	09:06	2006.3.25
114.0	1.707	1.625	2.022	09:07	2006.3.26
115.0	1.706	1.604	2.027	17:10	2006.3.27
115.0	1.679	1.553	1.985	17:10	2006.3.28
115.0	1.661	1.514	1.955	17:10	2006.3.29
114.0	1.692	1.514	1.980	17:11	2006.3.30
114.5	1.730	1.540	2.038	17:11	2006.3.31
114.5	1.719	1.516	2.023	17:12	2006.4.1
114.3	1.780	1.558	2.102	17:12	2006.4.2
114.5	1.738	1.513	2.055	17:13	2006.4.3
114.5	1.751	1.514	2.066	17:13	2006.4.4
114.5	1.814	1.560	2.149	17:13	2006.4.5
114.3	1.834	1.566	2.183	17:14	2006.4.6
114.4	1.817	1.548	2.171	17:14	2006.4.7

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time	Power losses w	NO.	A1	A2	A3	试验温度 ℃
			1.578	1.578	1.858	
2006.4.8 17:57	2.243	2.243	1.567	1.851	114.5	
2006.4.9 21:58	2.243	2.243	1.567	1.851	114.5	
2006.4.10 4:58	2.157	2.157	1.518	1.787	114.5	
2006.4.11 1:29	2.187	2.187	1.528	1.806	114.5	
2006.4.12 9:30	2.239	2.239	1.548	1.841	114.5	
2006.4.13 9:31	2.263	2.263	1.560	1.861	114.5	
2006.4.14 2:50	2.232	2.232	1.536	1.834	114.5	
2006.4.15 10:50	2.249	2.249	1.543	1.846	114.5	
2006.4.16 10:51	2.144	2.144	1.470	1.760	114.5	
2006.4.17 2:51	2.113	2.113	1.445	1.727	114.5	
2006.4.18 10:52	2.334	2.334	1.564	1.887	114.4	
2006.4.19 2:52	2.362	2.362	1.578	1.908	114.5	
2006.4.20 10:53	2.367	2.367	1.568	1.903	114.4	
2006.4.21 18:54	2.387	2.387	1.568	1.906	114.6	
2006.4.22 10:54	2.418	2.418	1.582	1.928	114.6	
2006.4.23 2:55	2.393	2.393	1.563	1.904	114.5	
2006.4.24 18:56	2.474	2.474	1.590	1.945	114.5	
2006.4.25 2:56	2.051	2.051	1.606	1.969	114.6	
2006.4.26 2:57	2.468	2.468	1.582	1.942	114.6	
2006.4.27 2:57	2.532	2.532	1.615	1.989	114.5	
2006.4.28 2:58	2.445	2.445	1.554	1.912	114.6	
2006.4.29 2:59	2.469	2.469	1.559	1.922	114.5	
2006.4.30 10:59	2.518	2.518	1.578	1.945	114.5	
2006.5.1 11:00	2.503	2.503	1.553	1.914	114.6	
2006.5.2 11:01	2.530	2.530	1.560	1.925	114.6	
2006.5.3 11:01	2.632	2.632	1.610	1.992	114.7	
2006.5.4 11:02	2.578	2.578	1.566	1.941	114.8	
2006.5.5 11:05	2.370	2.370	1.457	1.793	114.6	
Pict	2.285	1.932	1.887	AI:P2ct>P1ct		
P2ct	2.370	1.457	1.793	P2ct>I,IP3ct		
P3ct	1.955	1.514	1.661	A2,A3:P1ct>P2ct		
Kct	1.037					

stop test



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time	Power losses w	NO.	A1	A2	A3	试验温度 ℃
			1.578	1.578	1.858	
2006.4.8	17:57	2.243	1.578	1.578	1.858	114.4
2006.4.9	21:58	2.243	1.567	1.567	1.851	114.5
2006.4.10	4:58	2.157	1.518	1.518	1.787	114.5
2006.4.11	1:29	2.187	1.528	1.528	1.806	114.5
2006.4.12	9:30	2.239	1.548	1.548	1.841	114.5
2006.4.13	9:31	2.263	1.560	1.560	1.861	114.5
2006.4.14	2:50	2.232	1.536	1.536	1.834	114.5
2006.4.15	10:50	2.249	1.543	1.543	1.846	114.5
2006.4.16	10:51	2.144	1.470	1.470	1.760	114.5
2006.4.17	2:51	2.113	1.445	1.445	1.727	114.5
2006.4.18	10:52	2.334	1.564	1.564	1.887	114.4
2006.4.19	2:52	2.362	1.578	1.578	1.908	114.5
2006.4.20	10:53	2.367	1.568	1.568	1.903	114.4
2006.4.21	18:54	2.387	1.568	1.568	1.906	114.6
2006.4.22	10:54	2.418	1.582	1.582	1.928	114.6
2006.4.23	2:55	2.393	1.563	1.563	1.904	114.5
2006.4.24	18:56	2.474	1.590	1.590	1.945	114.5
2006.4.25	2:56	2.051	1.606	1.606	1.969	114.6
2006.4.26	2:57	2.468	1.582	1.582	1.942	114.6
2006.4.27	2:57	2.532	1.615	1.615	1.989	114.5
2006.4.28	2:58	2.445	1.554	1.554	1.912	114.6
2006.4.29	2:59	2.469	1.559	1.559	1.922	114.5
2006.4.30	10:59	2.518	1.578	1.578	1.945	114.5
2006.5.1	11:00	2.503	1.553	1.553	1.914	114.6
2006.5.2	11:01	2.530	1.560	1.560	1.925	114.6
2006.5.3	11:01	2.632	1.610	1.610	1.992	114.7
2006.5.4	11:02	2.578	1.566	1.566	1.941	114.8
2006.5.5	11:05	2.370	1.457	1.457	1.793	114.6
Pict	2.285	1.932	1.887	AI:P2ct>P1ct		
P2ct	2.370	1.457	1.793	P2ct>1.1P3ct		
P3ct	1.955	1.514	1.661	A2, A3:P1ct>P2ct		
Kct	1.037					

stop test



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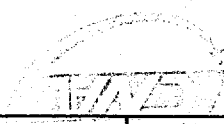
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5.2 High current impulse operating duty test (wave shape see Fig13-Fig21)

No.	01	02	03
8/20 μ s, U _{10kA} , before	7.84	7.90	7.87
U _r	3.00	3.00	3.00
U _c	2.40	2.40	2.40
P _{1c}	0.125	0.070	0.084
P _{2c}	0.130	0.073	0.087
U _c *	2.44	2.41	2.41
P _{1r}	0.555	0.380	0.490
P _{2r}	0.576	0.394	0.508
U _r *	3.01	3.01	3.02
Condition	Applied 1.2U _c *=2.93kV, 8/20 μ s, I _n =10 kA, 45° before peak		
test	Times	20	20
4/10 μ s high current impulse	1st. current	101.6	101.6
	2nd. Current	98.4	99.2
Applied power frequency voltage within 41.6 ms			
Applied U _r *	3.02	3.02	3.02
Power losses (max) at U _r *	1.95	2.85	3.45
Applied U _c *	2.44	2.44	2.44
Power losses at U _c * W	1 min	0.43	0.81
	10 min	0.29	0.46
	15 min	0.27	0.41
	25 min	0.25	0.33
	30 min	0.23	0.31
Checking samples	all right	all right	all right
8/20 μ s, U _{10kA} , after	7.75/7.69	7.81/7.85	7.88/7.87
Variety of U _{10kA}	1.1/1.9	1.1/0.6	0.1/0

Test Conclusion: Satisfied.



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6 Housing Insulation Withstand Test

6.1 Lightning impulse voltage withstand test (wave shape see Fig22-Fig23)

$P=973 \times 10^2$ Pa, $t_{dry}=15.5^\circ\text{C}$, $t_{wet}=11.5^\circ\text{C}$;

$K=0.9755$

No.	Req. KV	Test value KV	Adj. KV	Withstand times	Result	H	
						(+)	(-)
	160	160~168	164	15	passed	160	160
	160	160~172	164	15	passed	160	160

6.2 Power frequency insulation withstand test

$P=964 \times 10^2$ Pa, $t_{dry}=25.0^\circ\text{C}$, $t_{wet}=22.5^\circ\text{C}$; $t_{water}=22.5^\circ\text{C}$.

$P_{22.5}=99.1 \Omega \cdot \text{m}$, specific resistance of rain $P_{20}=104.1 \Omega \cdot \text{m}$.

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

$K=0.9920$

No.	Req. KV	Test value KV	Adj. KV	Keeping time min	Result
H	80	86	87	1	passed

Test Conclusion: Satisfied.

7 Moisture ingress test

7.1 Terminal torque test

$M=50 \text{ N} \cdot \text{m}$, withstand 30 s

7.2 Thermomechanical test

$F_1=147 \text{ N}$, $F_2=16.5 \text{ N}$, $F=(F_1+F_2)=163.5 \text{ N}$

No.	Test time	Temperature $^\circ\text{C}$	Applied angle degrees	Times h	Bend load N
14222	2006.04.17 16:20~2006.04.18 08:30(keeping)	60.0~-61.0	0	16	164
	2006.04.18 16:30~2006.04.19 08:40(keeping)	-25.0~-26.0	180	16	
	2006.04.19 16:10~2006.04.20 08:20(keeping)	45.0~-46.0	270	16	
	2006.04.20 16:40~2006.04.21 08:50(keeping)	-40.0~-41.0	90	16	
Req.	24h x 4	60 $^\circ\text{C}$ ~-25 $^\circ\text{C}$ 45 $^\circ\text{C}$ ~-40 $^\circ\text{C}$	0~360	≥ 16	163.5

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7.3 Water immersion test (wave shape see Fig24~Fig27)

No.	Boiling time (h)	Partial discharge value pc			Power losses W			Residual voltage of complete arrester at 5 kV kV		
		before	after	var.	before	after	var.	before	after	var.
14222	42	1	1	0	3.54	4.14	17	82.7	86.9	5.0
Req.	42	≤10			≤20			≤5		

Test Conclusion: Satisfied.

