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**XIHARI**

No. 210036R

# 检 验 报 告

## TEST REPORT

试 品 型 号: BKMJ 0.45-40-3  
TYPE  
试 品 名 称: 低电压自愈式并联电容器  
DESIGNATION LOW VOLTAGE SELF-HEALING SHUNT CAPACITOR  
委 托 单 位: 浙江正泰电器股份有限公司  
APPLICANT ZHEJIANG CHINT ELECTRICS CO., LTD.  
制 造 单 位: 浙江正泰电器股份有限公司  
MANUFACTURER ZHEJIANG CHINT ELECTRICS CO., LTD.  
检 验 类 别: 委托试验  
TEST CATEGORY ENTRUSTED TEST

**西安高压电器研究院有限责任公司**

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



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## 试品基本信息

### Description of the test object

型号名称: BKMJ 0.45-40-3 低电压自愈式并联电容器

Type and Designation: BKMJ 0.45-40-3 low voltage self-healing shunt capacitor

委托单位: 浙江正泰电器股份有限公司

Applicant: ZHEJIANG CHINT ELECTRICS CO., LTD.

地址: 浙江省温州市乐清市北白象镇正泰工业园正泰路 1 号 (325603)

Address: No.1 CHINT Road, CHINT Industrial Zone, North Baixiang, Yueqing, Zhejiang (325603)

电话 Tel: 62877777-709305 传真 Fax 0577-62763760

制造单位: 浙江正泰电器股份有限公司

Manufacturer: ZHEJIANG CHINT ELECTRICS CO., LTD.

地址: 浙江省温州市乐清市北白象镇正泰工业园正泰路 1 号 (325603)

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制造单位规定的试品主要技术数据 Main technical data assigned by the manufacturer:

额定电压 Rated voltage kV	0.45	✓
额定电流 Rated current A	51.3	✓
额定容量 Rated output kvar	40	✓
额定频率 Rated frequency Hz	50	✓
额定电容 Rated capacitance $\mu F$	629	✓
温度类别 Temperature category	-25/C	
介质结构 Dielectric	金属化聚丙烯膜 Metallized polypropylene film	✓
内部放电器件 Internal discharge device	放电电阻 Discharge resistor	✓
内部保护器件 Internal protecting device	过压力保护 Overpressure protection	
试验相数 Test phases	3 相 3phases/ $\Delta$	✓
外壳尺寸 Dimention of container mm	260×70×250	
端子与外壳间交流耐受电压 (干) AC voltage between terminals and container(dry) kV	3.0	✓
端子与外壳间雷电冲击耐受电压 Lightning impulse voltage between terminals and container kV	8.0	✓
最大(适用)的海拔 Altitude (applicable) m	2000	✓
浸渍剂 Impregnant	微晶蜡 Microcrystalline wax	



电容偏差 Deviation requirement of capacitance	-5%~+10%	✓
损耗要求 Requirement of tangent of the loss angle	0.0020	✓
出厂日期及编号 Manufacture date and serial number	2020-10/014412493303700001 2020-10/014412493303700002 2020-10/014412493303700003	
<p>注 1: 以上信息和数据由委托单位/制造单位提供, 本实验室不对其准确性负责。 Note1: The above information and data are provided by Applicant/Manufacturer and the laboratory is not responsible for its accuracy.</p> <p>注 2: “✓” 表示该额定值在本检验报告中已得到验证。 Note2: “✓” This rating has been proved by the tests in this report.</p>		



## 检验结论

## Conclusions

型号名称: BKMJ 0.45-40-3 低电压自愈式并联电容器

Type and Designation: BKMJ 0.45-40-3 low voltage self-healing shunt capacitor

委托单位: 浙江正泰电器股份有限公司

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电话 Tel: 0577-62763763 传真 Fax: 0577-62763760

依据标准 Standards for Test Performance:

GB/T 12747.1-2017 标称电压 1 000 V 及以下交流电力系统用自愈式并联电容器 第 1 部分: 总则 性能、试验和定额安全要求 安装和运行导则

Shunt power capacitors of the self-healing type for a.c. systems having a rated voltage up to and including 1 000 V –Part 1: General—Performance, testing and rating—Safety requirements—Guide for installation and operation ( IEC 60831-1:2014, IDT )

GB/T 12747.2-2017 标称电压 1 000 V 及以下交流电力系统用自愈式并联电容器 第 2 部分: 老化试验、自愈性试验和破坏试验

Shunt power capacitors of the self-healing type for a.c. systems having a rated voltage up to and including 1 000 V –Part 2: Ageing test, self-healing test and destruction test ( IEC 60831-2:2014, IDT )

实施的项目 Test have been performed:

序号 Serial	项目 Items	参数 Parameters	判定标准 Standards for Verdict	结果 Result
1	密封性试验 Sealing test	70℃,2h	GB/T 12747.1-2017 12	符合 Satisfied
2	端子间电压试验 Voltage test between terminals	2.15U <sub>N</sub> ,10s	GB/T 12747.1-2017 9.2	符合 Satisfied



序号 Serial	项目 Items	参数 Parameters	判定标准 Standards for Verdict	结果 Result
3	端子与外壳间交流电压试验 Voltage test between terminals and container	3.0kV,60s	GB/T 12747.1-2017 10.2	符合 Satisfied
4	内部放电器件试验 Test of internal discharge device	3 min, $\leq 75V$	GB/T 12747.1-2017 11	符合 Satisfied
5	电容测量和容量计算 Capacitance measurement and output caculation	-5%~+10%	GB/T 12747.1-2017 7	符合 Satisfied
6	电容器损耗角正切( $\tan \delta$ )测量 Measurement of the tangent of the loss angle ( $\tan \delta$ ) of the capacitor	$\tan \delta \leq 0.20\%$	GB/T 12747.1-2017 8	符合 Satisfied
7	热稳定性试验 Thermal stability test	50mm,50℃	GB/T 12747.1-2017 13	符合 Satisfied
8	高温下电容器损耗角正切( $\tan \delta$ )测量 Measurement of the tangent of the loss angle ( $\tan \delta$ ) of the capacitor at elevated temperature	$\tan \delta \leq 0.20\%$	GB/T 12747.1-2017 14	符合 Satisfied
9	放电试验 Discharge test	2.0U <sub>N</sub> ,5 次 2.0U <sub>N</sub> ,5 times	GB/T 12747.1-2017 16	符合 Satisfied
10	自愈性试验 Self-healing test	$\geq 5$ 次 $\geq 5$ times	GB/T 12747.2-2017 18	符合 Satisfied
11	端子与外壳间雷电冲击电压试验 Lightning impulse voltage test between terminals and container	8.0kV, $\pm 3$ 次 8.0kV, $\pm 3$ times	GB/T 12747.1-2017 15	符合 Satisfied

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2021-10-15

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2021-10-18





## 试品确认

## Identification of the test object

1、制造厂声明的试品主要使用原材料/元件信息如下 The main material/component parts of test object assigned by manufacturer as follows:

