



Power Industry Quality Inspection and Testing Center for
Electric Equipment and Instruments

EETC2017HG010J



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检测
TESTING
CNAS L0699



Test Report

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Power Industry Quality Inspection and Testing Center for Electric
Equipment and Instruments
Test Report

EETC2017HG010J

1 Client

Guangdong SiHui Instrument Transformer Works Co., Ltd

2 Sample Description

Name: Inductive voltage transformer

Type: JDQXF-110

Manufacturer: Guangdong SiHui Instrument Transformer Works Co.,Ltd

Manufacture Date: Nov., 2016

Sample No./Details: V1609110011

3 Standards/Specifications

GB20840.1-2010 Instrument transformers-Part 1: General requirements

GB20840.3-2013 Instrument transformers-Part 3: Additional requirements for inductive voltage transformers

IEC61869-1:2007 Instrument transformers-Part 1: General requirements

IEC61869-3:2011 Instrument transformers-Part 3: Additional requirements for inductive voltage transformers

4 Test Category

Routine Test /Type Test / Special Test

5 Test Date

03 Jan. 2017 to 04 Mar. 2017

6 Conclusion

The inductive voltage transformer with the type of JDQXF-110 offered by Guangdong SiHui Instrument Transformer Works Co.,Ltd meets the requirements of the corresponding items of the standards GB20840.1-2010,GB20840.3-2013,IEC61869-1:2007,IEC61869-3:2011.

Note 1: In the event of any difference in meanings of the text, the Chinese report shall take priority over the English version.

Note 2: (Period of validity: 5 years.)

Tested by: 刘西尧 万德峰

Checked by: 刘翔

Verified by: 苏华

Approved by: WJH

Date of issue: 2017-03-15

7 Inspection Items and Results

No.	Item	Requirements	Results	Evaluation
1	Verification of markings	The nameplate, sign, earthing terminal, terminal marking shall meet the requirements. The valve and the bursting plate shall be in good condition.	Meet the requirements	Pass
2	Power-frequency voltage withstand tests on secondary terminals	Applied voltage on winding-to-winding and winding-to-earth shall be 3kV/50Hz/60s.	Test voltage: 3kV/50Hz/60s No flashover and breakdown occurred.	Pass
3	Power-frequency voltage withstand tests on primary terminals	Induced voltage between primary winding and earth shall be 230kV/150Hz/40s. Applied voltage between earthed terminal of primary winding and earth shall be 5kV/50Hz/60s.	Test voltage: 230kV/150Hz/40s No flashover and breakdown occurred. Atmosphere correction factor: $K_1=0.9971$ Test voltage: 5kV/50Hz/60s No flashover and breakdown occurred.	Pass
4	Partial discharge measurement	Test frequency: 150 Hz Pre-stress voltage: 230 kV Test voltage: 126 kV Maximum permissible PD level: 10 pC Test voltage: 87.3 kV Maximum permissible PD level: 5 pC	Test frequency: 150 Hz Pre-stress voltage: 230 kV Test voltage: 126 kV PD level: 6 pC Test voltage: 87.5 kV PD level: 3 pC	Pass
5	Measurement of excitation characteristic	Exciting current shall be measured at 0.2, 0.5, 0.8, 1.0, 1.2 and 1.5 times of rated secondary voltage respectively.	Details are shown in item 2.5	---
6	Tests for accuracy	The errors of the secondary windings shall meet the requirements of accuracy class 0.2/0.5/3P.	Meet the requirements	Pass
7	Temperature-rise test	The voltage of $1.0U_{pr}$ is applied on primary winding with the secondary windings loaded with the thermal limiting burden. The temperature-rise of windings shall not exceed 75K.	AN: 42 K 2a2n: 40 K	Pass
		The voltage of $1.2U_{pr}$ is applied on primary winding with the secondary windings loaded with the maximum rated burden. The temperature-rise of windings shall not exceed 75K.	AN: 11 K 1a1n: 17 K 2a2n: 17 K	Pass
		The voltage of $1.5U_{pr}$ is applied on primary winding for 30s beginning from the cold condition with the secondary windings loaded with the rated burden. The temperature-rise of windings shall not exceed 10K.	AN: 0.3 K 1a1n: 0.6 K 2a2n: 0.4 K dadn: 0.7 K	Pass

No.	Item	Requirements	Results	Evaluation
8	Impulse voltage test on primary terminals(Lightning and chopped impulse voltage test on primary terminals)	Standard LI: 550kV/ ± 15 Waveform : 1.2/50 μ s Standard LI-chopped : 632.5kV/-2 Waveform : (2~5) μ s	552kV~555kV ± 15 636kV -2 No flashover and breakdown occurred.	Pass
9	Wet test for outdoor type transformers	In wet condition, induced voltage between primary winding and earth shall be 230kV/150Hz/40s.	Test voltage: 230kV/150Hz/40s No flashover and breakdown occurred. Atmosphere correction factor: $K_t=0.9976$ Water conductivity: 102 μ S/cm Vertical component: 1.4 mm/min Horizontal component: 1.1mm/min	Pass
10	Short-circuit withstand capability test	The rated voltage 57.7V is applied on secondary winding for 1.0s with primary winding connected to earth. There shall be no electrical and mechanical damage.	1aln Test voltage: 57.7 V Test current: 654 A Duration: 1.02 s	Pass
11	Power-frequency voltage withstand tests on secondary terminals (retrial)	Applied voltage on winding-to-winding and winding-to-earth shall be 2.7kV/50Hz/60s.	Test voltage: 2.7kV/50Hz/60s No flashover and breakdown occurred.	Pass
12	Power-frequency voltage withstand tests on primary terminals (retrial)	Induced voltage between primary winding and earth shall be 207 kV/150Hz/40s. Applied voltage between earthed terminal of primary winding and earth shall be 4.5kV/50Hz/60s.	Test voltage: 207kV/150Hz/40s No flashover and breakdown occurred. Test voltage: 4.5kV/50Hz/60s No flashover and breakdown occurred.	Pass
13	Partial discharge measurement (retrial)	Test frequency: 150 Hz Pre-stress voltage : 207 kV Test voltage: 126 kV Maximum permissible PD level : 10 pC Test voltage : 87.3 kV Maximum permissible PD level : 5 pC	Test frequency : 150 Hz Pre-stress voltage : 207 kV Test voltage: 126 kV PD level: 7 pC Test voltage: 87.3 kV PD level: 3 pC	Pass
14	Measurement of excitation characteristic (retrial)	Exciting current shall be measured at rated secondary voltage.	1aln: 2.79 A	---
15	Tests for accuracy (retrial)	The errors of the secondary winding shall meet the requirements of accuracy class 0.2.	Meet the requirements	Pass
16	Electromagnetic Compatibility (EMC) tests (RIV test)	The radio interference voltage shall not exceed 2500 μ V at 80kV.	Test voltage: 80kV/50Hz Radio interference voltage (0.5MHz): <140 μ V	Pass

