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TESTING
CNAS L0116

方圆电气检测
FANG YUAN ELECTRIC TEST

报 告 查 询
No.2113346615Y

TEST REPORT

NAME OF SAMPLE Dry Type Transformer

MODEL SCB14-2500/10-NX2

CUSTOMER Sichuan Zhongxin General Electric Power Co., Ltd.

TEST CATEGORY Type Test

浙江方圆检测集团股份有限公司
检验检测专用章
(2)

NATIONAL CENTER OF QUALITY INSPECTION FOR ELECTRICAL SAFETY (ZHEJIANG)

(ZHEJIANG FANGYUAN ELECTRICAL EQUIPMENT TESTING CO., LTD.)

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NATIONAL CENTER OF QUALITY INSPECTION FOR ELECTRICAL SAFETY (ZHEJIANG)

TEST REPORT

<table>
<tr><td>Product</td><td>Dry Type Transformer</td><td>Test category</td><td>Type test</td></tr>
<tr><td>Model</td><td>SCB14-2500/10-NX2</td><td>Serial No.</td><td>202105151</td></tr>
<tr><td>Client</td><td>Sichuan Zhongxin General Electric Power Co., Ltd.</td><td>Manufacturer</td><td>Sichuan Zhongxin General Electric Power Co., Ltd.</td></tr>
<tr><td>Client 's address</td><td>(Industrial Zone)No.998, Xinghua 5 Road, Xinjin District, Chengdu City</td><td>Manufacturer's address</td><td>(Industrial Zone)No.998, Xinghua 5 Road, Xinjin District, Chengdu City</td></tr>
<tr><td>Sample(s) deliverer</td><td>Sichuan Zhongxin General Electric Power Co., Ltd.</td><td>Date of manufacture</td><td>2021-05</td></tr>
<tr><td>Receiving number of sample(s)</td><td>1 set</td><td>Receiving date of sample(s)</td><td>2021-08-04</td></tr>
<tr><td>Test requirements decision criteria</td><td colspan="3">GB/T 1094.1-2013 Power transformers-Part 1: General
GB/T 1094.3-2017 Power transformers-Part 3: Insulation levels, dielectric tests and external clearances in air
GB/T 1094.5-2008 Power transformers-Part 5: Ability to withstand short circuit
GB/T 1094.10-2003 Power transformers-Part 10: Determination of sound levels
GB/T 1094.11-2007 Power transformers-Part 11: Dry-type transformers
GB/T 10228-2015 Specification and technical requirements for dry-type power transformers
GB/T 35710-2017 Rated power evaluation guide for 35 kV and below power transformers
GB 20052-2020 Minimum allowable values of energy efficiency and the energy efficiency grades for power transformers
IEC 60076-1:2011 Power transformers-Part 1: General
IEC 60076-3:2013 +AMD1: 2018 Power transformers-Part 3: Insulation levels, dielectric tests and external clearances in air
IEC 60076-5: 2006 Power transformers-Part 5: Ability to withstand short circuit
IEC 60076-10:2001 Power transformers-Part 10: Determination of sound levels
IEC 60076-11:2004 Power transformers-Part 11: Dry-type transformers
Power of attorney requirements</td></tr>
<tr><td>Test items</td><td colspan="3">Routine test, type test, special test, commission test
(Detailed test items are reported at test items and summary of results)</td></tr>
<tr><td>Description and condition of sample(s)</td><td colspan="3">The sample is sent by the customer, the appearance is perfect, and it is suitable for testing.</td></tr>
<tr><td>Test date</td><td>2021-08-05 ~ 2021-08-13</td><td>Test location</td><td>No. 400 Guangqiong Road, Jiaxing City</td></tr>
<tr><td>Test summary</td><td colspan="3">The entrusted sample have been tested according to GB/T 1094.1-2013, GB/T 1094.3-2017, GB/T 1094.5-2008, GB/T 1094.10-2003, GB/T 1094.11-2007, GB/T 10228-2015, GB/T 35710-2017, GB 20052-2020, IEC 60076-1: 2011, IEC 60076-3: 2013+AMD1: 2018, IEC 60076-5: 2006, IEC 60076-10:2001, IEC 60076-11:2004 and power of attorney requirements. The inspection results of the inspected items all meet the requirements of the standard (decision criteria).
Test seal
Date of approval: 2025-07-14</td></tr>
<tr><td>Remarks</td><td colspan="3">This report is a translation of report 2113346615. The GB/T 1094.10-2003, GB/T 1094.11-2007, GB/T 10228-2015 and GB 20052-2020 standards in the original report were obsoleted at the time of this report (2025-07-14).</td></tr>
</table>

Approved by: 沈渊涛 Verified by: 陈海杰 Complied by: 冯茹萍

TEST REPORT

NATIONAL CENTER OF QUALITY INSPECTION FOR ELECTRICAL SAFETY (ZHEJIANG)

1, Sample parameters

Rate power:	2500kVA		
Rate voltage:	10kV/0.4kV		
Rate current:	144.3A/3608.5A		
Rate frequency:	50Hz		
Phase number:	3		
Tapping range:	(10±2×2.5%) kV /0.4kV		
Connection symbol:	Dyn11		
Cooling method:	AN/AF		
Thermal class of insulation:	H		
Insulation level:	h.v. line terminal	LI /AC	75/35 kV
	l.v. line terminal and neutral point terminal	LI/AC	3kV

2, Test requirements

GB/T 1094.1-2013	Power transformers-Part 1: General
GB/T 1094.3-2017	Power transformers-Part 3: Insulation levels, dielectric tests and external clearances in air
GB/T 1094.5-2008	Power transformers-Part 5: Ability to withstand short circuit
GB/T 1094.10-2003	Power transformers-Part 10: Determination of sound levels
GB/T 1094.11-2007	Power transformers-Part 11: Dry-type transformers
GB/T 10228-2015	Specification and technical requirements for dry-type power transformers
GB/T 35710-2017	Rated power evaluation guide for 35 kV and below power transformers
GB 20052-2020	Minimum allowable values of energy efficiency and the energy efficiency grades for power transformers
IEC 60076-1: 2011	Power transformers-Part 1: General
IEC 60076-3: 2013 +AMD1: 2018	Power transformers-Part 3: Insulation levels, dielectric tests and external clearances in air
IEC 60076-5: 2006	Power transformers-Part 5: Ability to withstand short circuit
IEC 60076-10: 2001	Power transformers-Part 10: Determination of sound levels
IEC 60076-11: 2004	Power transformers-Part 11: Dry-type transformers

Power of attorney requirements

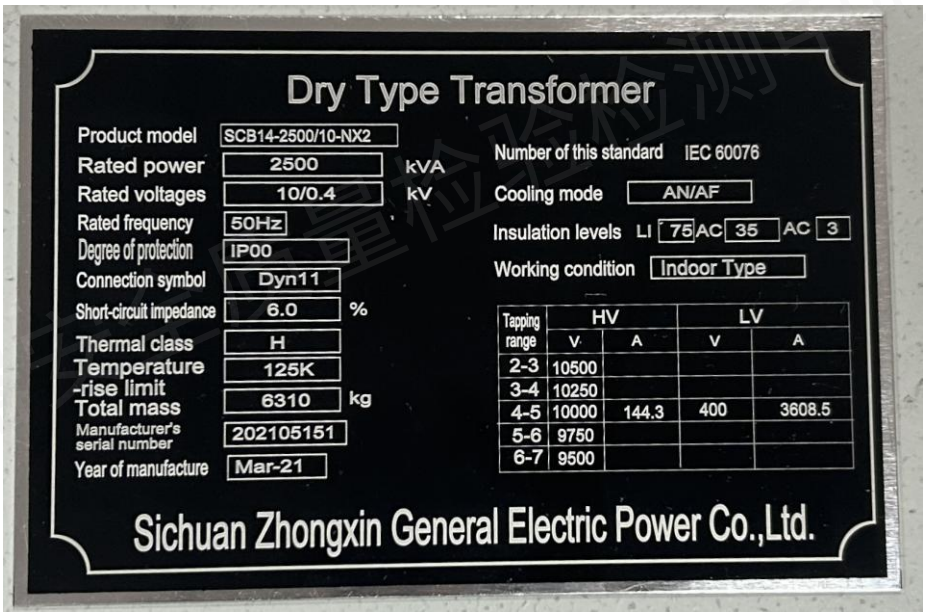
3, The sample specification

The dry type transformer is for indoors use, the structure of the coil is a non-circular concentric coil.

TEST REPORT	NATIONAL CENTER OF QUALITY INSPECTION FOR ELECTRICAL SAFETY (ZHEJIANG)

Photo of nameplate and sample(s) under test

Photo of nameplate



Front photo of sample

Side photo of sample

TEST REPORT	NATIONAL CENTER OF QUALITY INSPECTION FOR ELECTRICAL SAFETY (ZHEJIANG)

Test items and summary of results

Series number	Test category	Test items	Required value	Measured value		Conclusion
			Standard (Entrusted requirements)	Before short-circuit test	After short-circuit test	
01	Routine test	Measurement of voltage ratio and check of phase displacement	Voltage ratio tolerance of principal tapping: obtaining the lower of the following values between ±0.5% of declared ratio and ±1/10 of the actual percentage impedance Other tapping: Turn ratio ±0.5% of design value Connection symbol: Dyn11	-0.04% ~-0.02% Dyn11	-0.04% ~-0.02% Dyn11	Pass
02		Measurement of d.c. insulation resistance each winding to earth and between windings.	Provide measured value of insulation resistance (MΩ): HV--LV and earth LV--HV and earth HV and LV--earth	＞99.9×10^3 ＞99.9×10^3 ＞99.9×10^3	＞99.9×10^3 ＞99.9×10^3 ＞99.9×10^3	Measured
03		Measurement of winding resistance	Unbalance rate of winding resistance (max): Line resistance ≤2%	HV(line): 1.44% LV(line): 1.30%	HV(line): 1.44% LV(line): 1.33%	Pass
04		Measurement of no-load loss and current	No load current (%):≤$0.700^{+30\%}$ No-load loss (kW): ≤2.450	0.195 2.315	0.195 2.321	Pass
05		Measurement of short-circuit impedance and load loss	Reference temperature (℃): 145 Short-circuit impedance (%):$6.0^{\pm10\%}$ Load loss (kW): ≤16.605 Total loss (kW): ≤19.055	145 6.05 16.317 18.632	145 6.07 16.338 18.659	Pass
06		Applied voltage test	HV(kV): 35 Duration: 60s LV(kV): 3 Duration: 60s	35.4kV 60s 3.06kV 60s	35.5kV 60s 3.02kV 60s	Pass
07		Induced voltage withstand test	Applied voltage on LV side(kV): $2U_r$ Frequency(Hz): >50 Duration(s): 120×(rate frequency/test frequency)	0.805 150 40	0.807 150 40	Pass

TEST REPORT	NATIONAL CENTER OF QUALITY INSPECTION FOR ELECTRICAL SAFETY (ZHEJIANG)

Test items and summary of results

Series number	Test category	Test items	Required value	Measured value		Conclusion
			Standard (Entrusted requirements)	Before short-circuit test	After short-circuit test	
08	Routine test	Partial discharge measurement	Applied voltage(kV): $1.3U_r$	0.523	0.526	Pass
			Duration(s): 180	180	180	
			Discharge magnitude (pC): ≤5	A:4.0~4.5	A:3.8~4.3	
				B:3.6~4.1	B:3.8~4.1	
				C:3.6~4.4	C:3.7~4.5	
09	Type test	Measurement of no-load loss and current at 90% and 110% of rated voltage	90%U_r No load current (%):measured	0.140		Measured
			90%U_r No-load loss (kW): measured	1.452		
			110%U_r No load current (%):measured	0.264		
			110%U_r No-load loss (kW): measured	3.062		
10		Temperature rise test	HV winding temperature rise limit (K): ≤125	116.6		Pass
			LV winding temperature rise limit (K): ≤125	119.2		
11		Power measurement of fan and oil pump motor	Providing the measured power value of fan motor (W)	230.2		Measured
12		Lightning impulse test	10kV winding:			Pass
			LI(kV): $75^{\pm 3\%}$	LI(kV): 74.52~77.13		
13		Determination of sound levels	Sound pressure level $\overline{L_{PA}}$ (dB):	54.8		Pass
			Sound power level L_{WA} dB(A): ≤72	70.1		