序号 No.	类型 Type	名称及规格 Name and Size	制造厂家 Manufacturers	备注 Notes
1	放电电阻 Discharge Device	240kΩ/2W	温州正泰电阻有限公司 CHINT (WENZHOU) RESISTANCE Co., LTD	
2	浸渍剂 Impregnant	微晶蜡 Microcrystalline wax SP2078B	泰尔精蜡（上海）有限公司 JIANGSU TEL NEW MATERIALS Co., LTD	
3	箱壳 Shell	马口铁 Tinplate 260*70*250	乐清市庆梧电器有限公司 YUEQING ZHONGBANGCo.,LTD	
4	内熔丝 Internal Fuse	未使用 Unused	无 N/A	
5	金属化膜 Metallized film	金属化聚丙烯膜 Metallized polypropylene film 7.1 μ m × 75mm × 2.5mm	温岭华航电子有限公司 WENLING HUAHANG ELECTRONICS Co., LTD	

2、制造单位保证试品符合的技术文件 The test object is guaranteed by the manufacturer to comply with the following technical documents:

OZTR.102.017 BKMJ 干式电容器 技术任务书

BKMJ Dry type low voltage shunt capacitors mission statemnt

3、制造单位提供并由实验室确认的图纸 Drawings submitted by the manufacturer and identified by the laboratory:

1)、以下图纸编入本报告 The following drawings were attached in the report:

2ZTR.708.050.1 ~ 18 干式低电压并联电容器 Dry type low voltage shunt capacitors

浙江正泰电器股份有限公司 ZHEJIANG CHINT ELECTRICS CO., LTD. (日期 Date: 2021-08-25)

2)、本实验室已确认制造单位提供的资料和图纸充分代表了试品的部件和零件，但不对这些资料和图纸细节的准确性负责。The laboratory is responsible for checking that the drawings and data schedules submitted adequately represent essential details of the equipment tested, but is not responsible for the accuracy of detailed drawings

4、试品来源 Source of test object: 委托方提供 Provided by the applicant

5、样品确认日期 Date of identification of the test object: 2021-08-25

6、委托方代表 Tests witnessed by:

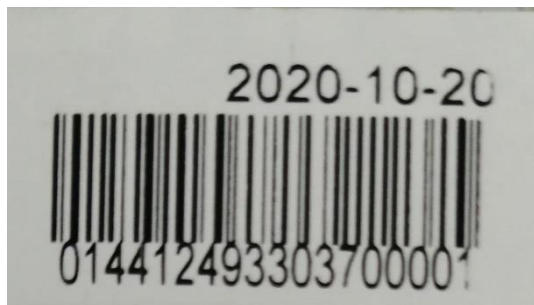
黄勇                  浙江正泰电器股份有限公司  
HuangYong      Zhejiang chint electrics co., ltd.

7、检验日期 Date of tests: 起 2021-08-27 止 2021-08-30。  
From 2021-08-27 to 2021-08-30.

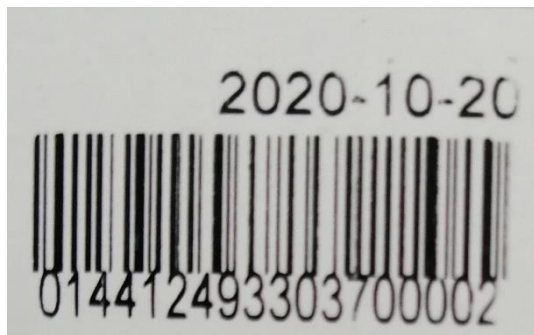
试品照片 Photographs:



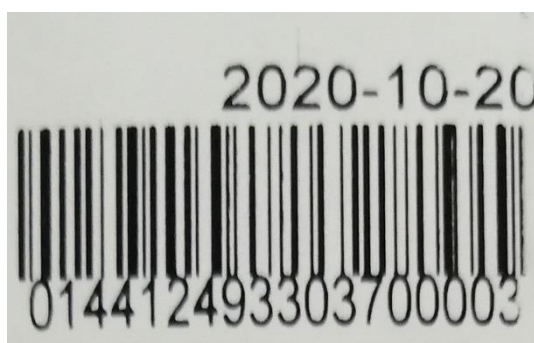
外观照片 Photograph 1



外观照片 Photograph 2



外观照片 Photograph 3



外观照片 Photograph 4



外观照片 Photograph 5



外观照片 Photograph 6

## 试验总则

### Test general

#### 1. 试验依据标准 Applied standards:

GB/T 12747.1-2017 标称电压 1 000 V 及以下交流电力系统用自愈式并联电容器 第 1 部分: 总则 性能、试验和定额安全要求 安装和运行导则

Shunt power capacitors of the self-healing type for a.c. systems having a rated voltage up to and including 1 000 V –Part 1: General—Performance, testing and rating—Safety requirements—Guide for installation and operation ( IEC 60831-1:2014, IDT )

GB/T 12747.2-2017 标称电压 1 000 V 及以下交流电力系统用自愈式并联电容器 第 2 部分: 老化试验、自愈性试验和破坏试验

Shunt power capacitors of the self-healing type for a.c. systems having a rated voltage up to and including 1 000 V –Part 2: Ageing test, self-healing test and destruction test ( IEC 60831-2:2014, IDT )

#### 2. 试品状态 Condition before tests:

试品是洁净的、新的自愈式并联电容器。

Test objects are clean and new shunt capacitors of the self-healing type.

3. 试品到样时间 Product receiving date: 2021-04-07。

4. 试验地点 Address of tests: 大庆路 642 号 。 No.642 Daqing road.

## 报告中使用的符号和缩写

## Symbols and abbreviation used in test records

符号和缩写 Symbols and abbreviation	说明 Description
$C_N$	额定电容 Rated Capacitance
$C_x$	实测电容 Measured capacitance
$C_{bt}$	试验前电容 Capacitance before test
$C_{at}$	试验后电容 Capacitance after test
$\Delta C$	试验后比试验前电容差值 Deviation of capacitance before and after test
T-to-T	极间 Terminal to terminal
T-to-C	极对壳 Terminals to Container
$U_c$	应施电压 Expected voltage
$U_t$	实测电压 Test voltage
$U_e$	额定耐受电压 Rated withstand voltage
$U_{EL}$	紧急情况过负荷电压 Emergency overload voltage
$U_d$	最大持续直流电压 Maximum continuous DC voltage
$U_m$	设备最高电压 Highest voltage for equipment
$U_{lim}$	极限电压 limiting voltage
$K_t$	大气修正因数 Atmospheric conditions Correction factor
$K_l$	空气密度修正因数 Air density correction factor
$K_a$	海拔修正因数 Altitude correction factor
$T_A$	恒温箱空气温度 Ambient Temperature in the oven
$I_{1m}$	放电电流第一峰值 The first peak of discharge current
$I_{2m}$	放电电流第二峰值 The second peak of discharge current
PD	局部放电 Partial discharge
PDIV	局部放电起始电压 Partial discharge inception voltage
PDEV	局部放电熄灭电压 Partial discharge extinction voltage

## 密封性试验

## Sealing test

试验日期 Test date: 2021-08-25 ~ 2021-08-26

## 1.试验方法 Test method:

使用加热法进行试验，通体加热到 70℃ 并保持规定时间，试验后检查试品有无渗漏。

The test samples shall be heated throughout to 70℃ for the stipulated time in the oven. Then check the sealing joint of the samples, whether some leakage has happened.