1 Identification of the tested object

1.1 Parameters

Name: Inductive voltage transformer

Type: JDQXF-110

Sample No.: V1609110011

Manufacturer: Guangdong SiHui Instrument Transformer Works Co.,Ltd

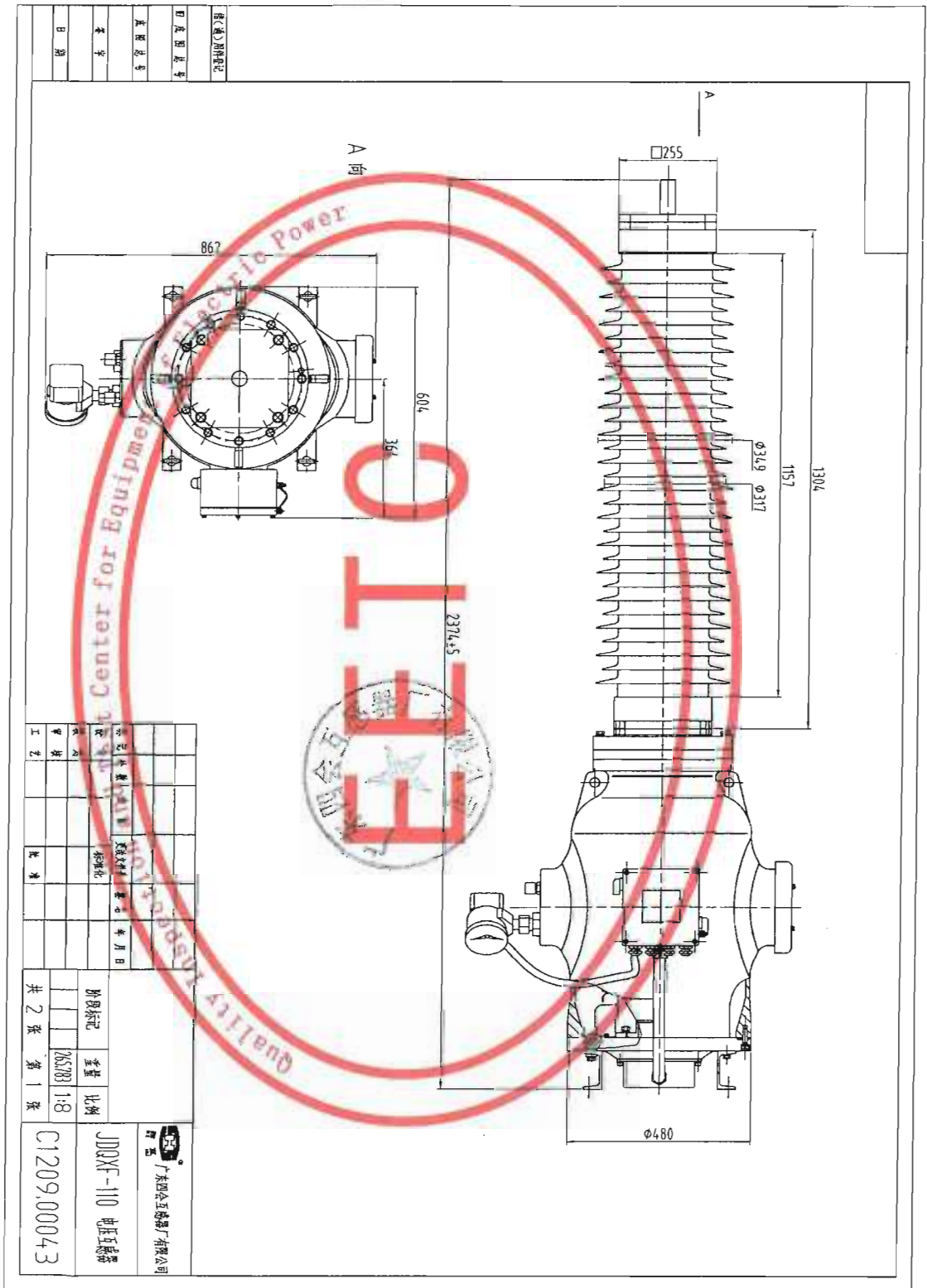
Sampling way: Offer by client

Date of Manufacture: Nov, 2016

Main parameters provided by the manufacturer:

Highest voltage for equipment(U_m)	126 kV	Rated primary voltage(U_{pr})	$110/\sqrt{3}$ kV
Equipment category	Outdoor	Rated frequency	50Hz
Rated filling pressure	0.65MPa	Minimum functional pressure	0.55MPa
Temperature categories	-25 °C/+40°C	Altitude	≤1000m
Rated transformation ratio	$110/\sqrt{3}/0.1/\sqrt{3}/0.1/\sqrt{3}/0.1$ kV		
Rated insulation level	126/230/550 kV		
Insulating class	E		
Rated voltage factor, rated time	$1.2U_{pr}$, Continuous; $1.5U_{pr}$, 30s		
Secondary winding/ Accuracy class	1a1n/0.2	2a2n/0.5	dadn/3P
Rated burden (VA) /Power factor	50/0.8	50/0.8	100/0.8
Rated thermal limiting output(VA)	/	2000	/

1.2 Drawings



1.3 Statement



1.3.1 The testing laboratory has checked that the drawings and other data submitted by the manufacturer can adequately represent the essential details and parts of the equipment to be tested, but isn't responsible for the accuracy of the detailed information.

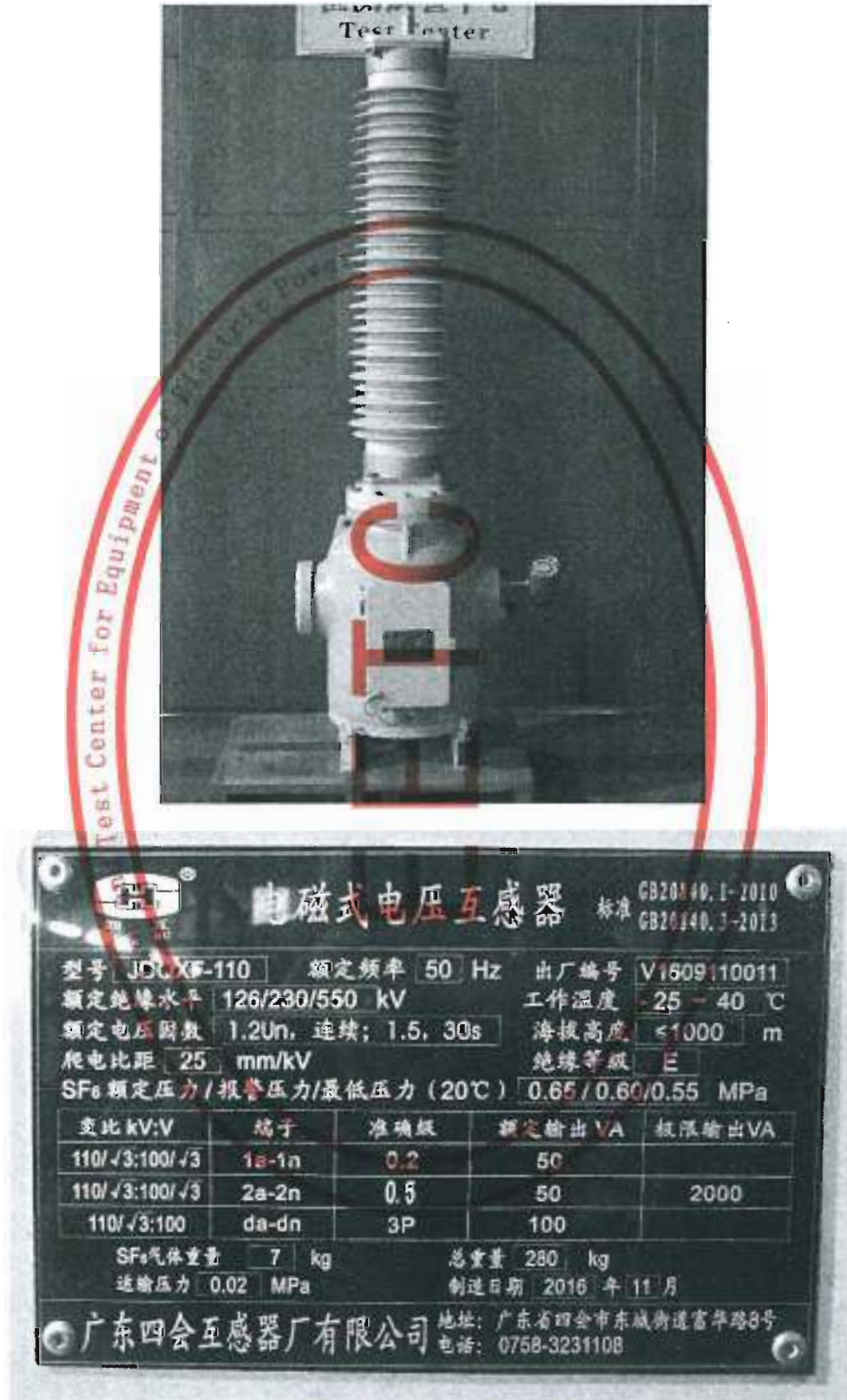
1.3.2 Before all the tests, the test object offered by the client is a new, clean inductive voltage transformer, including frame and all the other parts as in normal operation.

1.3.3 The test object is a single phase inductive voltage transformer with outer insulation of composite hollow insulator . The-creepage distance is 3.52m and the arcing distance is 1.22m.

1.3.4 Confirmed date of test object: 03 Jan. 2017

1.3.5 Client representative: Lu jianyi

1.4 Photographs of test object



2 Test items and results

2.1 Verification of markings

2.1.1 The main test device

No.	Name	Type/ Specification	Serial No.	Uncertainty / Accuracy class / Maximum Permissible Error	Valid date
1	Transformer calibrator	HEF-H	#K1020 (YQ320)	2	2018.02.25

2.1.2 Reference standard requirement

The nameplate and the mark of terminals shall meet the requirements. The valve and the bursting plate shall be in good condition.

2.1.3 Data

The nameplate, sign, earthing terminal, terminal marking meet the requirements. The valve and the bursting plate are in good condition.

2.1.4 Test result

The test object passed the tests.

2.2 Power-frequency voltage withstand tests on secondary terminals

2.2.1 The main test device

No.	Name	Type/ Specification	Serial No.	Uncertainty / Accuracy class / Maximum Permissible Error	Valid date
1	Equipment for secondary voltage withstand tests	HZSY-S	#6120611 (SB210)	3	2018.10.07

2.2.2 Reference standard requirement.

The test voltage of 3kV(50Hz) shall be applied for 60s between the short-circuited terminals of each winding and earth in turn. No flashover and breakdown occur.

2.2.3 Data

The test voltage of 3kV(50Hz) was applied for 60s between the short-circuited terminals of each winding and earth in turn. No flashover and breakdown occurred.

2.2.4 Test result

The test object passed the tests.

2.3 Power-frequency voltage withstand tests on primary terminals

2.3.1 The main test device

No.	Name	Type/ Specification	Serial No.	Uncertainty / Accuracy class / Maximum Permissible Error	Valid date
1	Series resonance measuring system	TRF1200-0.002	#111030 (YQ220)	3	2017.12.17
2	Series resonance testing device	YDGK-1200/3×400	#111023 (SB220)	/	2018.01.25
3	Equipment for secondary voltage withstand tests	HZSY-S	#6120611 (SB210)	3	2018.10.07

2.3.2 Reference standard requirement

The induced voltage of 230kV (150Hz) shall be applied between primary winding and earth for 40s. No flashover and breakdown occur.

The test voltage of 5kV(50Hz) shall be applied between earthed terminal of primary winding and earth for 60s. No flashover and breakdown occur.

2.3.3 Data

Ambient temperature: 8 °C Relative humidity: 60% Ambient air pressure: 102.6kPa

Atmosphere correction factor: $K_T=0.9971$

The induced voltage of 230kV (150Hz) was applied between primary winding and earth for 40s. No flashover and breakdown occurred.

