

电力工业电气设备质量检验检测中心

英版

Quality Inspection and Test Center
for Equipment of Electric Power

3317-550



2012) 检字

JHG616 号

检测报告

Inspection Report



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**Quality Inspection and Test Center for Equipment of Electric Power
Inspection Report**

(2012)QITC No.JHG 616

Client: Guangdong Sihui Instrument Transformer Works Co.,Ltd

Description of Sample

Name of test sample: Inductive voltage transformer
Type: SSVT-550
Sample NO.: V1207500001
Manufacturer: ABB S.p.A.-Power Products Division U.O.Adda-HV
Date of Manufacture: July -2012
Sampling way: offer by client

Inspection Standard/Reference

GB1207-2006 Inductive voltage transformers
DL/T726-2000 Specification of voltage transformer for electrical power for order
IEC60044-2:2003 Instrument transformers –Part 2: Inductive voltage transformers

Category of Inspection: Routine test /Type test/Special test

Inspection Dates: From 2012-10-29 to 2012-12-30

Conclusion:

Inductive voltage transformer with the type of SSVT-550 offered by Guangdong Sihui Instrument Transformer Works Co.,Ltd meets the requirements of the corresponding items of the standards GB1207—2006,etc.

Note: This English report is written at request of the client. In the event of any difference in meanings of the text , the Chinese report shall take precedence over the English version.

Valid Time 5 years

Inspected by: 王焱 万强峰

Checked by: 岑

Examined and verified by: 郭志勤

Approved by: 曹

Date of issue: 2013-02-06

Testing Item and Conclusion

No.	Item	Reference standard	Test result	Conclusion
1	Inspection semblance and verification of terminal markings	The nameplate, sign, earthing terminal, terminal marking shall meet the requirements. The valve and the blast slice shall be entireness.	OK	Pass
2	Power-frequency withstand test on secondary windings	Applied voltage on winding-to-winding and winding-to-earth shall be 3kV/50Hz/1min	Winding-to-winding and winding-to-earth Test voltage 3kV/50Hz/1min No disruptive puncture occurs.	Pass
3	Power frequency withstand test on earthed terminal of primary winding	Applied voltage between earthed terminal of primary winding and earth shall be 5kV/50Hz/1min	Test voltage 5kV/50Hz/1min No disruptive puncture occurs.	Pass
4	Induced voltage withstand test on primary windings	Induced voltage of the primary winding shall be 680kV/150Hz/40s	Atmosphere correction factor $K_t=1.008$ Test voltage 680kV/150Hz/40s No disruptive puncture occurs. Dry bulb temperature 27°C Wet bulb temperature 23°C Atmosphere pressure 100.9kPa	Pass
5	Partial discharge measurement	Testing frequency 150 Hz Pre-stress voltage 680 kV Test voltage 550 kV PD \leq 10 pC Test voltage 381 kV PD \leq 5 pC	Testing frequency 150 Hz Pre-stress voltage 680 kV Test voltage 550 kV PD 5 pC Test voltage 381 kV PD 3 pC Backgroundlevel 1.5 pC Ambienttemperature 27 °C Relativehumidity 66 %	Pass
6	Measurement of Excitation	Providing the test data	Details in appendix No. C.	--
7	Determination of errors	The errors of the second windings should fulfill the requirement of class 0.5.	The errors of secondary windings are measured at rated frequency and rated power factor within rated burden. Details in appendix No. D	Pass
8	Measurement of DC resistances	Providing the test data	AN: 229.9 Ω IaIn: 178.2 m Ω Ambient temperature 27°C	—

No.	Item	Reference standard	Test result	Conclusion
9	Temperature rise test	<p>The temperature rise of windings cannot exceed 75K under the voltage of 1.2Un.</p> <p>The temperature rise of windings cannot exceed 10K under the voltage of 1.5Un (30s) (beginning from the normality).</p>	<p>The voltage of 1.2Un is applied to primary winding when the secondary winding an load thermal limiting burden 200VA. After every part reaching a steady state, the values of temperature rise are shown as follows AN : 8 K an : 27 K Ambient temperature 27 °C</p> <p>The voltage of 1.5Un is applied to primary winding for 30s beginning from the normality when the secondary windings load rated burden. After every part reaching a steady state, the values of temperature rise are shown as follows AN: 1.0 K an: 1.5 K Ambient temperature 27 °C The details of 1.2Un in appendix No. E</p>	Pass
10	Lightning impulse test and chopped impulse test on primary winding	<p>Applied voltage on primary winding to secondary windings and earth shall be Standard LI 1550 kV Waveform 1.2/50 μs positive impulses 3 times negative impulses 3 times Standard LI-chopped 1783kV Waveform (2~5)μs negative impulses 2 times</p>	<p>3 consecutive LI in positive and negative polarities and two chopped LI in negative polarity were applied to primary terminal. Details in appendix No. F</p> <p>No disruptive puncture occurs.</p>	Pass
11	Switching impulse test	<p>Water resistance $100 \pm 15 \Omega \cdot m$ at 20°C Vertical precipitation 1.0~2.0mm/min Horizontal precipitation 1.0~2.0mm/min Standard LI 1175kV Waveform 250/2500μs positive impulses 15 times</p>	<p>Water resistance $105 \Omega \cdot m$ at 20°C Vertical precipitation 1.2mm/min Horizontal precipitation 1.2mm/min 15 Standard LI in positive polarity are applied to primary terminal. Details in appendix No. G</p> <p>No disruptive puncture occurs.</p>	Pass
12	Short-circuit withstand capability test	<p>The rated voltage 7.2kV is applied to secondary windings for 1.0s when primary winding is connected with the ground. There shall be no electrical and mechanical damage.</p>	<p>Secondary voltage 7.2 kV Secondary current 490 A Durative time 1.04 s Waveform in appendix No. H There is no electrical and mechanical damage. NOTE 1. The primary conductor is copper stick, the current density is $5.2A/mm^2$. 2.The secondary conductor is copper stick., the current density is $12.3A/mm^2$.</p>	Pass