## 2.试验数据 Test data:

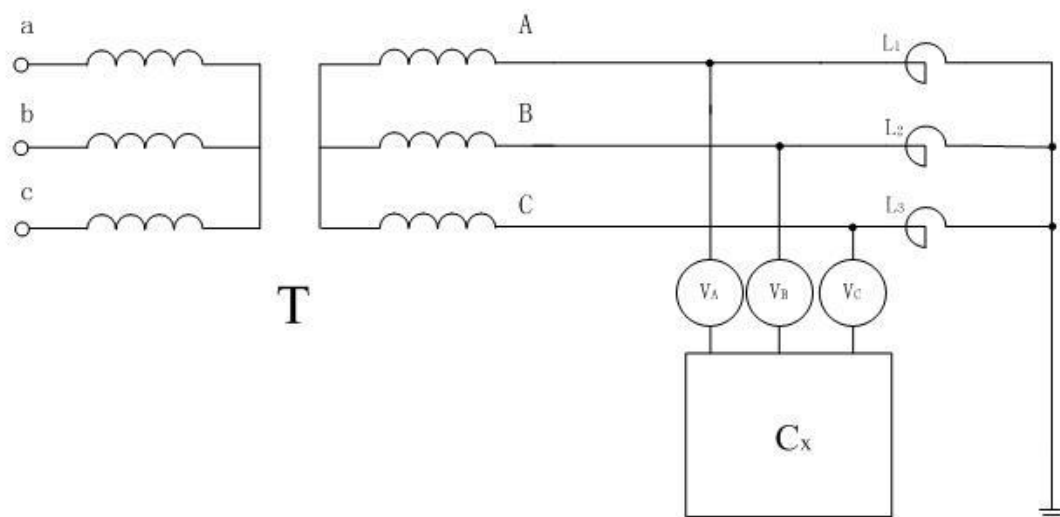
试品编号 Test object No.	014412493303700001	014412493303700002	014412493303700003
恒温箱空气温度 Ambient Temperature in the oven (℃)	70.0		
外壳温度 Container temperature (℃)	70.0	70.0	70.0
保持时间 Lasting time (h)	2	2	2
试验情况 Test condition	无渗漏 No leakage	无渗漏 No leakage	无渗漏 No leakage

## 3.试验结果 Result: 通过 Passed。

## 端子间电压试验

### Voltage test between terminals

试验回路原理图 Test circuit diagram:



T:试验变压器 Test transformer; CX:试品 Test object;

L:电抗器 Reactor; V: 电压测量系统 Voltage measurement system



## 端子间电压试验

## Voltage test between terminals

试验日期 Test date: 2021-08-27

试区大气条件(Atmospheric conditions):  $t=28.0\text{ }^{\circ}\text{C}$  RH= 46.5% P=96.81 kPa

## 1.试验数据 Test data:

试品编号 Test object No.		014412493303700 001	014412493303700 002	014412493303700 003
试验前电容 Capacitance before test ( $\mu\text{F}$ )	$C_{A-B}$	323	324	323
	$C_{B-C}$	324	323	322
	$C_{C-A}$	323	324	322
	C	646.7	647.3	644.7
额定电压倍数 Times of $U_N$		2.15		
实施电压 Test voltage ( kV )		0.97	0.97	0.97
持续时间 Lasting time (s)		10	10	10
试验后电容 Capacitance after test ( $\mu\text{F}$ )	$C_{A-B}$	323	324	323
	$C_{B-C}$	324	323	322
	$C_{C-A}$	323	324	322
	C	646.7	647.3	644.7
试验前后电容变 化量 Deviation of capacitance before and after test ( % )	要求值 Requirement	< 2	< 2	< 2
	实测值 Test value	0	0	0
试验情况 Test condition		无闪络 No flashover	无闪络 No flashover	无闪络 No flashover

注 Note:

试验时, 试验电压施加于试品端子之间。

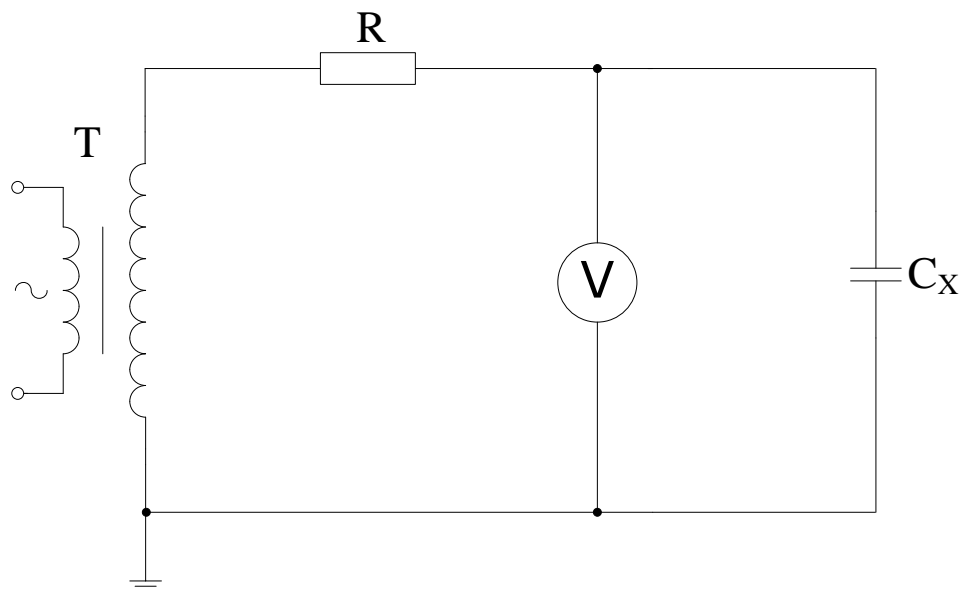
During the test, the voltage is applied between the terminals of the test sample.

2.试验结果 Result: 通过 Passed.

## 端子与外壳间电压试验

## Voltage test between terminals and container

试验回路原理图 Test circuit diagram:



T:试验变压器 Test transformer; C<sub>x</sub>:试品 Test sample;

R: 保护电阻 Protection resistance; V: 电压测量系统 Voltage measurement system

## 端子与外壳间电压试验

## Voltage test between terminals and container

试验日期 Test date: 2021-08-27

试区大气条件(Atmospheric conditions):  $t=28.0^{\circ}\text{C}$  RH= 46.5% P=96.81 kPa

## 1.试验数据 Test data:

试品编号 Sample No.	01441249330370 0001	01441249330370 0002	01441249330370 0003
应施电压 Expected voltage (kV)	3.0		
实施电压 Test voltage (kV)	3.0	3.0	3.0
持续时间 Lasting time (s)	60	60	60
试验情况 Test condition	无闪络 No flashover	无闪络 No flashover	无闪络 No flashover