The test voltage of 5kV(50Hz) was applied between earthed terminal of primary winding and earth for 60s. No flashover and breakdown occurred.

2.3.4 Test result

The test object passed the tests.

2.4 Partial discharge measurement

2.4.1 The main test device

No.	Name	Type/ Specification	Serial No.	Uncertainty / Accuracy class / Maximum Permissible Error	Valid date
1	Partial discharge detector	JFD-251	#20071203 (YQ380)	10	2018.02.03
2	Series resonance measuring system	TRF1200-0.002	#111030 (YQ220)	3	2017.12.17
3	Series resonance testing device	YDGK-1200/3×400	#111023 (SB220)	/	2018.01.25

2.4.2 Reference standard requirement

Pre-stress voltage: 230 kV, Test frequency: 150Hz

Test voltage: 126 kV, Maximum permissible PD level: 10 pC

Test voltage: 87.3 kV, Maximum permissible PD level: 5 pC

2.4.3 Data

Ambient temperature:8℃ Relative humidity:60%

Test frequency (Hz)	150	
Pre-stress voltage (kV)	230	
Test voltage (kV)	126	87.5
PD level (pC)	6	3

2.4.4 Test result

The test object passed the tests.

2.5 Measurement of excitation characteristic**2.5.1 The main test device**

No.	Name	Type/ Specification	Serial No.	Uncertainty / Accuracy class / Maximum Permissible Error	Valid date
1	V-A characteristic tester	ZZFA-IV	#10088 (YQ408)	0.2	2018.01.03

2.5.2 Reference standard requirement

Exciting current was measured at 0.2, 0.5, 0.8, 1.0, 1.2 and 1.5 times of rated secondary voltage respectively.

2.5.3 Data

Ambient temperature:8℃ Relative humidity: 60%

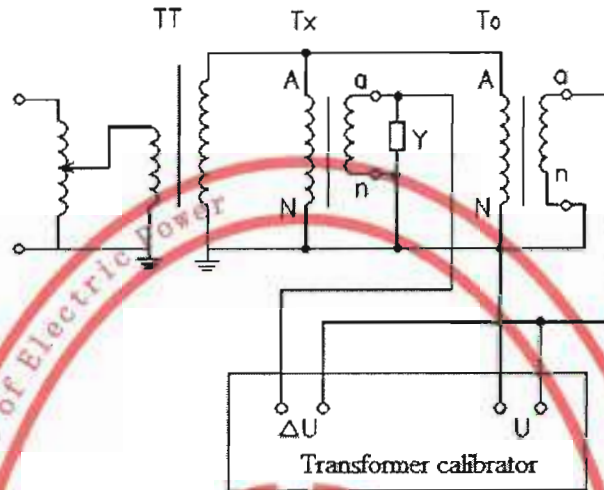
Percentage of rated secondary voltage(%)		20	50	80	100	120	150
Test voltage (V)		11.5	28.6	48.0	58.0	69.0	87.0
I ₀ / n _a	No-load current (A)	0.55	1.44	2.40	2.80	2.85	3.70
	No-load loss(W)	/	/	/	22.4	/	/

2.5.4 Test result

The test object was both in good conditions before and after the tests.

2.6 Tests for accuracy

2.6.1 Test circuit diagram



TT: Test transformer Tx: Test object To: Standard voltage transformer Y: Burden

2.6.2 The main test device

No.	Name	Type/ Specification	Serial No.	Uncertainty / Accuracy class / Maximum Permissible Error	Valid date
1	Standard voltage transformer	HJ-220	#03002 (YQ369)	0.02	2018.10.26
2	Transformer calibrator	HEF-H	#KI020 (YQ320)	2	2018.02.25

2.6.3 Reference standard requirement

The errors of the secondary windings shall meet the requirements of accuracy classes 0.2/0.5/3P.

2.6.4 Data

Ambient temperature: 8°C Relative humidity: 60%

Secondary windings	Accuracy class	U _{pr} %	Ratio error (%)	Phase displacement (°)	Burden(VA) cosφ=0.8			Ratio error (%)	Phase displacement (°)	Burden(VA) cosφ=0.8		
					1a 1n	2a 2n	da dn			1a 1n	2a 2n	da dn
1a1na	0.2	80	-0.02	-1	50	50	/	+0.18	0	12.5	0	/
		100	-0.02	-1				+0.18	0			
		120	-0.06	0				+0.14	+1			
2a2na	0.5	80	0	-2	50	50	/	+0.20	0	0	12.5	/
		100	0	0				+0.15	0			
		120	-0.05	0				+0.15	+2			

- 2) The voltage of $1.2U_{pr}$ is applied on primary winding with the secondary windings loaded with the maximum rated burden. After every part reaching a steady state, the temperature-rise of windings shall not exceed 75K.
- 3) The voltage of $1.5 U_{pr}$ for 30s is applied on primary winding beginning from the cold condition with the secondary windings loaded with the maximum rated burden, the temperature-rise of windings shall not exceed 10K.

2.7.4 Data

Winding	ANA (k Ω)	1a1na(m Ω)	2a2na(m Ω)	dadna(m Ω)	Ambient temperature($^{\circ}$ C)
Resistance at ambient temperature	29.37	54.25	52.67	67.61	10

The temperature-rise are shown as follow:

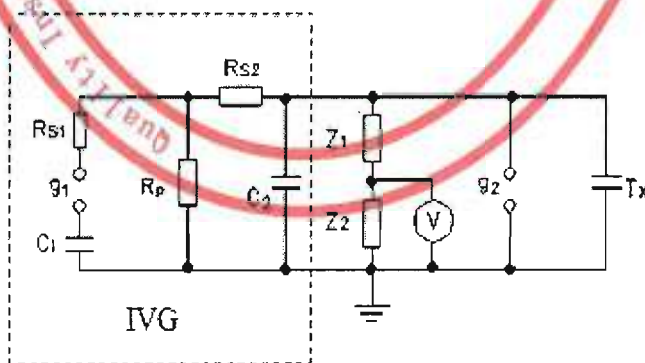
Winding Voltage	ANA(K)	1a1na(K)	2a2na(K)	dadna(K)	Ambient temperature($^{\circ}$ C)
$1.0U_{pr}$	42	/	40	/	10
$1.2U_{pr}$	11	17	17	/	11
$1.5U_{pr}$	0.3	0.6	0.4	0.7	10

2.7.5 Test result

The test object passed the tests.

2.8 Impulse voltage test on primary terminals (Lightning and chopped impulse voltage test on primary terminals)

2.8.1 Test circuit diagram



IVG: Impulse voltage generator Z_1, Z_2 : High voltage divider g_2 : Chopped device T_x : Test object

2.8.2 The main test device

No.	Name	Type/ Specification	Serial No.	Uncertainty / Accuracy class / Maximum Permissible Error	Valid date
1	Impulse voltage generator	4000kV, 300kJ	#17020001003 (SB202)	/	2018.05.05
2	Impulse voltage measuring system	3000kV	#550264 (YQ212)	3	2017.08.05

2.8.3 Reference standard requirement

The test object shall be subjected to 15 full lighting impulses of positive and negative polarity at 550kV(peak value), 2 chopped lighting impulses of negative polarity at 632.5kV(peak value).

No disruptive discharge or non-self restoring insulation shall occur and the number of disruptive discharge shall not exceed two for each series. No evidence of insulation failure shall be detected.

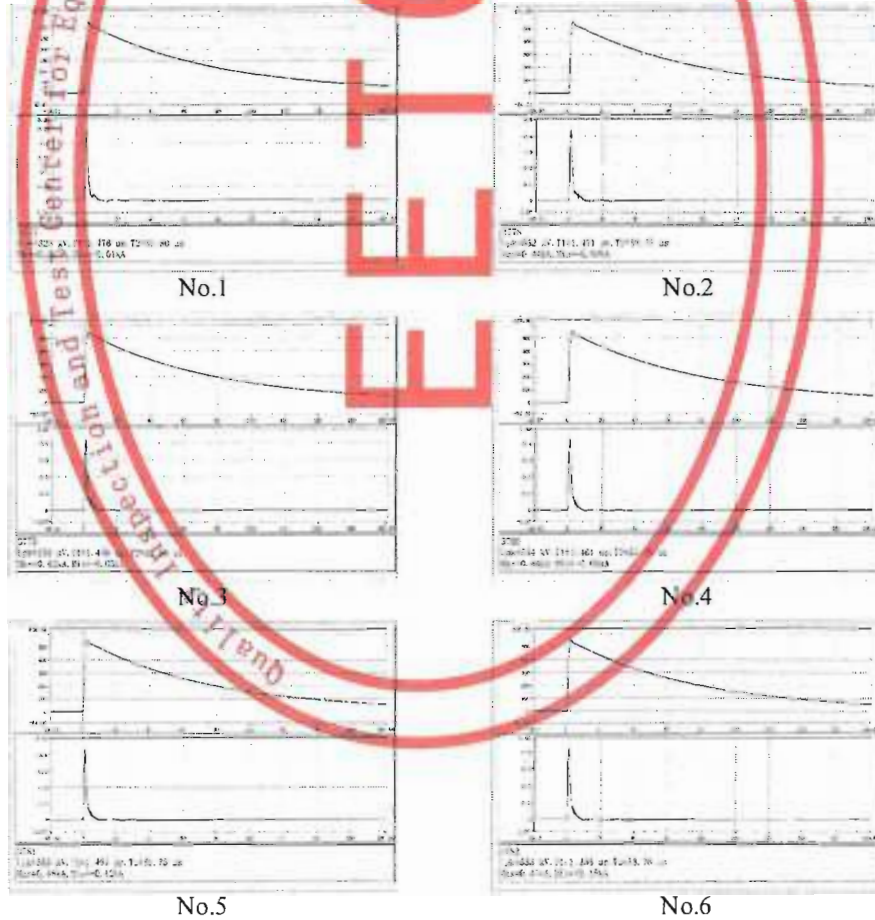
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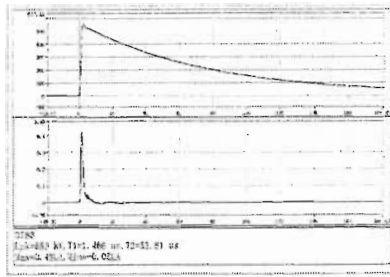
Ambient temperature: 12°C Relative humidity: 59%

