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CHPTL

TEST REPORT

No : CTQC/ZJ-25. 0204

Test object name: Resin-impregnated fiber capacitive
through-wall bushing

Test object type: QXFCRGW-252/4000-4

Entrusted by: Shandong Qixing High Voltage Electric
Co., Ltd.

Manufacturer: Shandong Qixing High Voltage Electric
Co., Ltd.

Kind of testing: Type tests



SHENYANG TRANSFORMER RESEARCH INSTITUTE CO., LTD.

CHINA NATIONAL TRANSFORMER QUALITY DETECTION AND TESTING CENTER

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Shenyang Transformer Research Institute Co., Ltd.

China National Transformer Quality Detection And Testing Center

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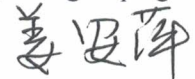
Test object name	Resin-impregnated fiber capacitive through-wall bushing	Test object type	QXFCRGW-252/4000-4
		Brand	/
Entrusted by	Shandong Qixing High Voltage Electric Co., Ltd.	Kind of testing	Type test
Manufacturer	Shandong Qixing High Voltage Electric Co., Ltd.	Sampling date	/
		Test date	Mar. 03, 2025~Mar. 05, 2025
Address	No.1228, Pengcheng Industrial Park, Pingli Road, Xiazhuang Town, Gaomi City, Weifang City, Shandong Province	Serial No	2502C001S
Standards	IEC60137 Edition 7.0 2017-06 GB/T4109-2022 Technical contract	Test items	Routine tests Type tests
Results	The test results of routine tests, type tests of QXFCRGW-252/4000-4 are in accordance with standards and technical contract. The sample passed the above tests.		
Note	  Signing and issuing date: 2025.3.10		

Approved by: Lv Xiangpeng

Checked by: Zeng Duo

Compiled by: Jiang Anping





- Statement: 1. Testing report is invalid without test special seal.
 2. Testing report is invalid without compiler, checker and approver's signature.
 3. Please inform CTQC in time after received the testing report if you have some disagreement to the testing report.
 4. Testing or witnessing only apply to sample.
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Test results

№	Test items	Specified values	Measured values	Conclusions
		Standards (Technical contract)		
1	Measurement of dielectric dissipation factor($\tan\delta$) and capacitances at ambient temperature (Before type test)	Applied voltage(kV): 2~20 $\tan\delta$: <0.004 Providing capacitance of the sample(pF)	10 0.00293 595.0	Passed
		Applied voltage(kV): $1.05U_m/\sqrt{3}$ $\tan\delta$: <0.004 Providing capacitance of the sample(pF)	152.8 0.00310 595.3	
		Applied voltage(kV): U_m $\tan\delta$: <0.004 Providing capacitance of the sample(pF)	252 0.00310 595.3	
2	Measurement of partial discharge quantity (Before type test)	Applied voltage(kV): U_m Partial discharge level(pC): ≤ 10	252 <4	Passed
		Applied voltage(kV): $1.5U_m/\sqrt{3}$ Partial discharge level(pC): ≤ 10	218.2 <4	
		Applied voltage(kV): $1.05U_m/\sqrt{3}$ Partial discharge level(pC): ≤ 5	152.8 <4	
3	Dry lightning impulse voltage withstand test (Type test)	Full wave voltage Positive polarity(kV): 1032.2(Corrected value) $\pm 3\%$ Negative polarity(kV): 1050 $\pm 3\%$ 15 positive and 15 negative polarity	1044.74~1053.96 1051.86~1062.52 Each 15 times	Passed
4	Wet power-frequency voltage withstand test (Type test)	Applied voltage(kV): 462.9(Corrected value) Duration(s): 60	462.9 60	Passed
5	Radio interference voltage test (Type test)	Applied voltage(kV): $1.1U_m/\sqrt{3}$ Duration(min): 5 Radio interference level(μV): ≤ 500	160 5 224	Passed
6	Verification of thermal short-time current withstand (Type test)	Thermal short-time current(kA): $25I_r$ Duration(s): 1 Final temperature ($^{\circ}C$): ≤ 180	100 1 151.4	Passed
7	Temperature rise test (Type test)	Temperature limit($^{\circ}C$): 105/120 Temperature rise limit(K): 75/90	See 4.7	Passed
8	Cantilever load withstand test (Type test)	Applied load(N): 5000 Duration(s): 60 Successfully repeat check items	5016(Outdoor) 5025(Indoor) 60 Passed	Passed

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№	Test items	Specified values	Measured values	Conclusions
		Standards(Technical contract)		
9	Visual inspection and dimensions check (Type test)	According to standard	See 4.9	Passed
10	Measurement of partial discharge quantity (After type test)	Applied voltage(kV): U_m Partial discharge level(pC): ≤ 10	252 <4	Passed
		Applied voltage(kV): $1.5U_m/\sqrt{3}$ Partial discharge level(pC): ≤ 10	218.2 <4	
		Applied voltage(kV): $1.05U_m/\sqrt{3}$ Partial discharge level(pC): ≤ 5	152.8 <4	
11	Measurement of dielectric dissipation factor($\tan\delta$) and capacitances at ambient temperature (After type test)	Applied voltage(kV): 2~20 $\tan\delta$: <0.004 Providing capacitance of the sample(pF)	10 0.00307 595.2	Passed
		Applied voltage(kV): $1.05U_m/\sqrt{3}$ $\tan\delta$: <0.004 Providing capacitance of the sample(pF)	152.8 0.00309 595.6	
		Applied voltage(kV): U_m $\tan\delta$: <0.004 Providing capacitance of the sample(pF)	252 0.00309 595.6	
12	Test of tap insulation (Routine test)	Dry power-frequency voltage withstand test: Applied voltage(kV): 2~3 Duration(s): 60	2 60	Passed
		Measurement of dielectric dissipation factor($\tan\delta$) and capacitances Applied voltage(kV): ≥ 1 $\tan\delta$: ≤ 0.05 Capacitance(pF): ≤ 10000	2 0.00962 535.1	
13	Dry lightning impulse voltage withstand test (Routine test)	Negative polarity(kV): 1102.5 $\pm 3\%$ 5 negative polarity	1108.40~1112.20 5 times	Passed
14	Dry power-frequency voltage withstand test (Routine test)	Applied voltage(kV): 460 Duration(s): 60	460 60	Passed
15	Measurement of partial discharge quantity (Routine test)	Applied voltage(kV): U_m Partial discharge level(pC): ≤ 10	252 <4	Passed
		Applied voltage(kV): $1.5U_m/\sqrt{3}$ Partial discharge level(pC): ≤ 10	218.2 <4	
		Applied voltage(kV): $1.05U_m/\sqrt{3}$ Partial discharge level(pC): ≤ 5	152.8 <4	

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№	Test items	Specified values	Measured values	Conclusions
		Standards(Technical contract)		
16	Measurement of dielectric dissipation factor($\tan\delta$) and capacitances at ambient temperature (Routine test)	Applied voltage(kV): 2~20 $\tan\delta$: <0.004 Providing capacitance of the sample(pF)	10 0.00308 595.2	Passed
		Applied voltage(kV): $1.05U_m/\sqrt{3}$ $\tan\delta$: <0.004 Providing capacitance of the sample(pF)	152.8 0.00309 595.6	
		Applied voltage(kV): U_m $\tan\delta$: <0.004 Providing capacitance of the sample(pF)	252 0.00309 595.6	
17	Visual inspection and dimensions check (Routine test)	According to standard	See 4.17	Passed

Note: 1. All the tests were field tests;
 2. Tested in Shandong Qixing High voltage Electric Co., Ltd. testing station.