注 Notes:

a)  $U_c=U_e \times K_t \times K_a$ ,  $K_a=1$ ,  $K_t=0.995$ , 实际试验时取 During test choosing  $K_t=1.000$ 。

b) 试验时将试品的所有出线端子短接, 试验电压施加于短接端子与外壳之间。

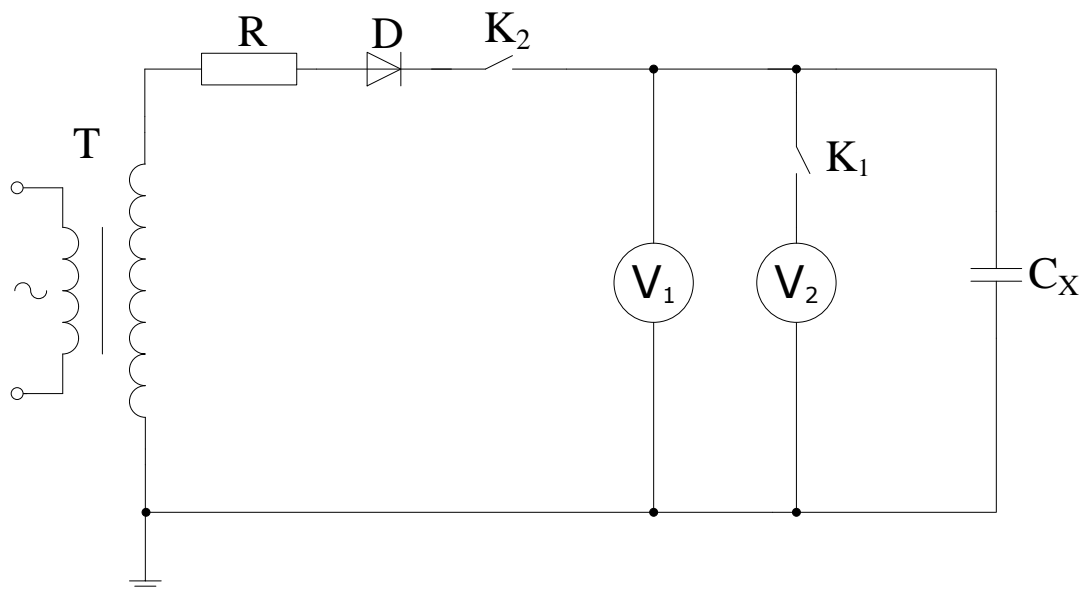
During the test, the voltage is applied between the terminals, which are connected together, and the container.

2.试验结果 Result: 通过 Passed。

## 内部放电器件试验

## Test of internal discharge device

试验回路原理图 Test circuit diagram:



T:试验变压器 Test transformer; R:保护电阻 Protection resistance;

D:整流硅堆 Rectifier diode;  $C_X$ :试品 Test object;

$K_1$   $K_2$ :开关 Switch;  $V_1$   $V_2$ :电压测量系统 Voltage measurement system

## 内部放电器件试验

## Test of internal discharge device

试验日期 Test date: 2021-08-27

试区大气条件(Atmospheric conditions):  $t=28.0^{\circ}\text{C}$  RH=46.5 % P= 96.81kPa

## 1.试验数据 Test data:

试品编号 Test object No.		014412493303700001	014412493303700002	014412493303700003
实施电压 Test voltage ( kV ) DC		0.64	0.64	0.64
持续时间 Lasting time (s)		180	180	180
剩余电压 (V) Residual voltage	要求值 Requirement		$\leq 75$	
	实测 值 Test value	A-BC	<30	<30
		C-AB	<30	<30

注 Notes:

a)试验时,  $\sqrt{2}U_N$  的试验电压施加于试品两短接端子与第三端子之间。During the test, the voltage of  $\sqrt{2}U_N$  is applied between the third terminal and the short-circuited terminals.

b)试验时使用直流电压进行试验。

The test is carried out with DC voltage.

c)采用自放电法测量剩余电压值。

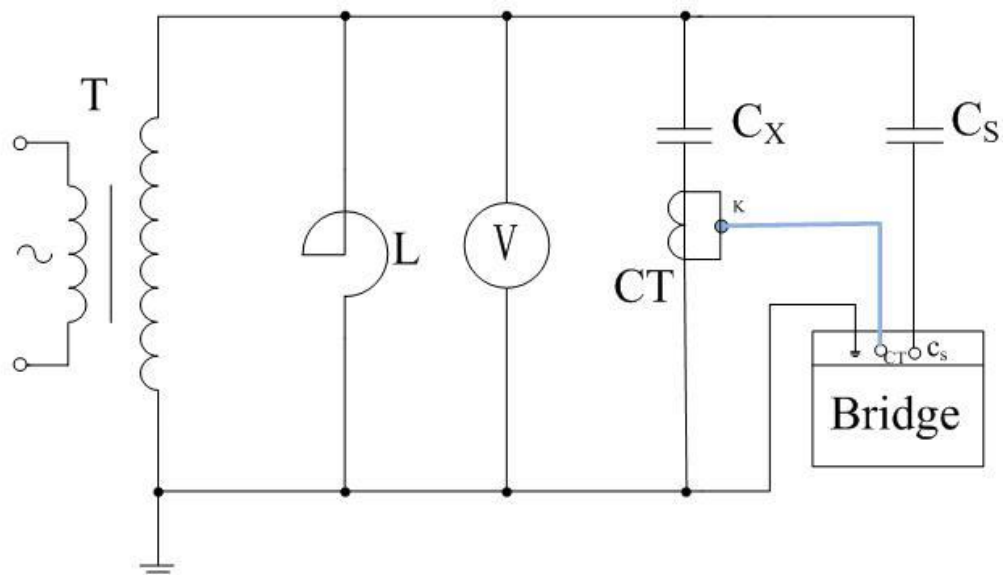
The residual voltage is measured by using self-discharge.

2.试验结果 Result: 通过 Passed.

## 电容测量和容量计算

## Capacitance measurement and output calculation

试验回路原理图 Test circuit diagram:



T:试验变压器 Test transformer; L:电抗器 Reactor; C<sub>X</sub>:试品 Test object;

V: 电压测量系统 Voltage measurement system; CT: 电流比较器 Current comparator;

C<sub>S</sub>: 标准电容器 Standard capacitor; Bridge: 西林电桥 Schering bridge

## 电容测量和容量计算

## Capacitance measurement and output calculation

试区大气条件(Atmospheric conditions): t= 28.0℃ RH=46.5 % P=96.81 kPa

试验日期 Test date: 20201-08-27

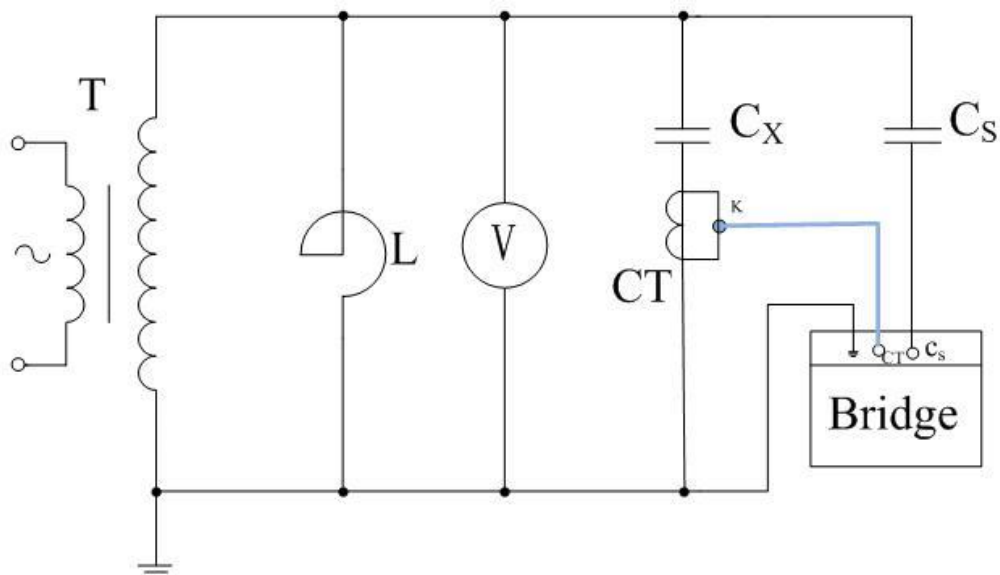
## 1.试验数据 Test data:

试品编号 Test object No.		014412493303700001			014412493303700002			014412493303700003		
测量部位 Measurement position		A-B	B-C	C-A	A-B	B-C	C-A	A-B	B-C	C-A
实施电压 Test voltage（kV）		0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
电容测量值 Measured capacitance（μF）		318.00	319.05	318.20	319.17	318.76	319.59	318.07	317.77	317.43
总电容值 Capacitance（μF）		636.83			638.35			635.51		
电容偏差 Deviation of capacitance before and after test    ΔC %	要求值 Requirement	-5 ~ +10								
	实测值 Test value	+1.24			+1.48			+1.03		
电容值最大与最小之比 Ratio of maximum to minimum value of the capacitance	要求值 Requirement	≤ 1.08								
	实测值 Test value	1.003			1.003			1.002		
容量计算 Calculated output(kvar)		40.49			40.59			40.41		

## 2.试验结果 Result: 通过 Passed.

电容器损耗角正切 ( $\tan \delta$ ) 测量Measurement of the tangent of the loss angle ( $\tan \delta$ ) of the capacitor

试验回路原理图 Test circuit diagram:



T: 试验变压器 Test transformer; L: 电抗器 Reactor; C<sub>x</sub>: 试品 Test object;

V: 电压测量系统 Voltage measurement system; CT: 电流比较器 Current comparator;

C<sub>s</sub>: 标准电容器 Standard capacitor; Bridge: 西林电桥 Schering bridge



电容器损耗角正切 ( $\tan \delta$ ) 测量Measurement of the tangent of the loss angle ( $\tan \delta$ ) of the capacitor试区大气条件(Atmospheric conditions):  $t=28.0\text{ }^{\circ}\text{C}$  RH= 46.5% P= 96.81kPa

试验日期 Test date: 2021-08-27

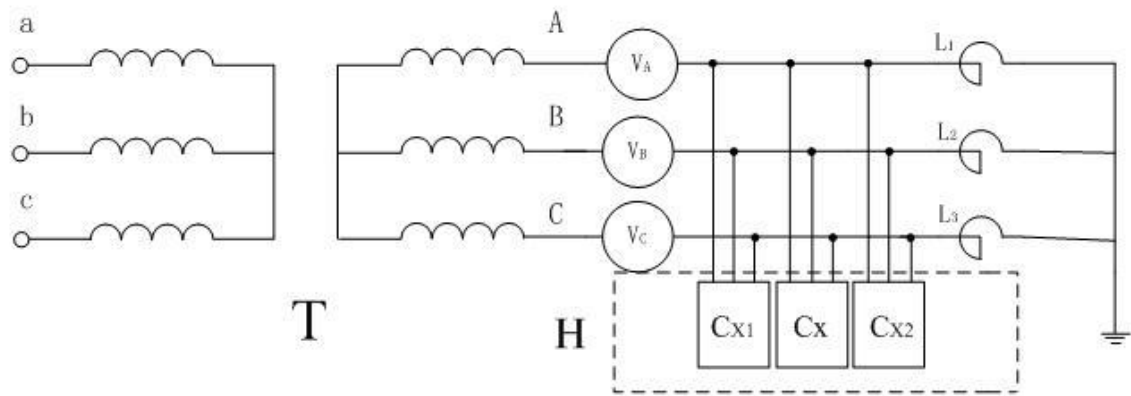
## 1. 试验数据 Test data:

试品编号 Test object No.		014412493303700001			014412493303700002			014412493303700003		
测量部位 Measurement position		A-B	B-C	C-A	A-B	B-C	C-A	A-B	B-C	C-A
实施电压 Test voltage (kV)		0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
tan $\delta$ %	要求值 Requirement	$\leq 0.20$								
	实测值 Test value	0.109	0.105	0.107	0.121	0.114	0.117	0.111	0.102	0.110

## 2. 试验结果 Result: 通过 Passed.

## 热稳定性试验 Thermal stability test

试验回路原理图 Test circuit diagram:



T:试验变压器 Test transformer; Cx:试品 Test object; Cx1 和 Cx2:陪试试品 Barrier units;

H:恒温箱 Oven; L:电抗器 Reactor; V 电压测量系统 Voltage measuring system

## 热稳定性试验

## Thermal stability test

试验日期 Test date: 2021-08-27 ~ 2021-08-30

## 1. 试验数据 Test data: :

## 1.1 试验条件 Test condition:

a) 恒温箱空气温度 The ambient air temperature of the oven  $50^{\circ}\text{C} \pm 1^{\circ}\text{C}$ 

b) 试品间距 The separation between the samples 50 mm

c) 对试品施加 0.54kV 正弦交流电压, 保持 48 h

The sample and barriers are subjected for a period of 48\_h, to an a.c. voltage of 0.54kV substantially sinusoidal form.

d) 测温元件固定在 3 台试品相邻侧的外壳大面中心线距底 2/3 的中心处

The temperature measuring element is fixed at the center line of the large surface of the shell of the 3 units and in the middle of the width and 2/3 of the height from the bottom.

## 1.2 热稳定性试验过程的最后 6h 内温度测试结果 Test result of the last 6 hours of the thermal stability test:

试品编号 Object No.		014412493303700001	014412493303700002	014412493303700003	恒温箱空气 温度 Ambient Temperature in the oven $^{\circ}\text{C}$
测温部位 Temperature measurement site		外壳温度 Container $^{\circ}\text{C}$	外壳温度 Container $^{\circ}\text{C}$	外壳温度 Container $^{\circ}\text{C}$	
累计时间 Accumulative test time (h)	42	66.1	67.3	66.8	50.3
	44	66.1	67.3	66.7	50.2
	46	66.0	67.3	66.6	50.4
	48	66.0	67.3	66.6	50.4
温升 Temperature rise(K)		15.6	16.9	16.2	/
温升变化量 Deviation of Temperature rise (K)		< 1	< 1	< 1	/

1.3 电容和损耗角正切值测试结果 Tested results of capacitance and tangent of loss angle ( $\tan \delta$ ):

试品编号 Test object No.		014412493303700002
测量部位 Measurement position		C-A
试验前 Before test (t= 28.0℃)	实施电压 Test voltage ( kV )	0.45
	$\tan \delta$ ( % )	0.117
	C ( $\mu F$ )	319.59
试验结束时 Ending of test (壳温 container67.3℃)	实施电压 Test voltage ( kV )	0.45
	$\tan \delta$ ( % )	0.111
	C ( $\mu F$ )	316.37
试验后 After test (t= 28.3℃)	实施电压 Test voltage ( kV )	0.45
	$\tan \delta$ ( % )	0.123
	C ( $\mu F$ )	319.50
试验后比试验前变化量 The change before and after test	$\Delta \tan \delta$ (%)	0.006
	$\Delta C$ (%)	-0.028
	$\Delta C$ 要求值 Requirement(%)	< 2