8 Weather ageing test

fog room: 10.83 m³
 temperature of fog room: 23.0°C~25.5°C
 water speed: (0.41~0.49)L/m³ · h NaCl in water: 5 kg/m³
 date of test: 2006.3.24~2006.5.5

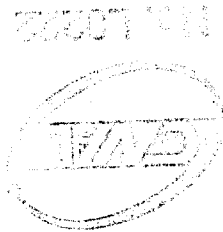
No.	Uc kV	Creep distance mm	Time h	Power frequency reference voltage at 1mA kV (peak/√2)			Partial discharge pc		
				before	after	var.	before	after	var.
11521	12	538	1007	15.4	15.3	0.6	1	1	0
Req.	12	/	≥1000	/			≤10		

Test Conclusion: Satisfied.

Testor: Zhang Yi-min, An Li, Wu Liang

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

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



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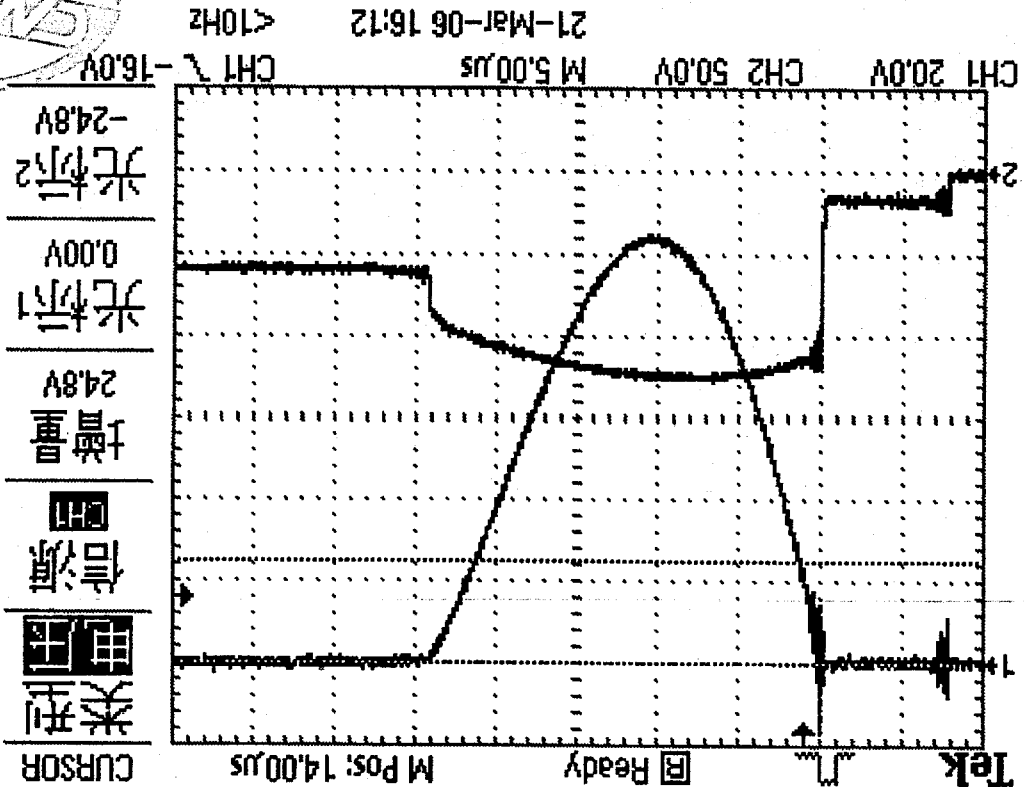


Fig. 1: R1 # 8/20µs 10kA



No. L0222

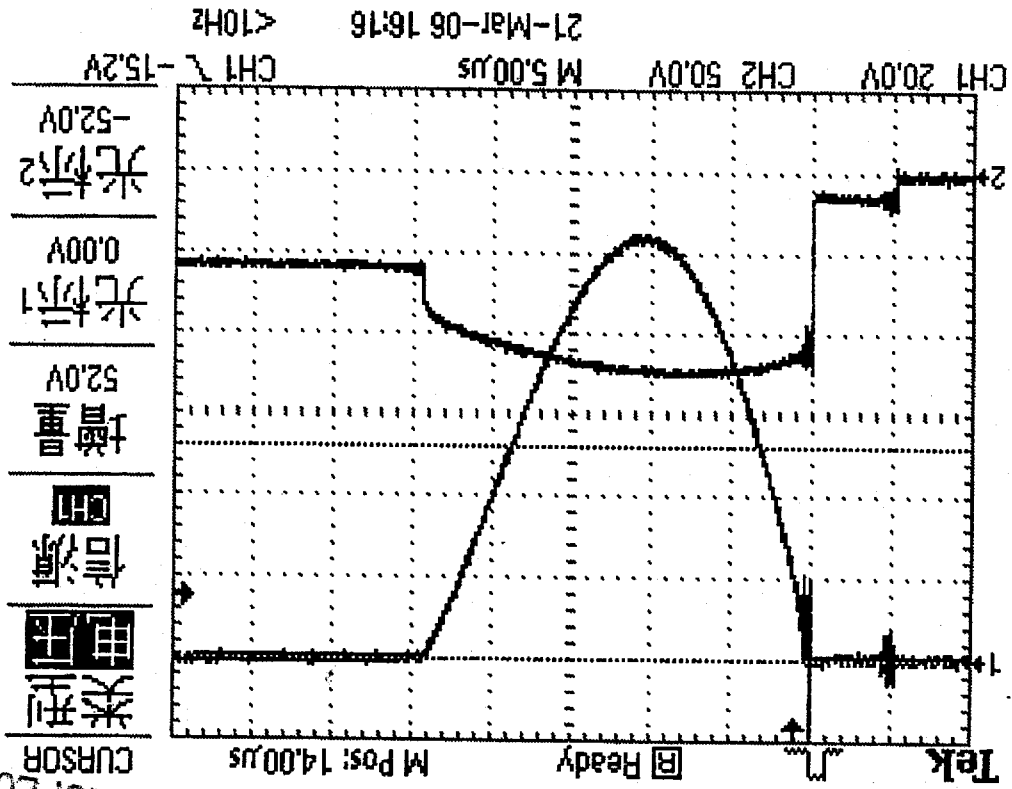


Fig. 2: R2 # 8/20µs 10kA

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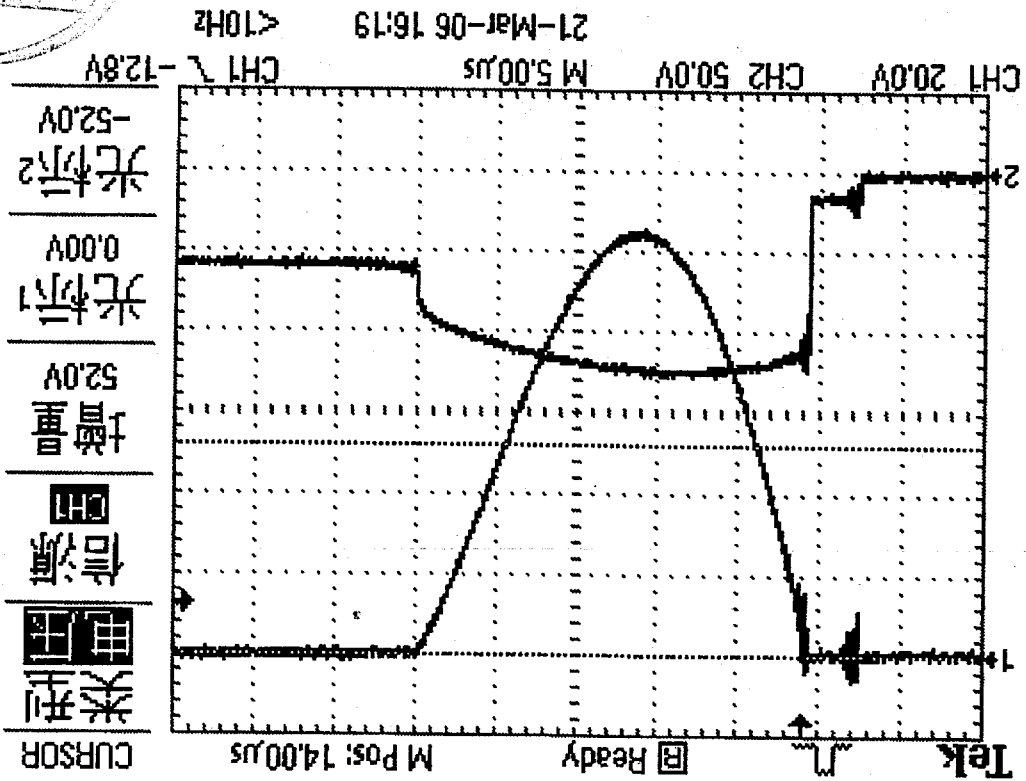