No.	Item	Reference standard	Test result	Conclusion
13	Power-frequency voltage withstand test on secondary windings (retrial)	Applied voltage on winding-to-winding and winding-to-earth shall be 3kV/50Hz/1min	Test voltage 3kV/50Hz/1min No disruptive puncture occurs.	Pass
14	Power frequency withstand test on earthed terminal of primary winding (retrial)	Applied voltage between earthed terminal of primary winding and earth shall be 5kV/50Hz/1min	Test voltage 5kV/50Hz/1min No disruptive puncture occurs.	Pass
15	Induced voltage withstand test on primary winding (retrial)	Induced voltage of the primary windings shall be 612kV/150Hz/40s	Test voltage 612kV/150Hz/40s No disruptive puncture occurs.	Pass
16	Partial discharge measurement (retrial)	Testing frequency 150 Hz Pre-stress voltage 612 kV Test voltage 550 kV PD \leq 10 pC Test voltage 381 kV PD \leq 5 pC	Testing frequency 150 Hz Pre-stress voltage 612 kV Test voltage 550 kV PD 7 pC Test voltage 381 kV PD 3 pC Backgroundlevel 1.9 pC	Pass
17	Measurement of Excitation (retrial)	Providing the test data	Magnetizing current at rated voltage 5.6mA	—
18	Determination of errors (retrial)	The errors of the second windings shall meet the requirement of class 0.5.	Details in appendix No. I.	Pass
19	Radio interference voltage measurement	The radio interference voltage at 349kV shall not exceed 500 μ V	Test voltage 349kV Radio interference voltage doesn't exceed 300 μ V (0.5MHz)	Pass
20	Mechanical test	The test loads shall be applied for 2.5kN, 60s for each of the conditions. And there should be no evidence of damage (deformation, rupture or leakage).	Horizontal(landscape orientation) to primary terminals 2.5kN, 1min Horizontal(longitudinal orientation) to primary terminals 2.5kN, 1min Vertical to primary terminals 2.5kN, 1min There is no evidence of damage (deformation, rupture or leakage).	Pass
21	The gas seal test	The relative ratio of gas giving off in one year should not exceed 0.5% at the rated pressure of 0.65MPa.	The relative ratio of gas giving off in one year doesn't exceed 0.1%	Pass
22	Measurement of the water contained in gas	The water contained in gas shall be less than 150 μ L/L	The water contained in gas is 75 μ L/L	Pass

No.	Item	Reference standard	Test result	Conclusion
23	Short time power frequency withstand test on primary winding in the case of no displayed pressure	In the case of no displayed pressure, The test voltage (318kV) shall be applied between the terminal of the primary wind and earth for 5min. The terminals of the secondary windings shall be connected to earth.	In the case of no displayed pressure Test voltage 318kV/5min No disruptive discharge occurs	Pass
24	Inspection of core	Clear, no displacement, no distortion. The sizes should accord with the requirements of design.	OK Photographs in appendix No.K	Pass

- Note
1. Main test circuits, Details in appendix No. J.
 2. The tests of 1~19 items were performed in the pressure of 0.55MPa . The tests of 20~22 items were performed in the rated pressure of 0.65MPa.
 3. The outer insulation of object is electrotechnical methyl-silicone rubber bushing. Creepage distance of external insulation is 14.34 m, and arc flash distance is 3.81 m.
 4. In addition to the above tests, the outline dimension was measured according to the requirements of factory (measuring positions and numbers in appendix No. L); Results of load loss measurement, no-load voltage ratio measurement, temperature rise test in appendix No. M.