No.	Voltage polarity	Test voltage (peak)(kV)	Chopped time (μ s)	Waveform No.	Result
1	Pos.LI	323	/	1	Pass
2	Pos.LI	552	/	2	Pass
3	Pos.LI	553	/	3	Pass
4	Pos.LI	554	/	4	Pass
5	Pos.LI	553	/	5	Pass
6	Pos.LI	553	/	6	Pass
7	Pos.LI	553	/	7	Pass
8	Pos.LI	553	/	8	Pass
9	Pos.LI	552	/	9	Pass
10	Pos.LI	554	/	10	Pass
11	Pos.LI	553	/	11	Pass
12	Pos.LI	553	/	12	Pass
13	Pos.LI	552	/	13	Pass
14	Pos.LI	553	/	14	Pass
15	Pos.LI	553	/	15	Pass
16	Pos.LI	552	/	16	Pass
17	Neg.LI	334	/	17	Pass
18	Neg.LI	555	/	18	Pass
19	Neg.LI-chopped	383	3.9	19	Pass
20	Neg.LI-chopped	636	4.1	20	Pass
21	Neg.LI-chopped	636	3.9	21	Pass
22	Neg.LI	551	/	22	Pass
23	Neg.LI	554	/	23	Pass
24	Neg.LI	553	/	24	Pass

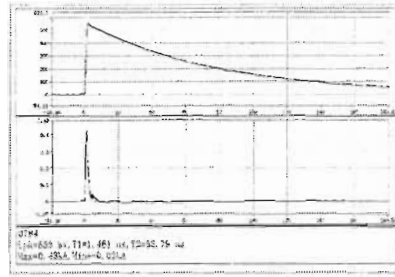
No.	Voltage polarity	Test voltage (peak)(kV)	Chopped time (μs)	Waveform No.	Result
25	Neg.LI	554	/	25	Pass
26	Neg.LI	553	/	26	Pass
27	Neg.LI	554	/	27	Pass
28	Neg.LI	553	/	28	Pass
29	Neg.LI	554	/	29	Pass
30	Neg.LI	554	/	30	Pass
31	Neg.LI	553	/	31	Pass
32	Neg.LI	554	/	32	Pass
33	Neg.LI	554	/	33	Pass
34	Neg.LI	553	/	34	Pass
35	Neg.LI	553	/	35	Pass

Waveform

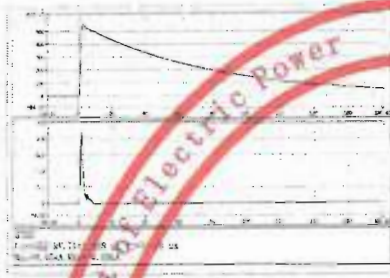




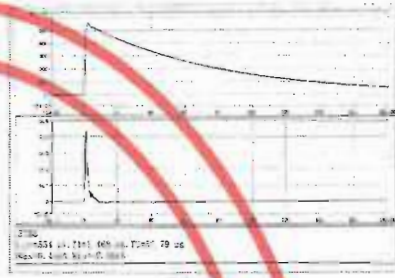
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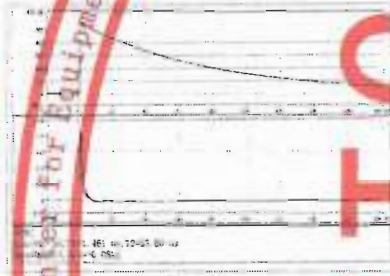
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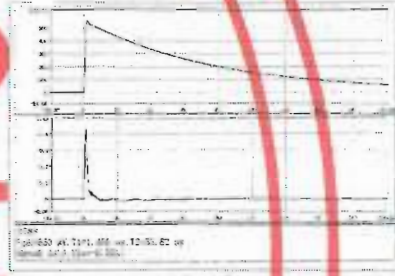
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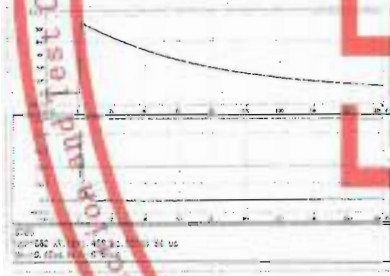
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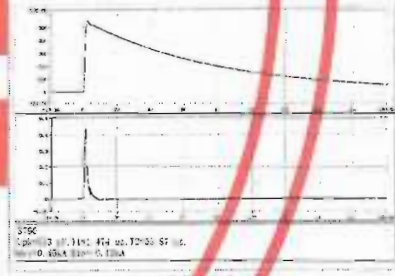
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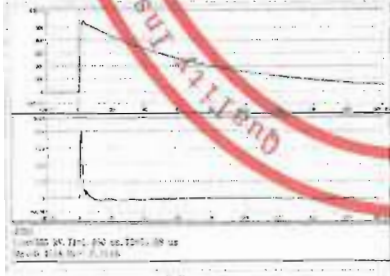
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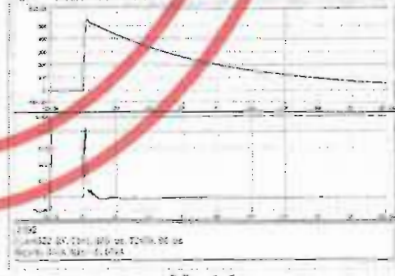
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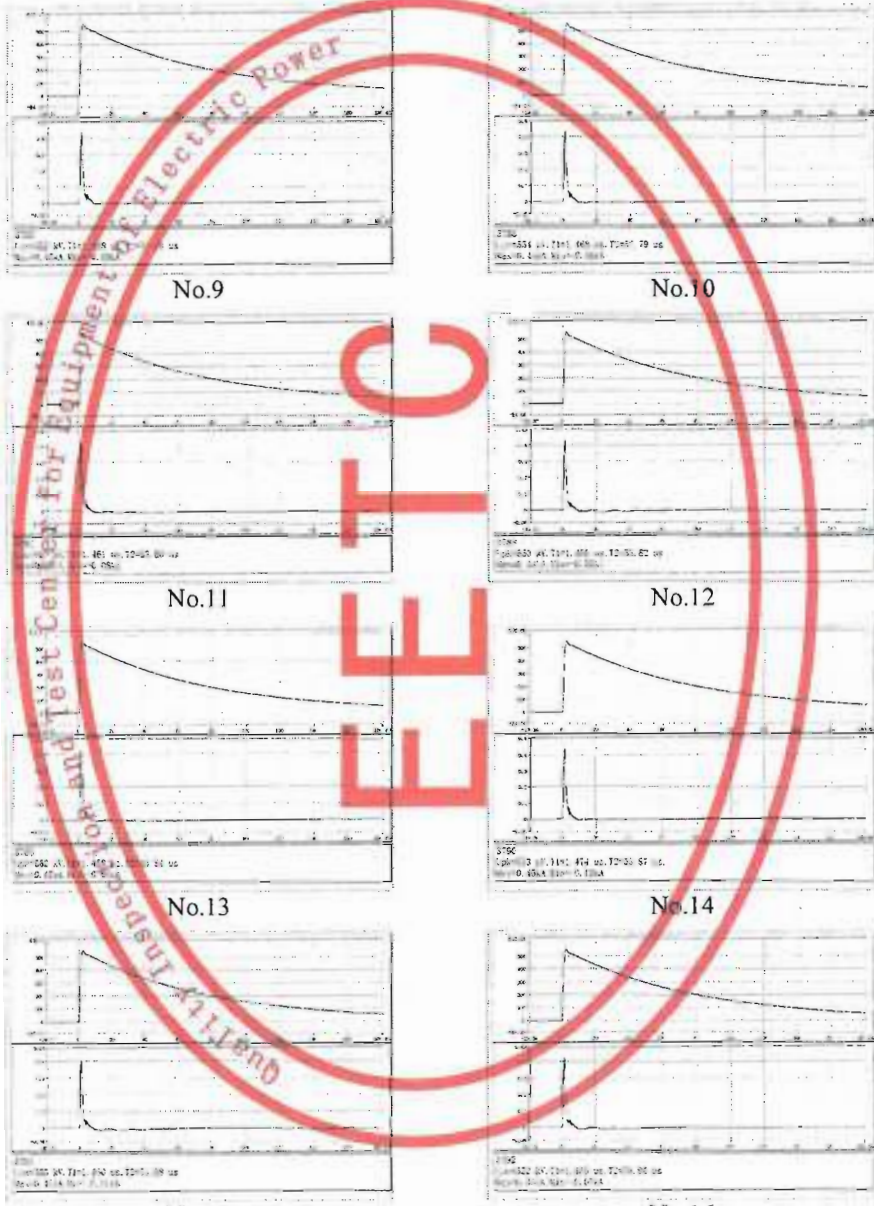
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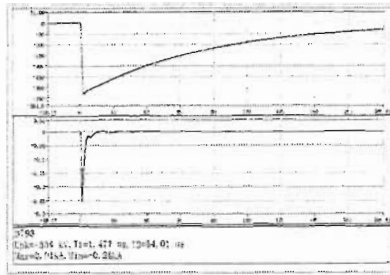