TEST REPORT	NATIONAL CENTER OF QUALITY INSPECTION FOR ELECTRICAL SAFETY (ZHEJIANG)

Test items and summary of results

Series number	Test category	Test items	Required value Standard (Entrusted requirements)	Measured value	Conclusion
14	Special test	Short-circuit withstand test	Test times of each phase: 3 times Duration(ms): $500^{\pm 10\%}$ Test current and voltage waveform have no abnormality After the short-circuit test, the coil, lead and support structure have no obvious displacement and deformation, and no discharge marks are found on the surface of the device. The reactance variation in phase before and after the test is less than 7.5% Routine retests shall be passed after short-circuit test	3 times per phase 519~541 Test current and voltage waveform have no abnormality After the short-circuit test, the coil, lead and support structure have no obvious displacement and deformation, and no discharge marks are found on the surface of the device. The maximum reactance variation in phase is 5.20% Routine retests after short-circuit test is passed	Pass
15	Commission test	Measurement of the harmonics of the no-load current	Providing harmonics of the no-load current of each phase	See 4.15	Measured
16		Power evaluation test on transformer	Rated power (kVA): 2500	2500	Pass

Note: /

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4, Test items and results

4.1 Measurement of voltage ratio and check of phase displacement (routine test) Test date: 2021-08-05

HV winding		LV winding		Transformer ratio by calculation	Measured voltage ratio deviation (%)			Connection symbol
Tapping position	Voltage (kV)	Tapping position	Voltage (kV)		AB/ab	BC/bc	CA/ca	
2-3	10.500	/	0.400	26.250	-0.02	-0.03	-0.02	Dyn11
3-4	10.250			25.625	-0.03	-0.04	-0.02	
4-5	10.000			25.000	-0.04	-0.03	-0.03	
5-6	9.750			24.375	-0.03	-0.04	-0.02	
6-7	9.500			23.750	-0.04	-0.02	-0.02	

Test conclusion: Pass.

4.2 Measurement of d.c insulation resistance between each winding to earth and between winding (routine test) Test date: 2021-08-05

Ambient temperature: 27.3℃ Relative humidity: 63.4%

Measured parts	Measured insulation resistance (MΩ)
HV--LV and earth	$>99.9\times10^{3}$
LV--HV and earth	$>99.9\times10^{3}$
HV and LV--earth	$>99.9\times10^{3}$

Test conclusion: Measured.

4.3 Measurement of winding resistance (routine test) Test date: 2021-08-05

Ambient temperature: 27.3℃ Relative humidity: 63.4%

Winding	Tapping position	Measured resistance (Ω)			Resistance unbalance rate (%)
		A~B	B~C	C~A	
HV	2-3	0.1610	0.1592	0.1609	1.12
	3-4	0.1574	0.1555	0.1572	1.21
	4-5	0.1539	0.1519	0.1538	1.31
	5-6	0.1496	0.1477	0.1495	1.28
	6-7	0.1464	0.1443	0.1462	1.44
LV	/	a~b	b~c	c~a	/
		0.2993×10^{-3}	0.2998×10^{-3}	0.3032×10^{-3}	1.30

Test conclusion: Pass.

TEST REPORT	NATIONAL CENTER OF QUALITY INSPECTION FOR ELECTRICAL SAFETY (ZHEJIANG)

4.4 Measurement of no-load loss and current (routine test) Test date: 2021-08-05

The test circuit is shown in test schematic diagram 1

Voltage multiple	Applied voltage (V)		No-load current		No-load loss (kW)	
	r.m.s. value	Average value	(A)	(%)	Measured value	Corrected value
100%U_r	400.8	400.6	7.02	0.195	2.316	2.315

Test conclusion: Pass.

4.5 Measurement of short-circuit impedance and load loss (routine test) Test date: 2021-08-05

The test circuit is shown in test schematic diagram 2 Ambient temperature: 27.3℃

Winding	Tapping position	Applied current		Average voltage (V)	HV short-circuit impedance (per phase)		Load loss (kW)	Total loss (kW)
		I(A)	I/I_r (%)		(%)	(Ω)	Corrected value	Corrected value
					t=145℃ $I=I_r$	t=145℃ $I=I_r$	t=145℃ $I=I_r$	t=145℃ $I=I_r$
HV-LV	2-3	72.06	52.4	335.2	6.11	2.69	16.180	18.495
	4-5	75.54	52.3	315.4	60.5	2.42	16.317	18.632
	6-7	83.58	55.0	312.1	5.99	2.16	16.448	18.763

Test conclusion: Pass.

4.6 Applied voltage test (routine test) Test date: 2021-08-06

The test circuit is shown in test schematic diagram 3.

Ambient temperature: 26.8℃ Relative humidity: 67.1% Atmospheric pressure: 100.7kPa

Testing position	Test voltage (kV)	Duration (s)	**Test conclusion**
HV-- LV and earth	35.4	60	**Pass**
LV-- HV and earth	3.06	60	

4.7 Induced voltage withstand test (routine test) Test date:2021-08-06

The test circuit is shown in test schematic diagram 4.

Ambient temperature: 26.8℃ Relative humidity: 67.1% Atmospheric pressure: 100.7kPa

Tapping position	Applied voltage (kV)	Frequency (Hz)	Duration (s)	**Test conclusion**
	LV side			
4-5	0.805	150	40	**Pass**

4.8 Partial discharge measurement (routine test) Test date:2021-08-06

Ambient temperature: 26.8℃

Frequency (Hz)	Applied voltage		Duration	**Partial discharge magnitude(pC)**		
	(kV)	Multiple		A	B	C
150	0.724	1.8Ur	30s	/	/	/
	0.523	1.3Ur	180s	4.0~4.5	3.6~4.1	3.6~4.4

Test conclusion: Pass.

TEST REPORT	NATIONAL CENTER OF QUALITY INSPECTION FOR ELECTRICAL SAFETY (ZHEJIANG)

4.9 Measurement of no-load loss and current at 90% and 110% of rated voltage (type test)

Test date: 2021-08-05

Voltage multiple	Applied voltage (V)		No-load current		No-load loss (kW)	
	r.m.s. value	Average value	(A)	(%)	Measured value	Corrected value
90%U_r	360.5	360.3	5.04	0.140	1.453	1.452
110%U_r	440.6	440.3	9.52	0.264	3.064	3.062

Test conclusion: Measured.

4.10 Temperature rise test (type test)

Test date:2021-08-09~08-10

The test circuit is shown in test schematic diagram 5.

Testing method: simulation load method. Tapping position: 4-5.

Temperature rise test under no-load loss: the specified voltage should be applied is 400V and the actual voltage applied is 400V. Test time from 08:15 to 17:30 (2021-08-09).

Temperature rise test under load loss: the specified current should be applied is 144.3A and the actual current applied is 144.4A. Test time from 18:00 to 08:50 (2021-08-09~10).

Temperature-rise data under no-load loss

Winding	Resistance measurement (Ω)		Ambient temperature (℃)		Winding temperature rise (K)
	Hot resistance	Cold resistance	Measured hot resistance	Measured cold resistance	
HV	0.1569	0.1519	26.4	27.3	9.5
LV	0.3190×10^{-3}	0.2998×10^{-3}			17.7

Temperature-rise data under load loss

Winding	Resistance measurement (Ω)		Ambient temperature (℃)		Winding temperature rise (K)
	Hot resistance	Cold resistance	Measured hot resistance	Measured cold resistance	
HV	0.2176	0.1519	28.1	27.3	112.5
LV	0.4270×10^{-3}	0.2998×10^{-3}			110.4

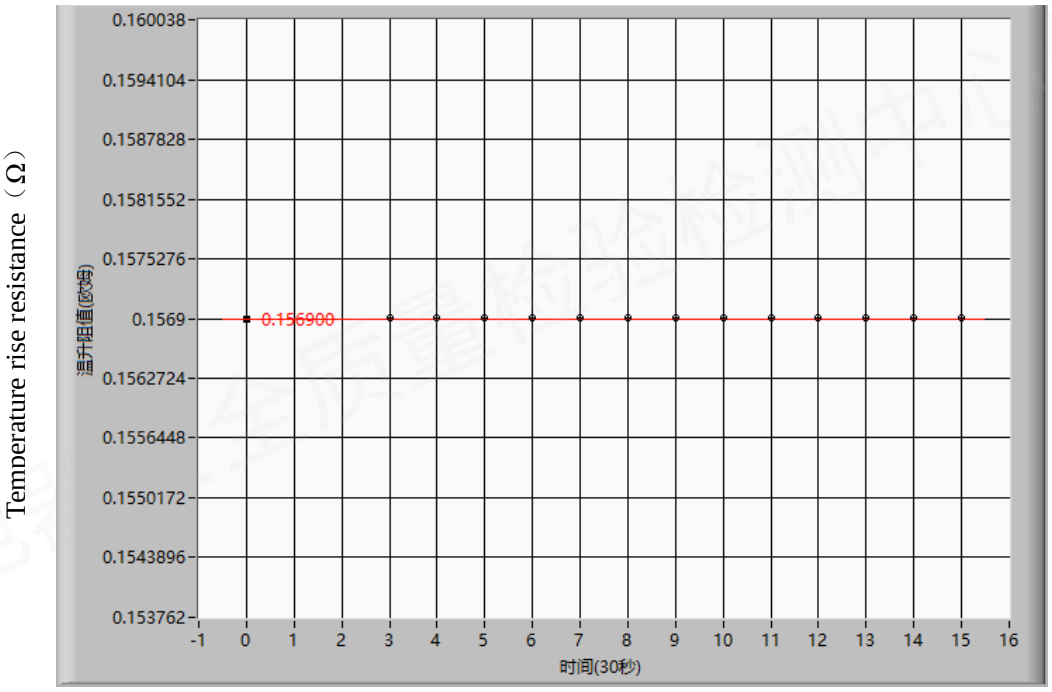
Temperature rise calculation result

Winding temperature rise (K)		
	HV (K)	116.6
	LV (K)	119.2

Test conclusion: Pass.