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<p>1. Test object parameters</p> <p>Highest voltage for equipment(kV): 252</p> <p>Rated phase-to-earth voltage(kV): $252/\sqrt{3}$</p> <p>Rated current(A): 4000</p> <p>Rated frequency(Hz): 50</p> <p>Altitude(m): ≤ 1000</p> <p>Temperature class of insulation: E</p> <p>Test tap(measured tap, $\tan\delta$): With</p> <p>Insulation type of bushing: RIF</p> <p>Rated voltage of tap(Tap of electric potential, tap of capacitance)(kV): /</p> <p>2. Sample condition description</p> <p>Sample exterior construction and major dimensions(length, outer diameter) are in compliance with outline drawings.</p> <p>Measured values: length is 5050 mm, flange outer diameter is $\Phi 550$ mm.</p>		
Outline dimensions	Rating plate	
CT9008	8QX.860.009G	
<p>Rating plate and outline drawings are in testing report annex.</p> <p>The design, performance data, specifications of sample rating plate are in compliance with drawing.</p> <p>The marking of the phase sequence on head terminal and end terminal of the sample is clear and right.</p> <p>The surface of the sample has no collision and damage.</p> <p>3. Standards</p> <p>IEC60137 Edition 7.0 2017-06 Insulated bushings for alternating voltages above 1000V</p> <p>GB/T4109-2022 Insulated bushings for alternating voltages above 1000V</p> <p>Technical contract</p>		

Test Report

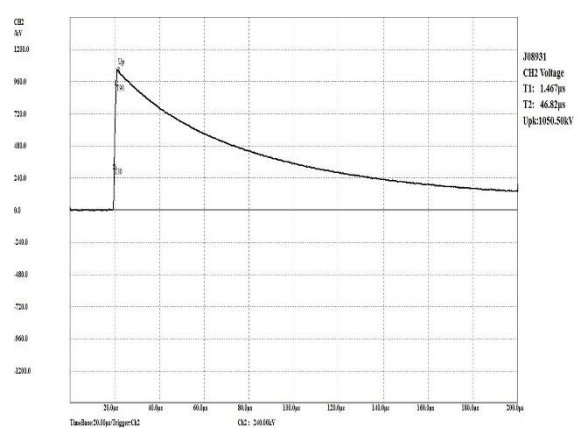
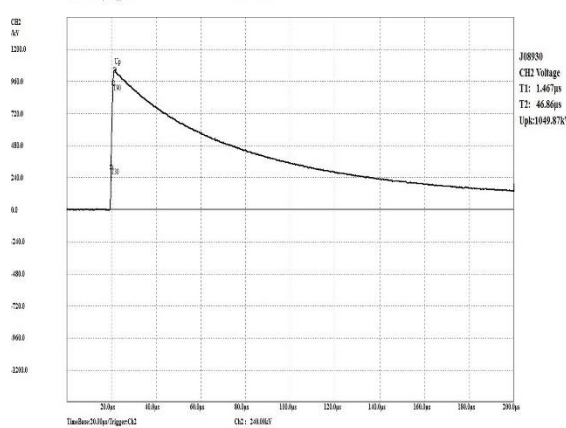
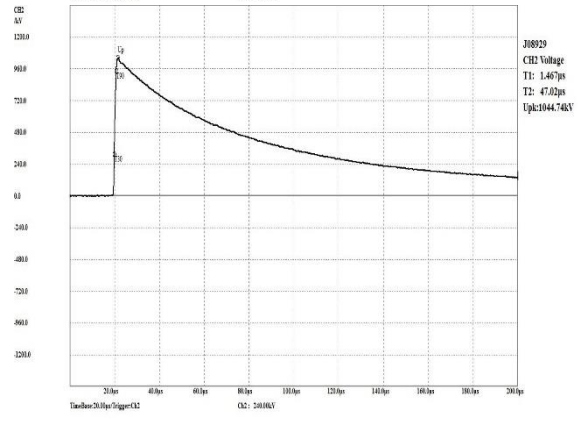
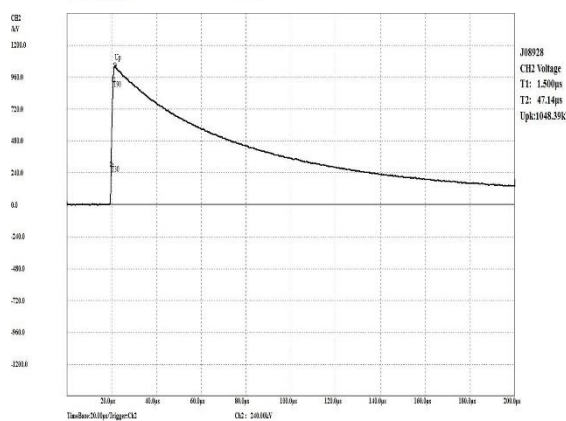
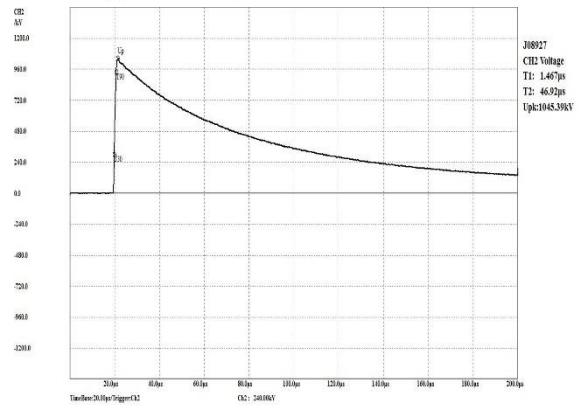
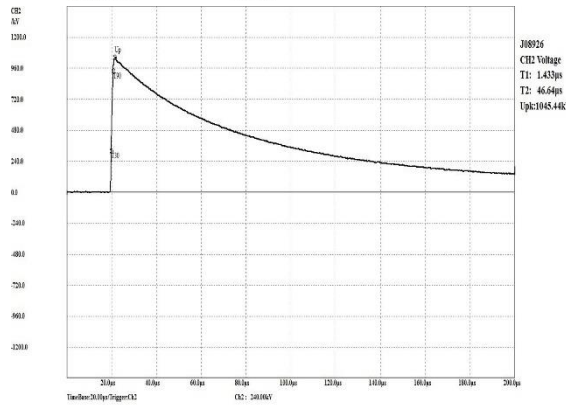
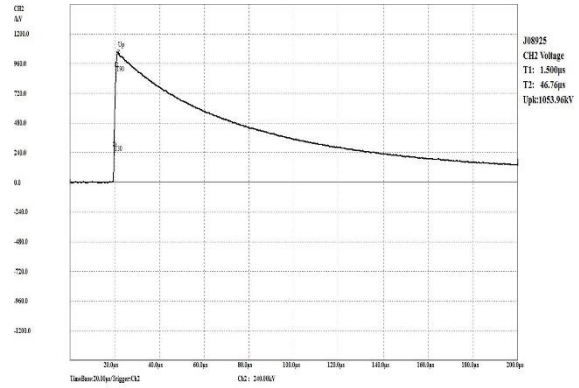
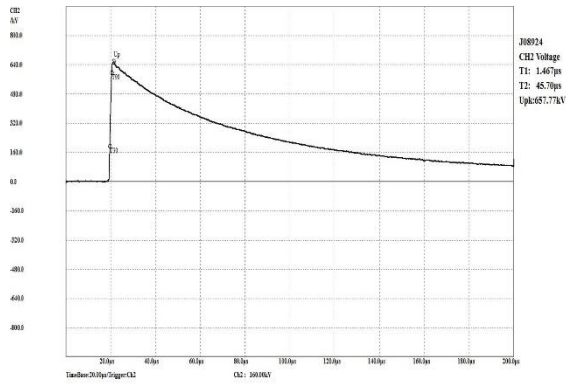
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Tested terminal: To earth