Appendix No. A Main characteristic Parameters of the Sample

Description: Inductive voltage transformer Sample NO.: V1207500001
 Type: SSVT-550 Highest voltage for equipment: 550kV
 Rated voltage: 525kV Rated frequency: 50 Hz
 Rated transformation: $525000/\sqrt{3} / 7200V$ Rated insulation level: 550/680/1550/1175kV
 Date of Manufacture: July-2012

Secondary windings	an
Accuracy class	0.5
Rated burden (VA)	0~200
Power factor (0.8)	

Appendix No. B Parameters of the main equipment

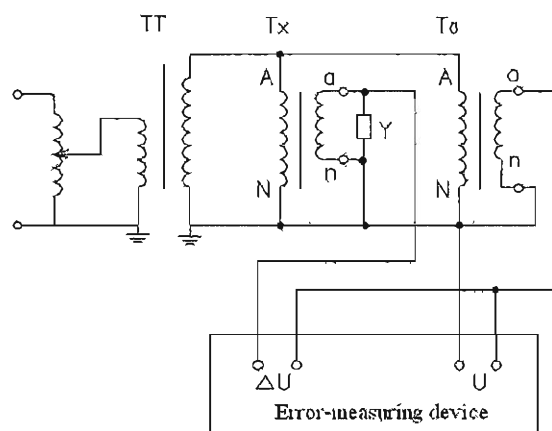
No.	Description/Type	Serial No.	Technical parameter	Accuracy class or uncertainty	Calibration institution	Valid date
1	Voltage transformer for measuring service HJ3-765	#05001 (YQ359)	$765/\sqrt{3}$ kV, $100/\sqrt{3}$ V	0.02	National center for high voltage measurement	2014.08.17
2	Inductive voltage divider FGB-02	#4447 (YQ317)	(0~200)V	0.0002	National center for high voltage measurement	2014.01.13
3	Instrument transformer test set HE20	#06104 (YQ382)	100、 $100/\sqrt{3}$ V	2	National center for high voltage measurement	2014.01.12
4	Partial discharge detector JFD-251	#20051112 (YQ381)	(0.5~2000)pC	10	National center for high voltage measurement	2013.08.30
5	Electromagnetic interference measuring receiver ZN3950	#051205 (YQ392)	150kHz~ 30MHz	< ± 1 kHz	Wu Han measurement center of Yawp	2013.04.10

Appendix No. C Measurement of Excitation

Percentage of rated secondary voltage (%)	20	50	80	100	120	150
No-load secondary current (mA)	1.6	4.4	6.2	5.5	18.4	158
Ambient temperature	27 °C		Relative humidity		66 %	

Appendix No. D Determination of errors

1. Test circuits



TT: Testing transformer

Tx: Object voltage transformer

T₀: standard voltage transformer

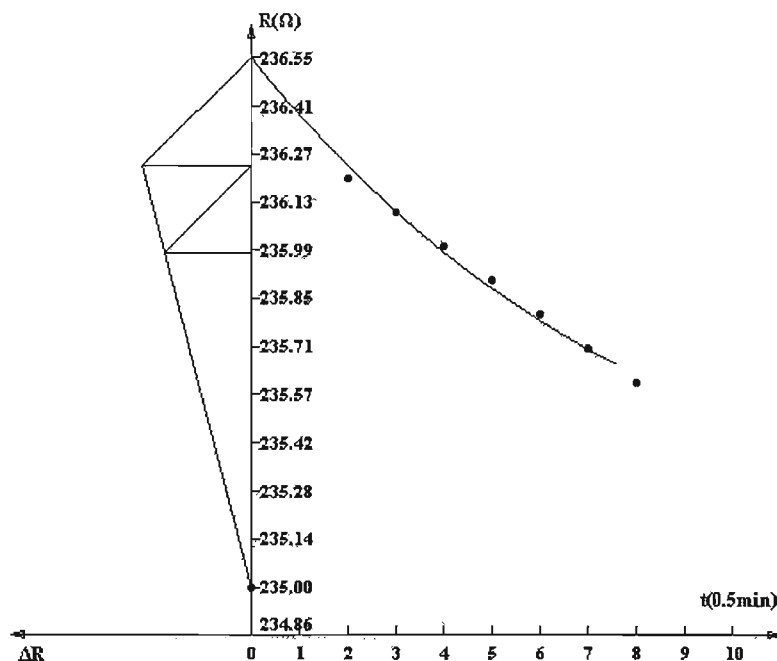
2. Test result

Secondary windings	Accuracy class	Error	Percentage of rated voltage			Burden /(VA/cos φ)
			80	100	120	
an	0.5	Ratio error(%)	-0.05	-0.05	-0.10	200 ----- 0.8
		Phase displacement(')	-2	-2	0	
		Ratio error(%)	-0.05	-0.05	-0.10	0
		Phase displacement(')	-2	-2	0	
Ambient temperature		27 °C		Relative humidity		66 %