Fig. 3: R3 8/20µs 10kA

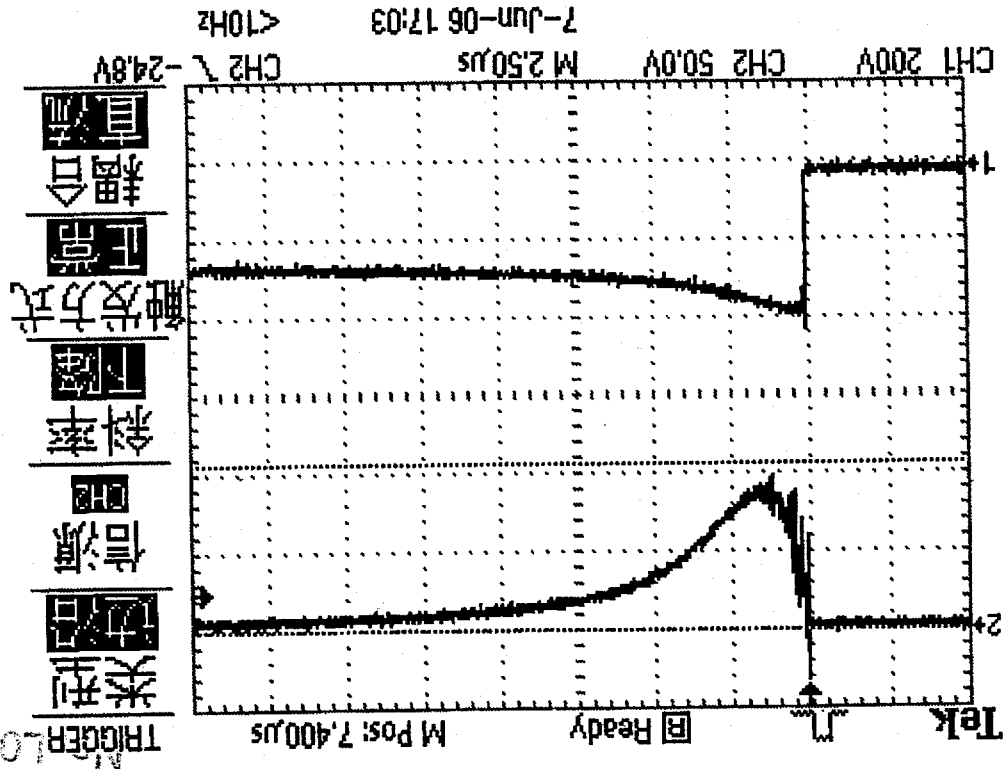


Fig. 4: R1 1/10µs 10kA

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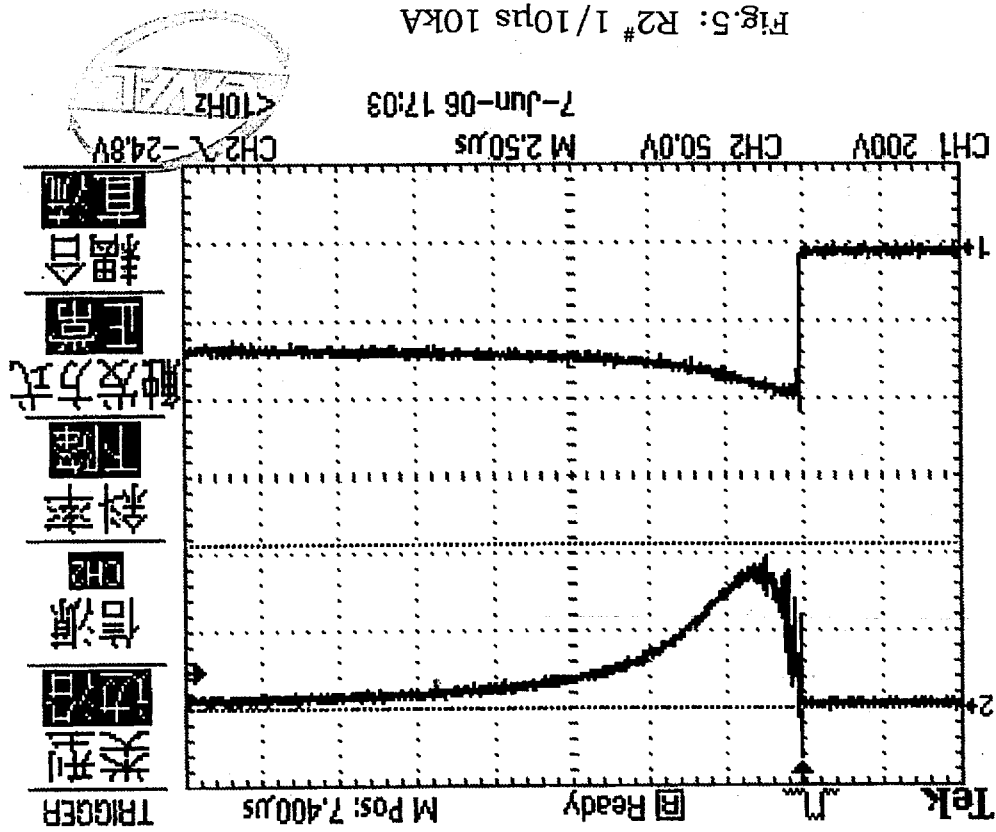