Test polarity: Positive

CH2: Voltage records



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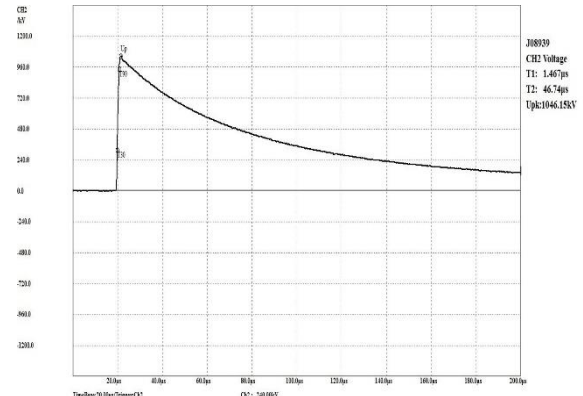
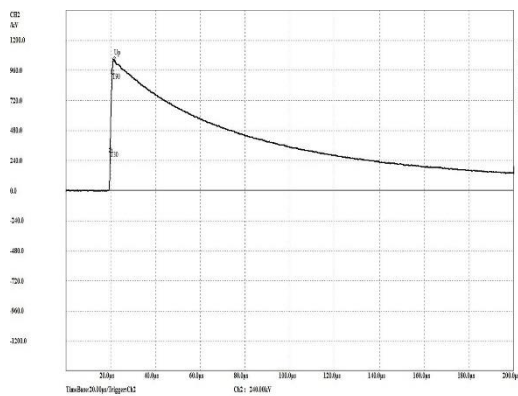
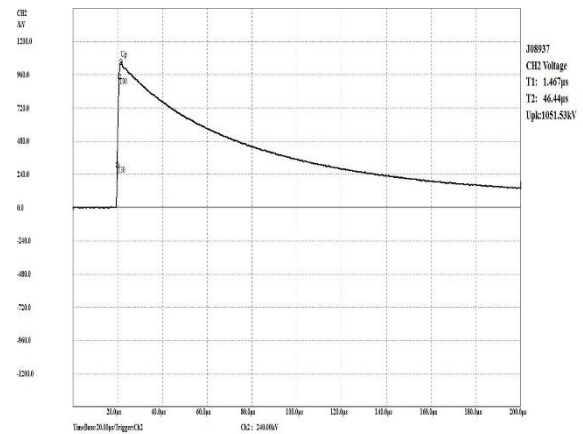
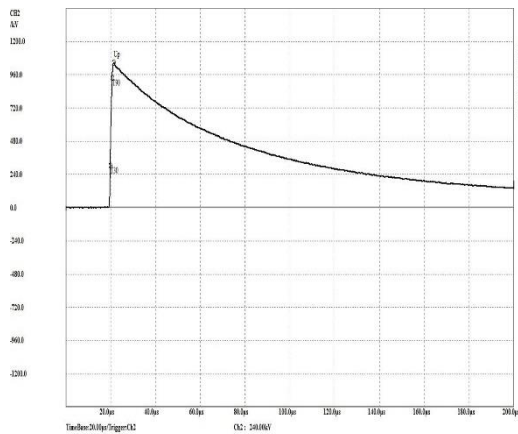
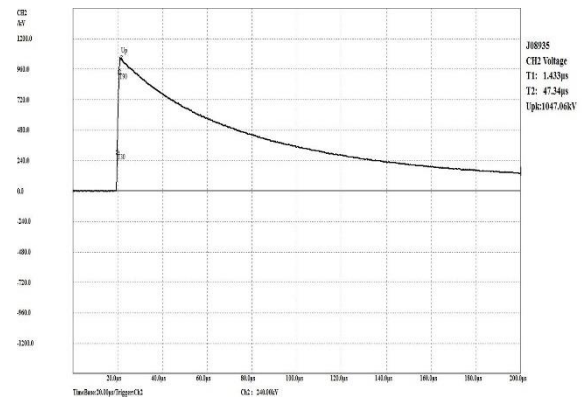
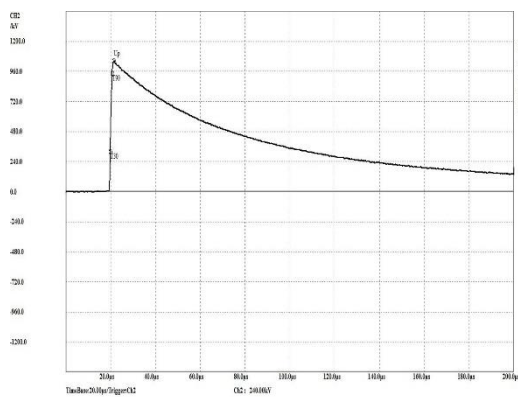
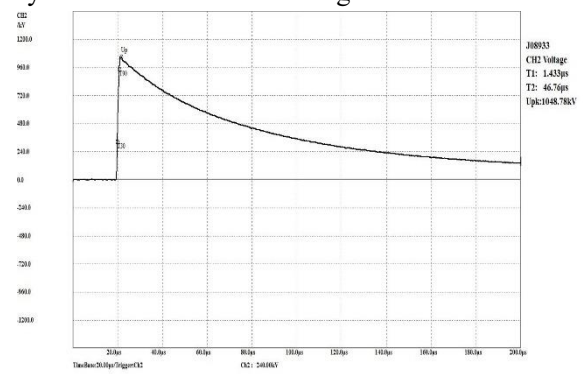
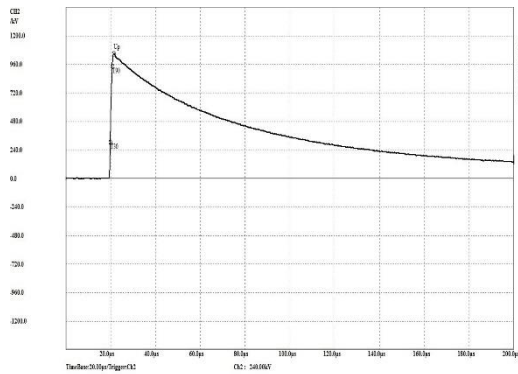
No: CTQC/ZJ-25.0204