TEST REPORT	NATIONAL CENTER OF QUALITY INSPECTION FOR ELECTRICAL SAFETY (ZHEJIANG)

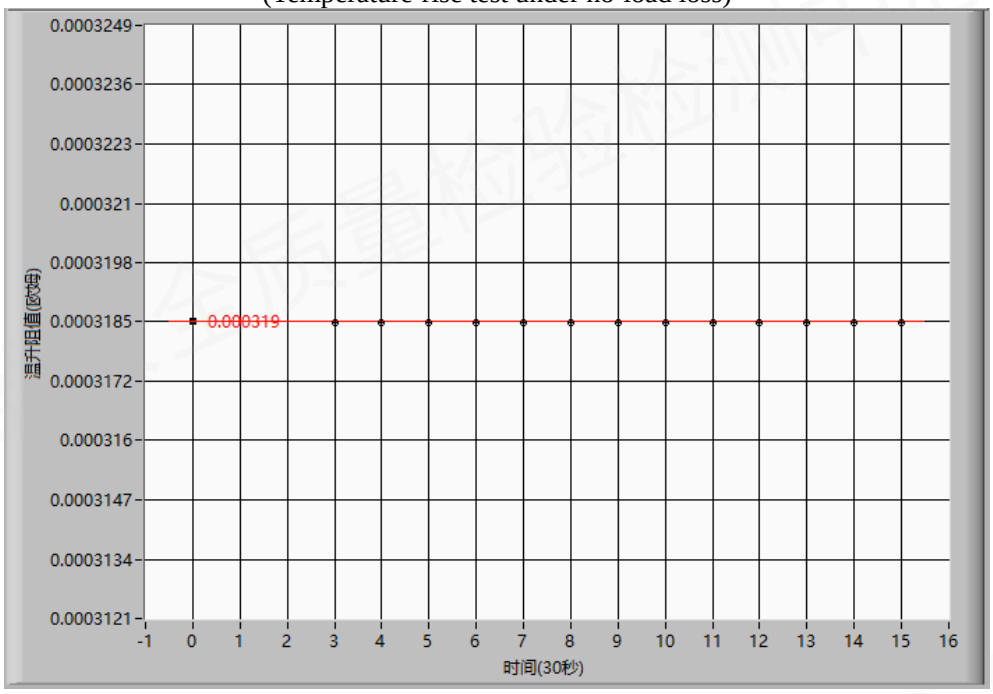
HV winding thermal resistance curve
(Temperature-rise test under no-load loss)



Temperature rise resistance（Ω）

Time(30s)

LV winding thermal resistance curve
(Temperature-rise test under no-load loss)



Temperature rise resistance（Ω）

Time(30s)

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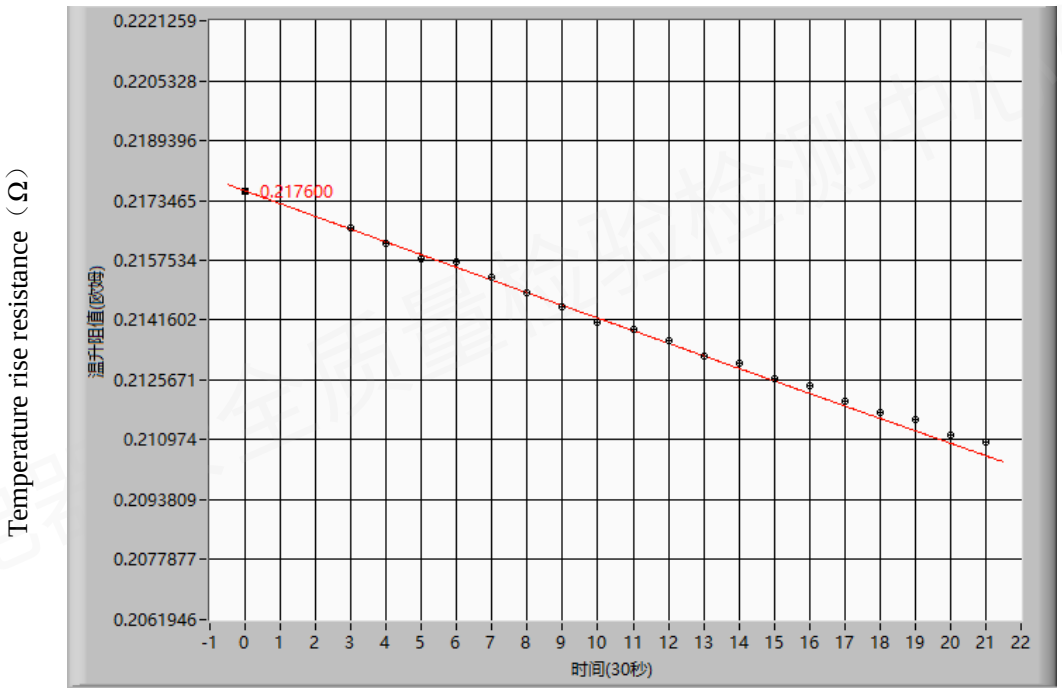
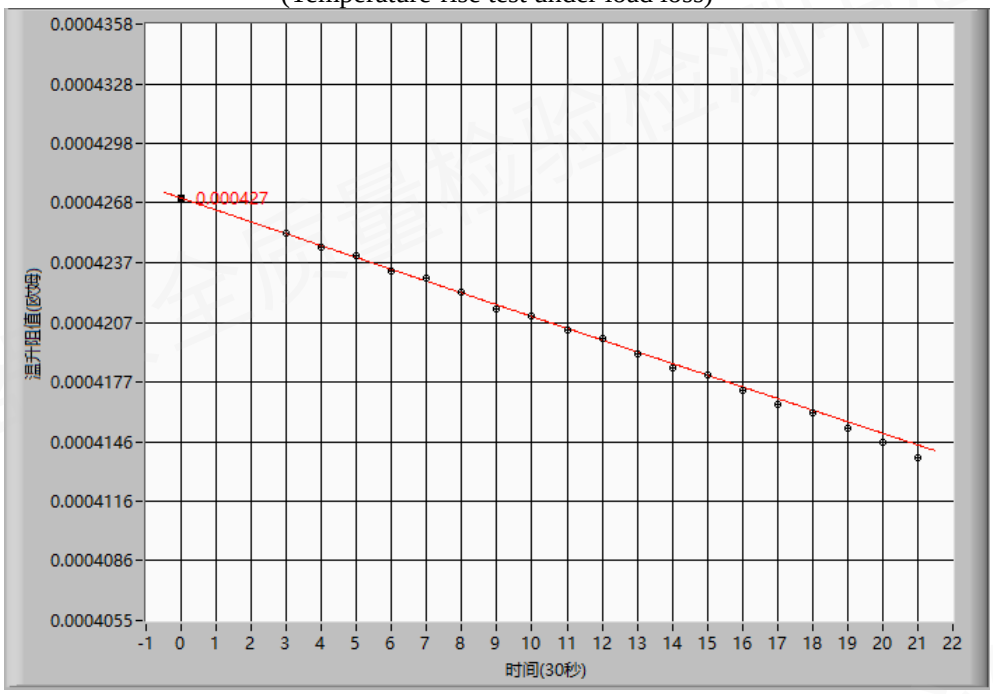
HV winding thermal resistance curve
(Temperature-rise test under load loss)



Temperature rise resistance（Ω）

Time(30s)

LV winding thermal resistance curve
(Temperature-rise test under load loss)



Temperature rise resistance（Ω）

Time(30s)

TEST REPORT	NATIONAL CENTER OF QUALITY INSPECTION FOR ELECTRICAL SAFETY (ZHEJIANG)

4.11 Power measurement of fan and oil pump motor (type test) Test date: 2021-08-06

	Test voltage (V)	Test current (A)	Test power (W)
■Fan motor	220	1.09	230.2
□Oil pump motor	/	/	/

Test conclusion: Measured.

4.12 Lightning impulse test (type test) Test date:2021-08-13

The test circuit is shown in the test schematic 6.

Ambient temperature: 28.2℃ Relative humidity: 64.6% Atmospheric pressure: 100.7kPa

Test items and voltage

Withstand terminals	Rated withstand voltage (kV)	Tapping position
	Lightning full wave	
A, B, C	$75^{\pm 3\%}$	4-5

Test procedure:

Terminal

One negative reduced level full wave impulse;

Three negative full level full wave impulses.

Test records:

T1: wave front time; T2: time to half of peak value; Upk: peak voltage.

For the waveforms, please check the lightning impulse oscilloscope.

Voltage ranges of oscillograms are as below:

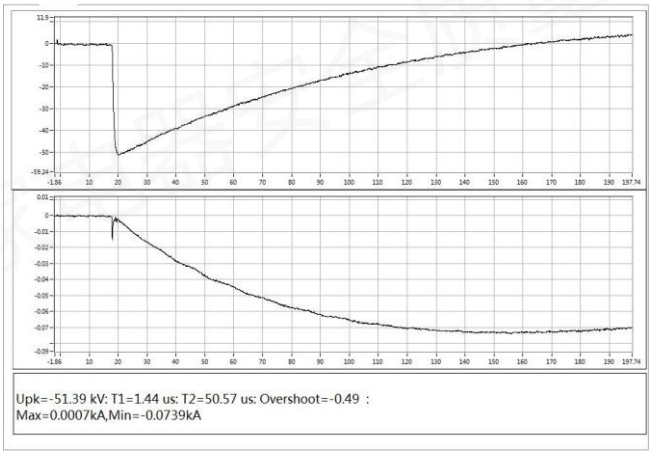
LI(kV)
74.52~77.13

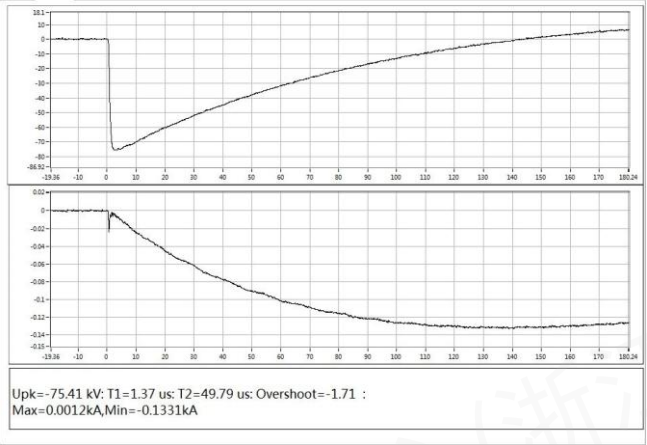
Test conclusion: Pass.

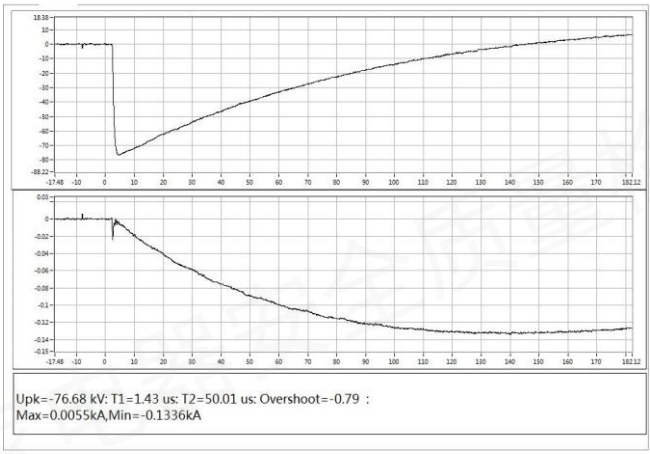
TEST REPORT	NATIONAL CENTER OF QUALITY INSPECTION FOR ELECTRICAL SAFETY (ZHEJIANG)

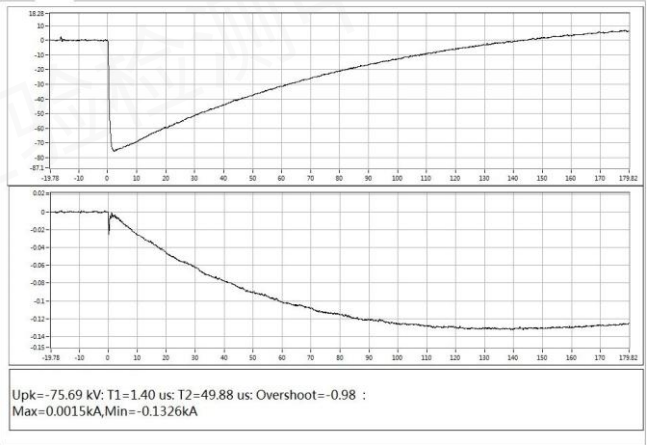
Lightning impulse oscilloscope

Tested terminal: A
Test polarity: negative
Tapping position: 4-5
Channel 1: voltage wave
Channel 2: current wave