2.试验结果 Result: 通过 Passed。



热稳定试验照片 1 Photograph 1 of thermal stability test

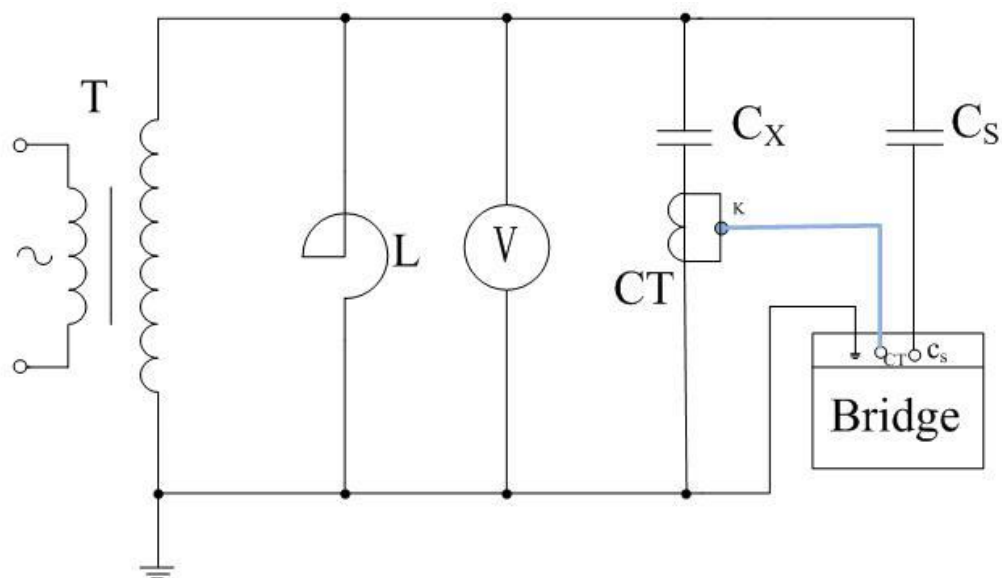


热稳定试验照片 2 Photograph 2 of thermal stability test

## 高温下电容器损耗角正切 ( $\tan \delta$ ) 测量

### Measurement of the tangent of the loss angle ( $\tan \delta$ ) of the capacitor at elevated temperature

试验回路原理图 Test circuit diagram:



T:试验变压器 Test transformer; L:电抗器 Reactor;  $C_X$ :试品 Test object;

V: 电压测量系统 Voltage measurement system; CT: 电流比较器 Current comparator;

$C_S$ : 标准电容器 Standard capacitor; Bridge: 西林电桥 Schering bridge

试验日期 Test date: 2021-08-29

1. 试验数据 Test data: :

试品编号 Test object No.		014412493303700001	014412493303700002	014412493303700003
测量部位 Measurement position		C-A	C-A	C-A
实施电压 Test voltage (kV)		0.45	0.45	0.45
tan $\delta$ (%)	要求值 Requirement	$\leq 0.20$		
	实测值 Test value	0.108	0.111	0.108

注 Note:

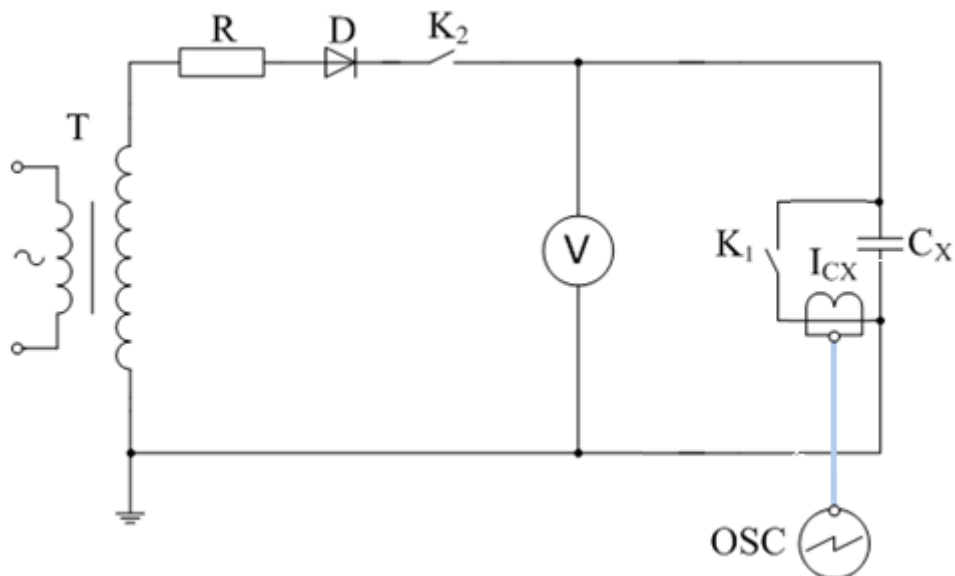
测量在热稳定试验结束后进行 Measurement carried out at the end of the thermal stability test.

2. 试验结果 Result: 通过 Passed.

## 放电试验

## Discharge test

试验回路原理图 Test circuit diagram:



T:试验变压器 Test transformer; Cx:试品 Test object; D:整流硅堆 Rectifier diode

R:保护电阻 Protection resistance ; V:电压测量系统 Voltage measurement system

K<sub>1</sub> K<sub>2</sub>: 开关 Switch; OSC: 示波器 Oscilloscope; I<sub>CX</sub>: 罗氏线圈 Rogowski coil



## 放电试验

## Discharge test

试区大气条件(Atmospheric conditions): t= 28.0℃ RH= 46.5% P= 96.81kPa

试验日期 Test date: 2021-08-27

## 1.试验数据 Test data:

试品编号 Test object No.		014412493303700001			014412493303700002			014412493303700003		
测量部位 Measurement position		A-B	B-C	C-A	A-B	B-C	C-A	A-B	B-C	C-A
试验前电容 Capacitance before test ( $\mu$ F )		323	324	323	324	323	324	323	322	322
额定电压倍数 Times of $U_N$		2								
实施放电电压 Test voltage ( kV ) DC		0.90			0.90			0.90		
放电次数 Discharge times		5			5			5		
端子间耐压值 Voltage Test between terminals ( kV ) AC		0.97			0.97			0.97		
试验后电容 Capacitance after test ( $\mu$ F )		323	324	323	324	323	324	323	322	322
试验前后电容变化量 Deviation of capacitance before and after test (%)	要求值 Requirement	< 2								
	实测值 Test value	0	0	0	0	0	0	0	0	0
试验情况 Test condition		无闪络 No flashover			无闪络 No flashover			无闪络 No flashover		

注 Notes:

a)试验时，试验电压施加于试品短接的两端子与第三端子之间。

During the test, the voltage is applied between the third terminal and the short-circuited two terminals.

b)试品通过直流充电，在 10 分钟内通过间隙进行 5 次放电。并在随后的 5 分钟内进行了一次端子间电压试验。

The sample is charged by means of d.c. and then discharged through a gap for 5times within 10 min.