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Tested terminal: To earth

Test polarity: Positive

CH2: Voltage records



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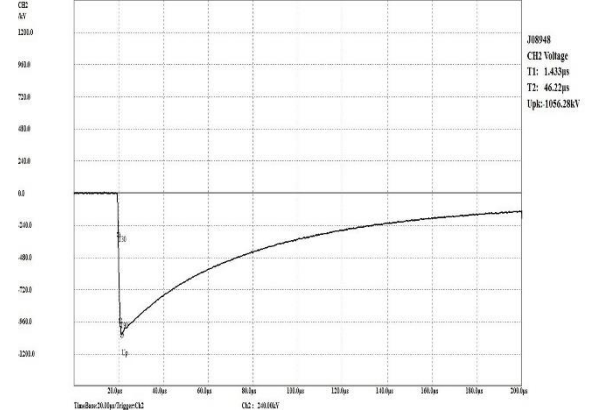
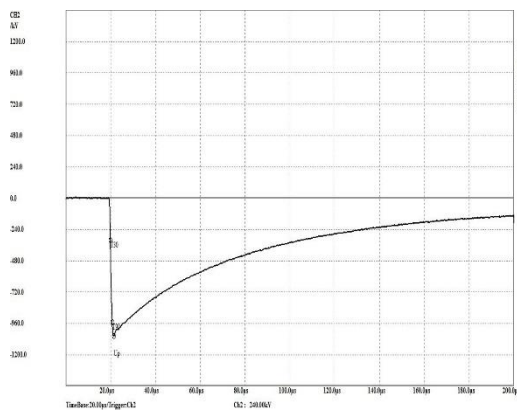
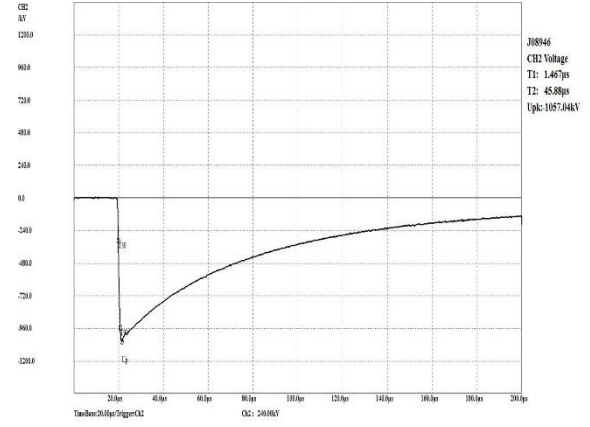
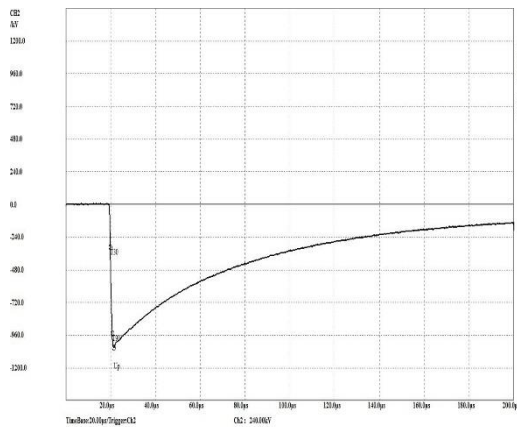
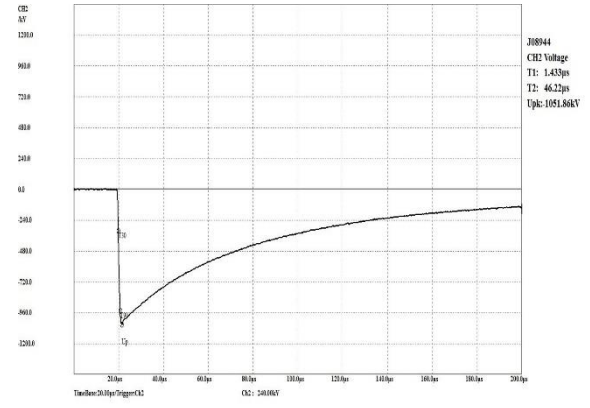
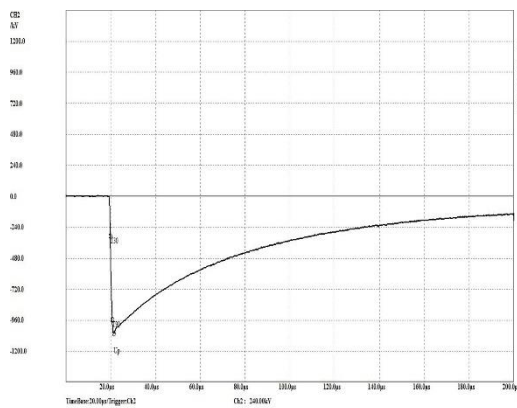
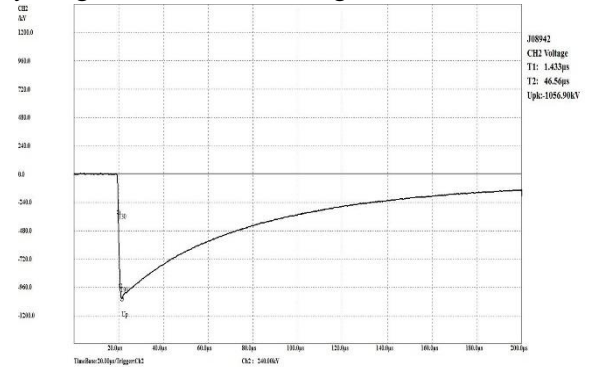
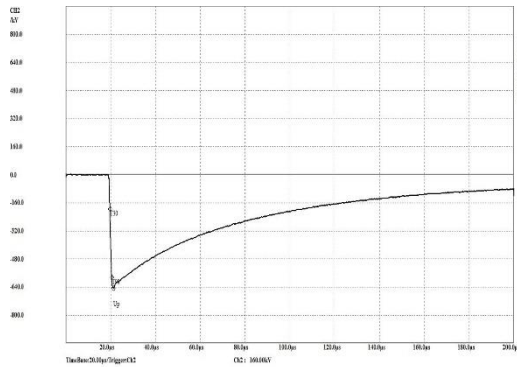
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Tested terminal: To earth

Test polarity: Negative

CH2: Voltage records



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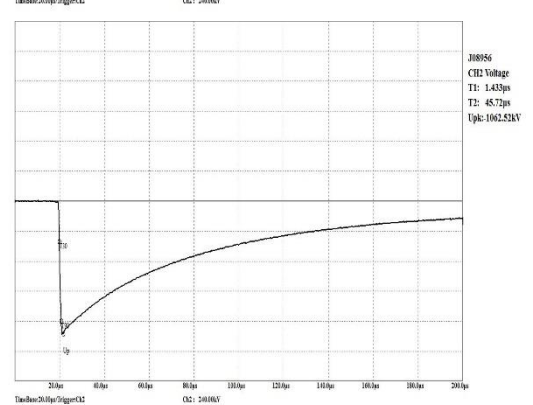
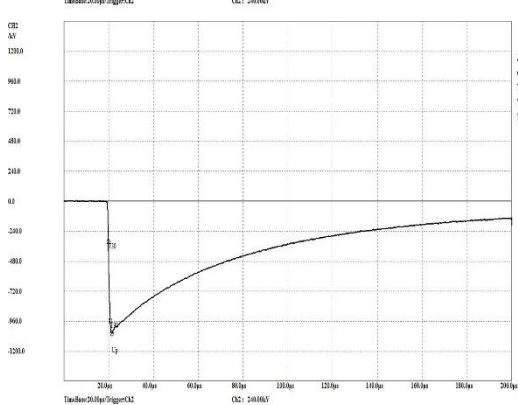
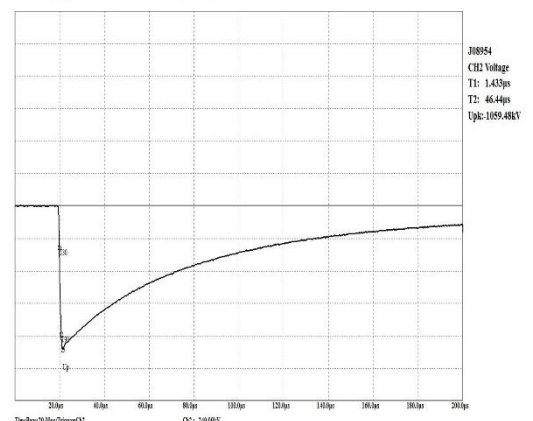
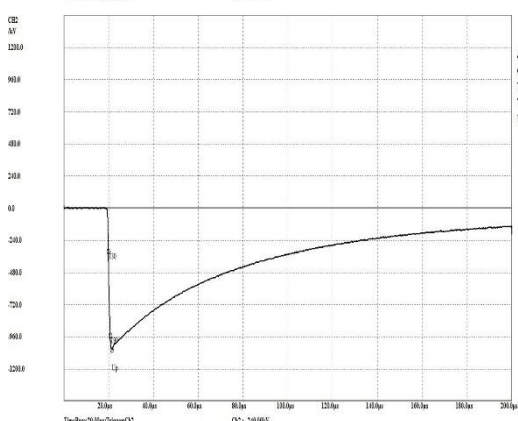
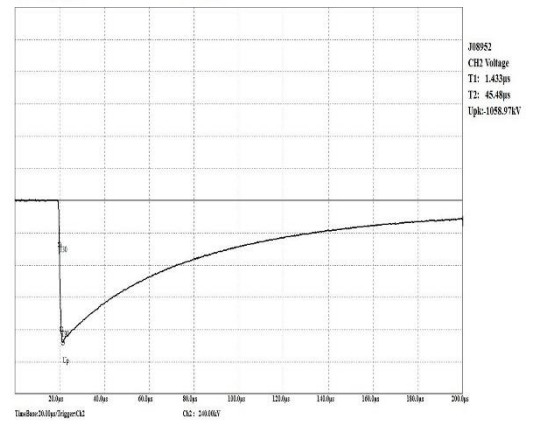
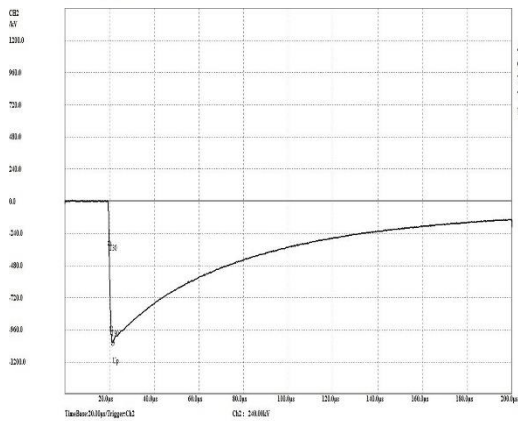
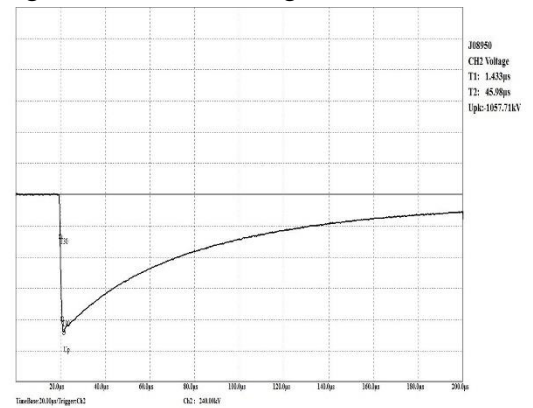
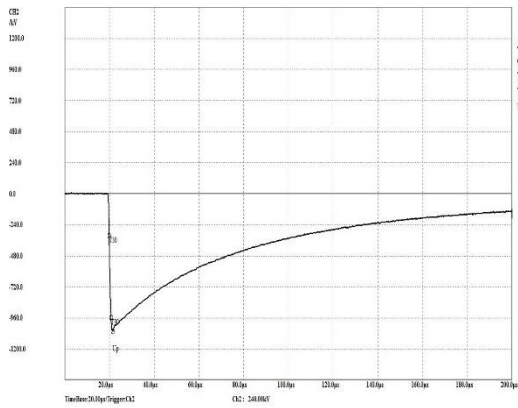
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Tested terminal: To earth