Appendix No. E Temperature rise test
1.2Un

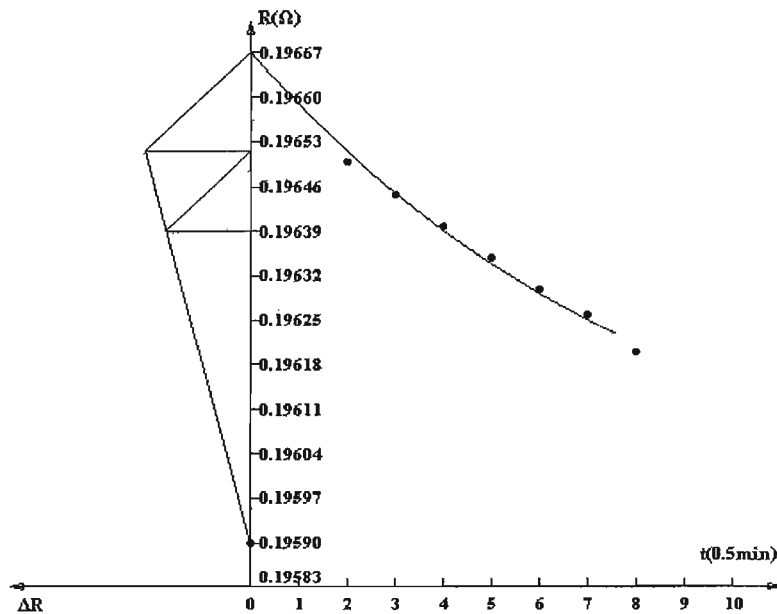
Temperature-rising curve of AN
The thermal resistance of $R_2=236.55 \Omega$

绕组热态电阻温升曲线
热态电阻 $R_2=236.55 \Omega$



Temperature-rising curve of an
The thermal resistance of $R_2=0.19667 \Omega$

绕组热态电阻温升曲线
热态电阻 $R_2=0.19667 \Omega$

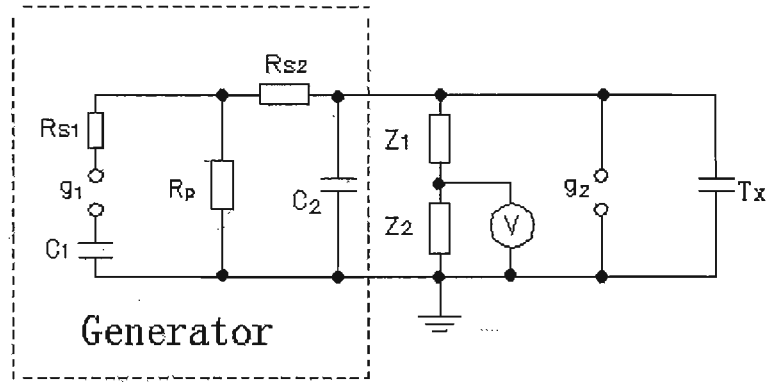


Appendix No. F Lightning impulse test and chopped lightning impulse test

1、Atmosphere conditions

Ambient temperature 7 °C Relative humidity 60 %

2、Test circuits



Rs2: front resistance Rp: tail resistance g1: discharging sphere gap
 g2: chopping sphere gap C1: front capacitor C2: tail capacitor
 Z1、Z2: divider Tx: object V: voltage meter

3、Test results

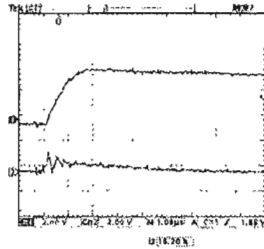
No.	The standard voltage(peak) (kV)	Waveform of voltage	The test voltage (peak) (kV) (kV)	The chopped time(μs)	Waveform No.	Result	Remarks
1	775	Pos.LI	983	/	1	OK	/
2	1550	Pos.LI	1580	/	2	OK	/
3	1550	Pos.LI	1571	/	3	OK	/
4	1550	Pos.LI	1557	/	4	OK	/
5	775	Neg.LI	967	/	5	OK	/
6	1550	Neg.LI	1568	/	6	OK	/
7	892	Chopped Neg.LI	983	4.4	7	OK	/
8	1783	Chopped Neg.LI	1716	4.5	8	OK	/
9	1783	Chopped Neg.LI	1759	4.5	9	OK	/
10	1550	Neg.LI	1576	/	10	OK	/
11	1550	Neg.LI	1553	/	11	OK	/

4、Conclusion

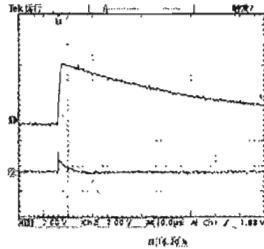
Pass

Appendix referential Waveform

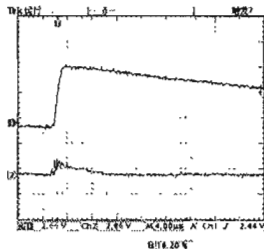
(1.50/50.7 μ s)



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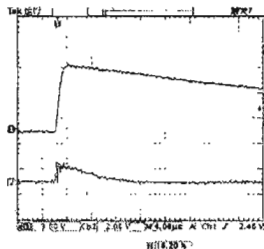