Fig. 5: R2 # 1/10µs 10kA

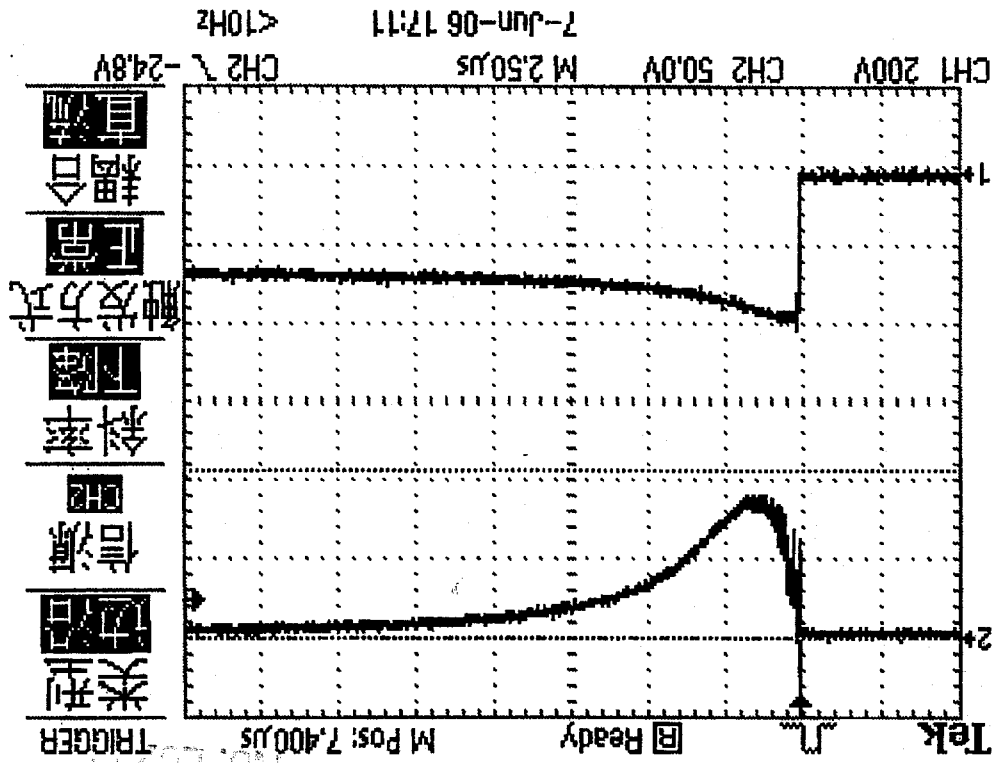


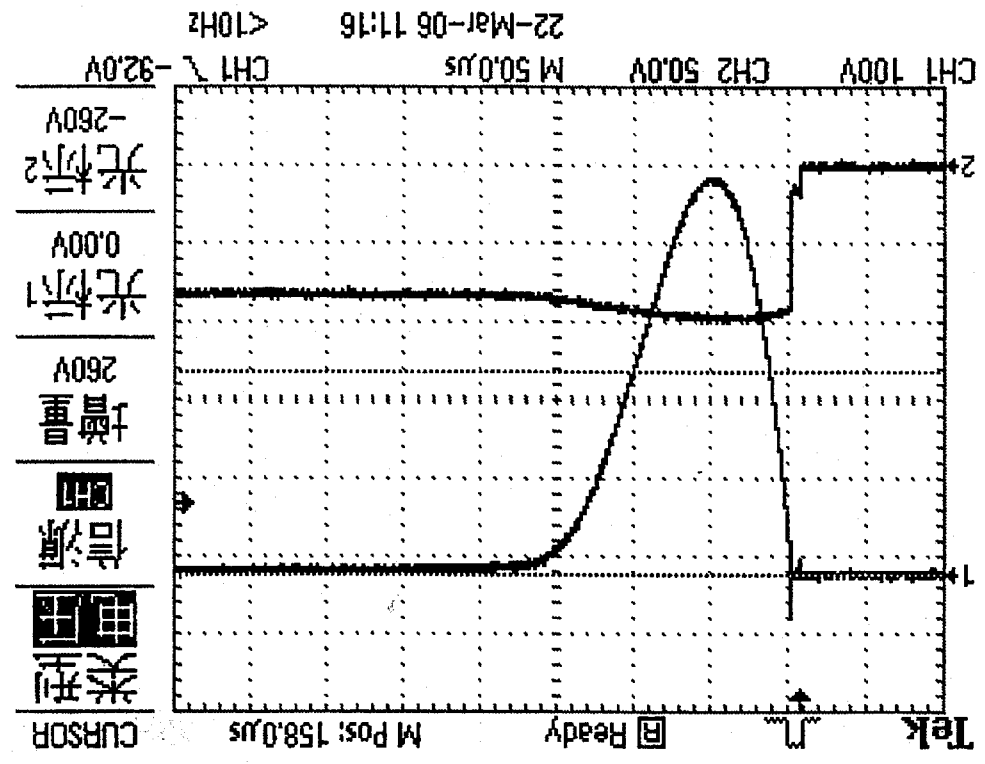
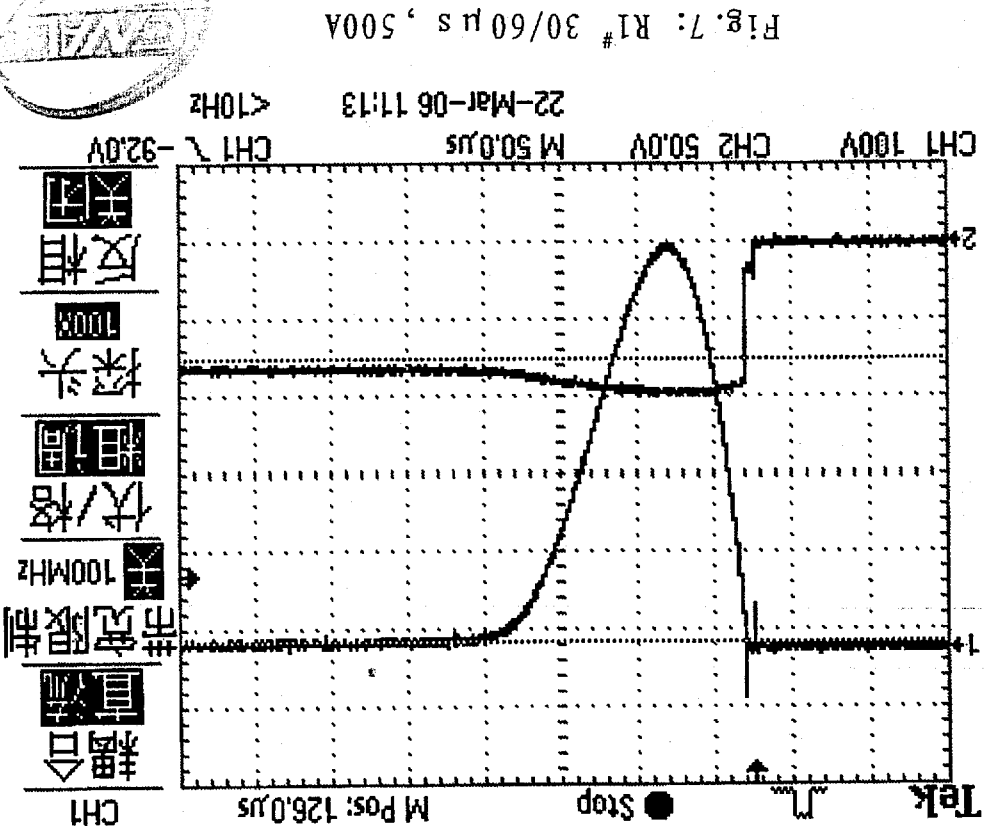
Fig. 6: R3 # 1/10µs 10kA

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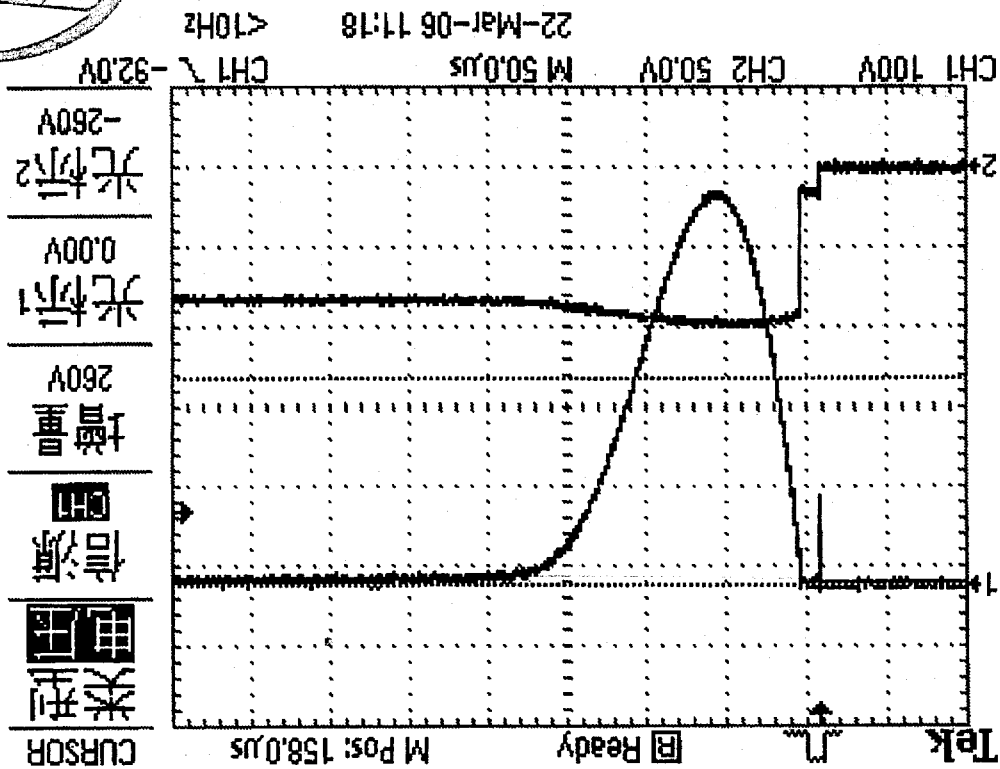