Test polarity: Negative

CH2: Voltage records



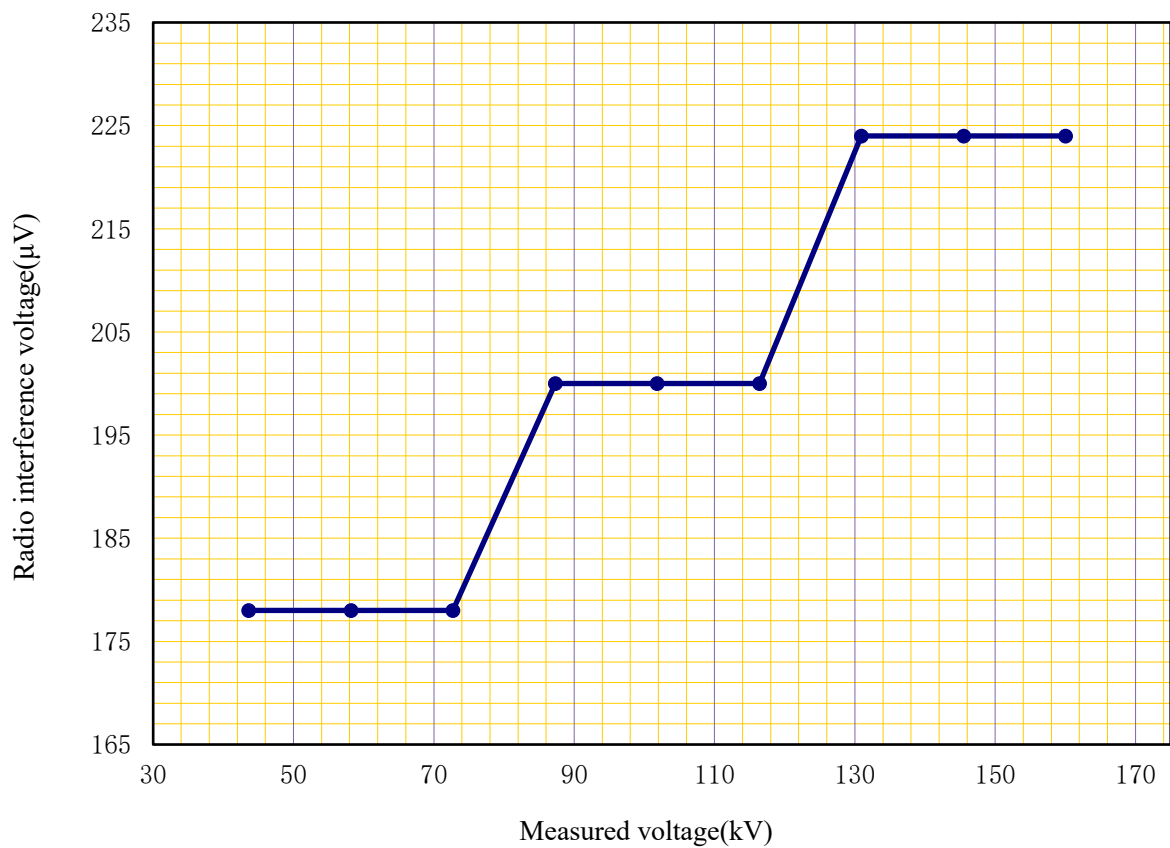
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4.4 Wet power-frequency voltage withstand test (Type test)				Test date: Mar. 03, 2025		
Humidity: 58.0%; Ambient temperature: 10.8°C; Atmospheric pressure: 102.4kPa						
Applied position	Applied voltage(kV)			Frequency (Hz)	Duration (s)	Result
	Standard value	Atmospheric corrected value	Applied value			
Terminal-earth	460	462.9	462.9	50	60	Passed
<p>Note: The conductivity of collected water is 100.8μS/cm at 20°C. Average precipitation rate: Vertical component 1.4mm/min, horizontal component 1.2mm/min.</p>						
4.5 Radio interference voltage test (Type test)				Test date: Mar. 04, 2025		
Humidity: 65.0%; Ambient temperature: 10.4°C; Atmospheric pressure: 101.2kPa						
Measured frequency (MHz)	Attenuation factor of measurement circuit (dB)	Attenuation factor of resistance network (dB)	Measured voltage (kV)	Radio interference reading B _m (dB)	Radio interference level (μ V)	
1.0	10	22	160	15	224	
			145.5	15	224	
			130.9	15	224	
			116.4	14	200	
			101.8	14	200	
			87.3	14	200	
			72.7	13	178	
			58.2	13	178	
			43.6	13	178	
<p>Note: Radio interference curve is shown in page 13. Result: Passed.</p>						