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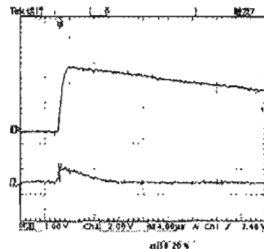
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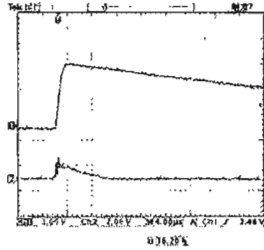
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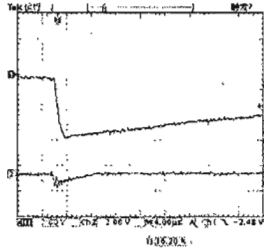
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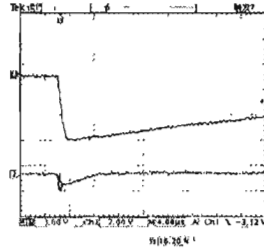
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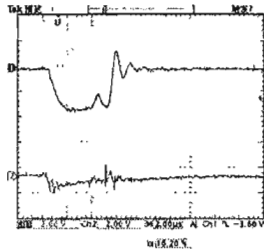
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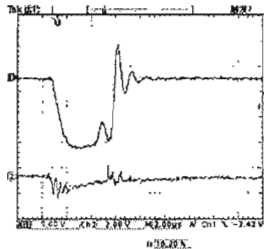
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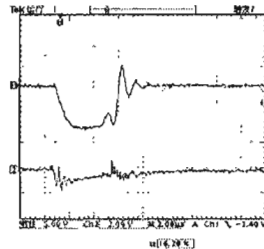
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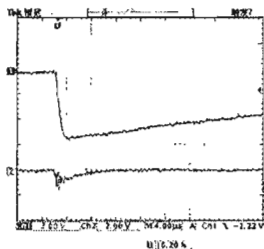
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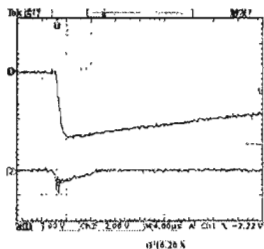
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15:09:47

No.9



25 12月 2012
15:17:44

No.10



25 12月 2012
15:19:47

No.11

Appendix No. G Switching impulse test

1、Atmosphere conditions

Water resistance: 105 $\Omega \cdot m$ at 20°C

Vertical precipitation: 1.2mm/min

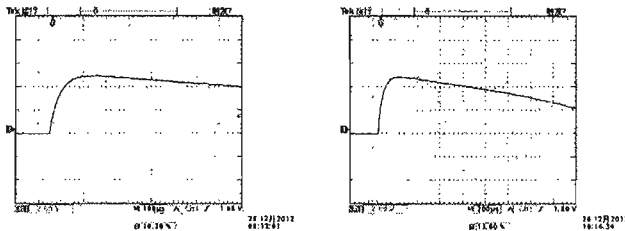
Horizontal precipitation: 1.2mm/min

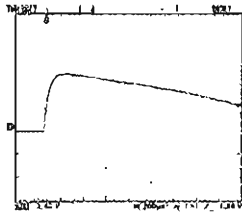
2、Test results

1	588	Pos.SI	703	/	1	OK	/
2	1175	Pos.SI	1177	/	2	OK	/
3	1175	Pos.SI	1172	/	3	OK	/
4	1175	Pos.SI	1174	/	4	OK	/
5	1175	Pos.SI	1174	/	5	OK	/
6	1175	Pos.SI	1160	/	6	OK	/
7	1175	Pos.SI	1173	/	7	OK	/
8	1175	Pos.SI	1165	/	8	OK	/
9	1175	Pos.SI	1177	/	9	OK	/
10	1175	Pos.SI	1175	/	10	OK	/
11	1175	Pos.SI	1173	/	11	OK	/
12	1175	Pos.SI	1173	/	12	OK	/
13	1175	Pos.SI	1171	/	13	OK	/
14	1175	Pos.SI	1165	/	14	OK	/
15	1175	Pos.SI	1172	/	15	OK	/
16	1175	Pos.SI	1175	/	16	OK	/

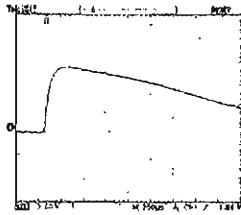
3、Conclusion

Pass

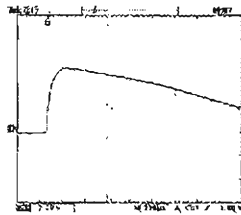
Appendix referential Waveform (231/1600 μs)