Fig. 9: R3 # 30/60 µs, 500A

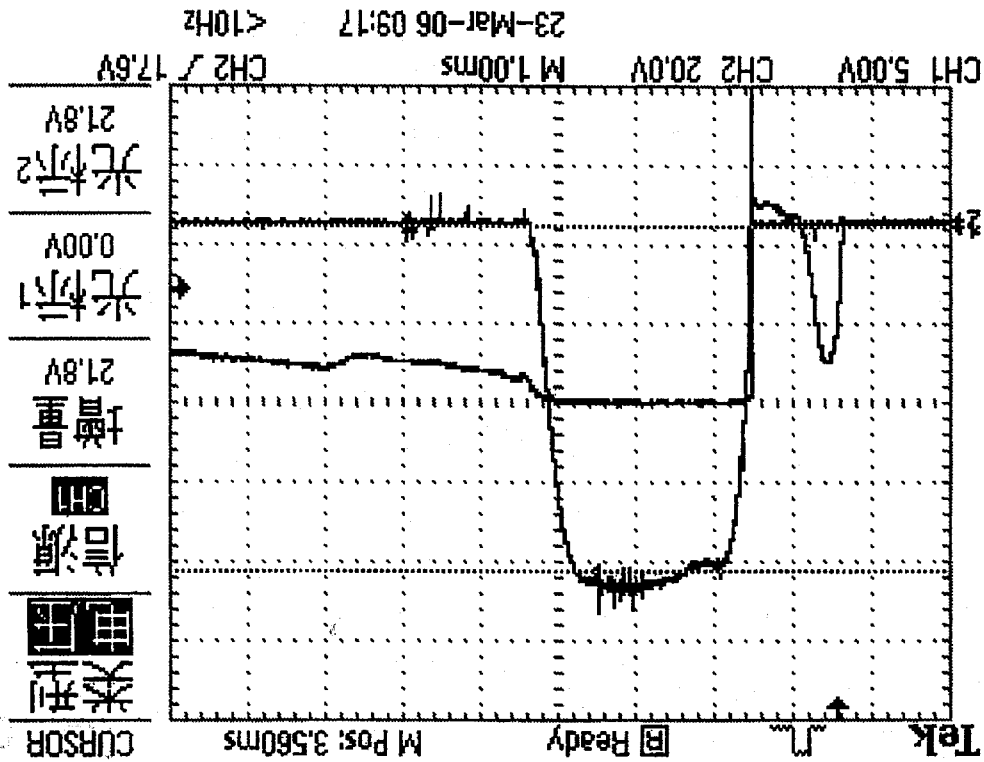


Fig. 10: L1 # Long Duration Current, 1st

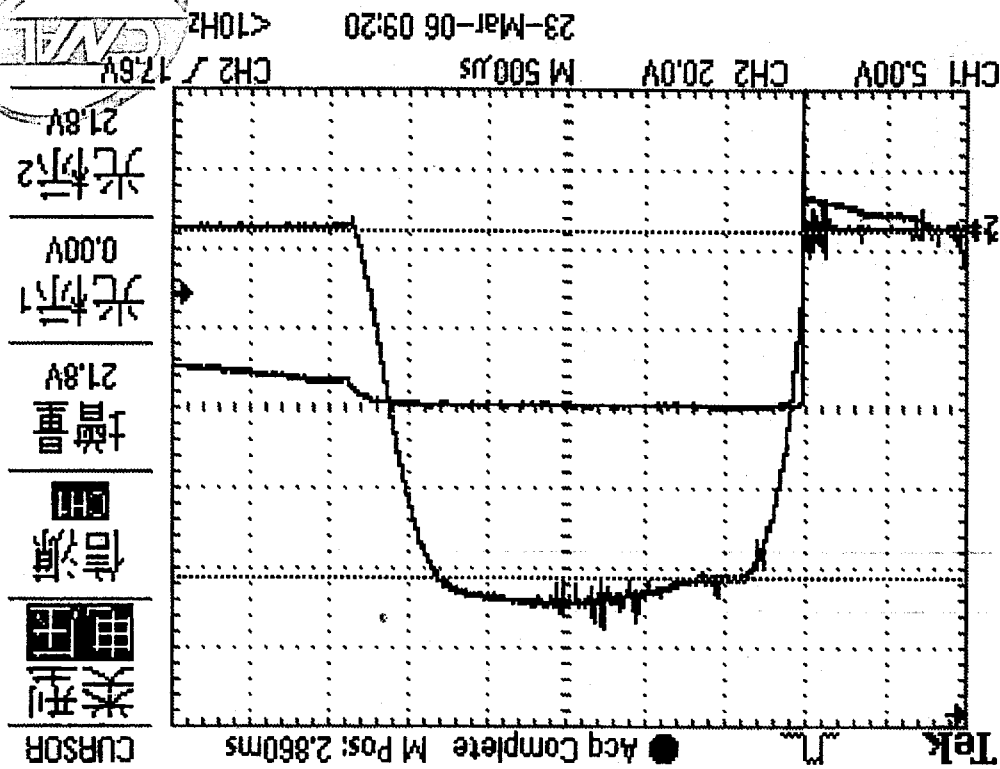


Fig. 11: L2# Long Duration Current, 1st

No. L0222

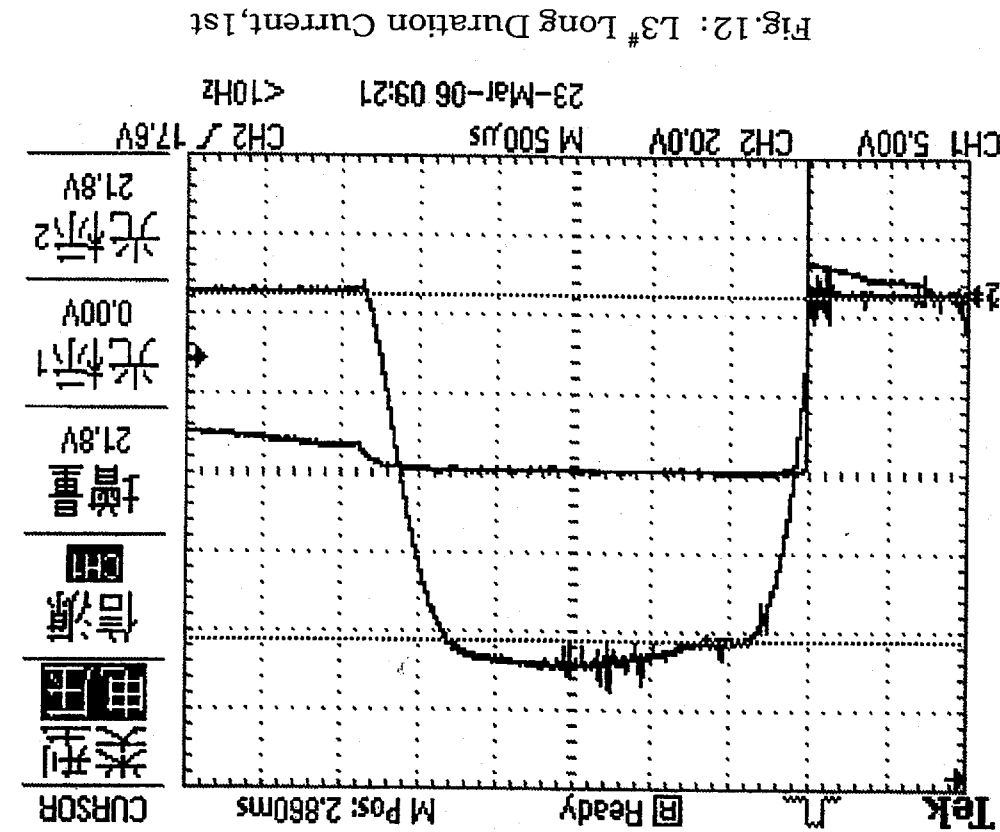


Fig. 12: L3# Long Duration Current, 1st

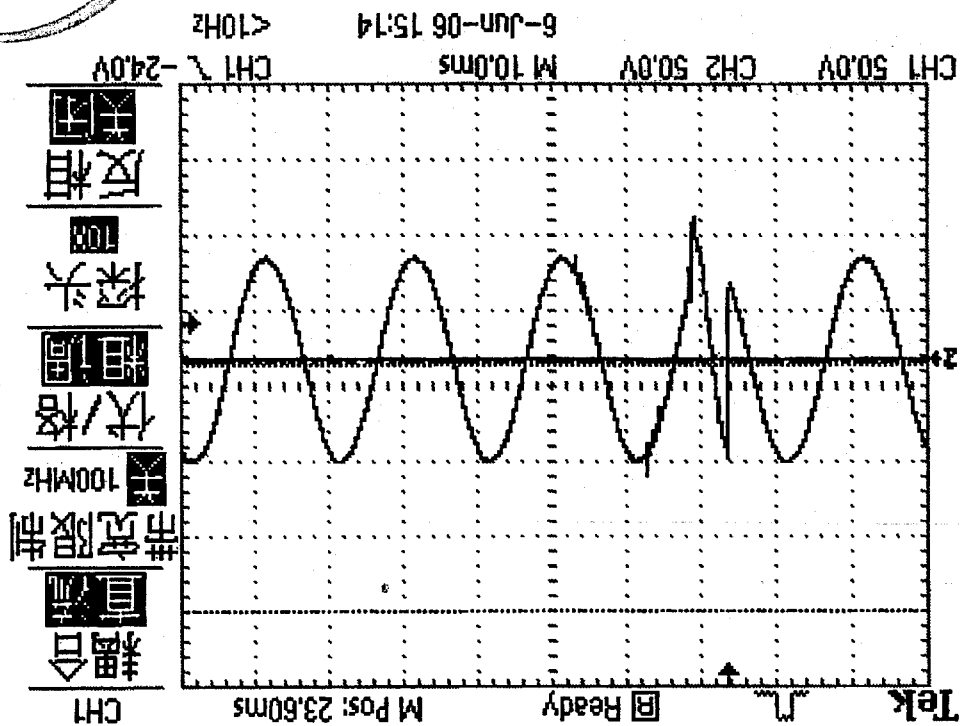


Fig. 13: 01 conditioning test, 10kA