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Radio interference curve



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<p>4.6 Verification of thermal short-time current withstand(Verify by the calculation) (Type test) Test date: Mar. 04, 2025</p> <p>The standard value of thermal short-time current of bushing $I_{th}=100\text{kA}$, duration was 1s. According to calculation final temperature of the conductor $\theta_f=151.4^\circ\text{C}$. If $\theta_f \leq 180^\circ\text{C}$, it was considered that the bushing could withstand the standard value I_{th} of thermal short-time current.</p> <p style="text-align: center;">Sample parameters</p>		
Conductor material of sample	Aluminium	
Conductor resistivity $\rho(\mu\Omega \cdot \text{cm})$	2.83	
Total cross section area $S_t(\text{cm}^2)$	38.465	
Measured temperature rise of the bushing(K)	90	
Rated current $I_r(\text{A})$	4000	
Standard value of rated thermal short-time current $I_{th}(\text{kA})$	100	
Rated duration $t_{th}(\text{s})$	1	
$\theta_0(^\circ\text{C})$	130	
Current penetration depth $d(\text{cm})$	1.198	
Diameter of the conductor $D(\text{cm})$	7.0	
$\alpha[(\text{K/s})/(\text{kA}/\text{cm}^2)^2]$	1.8	
Equivalent cross section area considering the skin effect $S_e(\text{cm}^2)$	21.826	
<p>Verify by the calculation:</p> $\theta_f = \theta_0 + \alpha \frac{I_{th}^2}{S_t \times S_e} \times t_{th} = 151.4^\circ\text{C}$		
<p>Result: Passed.</p>		

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4.7 Temperature rise test (Type test)

Test date: Mar. 04, 2025

Specified current was 4000A, injected current was 4000A during test, the test duration was 8h, stability duration was 1h.

Temperature-rise calculated value

No.	Measured position	Temperature of bushing (°C)	Temperature rise of bushing(K)	Ambient temperature (°C)	Result
1	Terminal in the air(Outdoor)	61.9	51.6	10.3	Passed
2	Fastening of terminals in the air(Outdoor)	64.3	54.0		
3	Flange	27.8	17.5		
4	Fastening of terminals in the air(Indoor)	66.1	55.8		
5	Terminal in the air(Indoor)	63.8	53.5		

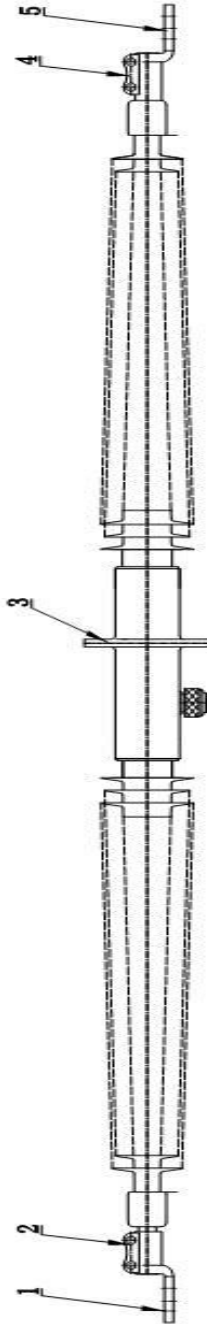
The measurement position drawing is shown in page 16.

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Schematic diagram of measured point of temperature rise



- 1. Terminal in the air(Outdoor)
- 2. Fastening of terminals in the air(Outdoor)
- 3. Flange
- 4. Fastening of terminals in the air(Indoor)
- 5. Terminal in the air(Indoor)

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4.8 Cantilever load withstand test (Type test)						Test date: Mar. 04, 2025
Load direction	Applied position	Standard value		Applied value		Result
		Load(N)	Duration(s)	Load(N)	Duration(s)	
Vertical	Terminal (Outdoor)	5000	60	5016	60	No damage, distortion, passed
Vertical	Terminal (Indoor)	5000	60	5025	60	No damage, distortion, passed
4.9 Visual inspection and dimensions check (Type test)						Test date: Mar. 04, 2025
It has smooth surface, no cracks. Dimensional check is accordance with the drawing requirement.						
Drawing values (mm): 5040±20 2280±10 1900±10 2340±10 Φ550 180						
Measured values (mm): 5050 2282 1902 2345 Φ550 180						
Arcing distance (mm): 2425(Outdoor) 2053(Indoor)						
Creepage(mm): 8683(Outdoor) 7185(Indoor)						
Result: Passed.						
4.10 Measurement of partial discharge quantity (After type test)						Test date: Mar. 04, 2025
Humidity: 65.0%; Ambient temperature: 10.4°C; Atmospheric pressure: 101.2kPa						
Prestress voltage (kV)	Duration(s)	Measured voltage(kV)	Partial discharge level(pC)	Result		
460	60	252	<4	Passed		
		218.2	<4			
		152.8	<4			
Note: Background level is <4pC before and after test.						
4.11 Measurement of dielectric dissipation factor (tan δ) and capacitances at ambient temperature (After type test)						Test date: Mar. 04, 2025
Humidity: 65.0%; Ambient temperature: 10.4°C; Atmospheric pressure: 101.2kPa						
Applied voltage(kV)	Dielectric dissipation factor(tanδ)	Capacitance(pF)	Result			
10	0.00307	595.2	Passed			
152.8	0.00309	595.6				
252	0.00309	595.6				
Note: tanδ(252kV)- tanδ(152.8kV) = 0.00000<0.001(Standard value), passed.						

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4.12 Tests of tap insulation(Routine test)				Test date: Mar. 05, 2025
Power-frequency voltage withstand test				
Humidity: 58.0%; Ambient temperature: 10.5°C; Atmospheric pressure: 102.4kPa				
Applied position	Applied voltage(kV)	Frequency(Hz)	Duration(s)	Result
Tap-earth	3	50	60	Passed
Measurement of dielectric dissipation factor(tanδ) and capacitances				
Humidity: 58.0%; Ambient temperature: 10.5°C; Atmospheric pressure: 102.4kPa				
Applied voltage(kV)	Dielectric dissipation factor(tanδ)	Capacitance(pF)	Result	
2	0.00962	535.1	Passed	
4.13 Dry lightning impulse voltage withstand test(Routine test)				Test date: Mar. 05, 2025
Test atmospheric conditions				
Humidity: 58.0%; Ambient temperature: 10.5°C; Atmospheric pressure: 102.4kPa				
Full wave rated withstand voltage: negative polarity(kV): 1102.5; 5 negative polarity				
Test sequence				
One negative reference full wave impulse;				
Five negative rated full wave impulses.				
Test records:				
T1: Front time;		T2: Time to half value;		Upk: Peak voltage.
Result: Passed.				