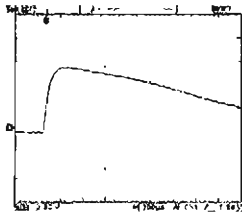
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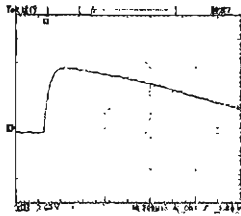
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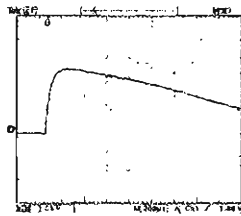
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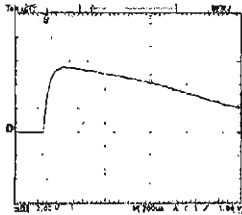
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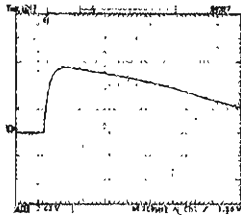
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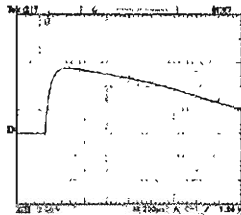
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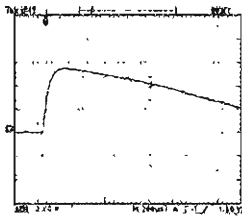
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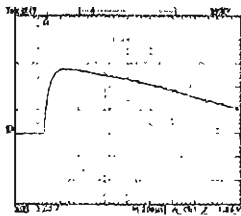
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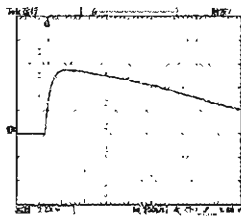
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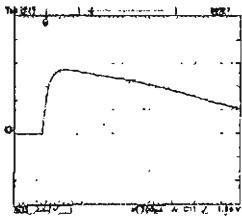
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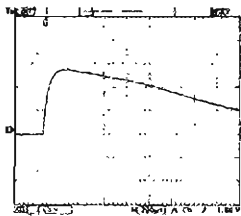
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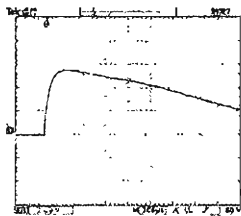
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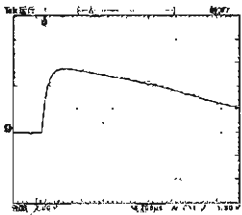
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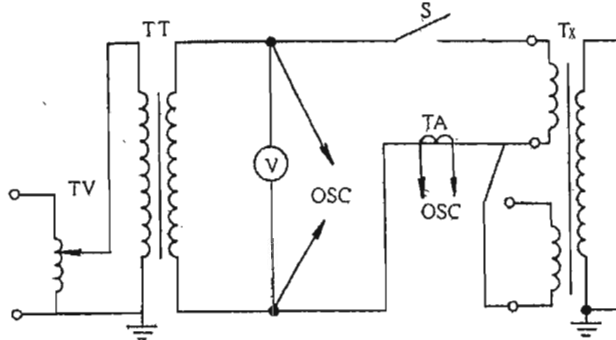
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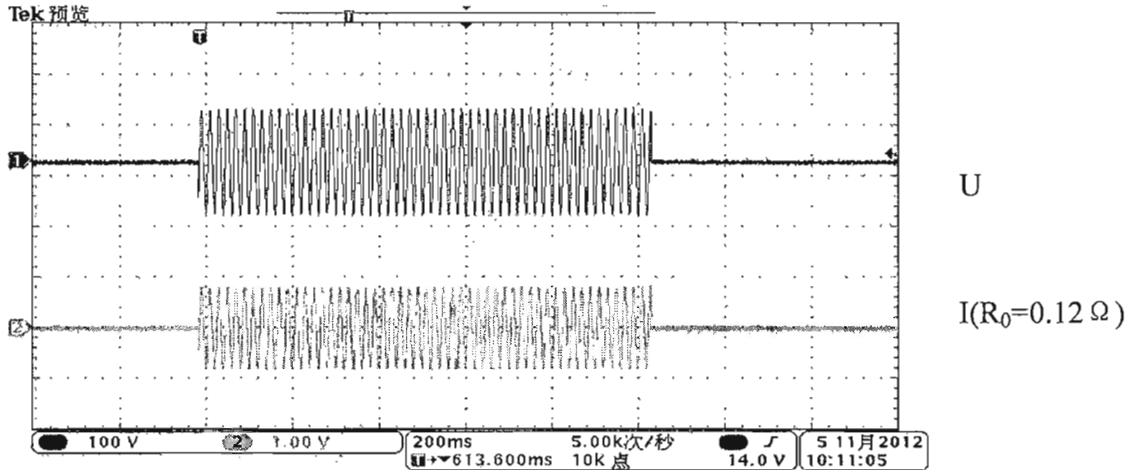
Appendix No. H Endurance of short circuit

1. Test circuits



TV: AC voltage regulator TT: Transformer S: Switch
 TA: Measuring current transformer OSC: Recording oscillograph V: Voltage meter
 Tx: Object voltage transformer