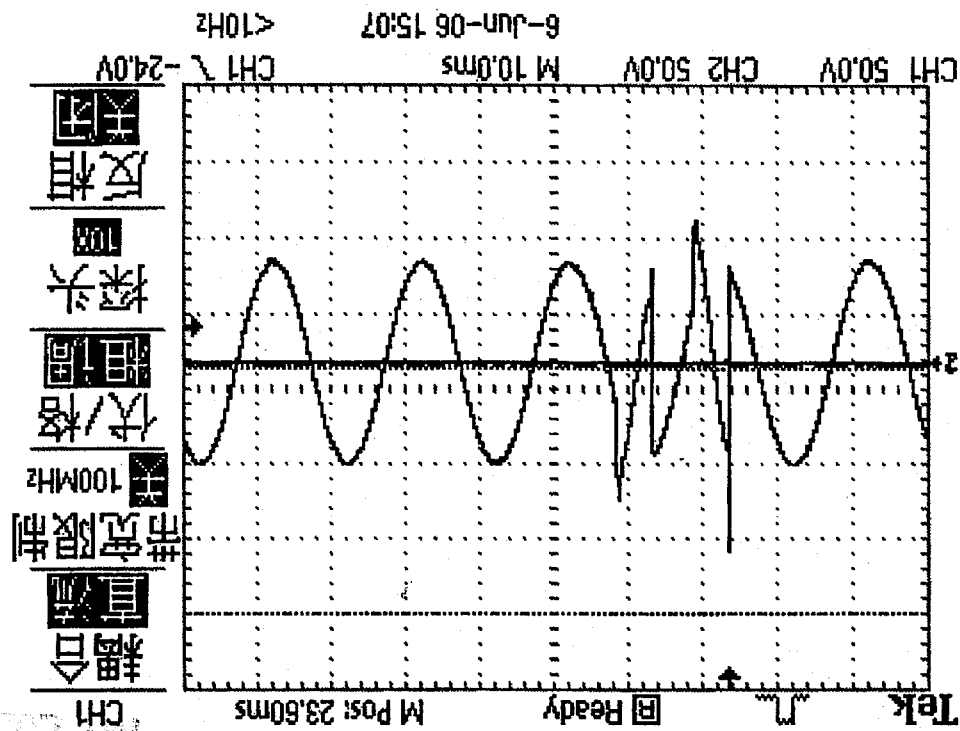


Fig. 14: 02 conditioning test, 10kA

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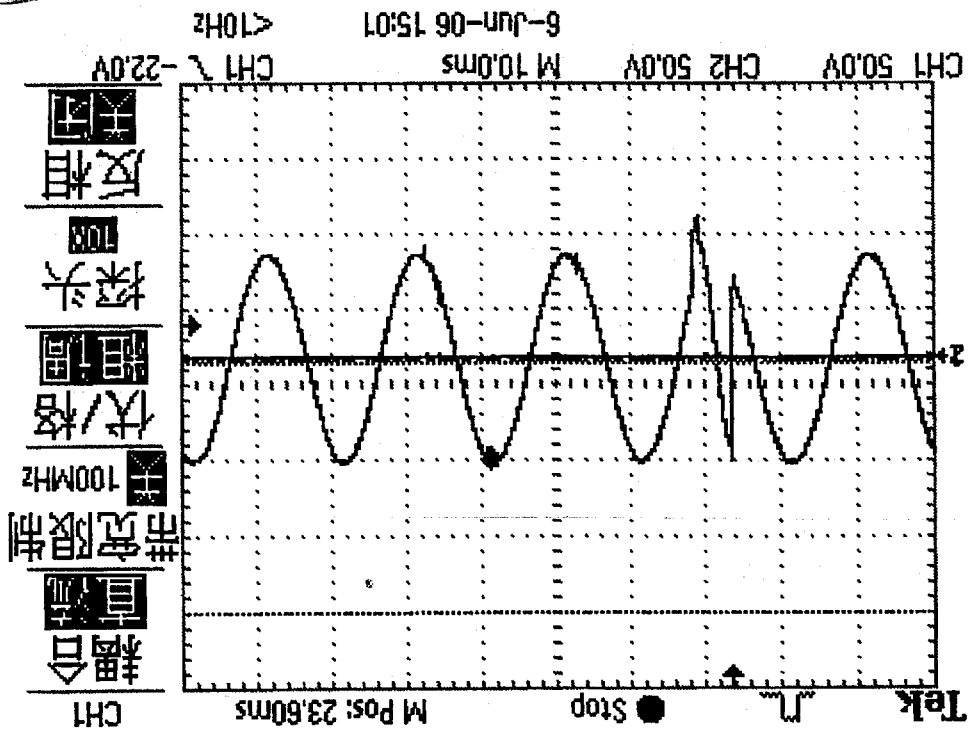


Fig. 15: 03# conditioning test, 10kA

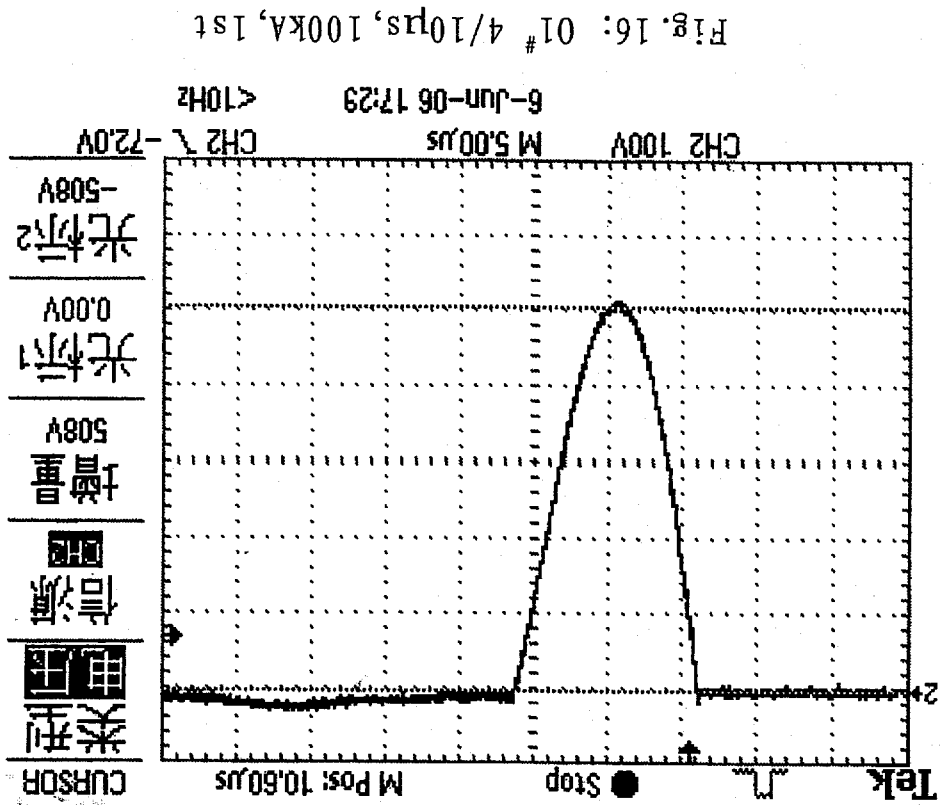
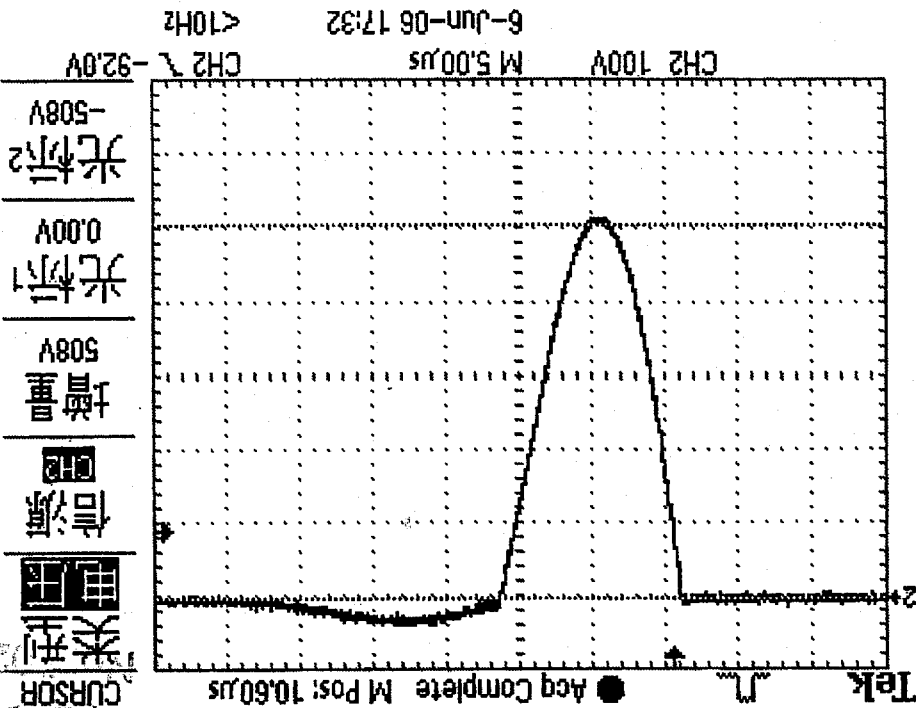
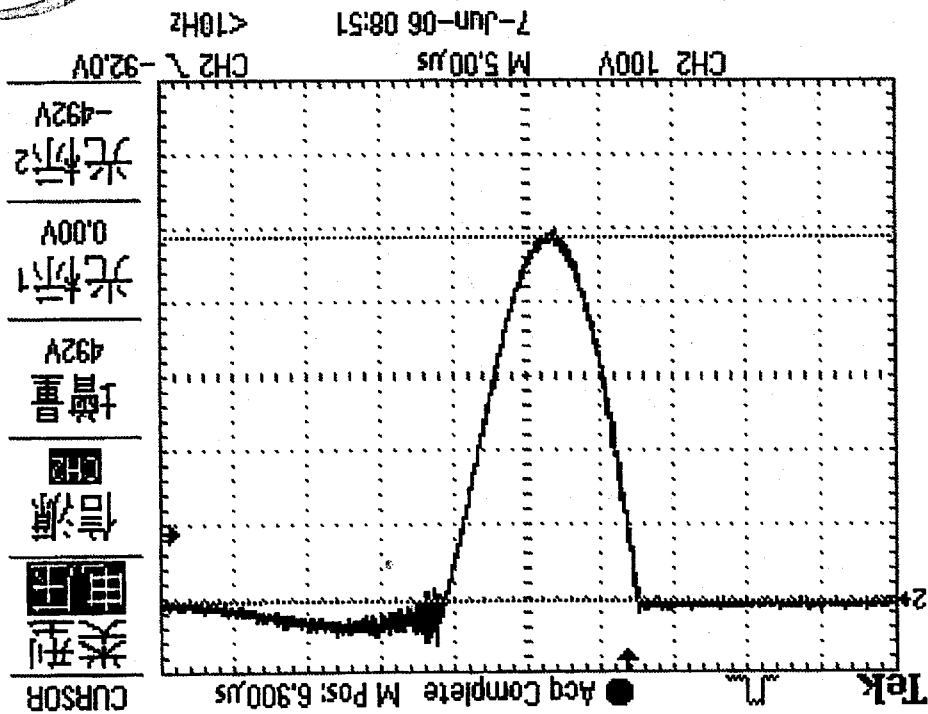