Test Report

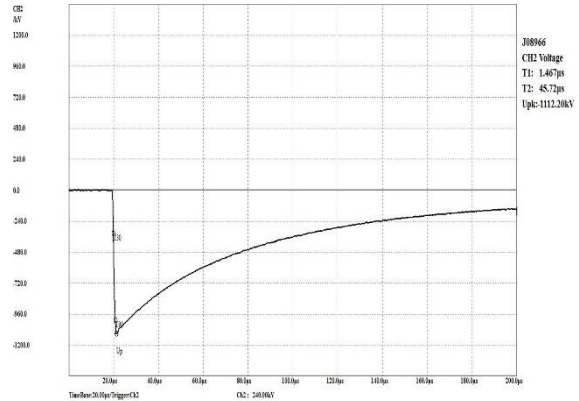
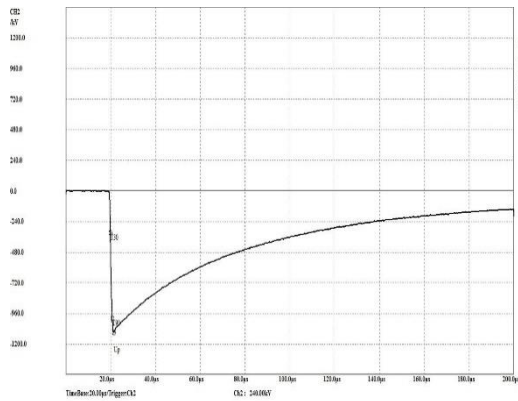
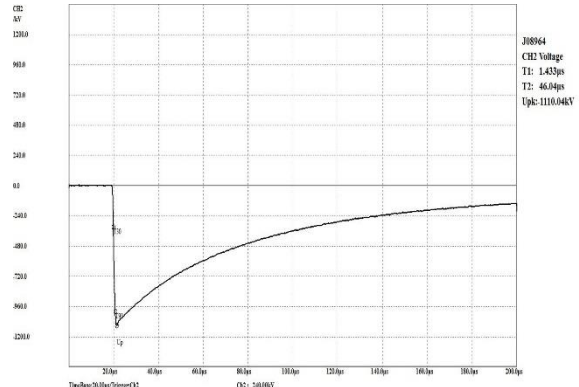
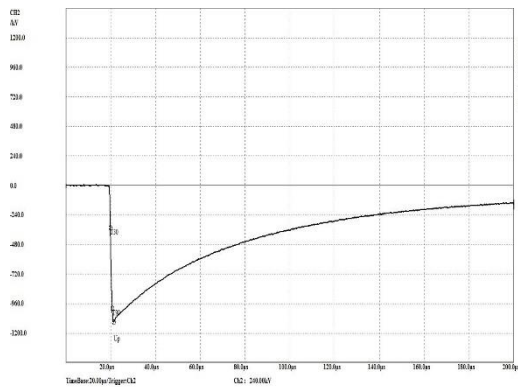
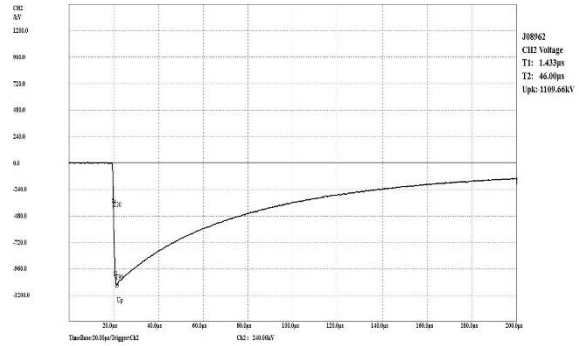
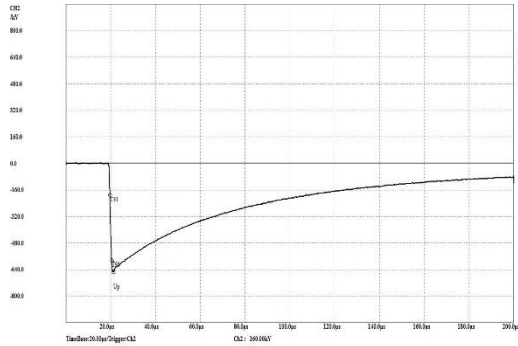
No: CTQC/ZJ-25.0204

Total 20 Page 19

Tested terminal: To earth

Test polarity: Negative

CH2: Voltage wave



Test Report					No: CTQC/ZJ-25.0204 Total 20 Page 20	
4.14 Dry power-frequency voltage withstand test (Routine test)					Test date: Mar. 05, 2025	
Humidity: 58.0%; Ambient temperature: 10.5°C; Atmospheric pressure: 102.4kPa						
Applied position	Applied voltage(kV)			Frequency (Hz)	Duration (s)	Result
	Standard value	Atmospheric corrected value	Applied value			
Terminal-earth	460	/	460	50	60	Passed
4.15 Measurement of partial discharge quantity (Routine test)					Test date: Mar. 05, 2025	
Humidity: 58.0%; Ambient temperature: 10.5°C; Atmospheric pressure: 102.4kPa						
Prestress voltage (kV)	Duration(s)	Measured voltage(kV)	Partial discharge level(pC)	Result		
460	60	252	<4	Passed		
		218.2	<4			
		152.8	<4			
Note: Background level is <4pC before and after test.						
4.16 Measurement of dielectric dissipation factor ($\tan \delta$) and capacitances at ambient temperature (Routine test)					Test date: Mar. 05, 2025	
Humidity: 58.0%; Ambient temperature: 10.5°C; Atmospheric pressure: 102.4kPa						
Applied voltage(kV)	Dielectric dissipation factor($\tan \delta$)		Capacitance(pF)	Result		
10	0.00308		595.2	Passed		
152.8	0.00309		595.6			
252	0.00309		595.6			
Note: $\tan \delta(252\text{kV}) - \tan \delta(152.8\text{kV}) = 0.00000 < 0.001$ (Standard value), Passed.						
4.17 Visual inspection and dimensions check (Routine test)					Test date: Mar. 05, 2025	
It has smooth surface, no cracks. Dimensional check is accordance with the drawing requirement.						
Dimensional inspection see 4.9.						
Result: Passed.						

RATING PLATE AND OUTLINE PHOTOS

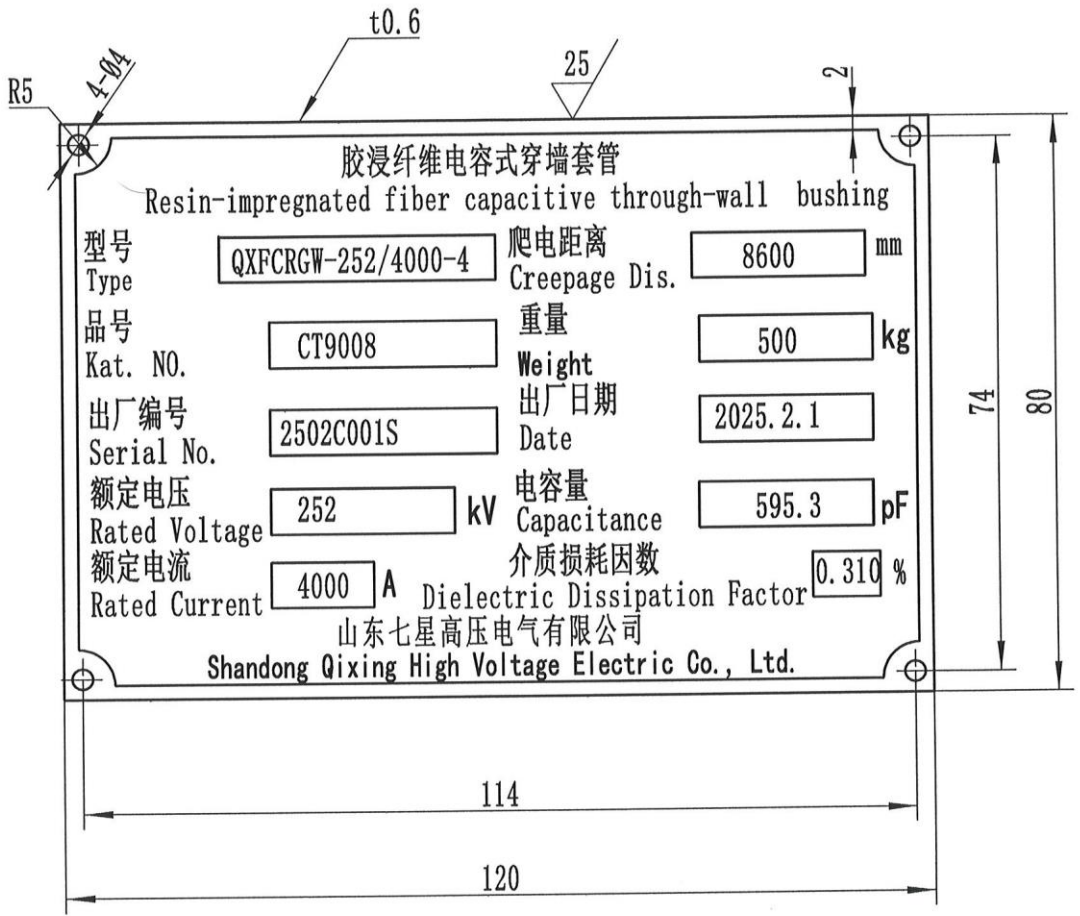
Rating plate:

胶浸纤维电容式穿墙套管 Resin-impregnated fiber capacitive through-wall bushing			
型号 Type	QXFCRGW-252/4000-4	爬电距离 Creepage Dis.	8600 mm
品号 Kat. NO.	CT9008	重量 Weight	500 kg
出厂编号 Serial NO.	2502C001S	出厂日期 Date	2025.2.1
额定电压 Rated Voltage	252 kV	电容量 Capacitance	595.3 pF
额定电流 Rated Current	4000 A	介质损耗因数 Dielectric Dissipation Factor	0.310 %
山东七星高压电气有限公司 Shandong Qixing High Voltage Electric Co., Ltd.			