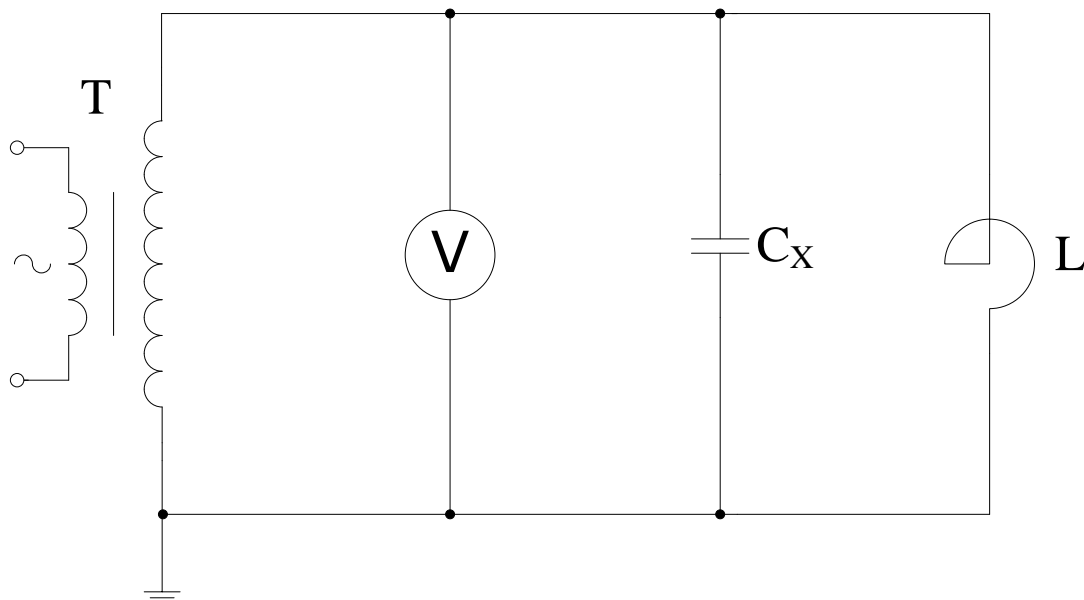
Within 5 min after this test, the sample is subjected to a voltage test between terminals.

2.试验结果 Result: 通过 Passed。

## 自愈性试验

### Self-healing test

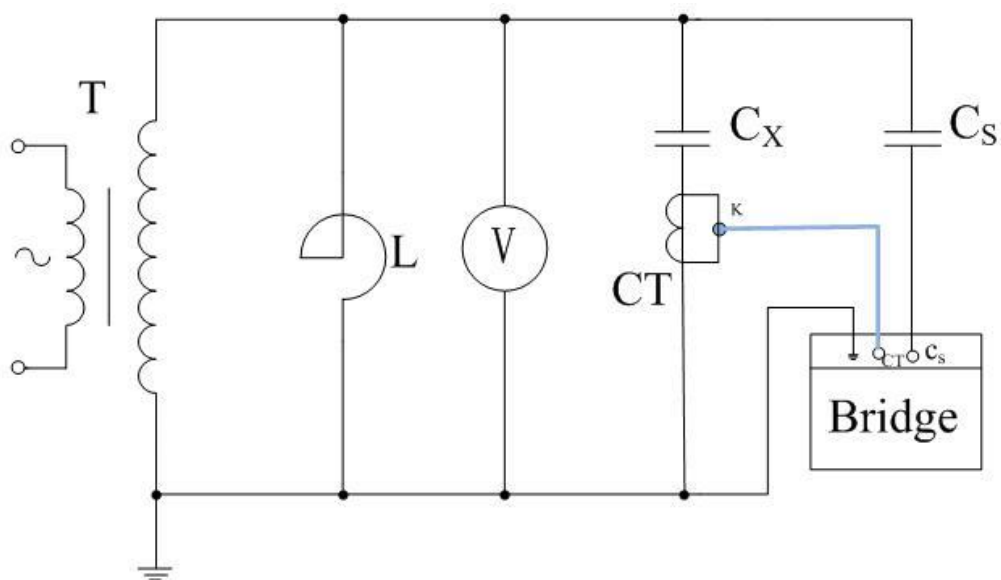
试验回路原理图 Test circuit diagram:



T:试验变压器 Test transformer; C<sub>x</sub>:试品 Test object;

L:电抗器 Reactor; V: 电压测量系统 Voltage measurement system

电容测量回路原理图 Circuit diagram for capacitance measurement:



T:试验变压器 Testing transformer; L:电抗器 Reactor; C<sub>x</sub>:试品 Test object;

V: 电压测量系统 Voltage measurement system; CT: 电流比较器 Current comparator;

C<sub>s</sub>: 标准电容器 Standard capacitor; Bridge: 西林电桥 Schering bridge

## 自愈性试验

## Self-healing test

试区大气条件(Atmospheric conditions): t= 28.0℃ RH= 46.5% P=96.81 kPa

试验日期 Test date: 2021-08-27

## 1.试验数据 Test data:

试品编号 Test object No.		014412493303700001			014412493303700002			014412493303700003		
测量部位 Measurement position		A-B	B-C	C-A	A-B	B-C	C-A	A-B	B-C	C-A
试验前 Before test	施加电压 Test voltage ( kV )		0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
	tanδ <sub>0</sub> ( % )		0.112	0.110	0.111	0.111	0.107	0.108	0.110	0.106
	试验前电容 Capacitance before test( μ F )		318.09	319.14	318.29	319.25	318.84	319.66	318.16	317.85
额定电压倍数 Times of U <sub>N</sub>		2.3								
实施电压 Test voltage ( kV )		1.04			1.04			1.04		
持续时间 Lasting time ( s )		10			10			10		
自愈次数 Self-healing times		> 5			> 5			> 5		
试验后 After test	施加电压 Test voltage ( kV )		0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
	tanδ ( % )	要求值 Requirement	0.133	0.131	0.132	0.132	0.128	0.129	0.131	0.127
		实测值 Test value	0.109	0.105	0.107	0.121	0.114	0.117	0.111	0.102
	试验后电容 Capacitance after test ( μ F )		318.00	319.05	318.20	319.17	318.76	319.59	318.07	317.77

试验前后电容变化量 Deviation of capacitance before and after test ( % )	要求值 Requirement	< 0.5								
	实测值 Test value	-0.028	-0.028	-0.028	-0.025	-0.025	-0.021	-0.028	-0.025	-0.025
试验情况 Test condition		无闪络 No flashover			无闪络 No flashover			无闪络 No flashover		

注 Notes:

a)试验后  $\tan\delta$  要求值 (  $\tan\delta$  requirement after test ):  $\tan\delta \leq 1.1\tan\delta_0 + 1 \times 10^{-4}$ .

b)试验时, 试验电压施加于试品两端子之间。

During the test, the voltage is applied between the two terminals of the test sample.

c)试验使用交流电压进行试验。

The test is carried out with AC voltage.

d)电容测量使用电桥在规定电压下进行。

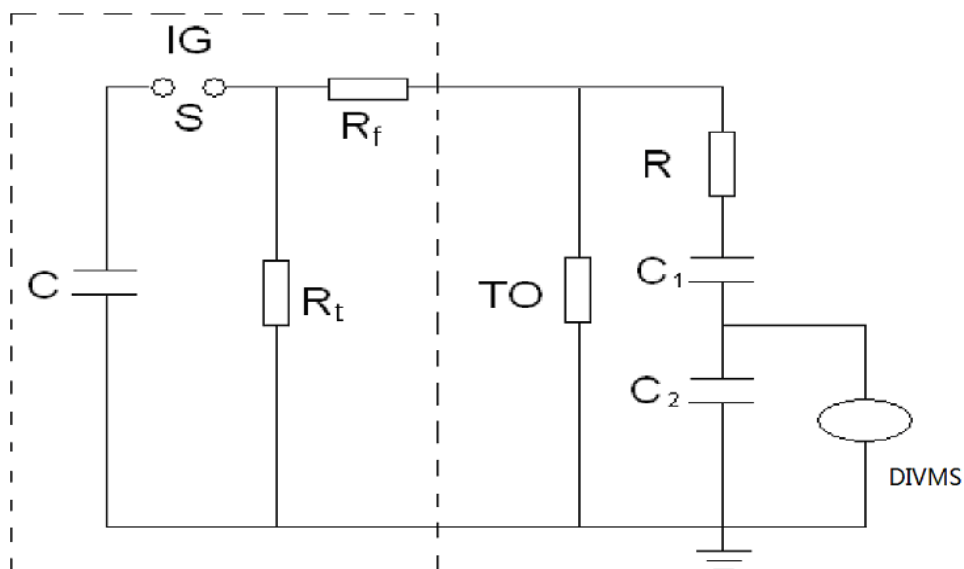
The measurement of capacitance and loss tangent is carried out at specified voltage by high voltage bridge.