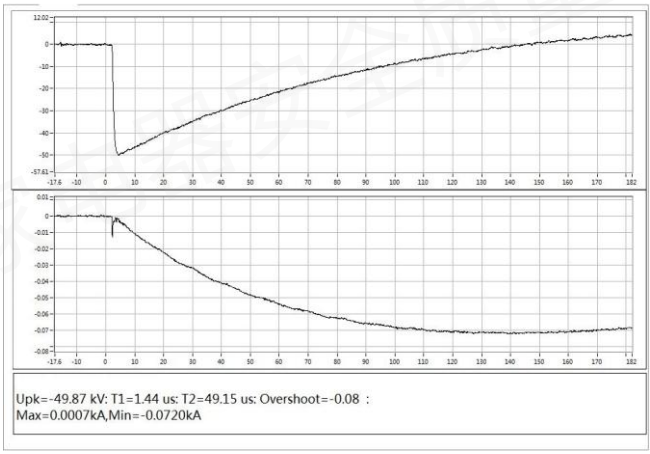


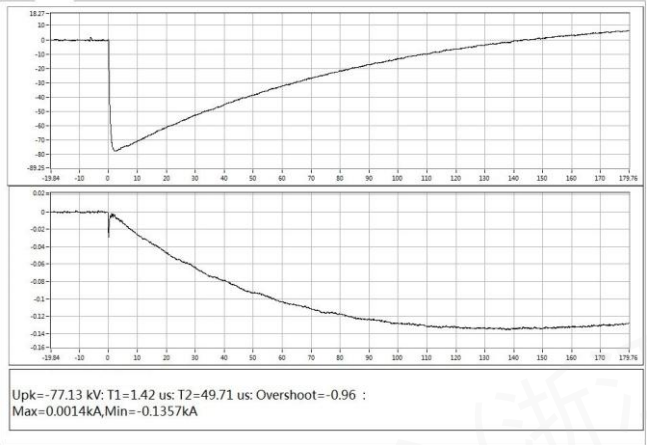


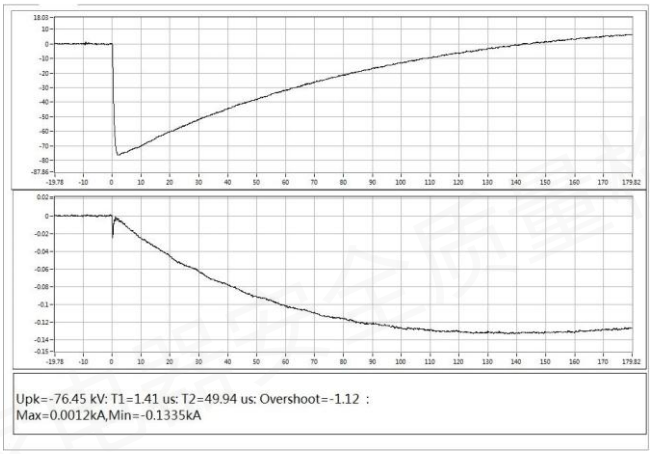
TEST REPORT	NATIONAL CENTER OF QUALITY INSPECTION FOR ELECTRICAL SAFETY (ZHEJIANG)

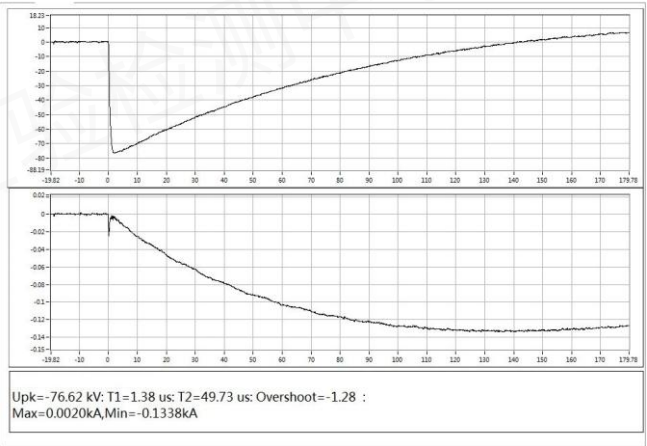
Lightning impulse oscilloscope

Tested terminal: B
Test polarity: negative
Tapping position: 4-5
Channel 1: voltage wave
Channel 2: current wave





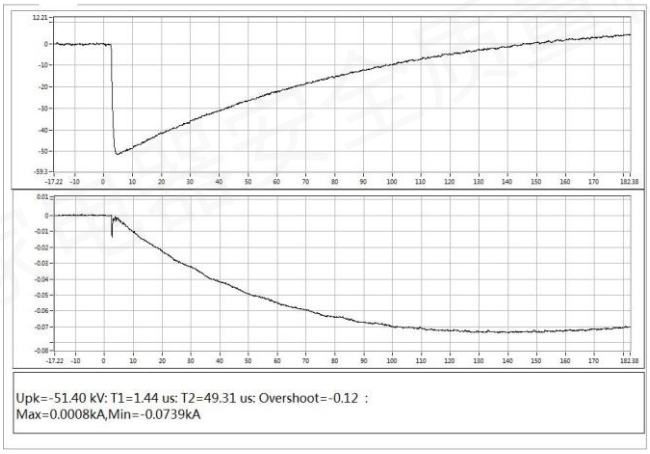


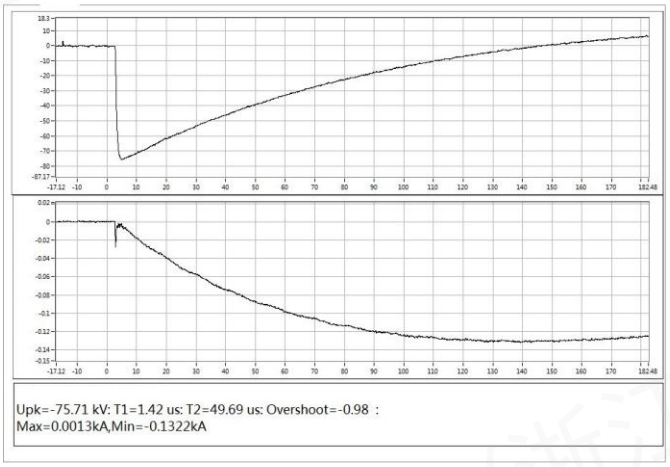


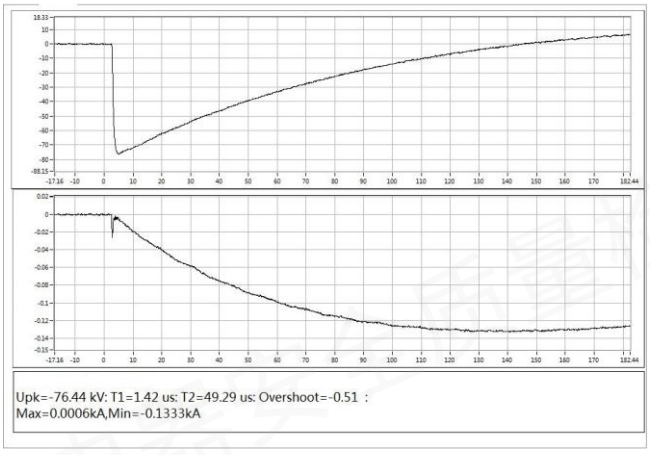
TEST REPORT	NATIONAL CENTER OF QUALITY INSPECTION FOR ELECTRICAL SAFETY (ZHEJIANG)

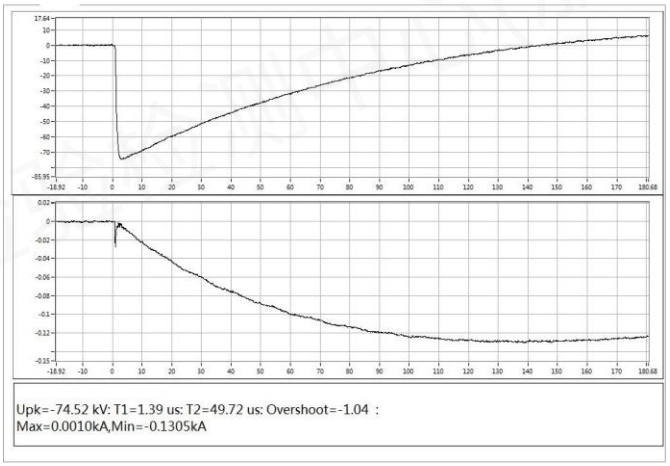
Lightning impulse oscilloscope

Tested terminal: C
Test polarity: negative
Tapping position: 4-5
Channel 1: voltage wave
Channel 2: current wave









TEST REPORT	NATIONAL CENTER OF QUALITY INSPECTION FOR ELECTRICAL SAFETY (ZHEJIANG)

4.13 Determination of sound level (type test) Test date: 2021-08-06

The test circuit is shown in test schematic diagram 7.

4.13.1 Rough estimation of the load current sound power level

Calculation formula: $L_{WA,IN} \approx 39+18\lg\frac{S_r}{S_p} \approx 46.2$dB(A)

$L_{WA,IN}$: A-weighted sound power level of transformer at rated frequency, rated current and short-circuit impedance, unit dB(A)

In the formula: S_r : rated power, 2.50MVA;

S_p : reference power, 1MVA.

Because $L_{WA,IN}$ is less 8 dB(A) than the guaranteed sound power level 72dB(A), according to standard requirement, it need not to measure load current sound power level.

4.13.2 Measurement of sound pressure level and calculation of sound power level

The transformer is rated excitation, the prescribed contour shall be spaced 1.0m away from the principal radiating surface, the distance between measured points is 0.85m, the number of measured points is 15, the height of measured point is 0.80m.

Measuring environmental conditions Ambient temperature: 26.8℃

The total area of the surface of the test room Sv(m^2)	The average acoustic absorption coefficient α	Sound absorption A (m^2)	Distance from the principal radiating surface (m)	Measuring surface area S(m^2)	Environmental correction K (dB)
3358.6	0.15	503.8	1.0	33.3	1.02

Measurement results dB(A)

Status of cooling device	Background noise average value		The uncorrected average A-weighted sound pressure level $\overline{L_{PAO}}$	A-weighted sound pressure level $\overline{L_{pA}}=10\lg(10^{0.1\overline{L_{pAO}}}-10^{0.1\overline{L_{bgA}}})-K$	A weighted sound power level $L_{WA}=\overline{L_{pA}}+10\lg\frac{S}{S_0}$
	Before the test	After the test			
AN	35.3	35.2	55.9	54.8	70.1

Note: $\overline{L_{PAO}}$: the uncorrected average A-weighted sound pressure level $\overline{L_{pAO}}=10\lg(\frac{1}{N}\sum_{i=1}^{N}10^{0.1L_{pAI}})$

$\overline{L_{bgA}}$: the lower of background sound A-weighted sound pressure level measured at each measuring point before and after the test $\overline{L_{bgA}}=10\lg(\frac{1}{M}\sum_{i=1}^{M}10^{0.1L_{bgAI}})$

M: the total number of microphone position

Test conclusion: Pass

TEST REPORT	NATIONAL CENTER OF QUALITY INSPECTION FOR ELECTRICAL SAFETY (ZHEJIANG)

4.14 Short-circuit withstand test (special test) Test date: 2021-08-12

4.14.1 Current calculation of short-circuit test (reference temperature 145℃) Ambient temperature: 28.7℃

Tapping position	Phase asymmetric short circuit current First peak(A)	Phase symmetrical short-circuit current Root mean square(A)	Peak coefficient ($K\sqrt{2}$)
2-3	$132.9^{\pm5\%}$	$54.6^{\pm10\%}$	2.44
4-5	$133.8^{\pm5\%}$	$55.1^{\pm10\%}$	2.43
6-7	$134.6^{\pm5\%}$	$55.6^{\pm10\%}$	2.42

4.14.2 Current injection of short-circuit test

Three-phase power supply should be used for total of 9 tests, current and voltage waveforms should be normal.