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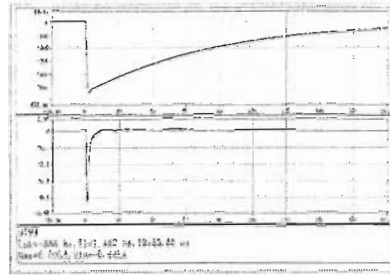


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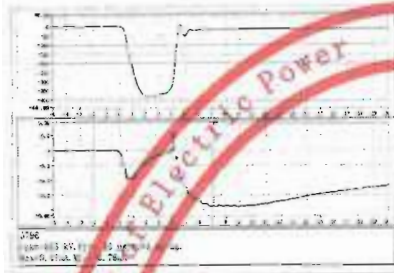




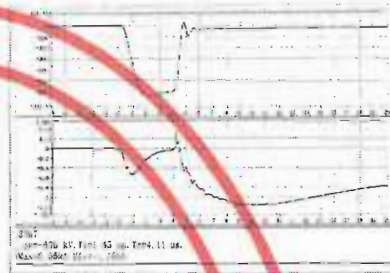
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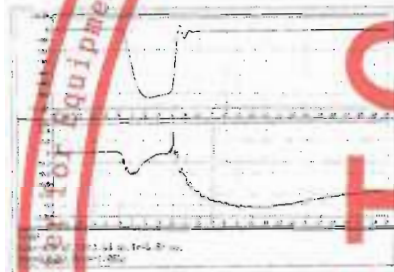
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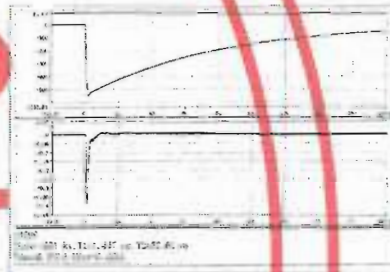
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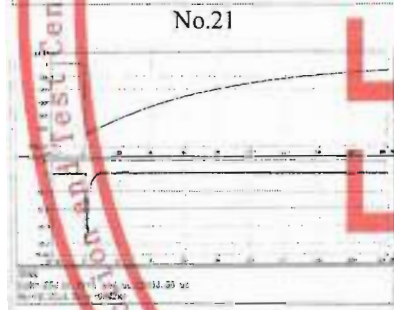
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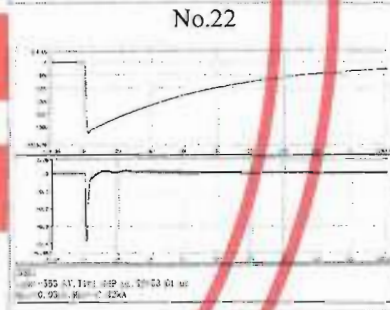
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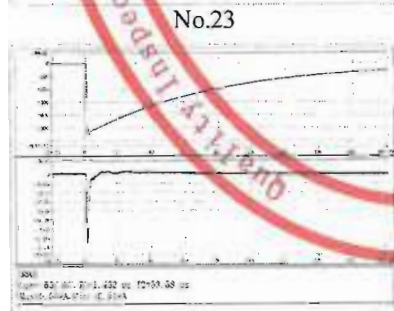
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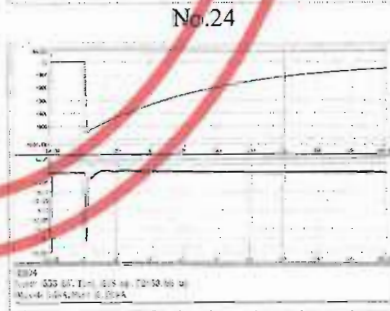
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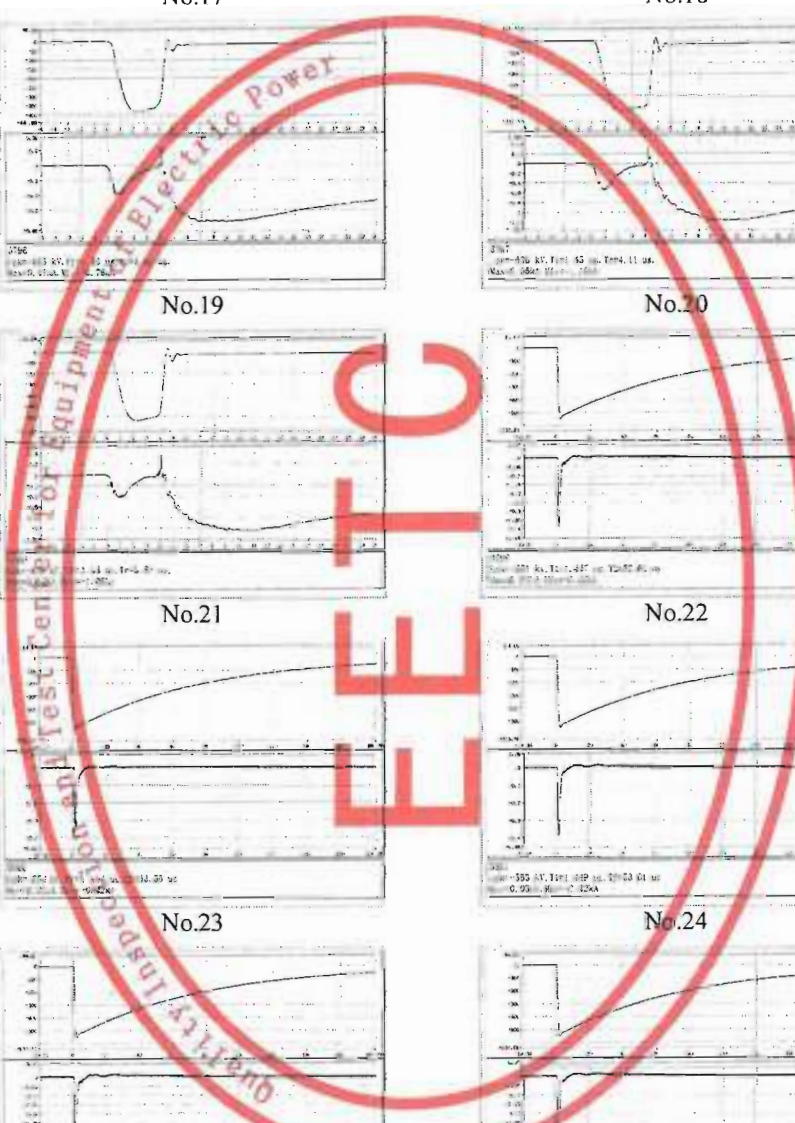
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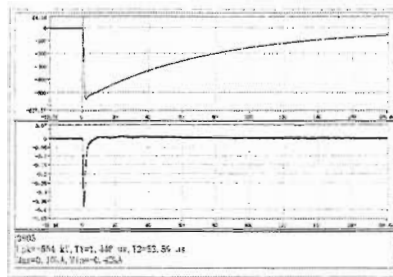


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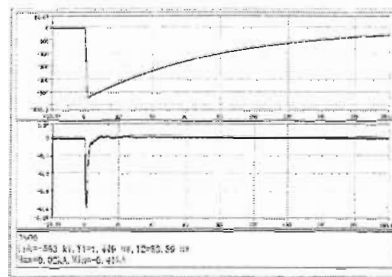


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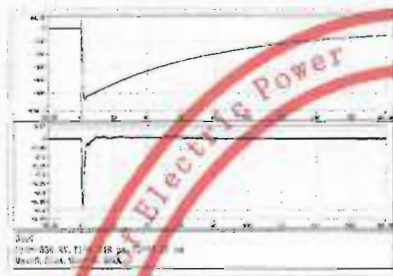




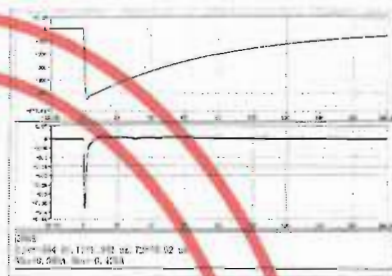
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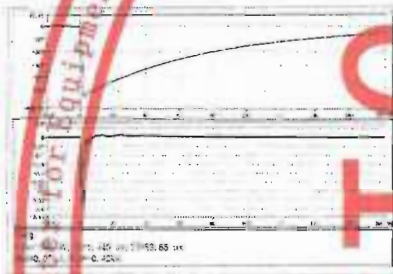
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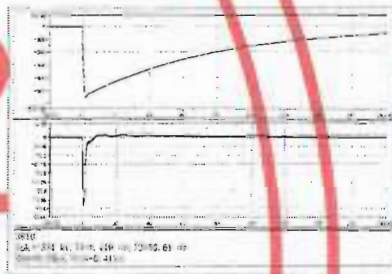
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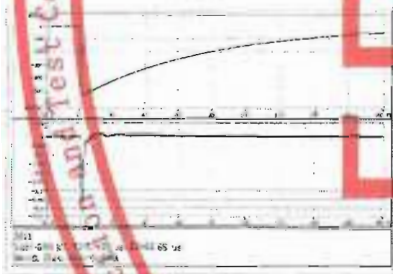
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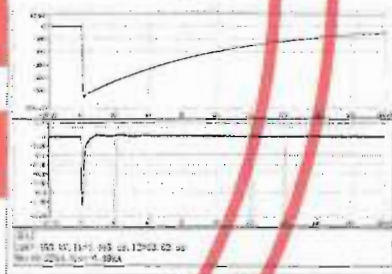
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No.32



No.33



No.34



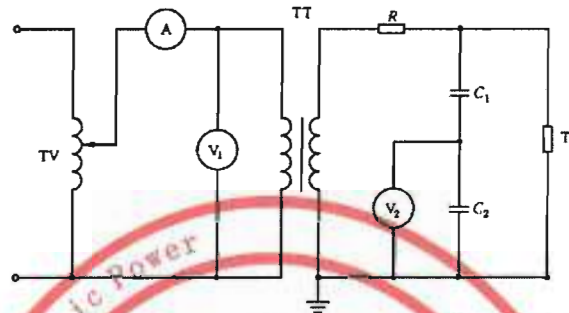
No.35

2.8.5 Test result

The test object passed the tests.