Fig. 16: 01# 4/10us, 100kA, 1st

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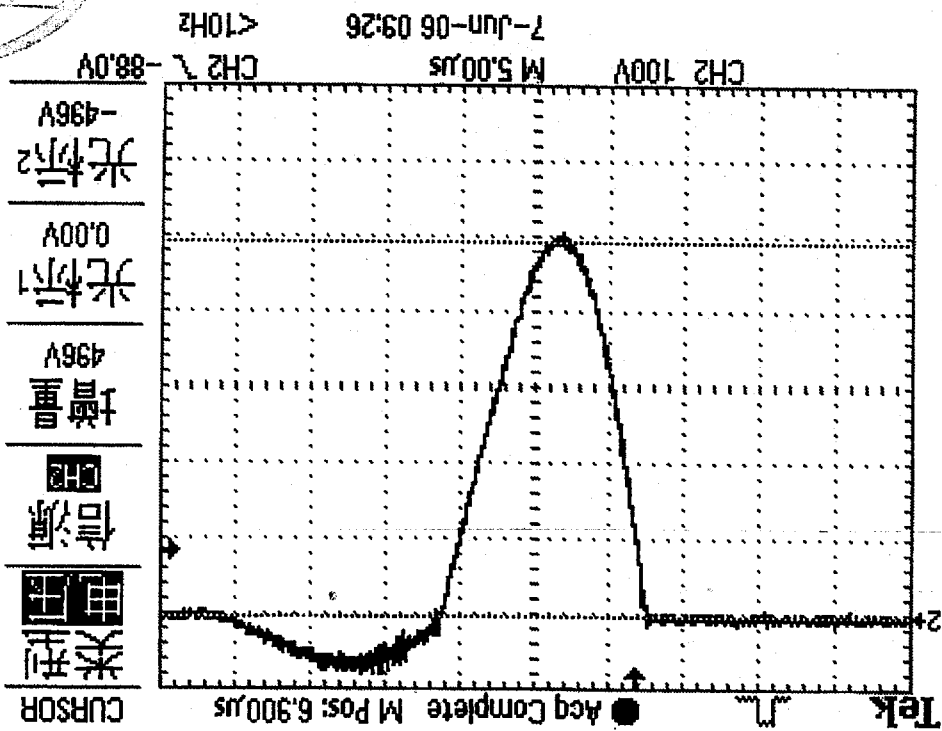


Fig. 19: 02 # 4/10µs, 100kA, 2nd

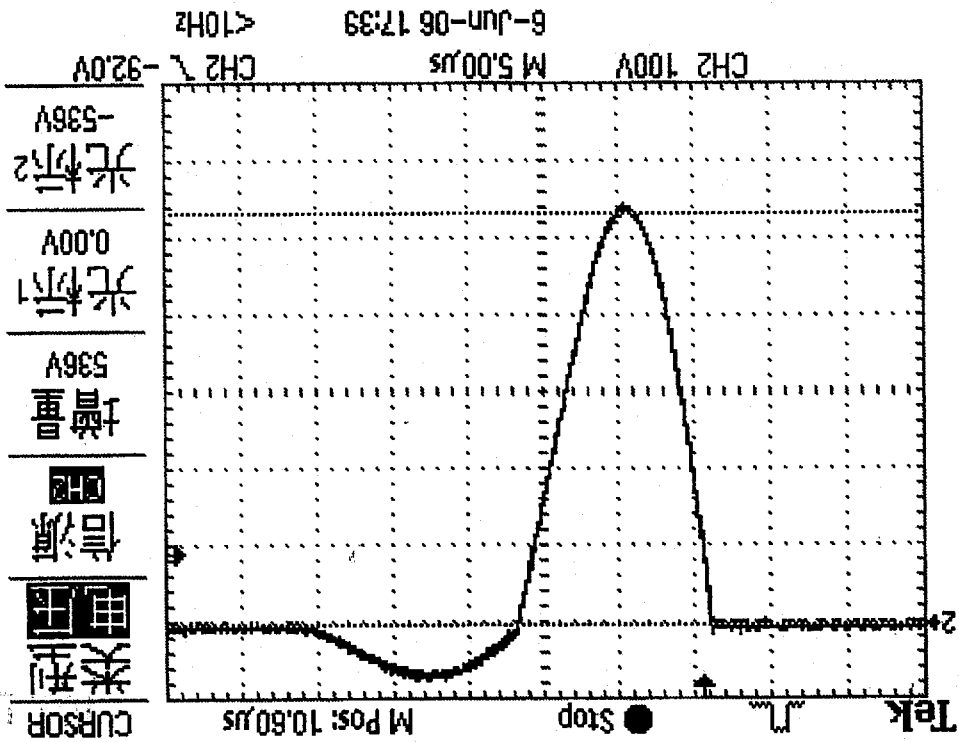


Fig. 20: 03 # 4/10µs, 100kA, 1st

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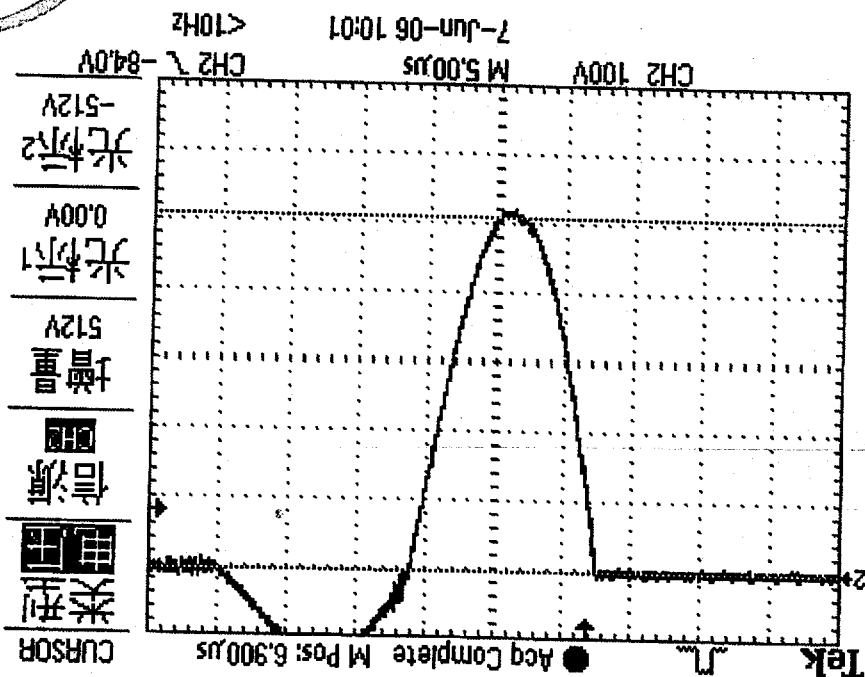


Fig. 21: 03 # 4/10µs, 100kA, 2nd

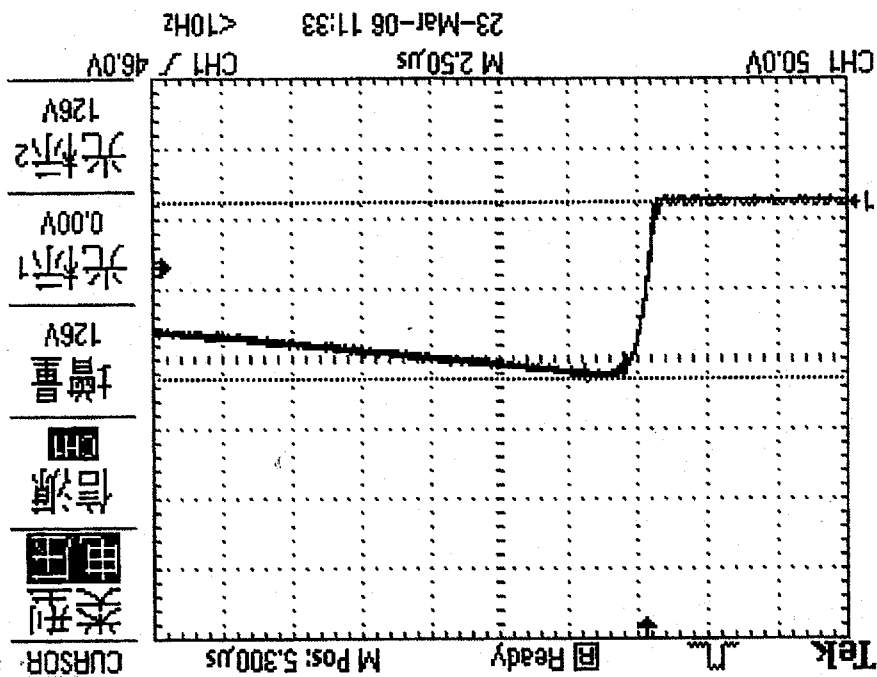


Fig. 22: H# wave of 1.2/50µs impulse voltage

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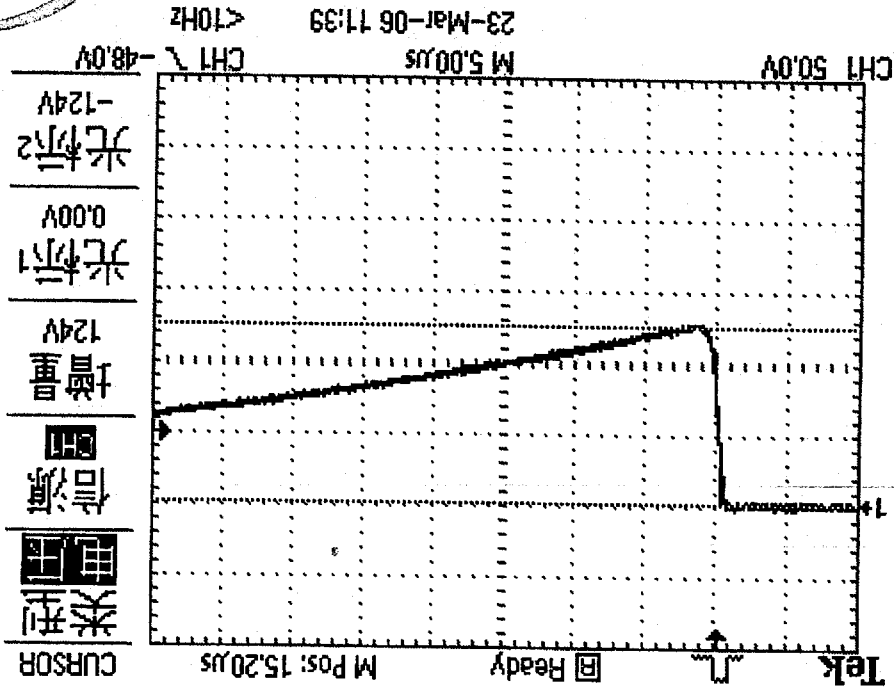