The first peak value of the asymmetric short-circuit current and the root mean square of the symmetric short-circuit current are the measured value ratio and the calculated current value.

Tapping position	Times	Applied voltage terminal	Measurement of current					
			Phase asymmetric short circuit current First peak		Phase symmetrical short-circuit current Root mean square		Duration (ms)	Oscillogram No
			Measured value (kA)	(%)	Measured value (kA)	(%)		
2-3	1st	a	132.3	-0.451	54.1	-0.916	525	S2146615001
		b	113.0	-15.0	54.3	-0.549		
		c	79.9	-39.9	54.3	-0.549		
	2nd	a	133.2	0.226	54.7	0.183	523	S2146615002
		b	109.5	-17.6	54.6	0.000		
		c	89.6	-32.6	54.7	0.183		
	3rd	a	133.6	0.527	54.8	0.366	528	S2146615003
		b	113.4	-14.7	54.7	0.183		
		c	81.4	-38.8	54.7	0.183		

Times	Measurement of reactance					
	Phase reactance (Ω)			Phase reactance deviation (%)		
	X_A	X_B	X_C	X_A	X_B	X_C
Before the test	8.17	7.98	7.81	/	/	/
1st	8.22	7.99	7.83	0.62	0.20	0.25
2nd	8.24	8.02	7.86	0.88	0.48	0.71
3rd	8.28	8.04	7.87	1.34	0.75	0.85

TEST REPORT	NATIONAL CENTER OF QUALITY INSPECTION FOR ELECTRICAL SAFETY (ZHEJIANG)

Tapping position	Times	Applied voltage terminal	Measurement of current					
			Phase asymmetric short circuit current First peak		Phase symmetrical short-circuit current Root mean square		Duration (ms)	Oscillogram No
			Measured value (kA)	(%)	Measured value (kA)	(%)		
4-5	1st	a	86.7	-35.2	55.4	0.544	527	S2146615004
		b	133.4	-0.299	55.3	0.363		
		c	112.4	-16.0	55.2	0.181		
	2nd	a	84.4	-36.9	55.5	0.726	519	S2146615005
		b	133.8	0.000	55.4	0.544		
		c	112.0	-16.1	55.2	0.181		
	3rd	a	89.8	-32.9	55.4	0.544	528	S2146615006
		b	133.7	-0.075	55.4	0.544		
		c	113.4	-15.2	55.1	0.000		

Times	Measurement of reactance					
	Phase reactance (Ω)			Phase reactance deviation (%)		
	X_A	X_B	X_C	X_A	X_B	X_C
Before the test	7.23	7.09	7.00	/	/	/
1st	7.33	7.19	7.07	1.35	1.42	0.97
2nd	7.34	7.21	7.09	1.48	1.68	1.32
3rd	7.35	7.25	7.12	1.65	2.29	1.76

TEST REPORT	NATIONAL CENTER OF QUALITY INSPECTION FOR ELECTRICAL SAFETY (ZHEJIANG)

Tapping position	Times	Applied voltage terminal	Current measurement					
			Phase asymmetric short circuit current First peak		Phase symmetrical short-circuit current Root mean square		Duration (ms)	Oscillogram No
			Measured value (kA)	(%)	Measured value (kA)	(%)		
6-7	1st	a	110.5	-17.9	56.6	1.80	531	S2146615007
		b	99.9	-25.8	56.4	1.44		
		c	134.3	-0.223	56.4	1.44		
	2nd	a	108.6	-19.3	56.3	1.26	534	S2146615008
		b	105.3	-21.8	56.8	2.16		
		c	134.6	0.000	56.7	1.98		
	3rd	a	112.4	-16.5	56.7	1.98	541	S2146615009
		b	99.7	-25.9	56.8	2.16		
		c	134.3	-0.223	56.6	1.80		

Times	Measurement of reactance					
	Phase reactance(Ω)			Phase reactance deviation (%)		
	X_A	X_B	X_C	X_A	X_B	X_C
Before the test	6.36	6.25	6.19	/	/	/
1st	6.49	6.42	6.41	2.03	2.65	3.64
2nd	6.50	6.44	6.44	2.30	2.93	4.11
3rd	6.51	6.47	6.51	2.37	3.44	5.20

The maximum phase reactance deviation is: 5.20%

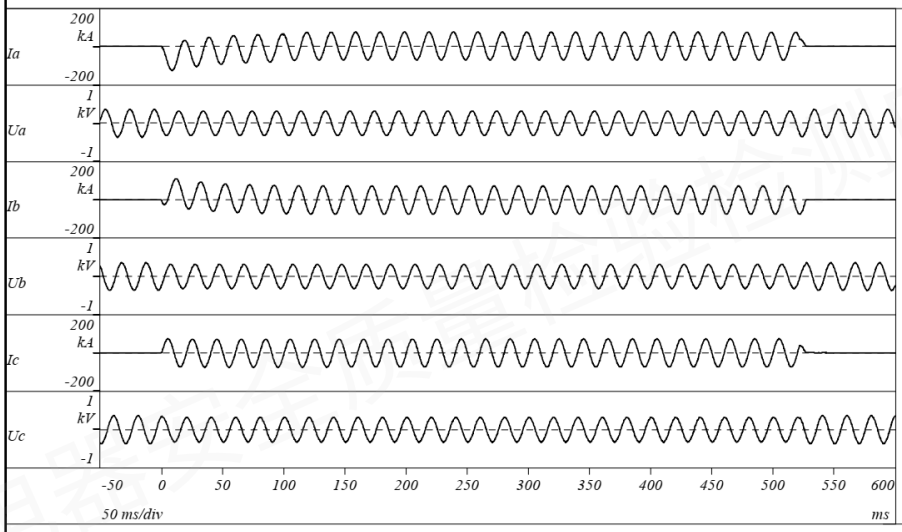
4.14.3 The out-of-tank inspection

After the short-circuit test, the out-of-tank inspection does not reveal any defects such as displacements, deformation of windings, connections or supporting structures and no traces of discharge are found on the device.

For the pictures before and after the test, see Page 27 to Page 28.

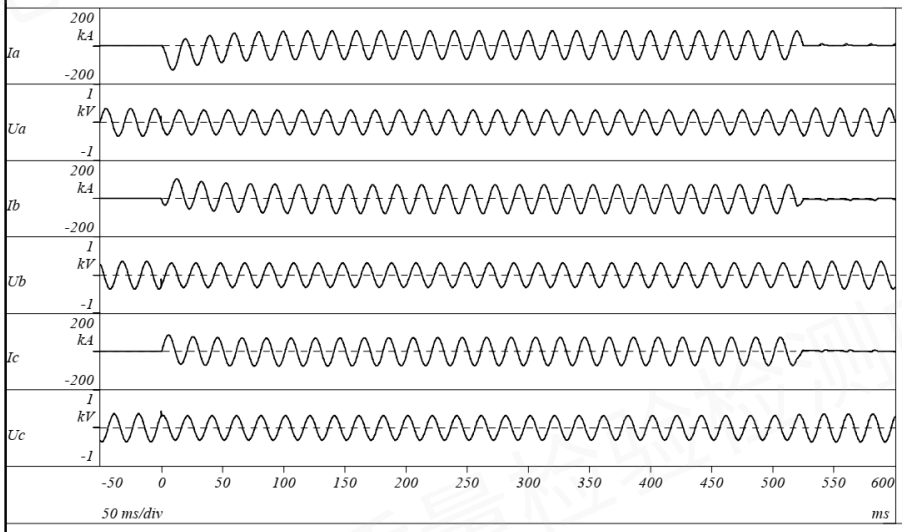
TEST REPORT	NATIONAL CENTER OF QUALITY INSPECTION FOR ELECTRICAL SAFETY (ZHEJIANG)

试 验 示 波 图 2113346615



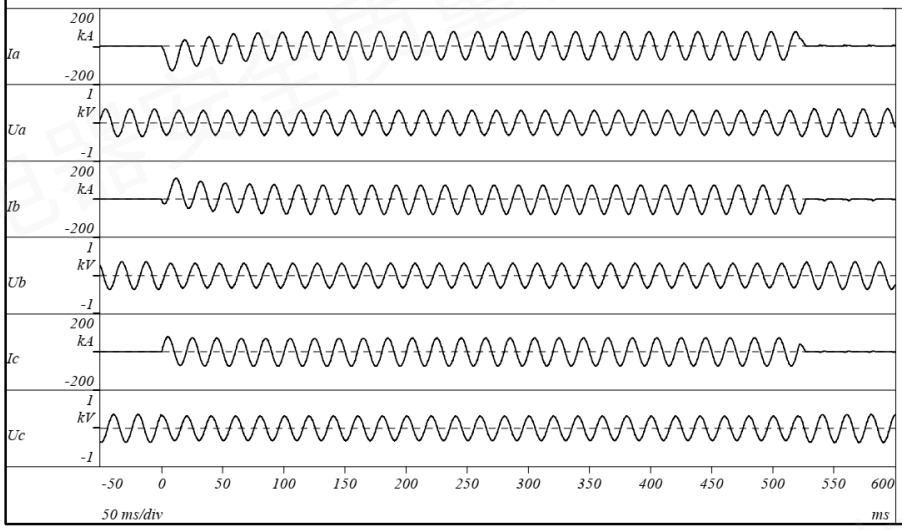
SCB14-2500/10-NX2

1# 分接2-3
No.1
Ua = 258. V
Ub = 255. V
Uc = 259. V
$Irms_{(a)}$= 54.1 kA
$Irms_{(b)}$= 54.3 kA
$Irms_{(c)}$= 54.3 kA
$I_{p(a)}$= 132.3 kA
$I_{p(b)}$= 113.0 kA
$I_{p(c)}$= 79.9 kA
通断时间: 525. ms
S2146615001



SCB14-2500/10-NX2

1# 分接2-3
No.2
Ua = 258. V
Ub = 255. V
Uc = 260. V
$Irms_{(a)}$= 54.7 kA
$Irms_{(b)}$= 54.6 kA
$Irms_{(c)}$= 54.7 kA
$I_{p(a)}$= 133.2 kA
$I_{p(b)}$= 109.5 kA
$I_{p(c)}$= 89.6 kA
通断时间: 523. ms
S2146615002



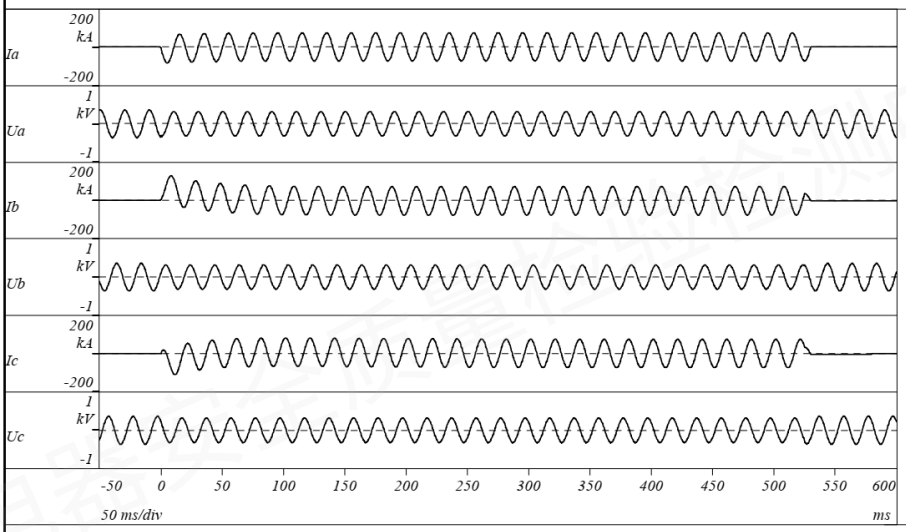
SCB12-2500/10

1# 分接2-3
No.3
Ua = 258. V
Ub = 255. V
Uc = 260. V
$Irms_{(a)}$= 54.8 kA
$Irms_{(b)}$= 54.7 kA
$Irms_{(c)}$= 54.7 kA
$I_{p(a)}$= 133.6 kA
$I_{p(b)}$= 113.4 kA
$I_{p(c)}$= 81.4 kA
通断时间: 528. ms
S2146615003