2.试验结果 Result: 通过 Passed.

## 端子与外壳间雷电冲击电压试验

### Lightning impulse voltage test between terminals and container

试验回路原理图 Test circuit diagram:



C: 冲击发生器主电容 IG capacitance; R<sub>f</sub>:波头电阻 Front resistance

R<sub>t</sub>:波尾电阻 Tail resistance; S:点火球隙 Sphere gap; R:阻尼电阻 Damping resistance

C<sub>1</sub>:高压臂电容 H.V arm capacitance; C<sub>2</sub>:低压臂电容 L.V arm capacitance

TO:试品 Test object; DIVMS:冲击电压测量系统 Impulse voltage measuring system

## 端子与外壳间雷电冲击电压试验

## Lightning impulse voltage test between terminals and container

试验日期 Test date: 2021-08-30

试区大气条件(Atmospheric conditions):  $t=28.3^{\circ}\text{C}$  RH=53.3 % P=96.74 kPa

## 1.试验数据 Test data:

试品编号 Test object No.		014412493303700001、014412493303700002		
应施电压 Expected voltage (kV)		8.0		
实施电压 Test voltage (kV)	正极性 Positive polarity	8.12	7.89	7.95
	负极性 Negative polarity	8.23	8.08	8.25
试验情况 Test condition		无闪络 No flashover	无闪络 No flashover	无闪络 No flashover

注 Notes:

a)  $U_c=U_e \times K_t \times K_a$ ,  $K_a=1$ ,  $K_t=0.978$ , 实际试验时取 During test choosing  $K_t=1.000$ 。其中  $U_e$  为额定耐受电压值,  $K_t$  为大气修正因数,  $K_a$  为海拔修正因数。

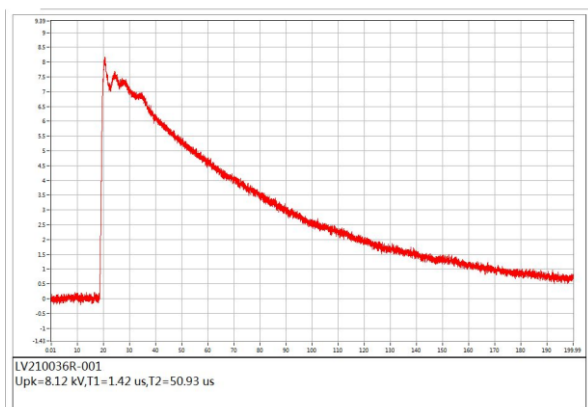
The  $U_e$  is rated withstand voltage value,  $K_t$  is the air density correction factor,  $K_a$  is the altitude correction factor.

b) 试验时将试品的所有出线端子短接, 试验电压施加于短接端子与外壳之间。

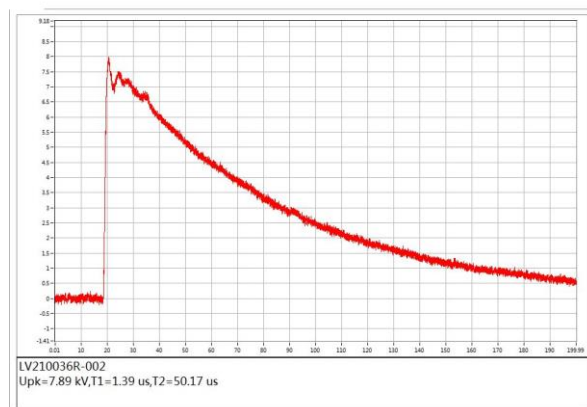
During the test, the voltage is applied between the terminals, which are connected together, and the container.

2.试验结果 Result: 通过 Passed。

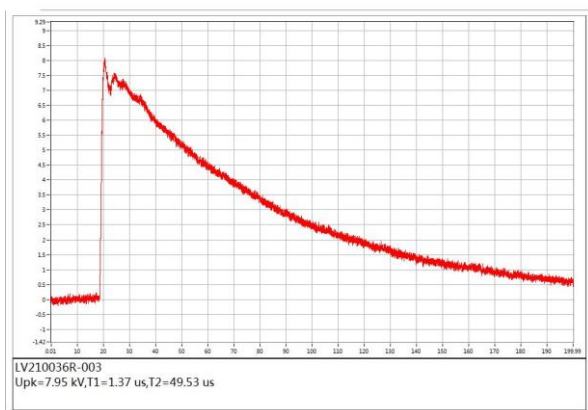
## 示波图 Oscillogram



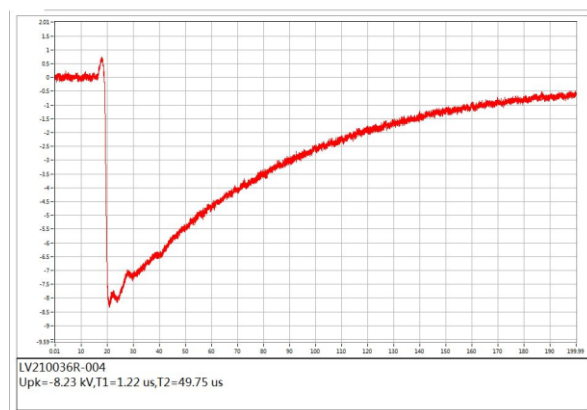
210036R--01



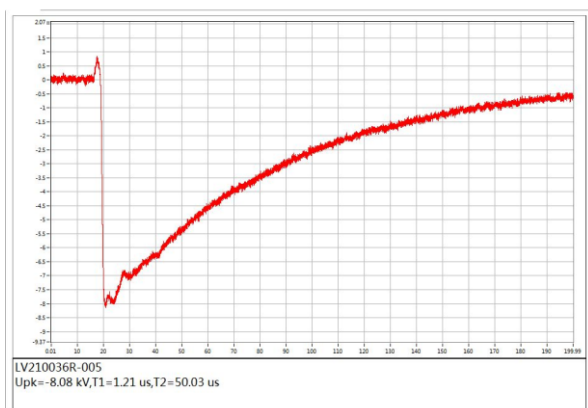
210036R--02



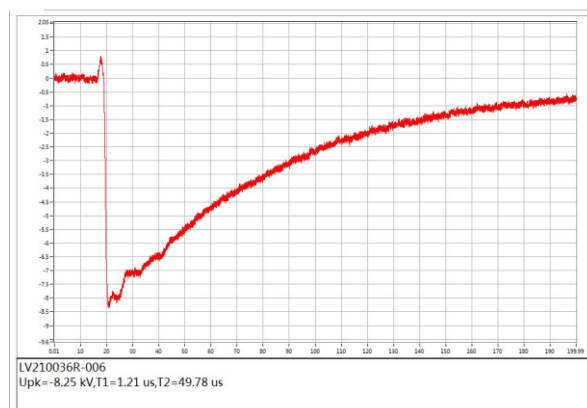
210036R--03



210036R--04



210036R--05



210036R--06