2. Test Waveform



Appendix No. I Determination of errors(retrial)

Secondary windings	Accuracy class	Error	Percentage of rated current			Burden
			80	100	120	$\frac{\text{an}}{\cos\phi}$
an	0.5	Ratio error(%)	-0.05	-0.05	-0.10	$\frac{200}{0.8}$
		Phase displacement(')	-2	-2	0	
		Ratio error(%)	-0.05	-0.05	-0.10	0
		Phase displacement(')	-2	-2	0	
Ambient temperature		6°C	Relative humidity		61%	

Appendix No. J Main test circuits

Figure 1—Power-frequency withstand test on primary windings

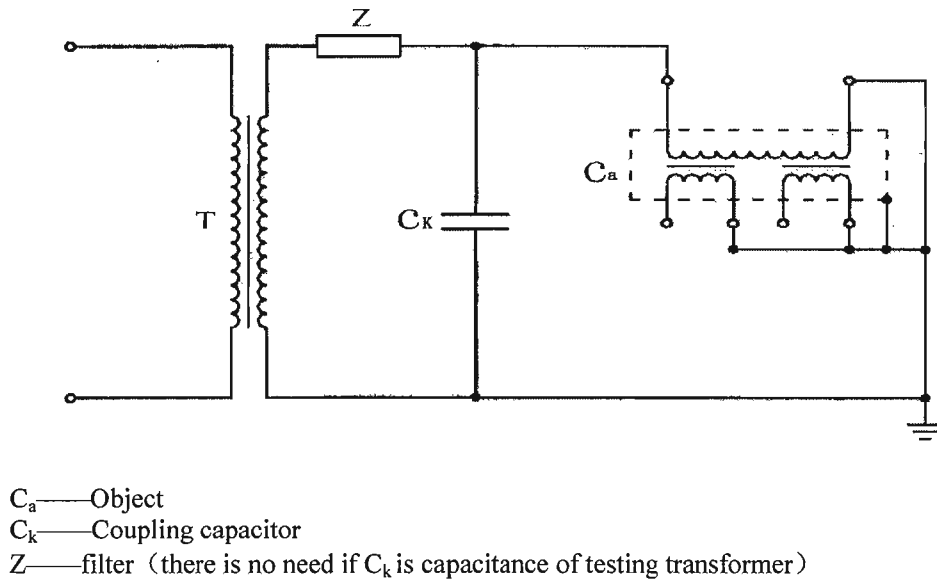
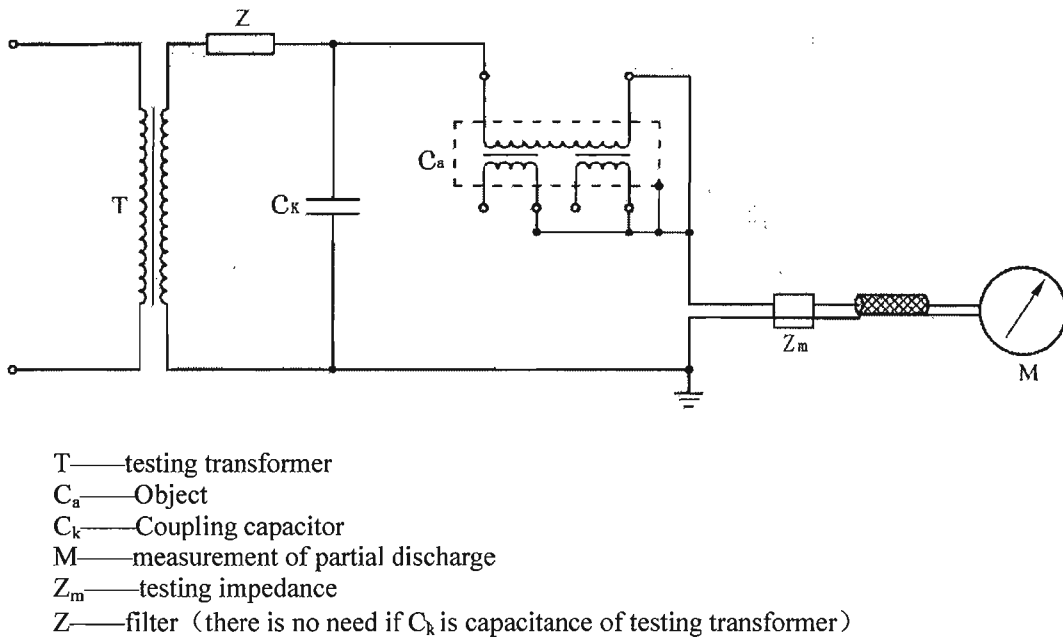