TEST REPORT

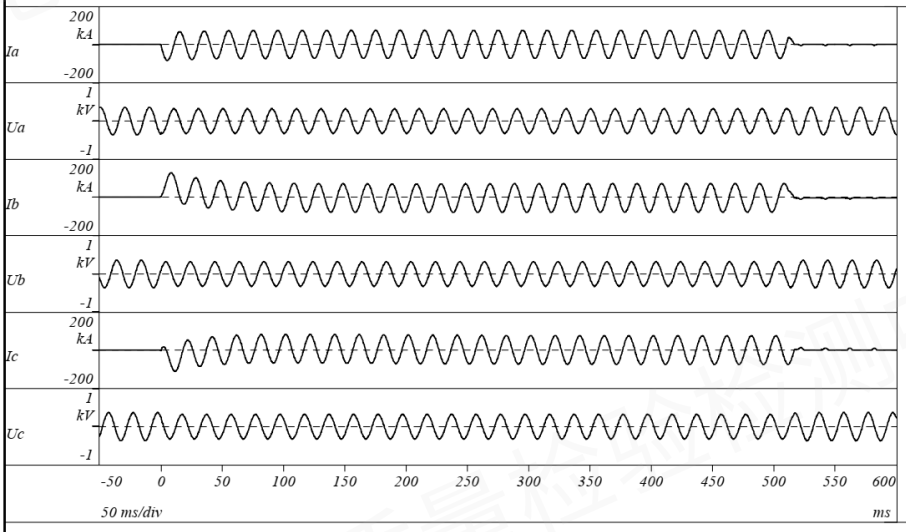
NATIONAL CENTER OF QUALITY INSPECTION FOR ELECTRICAL SAFETY (ZHEJIANG)

试 验 示 波 图 2113346615



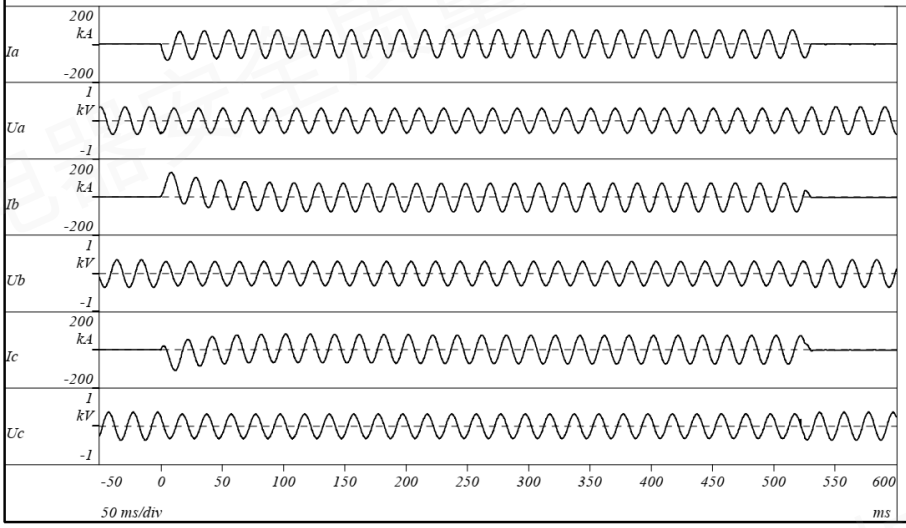
SCB14-2500/10-NX2

1# 分接4-5
No.1
Ua = 258. V
Ub = 255. V
Uc = 259. V
$Irms_{(a)}$= 55.4 kA
$Irms_{(b)}$= 55.3 kA
$Irms_{(c)}$= 55.2 kA
$I_{p(a)}$= 86.7 kA
$I_{p(b)}$= 133.4 kA
$I_{p(c)}$= 112.4 kA
通断时间: 527. ms
S2146615004



SCB14-2500/10-NX2

1# 分接4-5
No.2
Ua = 258. V
Ub = 256. V
Uc = 259. V
$Irms_{(a)}$= 55.5 kA
$Irms_{(b)}$= 55.4 kA
$Irms_{(c)}$= 55.2 kA
$I_{p(a)}$= 84.4 kA
$I_{p(b)}$= 133.8 kA
$I_{p(c)}$= 112.2 kA
通断时间: 519. ms
S2146615005

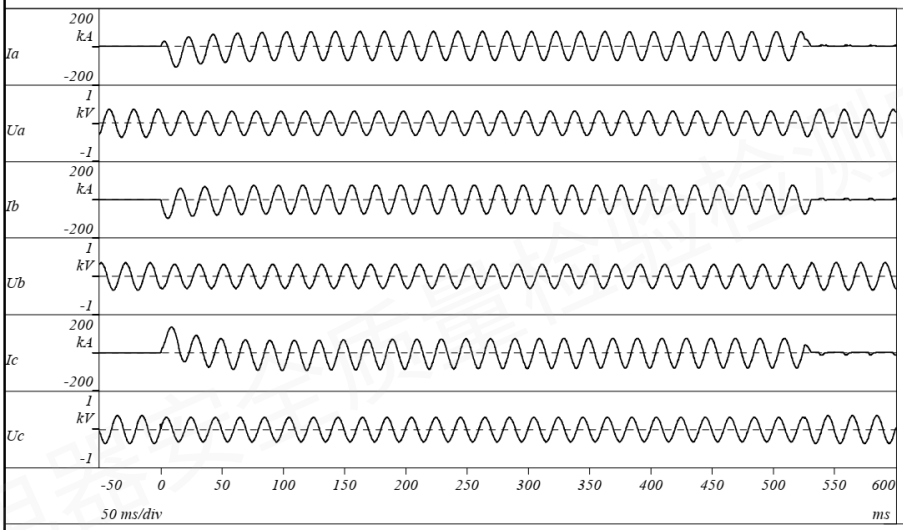


SCB14-2500/10-NX2

1# 分接4-5
No.3
Ua = 258. V
Ub = 255. V
Uc = 259. V
$Irms_{(a)}$= 55.4 kA
$Irms_{(b)}$= 55.4 kA
$Irms_{(c)}$= 55.1 kA
$I_{p(a)}$= 89.8 kA
$I_{p(b)}$= 133.7 kA
$I_{p(c)}$= 113.4 kA
通断时间: 528. ms
S2146615006

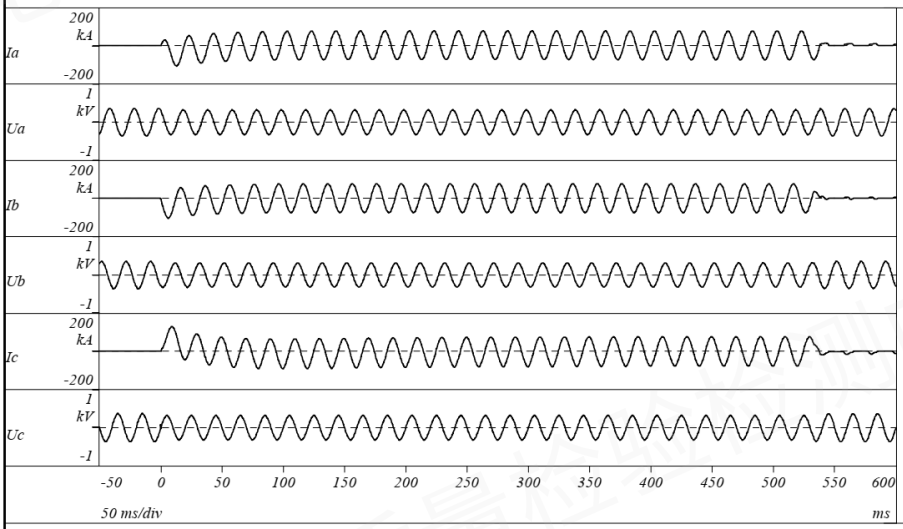
TEST REPORT	NATIONAL CENTER OF QUALITY INSPECTION FOR ELECTRICAL SAFETY (ZHEJIANG)

试 验 示 波 图 2113346615



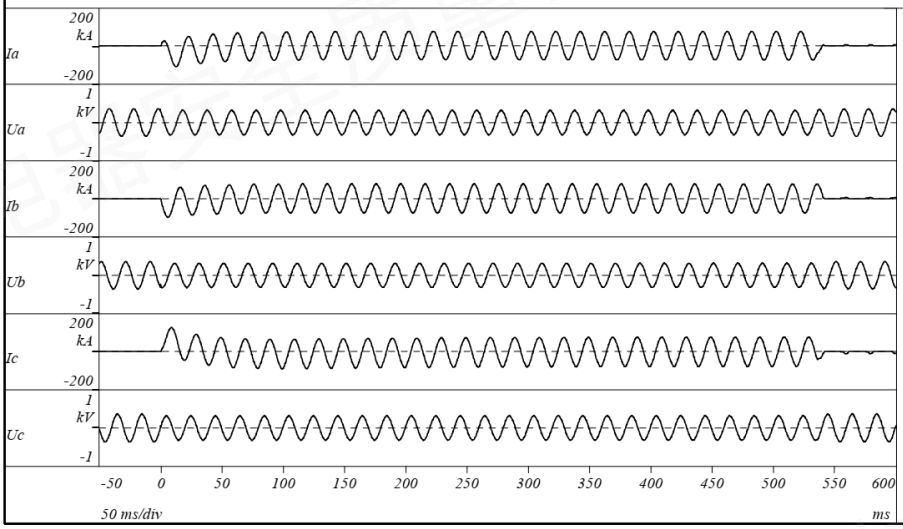
SCB14-2500/10-NX2

1# 分接6-7
No.1
Ua = 259. V
Ub = 255. V
Uc = 259. V
$Irms_{(a)}$= 56.6 kA
$Irms_{(b)}$= 56.4 kA
$Irms_{(c)}$= 56.4 kA
$I_{p(a)}$= 110.5 kA
$I_{p(b)}$= 99.9 kA
$I_{p(c)}$= 134.3 kA
通断时间: 531. ms
S2146615007



SCB14-2500/10-NX2

1# 分接6-7
No.2
Ua = 258. V
Ub = 254. V
Uc = 259. V
$Irms_{(a)}$= 56.3 kA
$Irms_{(b)}$= 56.8 kA
$Irms_{(c)}$= 56.7 kA
$I_{p(a)}$= 108.6 kA
$I_{p(b)}$= 105.3 kA
$I_{p(c)}$= 134.6 kA
通断时间: 534. ms
S2146615008



SCB14-2500/10-NX2

1# 分接6-7
No.3
Ua = 258. V
Ub = 255. V
Uc = 259. V
$Irms_{(a)}$= 56.7 kA
$Irms_{(b)}$= 56.8 kA
$Irms_{(c)}$= 56.6 kA
$I_{p(a)}$= 112.4 kA
$I_{p(b)}$= 99.7 kA
$I_{p(c)}$= 134.3 kA
通断时间: 541. ms
S2146615009

TEST REPORT	NATIONAL CENTER OF QUALITY INSPECTION FOR ELECTRICAL SAFETY (ZHEJIANG)

4.14.4 Routine retest

4.14.4.1 Measurement of voltage ratio and check of phase displacement (routine test) Test date: 2021-08-13

HV winding		LV winding		Transformer ratio by calculation	Measured voltage ratio deviation (%)			Connection symbol
Tapping position	Voltage (kV)	Tapping position	Voltage (kV)		AB/ab	BC/bc	CA/ca	
2-3	10.500	/	0.400	26.250	-0.02	-0.03	-0.03	Dyn11
3-4	10.250			25.625	-0.03	-0.04	-0.02	
4-5	10.000			25.000	-0.04	-0.03	-0.03	
5-6	9.750			24.375	-0.03	-0.04	-0.03	
6-7	9.500			23.750	-0.04	-0.02	-0.02	

Test conclusion: Pass.