Outline:



BUSHING DRAWINGS



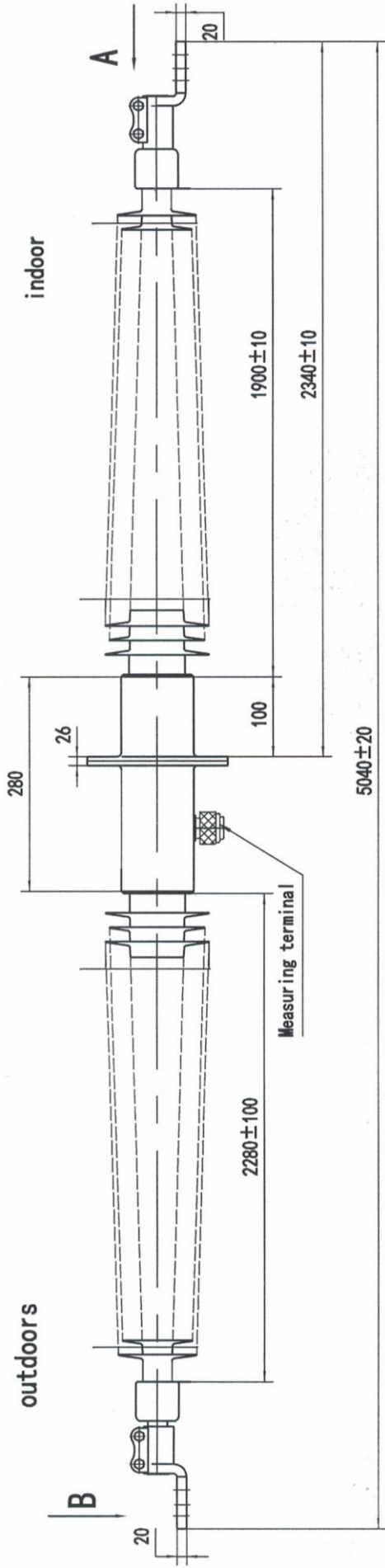
借(通)用
件 登 记

旧底图总号								产品型号		装配图代号	序号	
底图总号								铭牌nameplate		8QX.860.009G		
签 字									图样标记	重 量	比 例	
日 期	标记	处数	分 区	更改文件号	签 字	日 期				0.030	1:1	
档案员	日期	设计	张 学 明	2025.2.1	标准 化			316L	共 张	第 张		
		校核	石 孝 刚	2025.2.1	审 定							
		会 签			批 准	曹 明 波	2025.2.1					

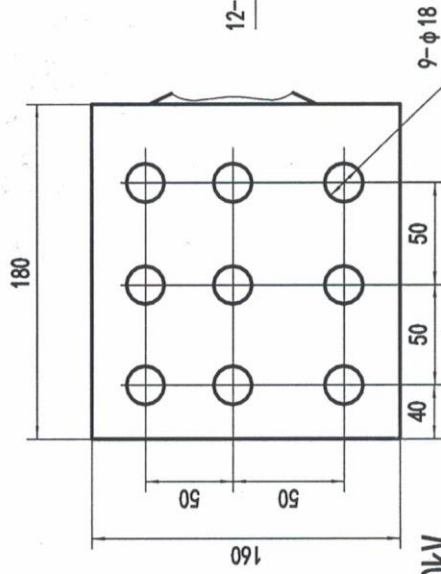


outdoors

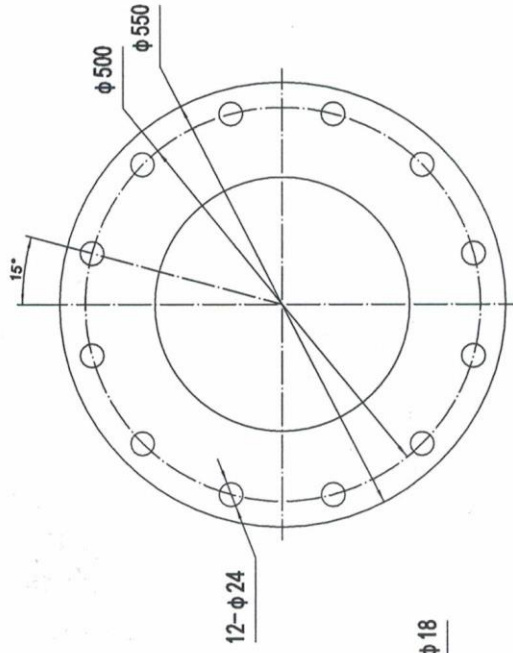
indoor



B-direction diagram



A-direction diagram



Technical parameters

1. Rated voltage: 252kV
2. Rated current :4000A
3. 1min power frequency withstand voltage: 460kV
4. Lightning impulse withstand voltage: 1050kV
5. Dielectric loss tangent: $\nlessgtr 0.4\%$
6. PD: Um measured $\nlessgtr 10$
7. Bending load: 5000N
8. Creepage distance: 8600mm
9. Operating ambient temperature: $+60^\circ\text{C} \sim -60^\circ\text{C}$

Shandong Xuehai High Voltage Electric Co., LTD		CT9008		比例	1:1.2
Impregnated fiber composite wall bushing		价格标记	重量	张第	
标记	处数	分区	更改文件号	签名	年、月、日
设计	张学明	2025.2.1	标准化		
审核	石学刚	2025.2.1		批准	曹明达 2025.2.1
工艺					

CHPTL

中国大容量试验联盟(简称 CHPTL)是中国同类试验机构的唯一协作组织,隶属于中国电工技术学会。其主要目标是规范国家标准、行业标准及 IEC 标准在电力设备(交流 1000V 以上,直流 1200V 以上)Type test 试验中的协调应用。

China High Power Testing liaison (CHPTL) is the only organization in China which is formed to promote and coordinate the application of IEC/GB standard as well as industry standards in power electrical equipment type test (AC above 1000V, DC above 1200V). CHPTL is under the leadership and management of China Electro-technical Society.

CHPTL 成员单位如下:

The members of CHPTL are as follows:

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Xi'an High Voltage Apparatus Research Institute Co., Ltd. (XIHARI)

中国电力科学研究院(CEPRI)

China Electrical Power Research Institute (CEPRI)

辽宁高压电器产品质量检测有限公司(AQTC)

Liaoning High Voltage Apparatus Quality Test Co., Ltd. (AQTC)

沈阳变压器研究院有限公司变压器实验室(STRI)

Shenyang Transformer Institute Co., Ltd Transformer Laboratory (STRI)

上海电气输配电试验中心有限公司(SETC)

Shanghai Electric Power Transmission & Distribution Testing Center Co., Ltd. (SETC)

电力工业无功补偿成套装置质量检验测试中心(PRCIQTC)

Power Industry Reactive Compensation Equipment Quality Inspection & Test Center(PRCIQTC)

CHPTL 作为一个协作组织,本身并不出具 Type test 试验报告。每一个 CHPTL 成员对其出具的 Type test 试验报告的有效性和内容负责。

CHPTL as a collaboration does not itself issue test reports. Each CHPTL member issuing a test report is responsible for the validity and contents of