Figure 2—Partial discharge measurement

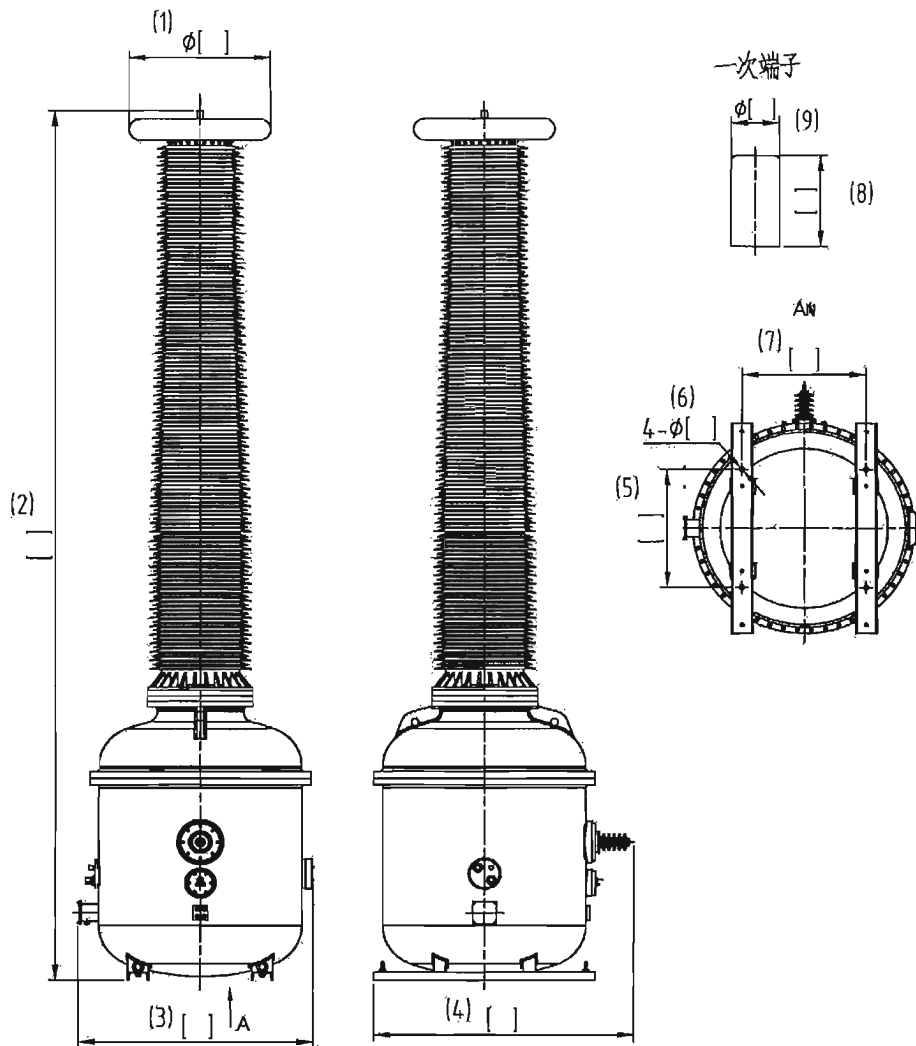


Appendix No. K Inspection of core



ABB 站用电压互感器		标准 IEC 60044-2		
型号 SSVT-550	额定频率 50 Hz	编号 V1207500001	电气原理图 	
绝缘水平 550/680/1175/1550 kV		图号		
电压因数 1.2/连续 1.5/30s	温度类别 -25 ~ 40 °C			
绝缘等级 E	污秽等级 III			
SF ₆ 额定 / 报警 / 最低压力 20°C 0.65 / 0.60 / 0.55 MPa				
变比 kV:V	端子	容量 kVA	阻抗 %	空载电流 A
525√3:7200	a n	333	10	10
变比 kV:V	端子	容量 VA	准确级	
525√3:7200	a n	200	0.5	
SF ₆ 143 kg	总重量 4300 kg	制造日期 2012.7		
意大利ABB高压产品分部				

Appendix No. L Dimension measurement



Unit: mm

1	952
2	6139
3	1582
4	1749
5	831
6	30.2
7	830
8	81
9	40.1

Appendix No. M

No.	Item	Entrusted requirements	Test result	Conclusion
1	Load loss measurement	Power frequency current 46.25 A is applied to secondary winding when primary winding is short circuit. Root mean square voltage active power absorbed shall be measured.	Secondary exciting current:46.25 A Secondary voltage: 665 V Load loss: 1216 W Ambient temperature: 26°C Relative humidity: 57%	—
2	Temperature rise test	Power frequency current 46.25A is applied to the secondary winding when primary winding is short circuit. The temperature rise of windings cannot exceed 75K	Power frequency current 46.25A is applied to the secondary winding when primary winding is short circuit. After every part reaching a steady state, the values of temperature rise are shown as follows AN : 45 K an : 68 K Ambient temperature 26 °C	—
3	No-load voltage ratio measurement	No-load voltage ratio shall not exceed $\pm 0.5\%$ of the rated voltage ratio.	an: -0.09% Ambient temperature:26°C Relative humidity:57%	—

Note: The above tests were performed in the pressure of 0.55MPa .