4.14.4.2 Measurement of d.c. insulation resistance between each winding to earth and between winding (routine test) Test date:2021-08-13

Ambient temperature: 28.2℃ Relative humidity: 64.6%

Testing position	Measured insulation resistance (MΩ)
HV--LV and earth	＞99.9×10^{3}
LV--HV and earth	＞99.9×10^{3}
HV and LV--earth	＞99.9×10^{3}

Test conclusion: Measured.

4.14.4.3 Measurement of winding resistance (routine test) Test date: 2021-08-13

Ambient temperature: 28.2℃

Winding	Tapping position	Measured resistance (Ω)			Resistance unbalance rate (%)
		A~B	B~C	C~A	
HV	2-3	0.1616	0.1597	0.1616	1.18
	3-4	0.1579	0.1560	0.1577	1.21
	4-5	0.1544	0.1524	0.1544	1.30
	5-6	0.1501	0.1482	0.1501	1.27
	6-7	0.1469	0.1448	0.1467	1.44
LV	/	a~b	b~c	c~a	/
		0.3002×10^{-3}	0.3008×10^{-3}	0.3042×10^{-3}	1.33

Test conclusion: Pass.

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4.14.4.4 Measurement of no-load loss and current (routine test) Test date:2021-08-13

Voltage multiple	Applied voltage(V)		No-load current		No-load loss(kW)	
	r.m.s. value	Average value	(A)	(%)	Measured value	Corrected value
100%U_r	400.7	400.5	7.03	0.195	2.322	2.321

Test conclusion: Pass.

4.14.4.5 Measurement of short-circuit impedance and load loss (routine test) Test date:2021-08-13

Ambient temperature: 28.2℃

Winding	Tapping position	Applied current		Average voltage (V)	HV short-circuit impedance (per phase)		Load loss(kW)	Total loss(kW)
		I(A)	I/I_r(%)		(%)	(Ω)	Corrected value	Corrected value
					t=145℃ $I=I_r$	t=145℃ $I=I_r$	t=145℃ $I=I_r$	t=145℃ $I=I_r$
HV - LV	2-3	73.81	53.7	344.1	6.12	2.70	16.205	18.526
	4-5	77.05	53.4	322.9	6.07	2.43	16.338	18.659
	6-7	85.21	56.1	318.9	6.01	2.17	16.468	18.789

Test conclusion: Pass.

4.14.4.6 Applied voltage test (routine test) Test date: 2021-08-13

Ambient temperature: 28.2℃ Relative humidity: 64.6% Atmospheric pressure: 100.7kPa

Testing position	Test voltage (kV)	Duration (s)	**Test conclusion**
HV-- LV and earth	35.5	60	**Pass**
LV-- HV and earth	3.02	60	

4.14.4.7 Induced voltage tests (routine test) Test date:2021-08-13

Ambient temperature: 28.2℃ Relative humidity: 64.6% Atmospheric pressure: 100.7kPa

Tapping position	Applied voltage (kV)	Frequency (Hz)	Duration (s)	**Test conclusion**
	LV side			
4-5	0.807	150	40	**Pass**

4.14.4.8 Partial discharge measurement (routine test) Test date:2021-08-13

Ambient temperature: 28.2℃

Frequency (Hz)	Applied voltage		Duration	Partial discharge magnitude (pC)		
	(kV)	Multiple		A	B	**C**
150	0.724	1.8Ur	30s	/	/	/
	0.526	1.3Ur	180s	3.8~4.3	3.8~4.1	3.7~4.5

Test conclusion: Pass.

4.14.4.9 Test conclusion: short circuit withstand test is pass.

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4.15 Measurement of the harmonics of the no-load current (commission test) Test date: 2021-08-06

Number of no-load current harmonics	THD(%): 20.6	THD(%): 26.3	THD(%): 28.4
	Phase A (%)	Phase B (%)	Phase C (%)
1	100	100	100
2	2.6	3.0	2.7
3	9.7	10.6	12.4
4	1.8	1.9	1.6
5	16.8	22.4	23.6
6	0.0	0.0	0.0
7	5.6	9.5	8.4
8	0.0	0.0	0.3
9	0.6	0.7	0.4
10	0.0	0.0	0.0
11	1.8	2.6	2.0
12	0.2	0.1	0.0
13	1.8	2.5	2.2
14	0.0	0.0	0.0
15	0.0	0.0	0.0
16	0.0	0.4	0.0
17	0.0	0.3	0.2
18	0.0	0.0	0.0
19	0.0	0.0	0.0

Test conclusion: Measured.

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4.16 Power evaluation test on transformer (commission test) Test date: 2021-08-05

4.16.1 Measurement of winding resistance

Winding	Tapping position	Measured resistance (Ω)			Ambient temperature of resistance testing (℃)	Ambient temperature of loss testing (℃)
		R_{AB}	R_{BC}	R_{CA}		
HV	4-5	0.1539	0.1519	0.1538	27.3	27.3
LV	/	R_{ab}	R_{bc}	R_{ca}		
		0.2993×10^{-3}	0.2998×10^{-3}	0.3032×10^{-3}		

4.16.2 Measurement of short-circuit impedance and load loss under preset power

Tapping position 4-5

No.	Preset power (kVA)	Short-circuit impedance			Load loss impedance				
		Specified value (%)	Measured value (%)	Within the allowable range of error or not	Average voltage (V)	Average current (A)	Measured loss (kW)	Corrected current (A) t=145℃	Corrected load loss (kW) t=145℃
1	2500	$6.0^{\pm10\%}$	6.05	Yes	315.4	75.54	3.266	144.3	16.317

4.16.3 Measurement of transformer power Test date: 2021-08-05/08-10

Ambient temperature: 27.3/26.8℃

Tapping position 4-5

The preset power of the short-circuit impedance within the allowable value range of the standard short-circuit impedance error in the actual measurement results (kVA): 2500

Preset power 1 (kVA)	Measured no-load loss (kW)	The temperature rise results content the requirements or not
2500	2.316	Yes

The measured power of the transformer conforms to the nominal rated power of the nameplate: 2500kVA.

Test conclusion: Pass.

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HV side before short-circuit withstand test :

LV side before short-circuit withstand test :

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HV side after short-circuit withstand test :

LV side after short-circuit withstand test :

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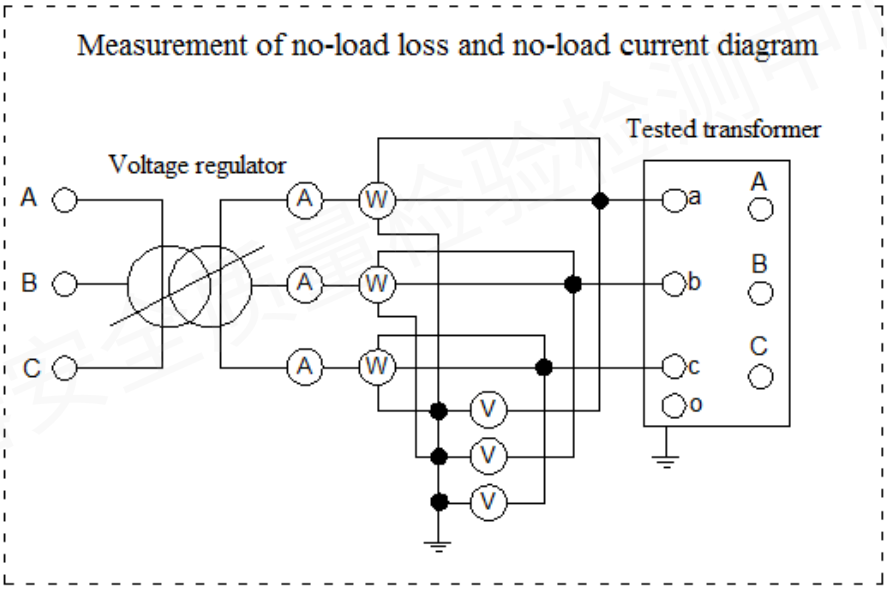
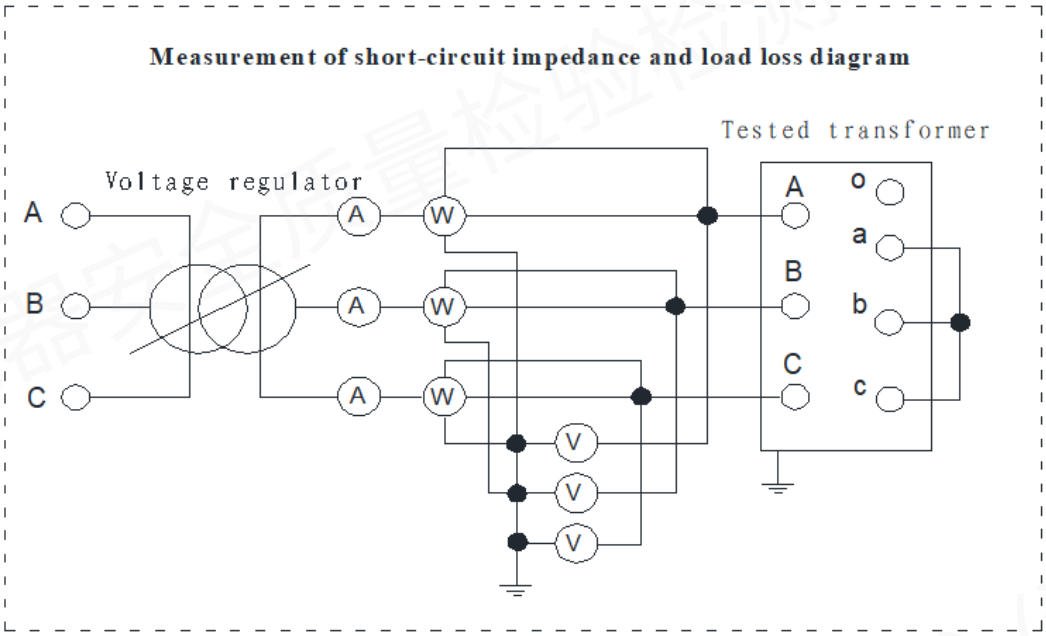
Test schematic diagram 1 of no-load loss and no-load current measurement