2.9 Wet test for outdoor type transformers

2.9.1 Test circuit diagram



TV: Voltage regulator TT: Test transformer C₁,C₂: High voltage divider T_x: Test object

2.9.2 The main test device

No.	Name	Serial No.	Type/ Specification	Uncertainty / Accuracy class / Maximum Permissible Error	Valid date
1	Series resonance measuring system	TRF1200-0.002	#111030 (YQ220)	3	2017.12.17
2	Series resonance testing device	YDGK-1200/3×400	#111023 (SB220)	/	2018.01.25
3	Conductivity Meter	DDS-307	#722014072713 (YQ307)	1.0	2018.01.29

2.9.3 Reference standard requirement

In wet condition, the induced voltage of 230kV (150Hz) shall be applied between primary winding and earth for 40s. No flashover and breakdown occur.

2.9.4 Data

Atmosphere correction factor: Kt=0.9976

Water conductivity: 102μS/cm Vertical component: 1.4 mm/min

Horizontal component: 1.1mm/min

Ambient temperature: 9 °C

Relative humidity:77 %

Ambient air pressure: 100.9kPa

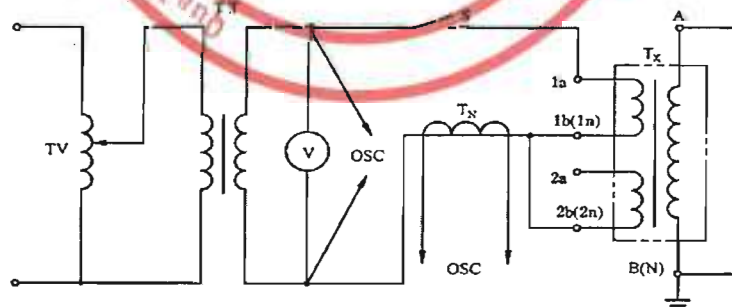
In wet condition, the induced voltage of 230kV (150Hz) was applied between primary winding and earth for 40s. No flashover and breakdown occurred.

2.9.5 Test result

The test object passed the tests.

2.10 Short circuit withstand capability test

2.10.1 Test circuit diagram



TV: Voltage regulator TT: Test transformer OSC:Oscillograph TA: Measuring current transformer Tx:Test object

2.10.2 The main test device

No.	Name	Type/ Specification	Serial No.	Uncertainty / Accuracy class / Maximum Permissible Error	Valid date
1	Measuring current transformer	HL-43A	#16006 (YQ422)	0.2	2018.02.21
2	Test transformer	SYG-950/0.4	#99012078 (SB345)	/	2018.05.05
3	Oscilloscope	DPO3014B	#C012465 (YQ405)	±3%	2017.03.24

2.10.3 Reference standard requirement

The rated voltage 57.7V is applied on secondary winding for 1.0s with primary winding connected to earth. There shall be no electrical and mechanical damage.

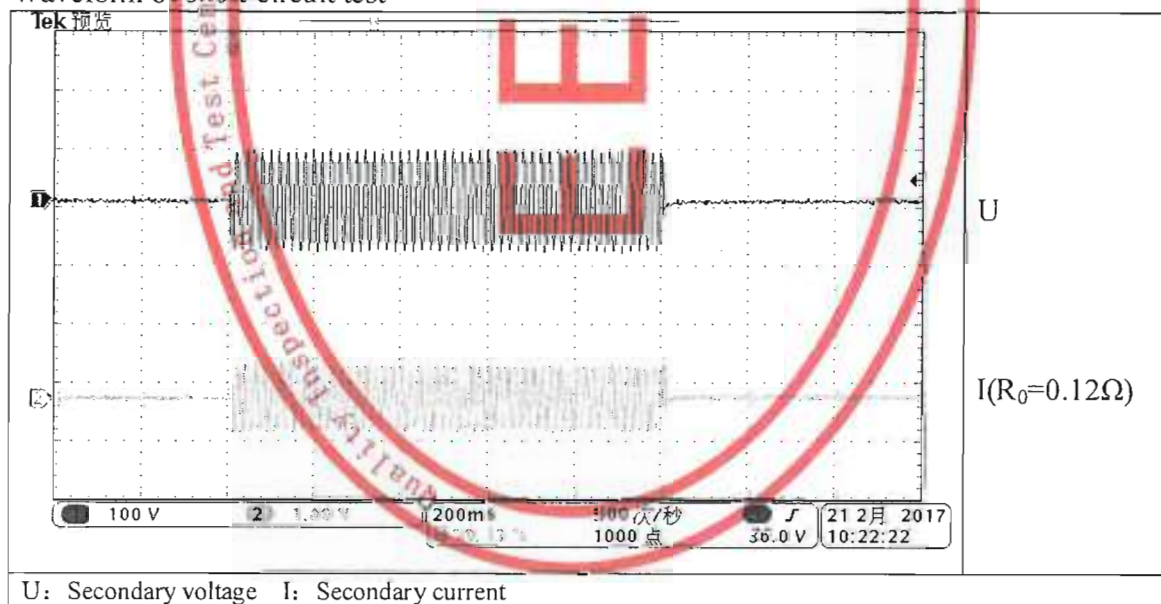
2.10.4 Data

Ambient temperature: 9℃ Relative humidity: 63%

Secondary winding	Secondary voltage (V)	Secondary short-circuit current (A)	Duration (s)
1alra	57.7	654	1.02

Note: The primary winding is of copper, and the calculated current density is 23.8A/mm². The secondary winding is of copper, and the calculated current density is 80A/mm².

Waveform of short-circuit test



2.10.5 Test result

The test object was in good conditions before and after this test, no electrical and mechanical damage. The test object passed the tests.

2.11 Power-frequency voltage withstand tests on secondary terminals (retrial)

2.11.1 The main test device

No.	Name	Type/ Specification	Serial No.	Uncertainty / Accuracy class / Maximum Permissible Error	Valid date
1	Equipment for secondary voltage withstand tests	HZSY-S	#6120611 (SB210)	3	2018.01.25

2.11.2 Reference standard requirement

The test voltage of 2.7kV(50Hz) shall be applied for 60s between the short-circuited terminals of each winding and earth in turn. No flashover and breakdown occur.

2.11.3 Data

The test voltage of 2.7kV(50Hz) was applied for 60s between the short-circuited terminals of each winding and earth in turn. No flashover and breakdown occurred.

2.11.4 Test result

The test object passed the tests.

2.12 Power-frequency voltage withstand tests on primary terminals (retrial)

2.12.1 The main test device

No.	Name	Type/ Specification	Serial No.	Uncertainty / Accuracy class / Maximum Permissible Error	Valid date
1	Series resonance measuring system	TRF1200-0.002	#111030 (YQ220)	3	2017.12.17
2	Series resonance testing device	YDGK-1200/3×400	#111023 (SB220)	/	2018.01.25
3	Equipment for secondary voltage withstand tests	HZSY-S	#6120611 (SB210)	3	2018.01.25

2.12.2 Reference standard requirement

The induced voltage of 207kV (150Hz) shall be applied between primary winding and earth for 40s. No flashover and breakdown occur.

The test voltage of 4.5kV(50Hz) shall be applied between earthed terminal of primary winding and earth for 60s. No flashover and breakdown occur.

2.14 Measurement of excitation characteristic (retrial)

2.14.1 The main test device

No.	Name	Type/ Specification	Serial No.	Uncertainty / Accuracy class / Maximum Permissible Error	Valid date
1	V-A characteristic tester	ZZFA-IV	#10088 (YQ408)	0.2	2018.01.03

2.14.2 Reference standard requirement

Exciting current shall be measured at rated secondary voltage.