Fig. 23: H# wave of 1.2/50µs impulse voltage

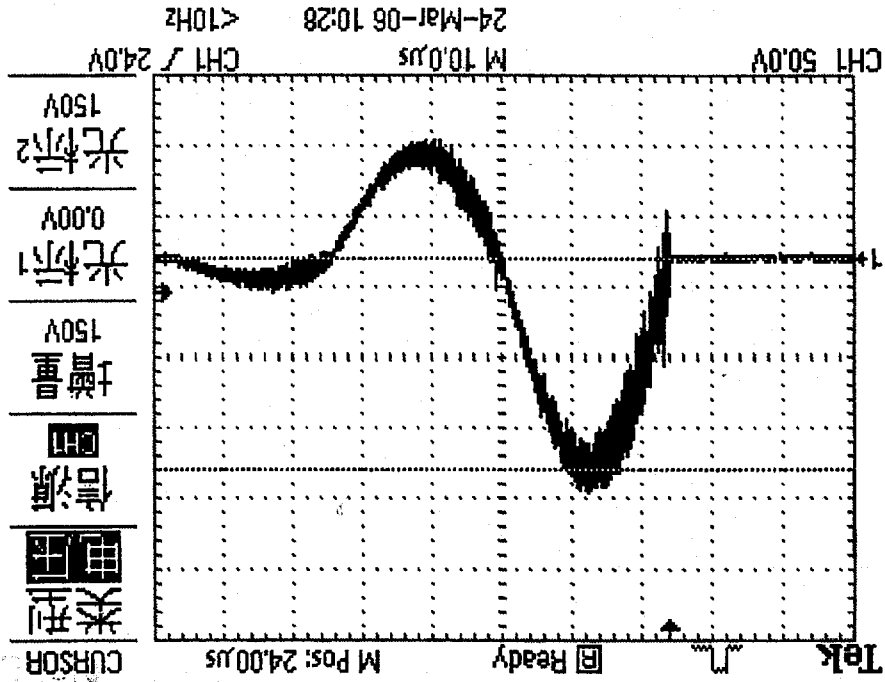


Fig. 24: 14222# the current wave before moisture ingrees test

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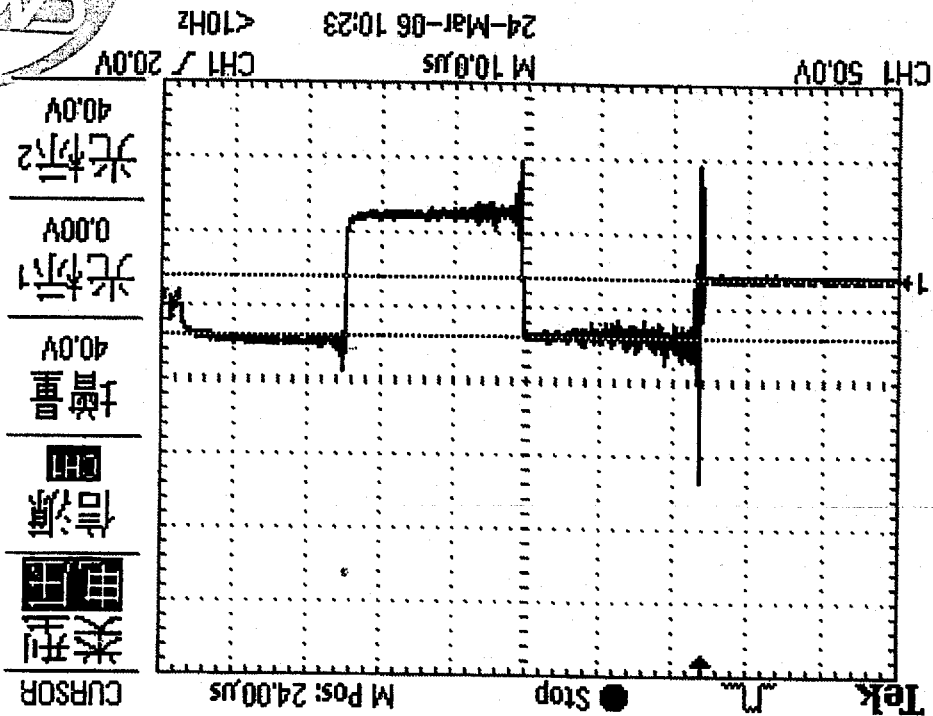


Fig. 25: 14222# the voltage wave before moisture ingress test

No. L0232

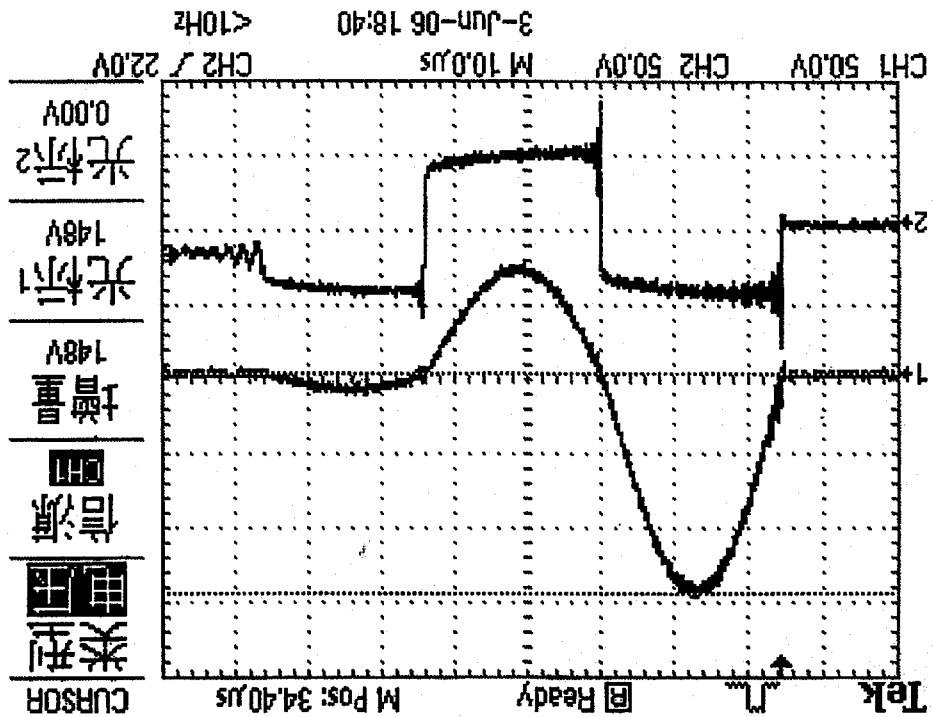


Fig. 26: 14222# U_{10kA} after moisture ingress test

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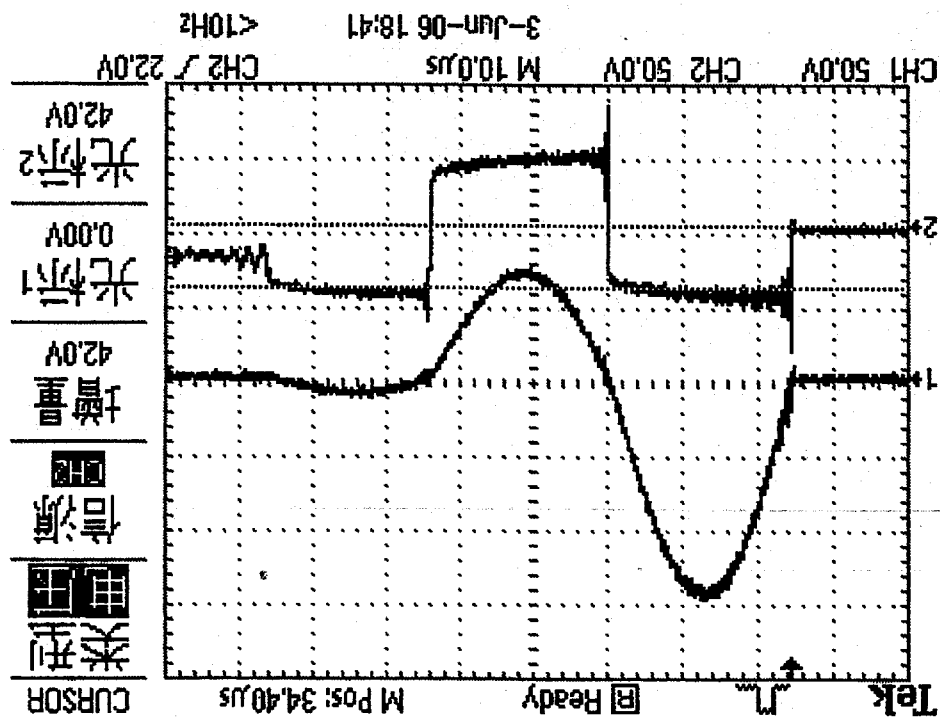


Fig. 27: 14222# U_{10kV} after moisture ingress test



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