Test schematic diagram 2 of short-circuit impedance and load loss measurement



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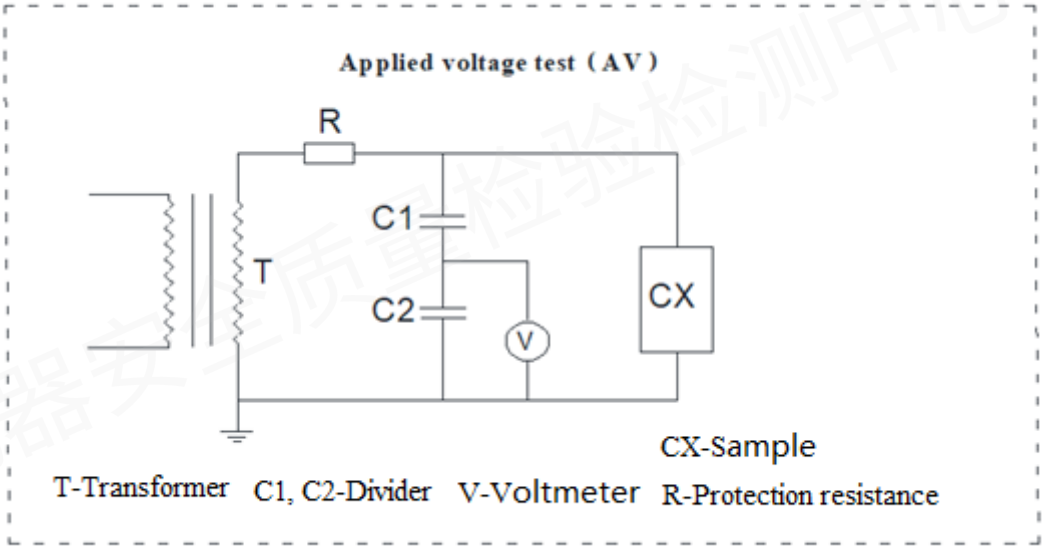
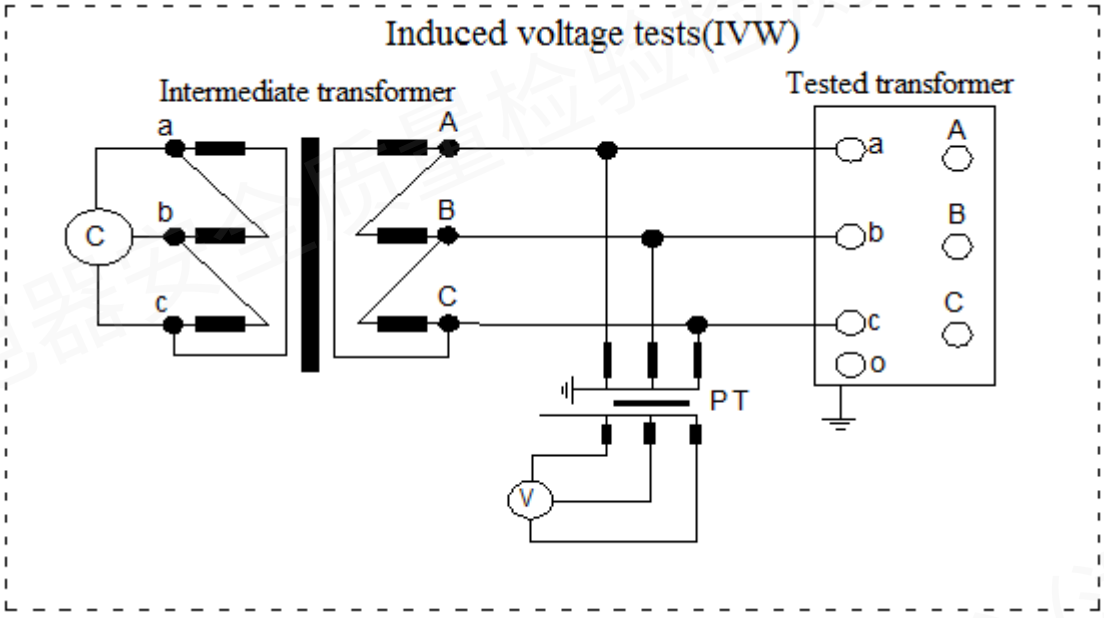
Test schematic diagram 3 of applied voltage test



Test schematic diagram 4 of induced voltage test



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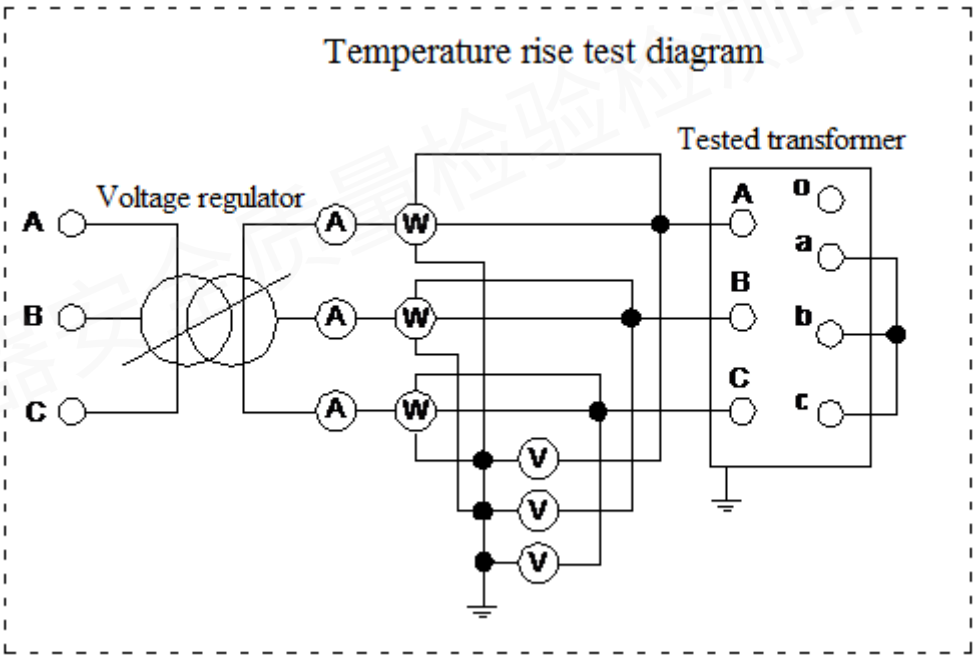
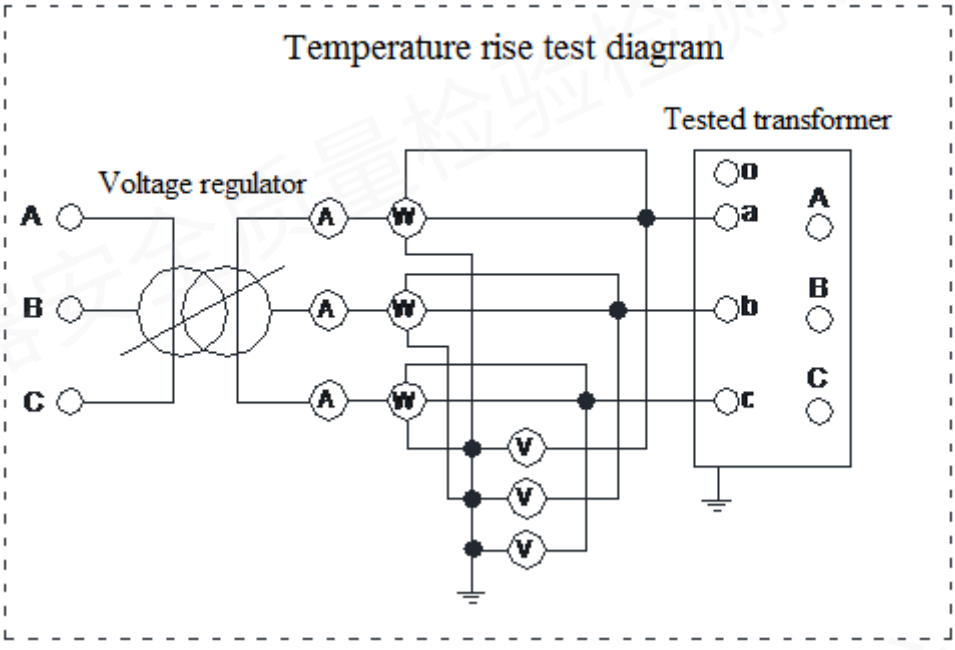
Test schematic diagram 5 of temperature-rise test





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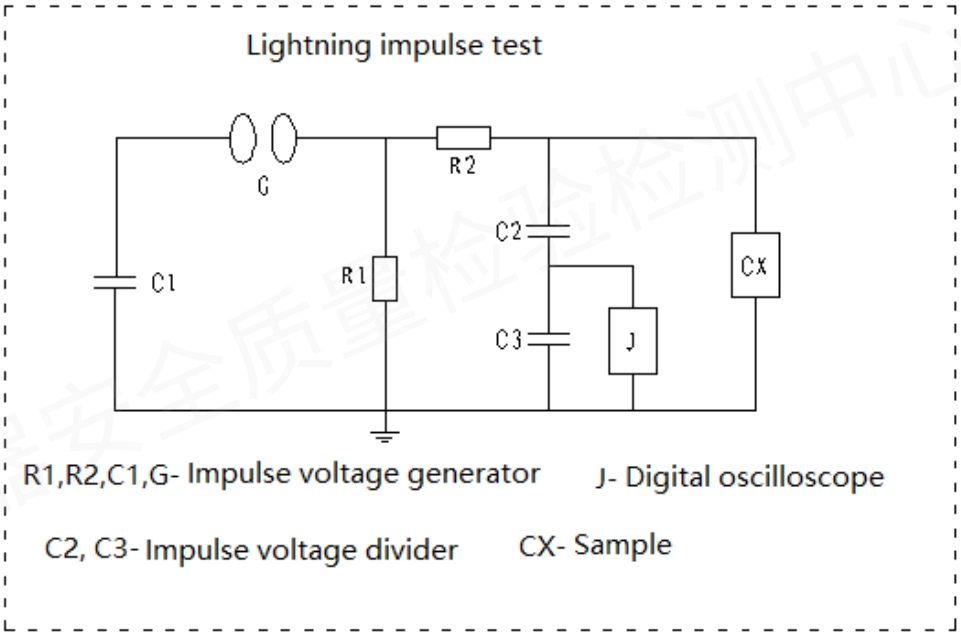
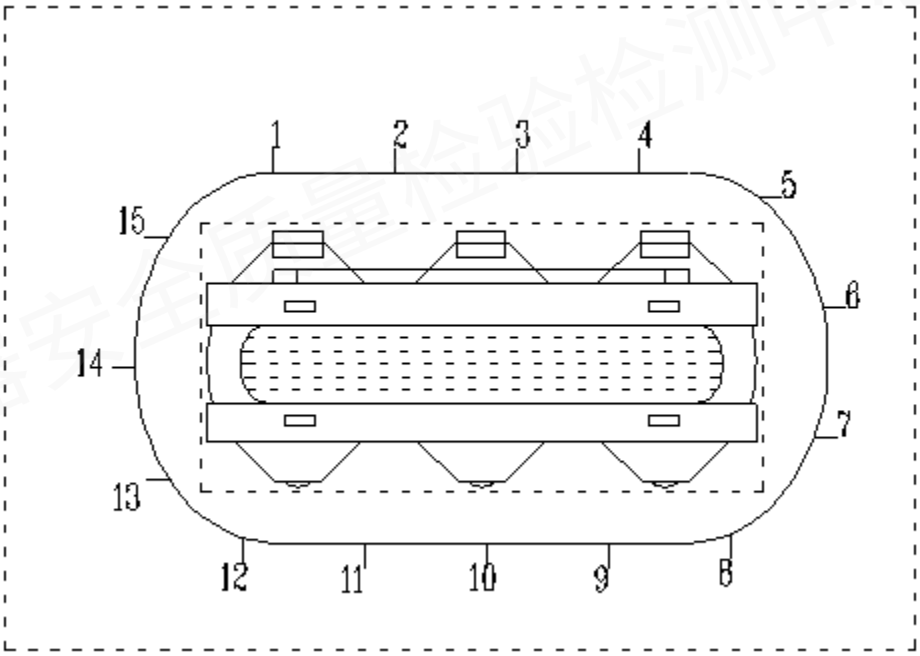
Test schematic diagram 6 of lightning impulse test



Test schematic diagram 7 of sound level test



TEST REPORT END