2.14.3 Data

Ambient temperature:19℃ Relative humidity:54%

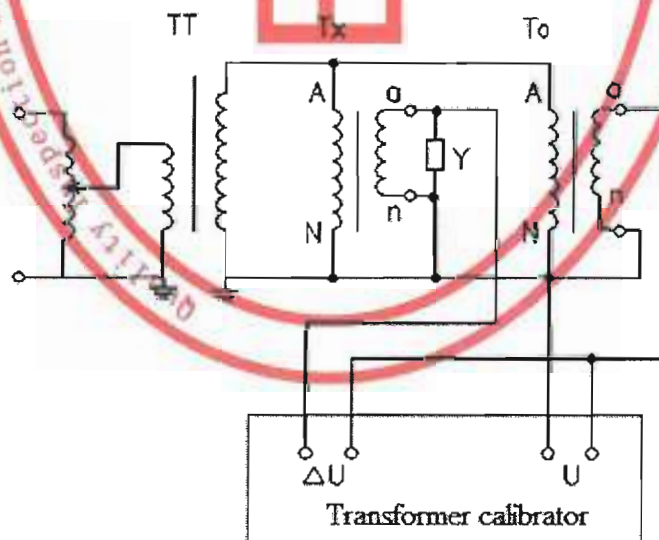
Percentage of rated secondary voltage(%)		100
Test voltage (V)		57.9
I _a I _{na}	No-load current (A)	2.79
	No-load loss (W)	22.0

2.14.4 Test result

The test object was in good conditions before and after this test.

2.15 Tests for accuracy (retrial)

2.15.1 Test circuit diagram



TT: Test transformer

Tx: Test object

T₀: Standard voltage transformer Y:Burden

2.15.2 The main test device

No.	Name	Type/ Specification	Serial No.	Uncertainty / Accuracy class / Maximum Permissible Error	Valid date
1	Standard voltage transformer	HJ-220	#03002 (YQ369)	0.02	2018.10.26
2	Transformer calibrator	HEF-H	#KI020 (YQ320)	2	2018.02.25

2.15.3 Reference standard requirement

The errors of the secondary winding (1a1n) shall meet the requirements of the accuracy class 0.2.

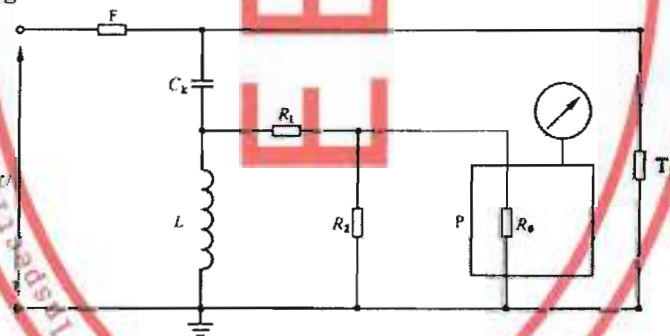
2.15.4 Data

Ambient temperature: 19℃ Relative humidity : 54%

Secondary windings	Accuracy class	U _{pr} %	Ratio error (%)	Phase displacement (')	Burden(VA) cosφ=0.8			Ratio error (%)	Phase displacement (')	Burden(VA) cosφ=0.8		
					1a 1n	2a 2n	da dn			1a 1n	2a 2n	da dn
1a1n	0.2	80	-0.02	0	50	50	/	+0.18	0	12.5	0	/
		100	-0.02	0				+0.18	0			
		120	-0.06	+1				+0.14	0			

2.15.5 Test result

The test object passed the tests.

2.16 Electromagnetic Compatibility (EMC) tests (RIV test)**2.16.1 Test circuit diagram**

F: Filter C_k: Coupling capacitor L: Reactance R₁, R₂: Resistance
P: Radio interference tester with input resistance R₀ T_x: Test object

2.16.2 The main test device

No.	Name	Type/ Specification	Serial No.	Uncertainty / Accuracy class / Maximum Permissible Error	Valid date
1	Radio interference tester	ZN3950	#051205 (YQ392)	±2dB	2017.03.11
2	Power-frequency voltage measuring system	TJF1200-1000	#1105415 (YQ209)	3	2018.02.03

2.16.3 Reference standard requirement

A pre-stress voltage of $1.5U_m/\sqrt{3}$ shall be applied and maintained for 30s. The voltage shall then be decreased to $1.1U_m/\sqrt{3}$ in about 10s and maintained to this value for 30s before measuring the radio interference voltage. The radio interference voltage shall not exceed $2500\mu\text{V}$ at $1.1U_m/\sqrt{3}$.

2.16.4 Data

Ambient temperature: 9°C Relative humidity: 77%

Test voltage (kV)	Tuning frequency of measuring circuit (MHz)	Radio interference voltage (μV)
80	0.5	<140

2.16.5 Test result

The test object passed the tests.

2.17 Transmitted overvoltage test

2.17.1 The main test device

No.	Name	Type/ Specification	Serial No.	Uncertainty / Accuracy class / Maximum Permissible Error	Valid date
1	Type A impulse generator	CDF-800	#001 (SB315)	/	2019.02.14
2	Type A impulse measuring system	TZF600-800	BHT20130 5001 (YQ368)	3	2017.08.05

2.17.2 Reference standard requirement

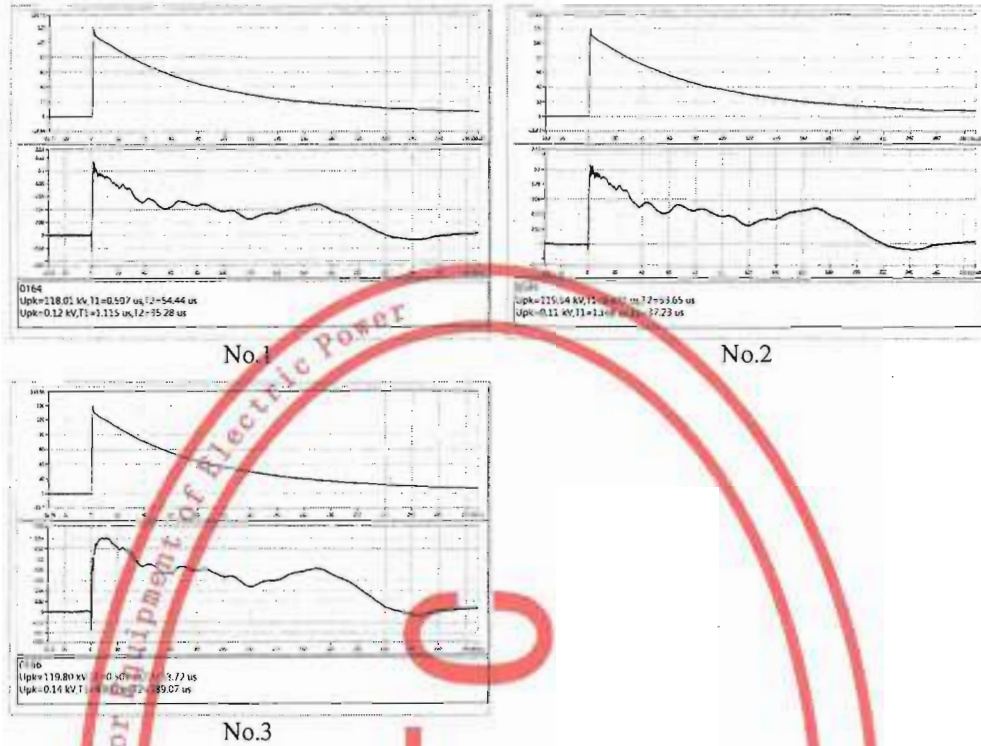
A low-voltage impulse (U_1) ($T_1=50\mu\text{s}\pm 20\%$, $T_2\geq 50\mu\text{s}$) shall be applied between one of the primary terminals and earth. The transmitted overvoltage shall not exceed 1.6kV.

2.17.3 Data

Secondary winding	Type of impulse	Peak voltage of primary winding (U_1) (kV)	Peak voltage of secondary winding (U_2) (V)	Calculated transmitted overvoltage (U_s) (V)	Wave No.
1a1n	Type A impulse	118	120	168	1
2a2n	Type A impulse	120	110	151	2
dadn	Type A impulse	120	140	193	3

$$\text{Note: } U_s = \frac{U_2}{U_1} \times U_p \quad U_p = 1.6 \frac{\sqrt{2}U_m}{\sqrt{3}}$$

Waveform



2.17.4 Test result

The test object passed the tests.

2.18 Mechanical tests

2.18.1 The main test device

No.	Name	Type/ Specification	Serial No.	Uncertainty / Accuracy class / Maximum Permissible Error	Valid date
1	Ergometer	XK3100-B1	#9119/C004 (YQ371)	1	2017.07.06

2.18.2 Reference standard requirement

The test load(1500N) shall be applied on primary terminal for at least 60s. There shall be no evidence of damage (deformation, rupture or leakage).

2.18.3 Data

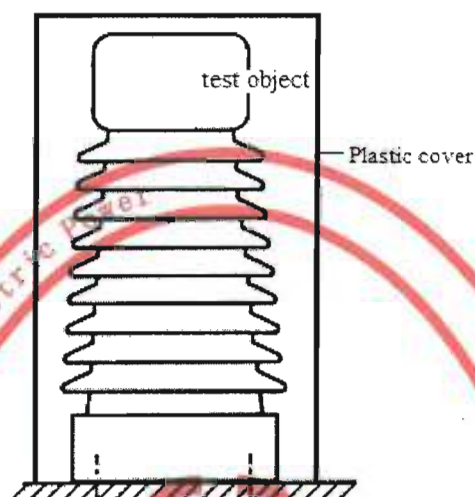
Modality of application(N)		Duration (s)	Test results
Horizontal(landscape orientation)	1500	60	No evidence of damage (deformation, rupture or leakage) .
Horizontal(longitudinal orientation)	1500	60	
Vertical	1500	60	

2.18.4 Test result

The test object passed the tests.

2.19 Enclosure tightness test at ambient temperature

2.19.1 Test circuit diagram



2.19.2 The main test device

No.	Name	Type/ Specification	Serial No.	Uncertainty / Accuracy class / Maximum Permissible Error	Valid date
1	SF ₆ gas detector	LF-I	#1984 (YQ334)	5%	2017.07.24

2.19.3 Reference standard requirement

The relative leakage rate (F_{rel}) shall not exceed 0.5% per year at rated filling pressure.

2.19.4 Data

Measuring volume $V_m(m^3)$	Gas chamber volume $V(m^3)$	Rated filling pressure P_r (MPa)	Tracer gas concentration C_1-C_0 (cm^3/m^3)	$F_{rel}/year$ (%)
0.06	0.18	0.65	2.8	<0.1

2.19.5 Test result

The test object passed the tests.

2.20 Gas dew point test

2.20.1 The main test device

No.	Name	Type/ Specification	Serial No.	Uncertainty / Accuracy class / Maximum Permissible Error	Valid date
1	Dew-point meter	DP99mini	#190171110 (YQ213)	$\pm 1^\circ C$	2017.07.18

2.20.2 Reference standard requirement

The dew-point is not higher than -38.6°C for a measurement at 20°C . The water content of gas shall be less than $150\mu\text{L/L}$.

2.20.3 Data

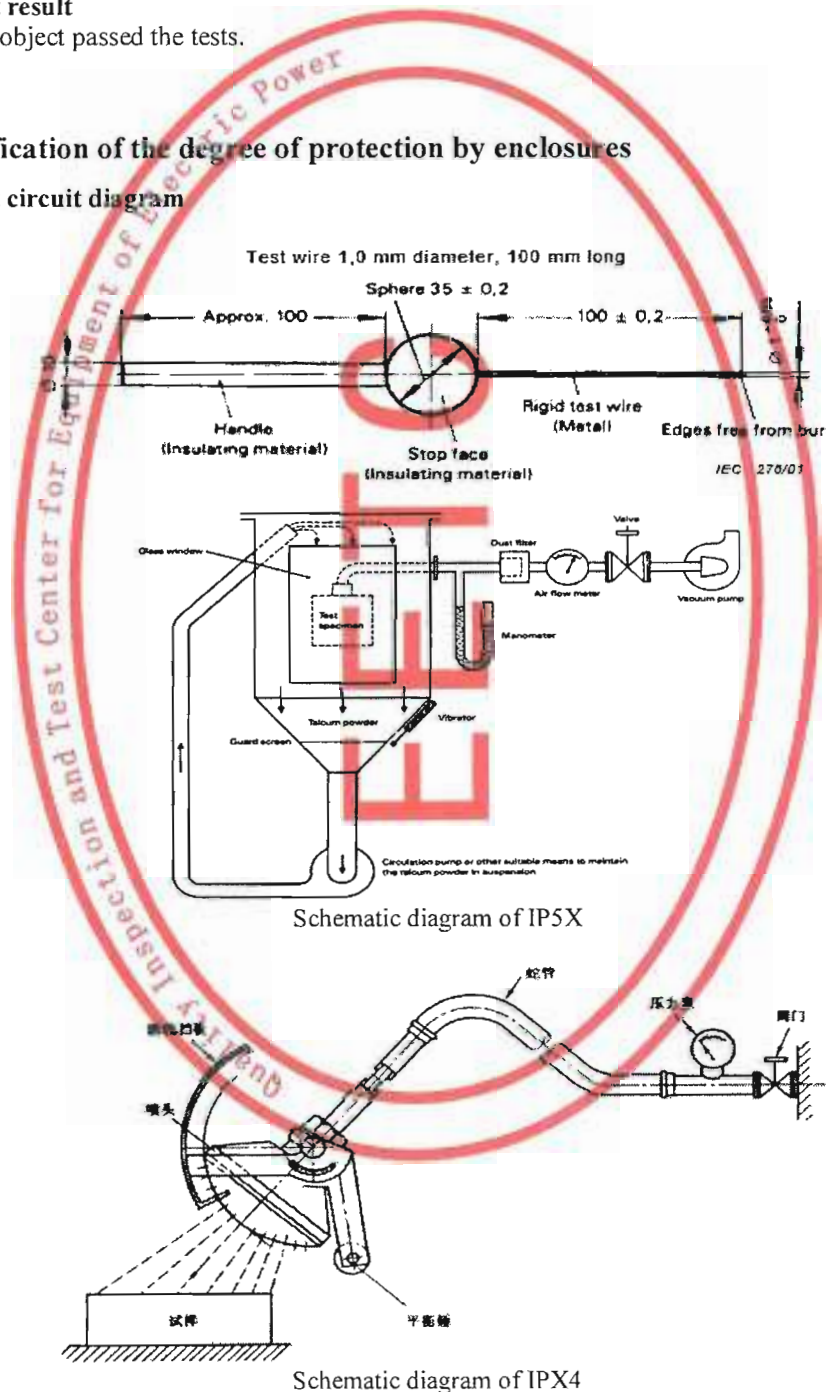
Dew-point at ambient temperature ($^{\circ}\text{C}$)	Dew-point at 20°C ($^{\circ}\text{C}$)	The water content of SF_6 (20°C) $\mu\text{L/L}$
-47.8	-46.7	58

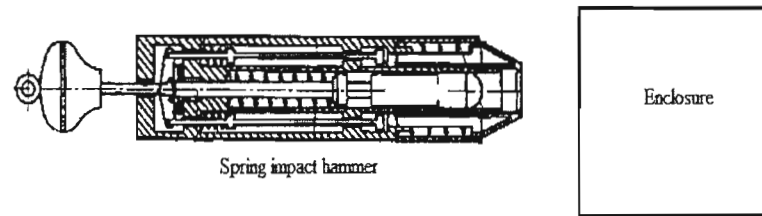
2.20.4 Test result

The test object passed the tests.

2.21 Verification of the degree of protection by enclosures

2.21.1 Test circuit diagram





Schematic diagram of the mechanical shock test

2.21.2 The main test device

No.	Name	Type/ Specification	Serial No.	Uncertainty / Accuracy class / Maximum Permissible Error	Valid date
1	Object probe	GR-F4D	#GR15091204 (YQ231-5)	1.0 ^{+0.05} mm	2017.09.11
2	Raining control system	JL-1-2	#200912088 (SB326)	/	2018.05.05
3	Impact hammer	ZLT-CJ3	#C021505 (YQ232)	1	2017.07.20
4	Dust chamber	SC-080	#1508060 (SB221)	/	2017.06.21

2.21.3 Reference standard requirement

Verification of the IP coding: The degree of protection of low-voltage control and/or auxiliary enclosures for outdoor instrument transformers is IP54.

Mechanical impact test: The level of protection against effects of mechanical impacts is impact level IK07.

2.21.4 Data

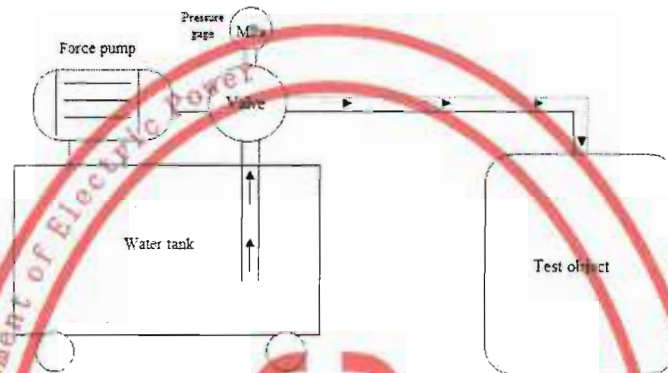
Verification of the IP coding: First characteristic Number of IP code: 5	
The test for protection against access to hazardous parts	The test for protection against solid foreign objects.
Test load: 1 N The test wire of 1.0mm ϕ did not penetrate and kept adequate clearance.	Duration:8h Ingress of dust was not totally prevented, but the dust did not penetrate in a quantity to interfere with satisfactory operation of the apparatus or to impair safety.

Verification of the IP coding: Second characteristic Number of IP code: 4		
The test for protection against water		
Water flow (L/min)	Test pressure (kPa)	Duration (min)
10.5	105	5

Mechanical impact test (IK07):		
Standard kinetic energy (J)	Test kinetic energy (J)	Test times
2.00±0.10	2	3

2.21.5 Test result

The test object passed the tests.

2.22 Pressure test for the enclosure**2.22.1 Test circuit diagram****2.22.2 The main test device**

No.	Name	Type/ Specification	Serial No.	Uncertainty Accuracy class / Maximum Permissible Error	Valid date
1	Water pump for the test	4DSY-100/10	#201505012 (SB388)	/	2017.05.25
2	Pressure gage	YB-150A	#08.03.788 (BJ326)	0.4	2017.07.13

2.22.3 Reference standard requirement

Welded aluminum enclosure shall withstand $(3.5/0.7) \times$ "design pressure" for 1 min, no broken or permanent deformation.

Composite hollow insulator shall withstand $4.0 \times$ MSP for 5min, no visible damage occurred.

2.22.4 Data

Ambient temperature: 19°C Relative humidity :54%

Texture	Test pressure (MPa)	Design pressure (MPa) /MSP	Duration (min)
Welded aluminum enclosure	3.5	0.7	1
Composite hollow insulator	2.8	0.7	5

2.22.5 Test result

The test object passed the tests.