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实验室名称: 苏州电器科学研究院股份有限公司
国家电器产品质量检验检测中心

Lab Name: Suzhou Electrical Apparatus Science Research Institute Co., Ltd.
China National Center for Quality Inspection and Test of Electrical
Apparatus Products

No 24M1159-S

检验（试验）报告 Test Report

委托单位: 江苏新特变科技股份有限公司

Client: JIANGSU XIN TEBIAN SCIENCE & TECHNOLOGY CO., LTD (1)

产品名称: 有载调压整流变压器

Name of Product: ON-LOAD TAP-CHANGING RECTIFIER TRANSFORMER

产品型号: ZHSFT-13220/35

Product Type:

检验类别: 委托试验

Test Category: Commission test

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Client	JIANGSU XIN TEBIAN SCIENCE & TECHNOLOGY CO.,LTD.	Test category	Commission test
Manufacturer	JIANGSU XIN TEBIAN SCIENCE & TECHNOLOGY CO.,LTD.	Date of sample receiving	Oct. 17, 2024
Name of sample	ON-LOAD TAP-CHANGING RECTIFIER TRANSFORMER	Type of sample	ZHSFT-13220/35
Address of manufacturer	No.833, West Tangshi Street, Yangshe Town, Zhangjiagang Economic Technology Development Zone, Jiangsu	Original number or date of production	2405007.2
Date of test	From Oct. 24, 2024 to Oct. 25, 2024	Number of sample	1 set
Test items	Measurement of short-circuit impedance and load loss Temperature-rise test	Test standards	GB/T 1094.2—2013 GB/T 18494.1—2014 IEC 60076-2:2011 IEC 61378-1:2011 Commission requirements
Test conclusion	The test results of measurement of short-circuit impedance and load loss and temperature-rise test of the on-load tap-changing rectifier transformer (type: ZHSFT-13220/35) are in accordance with test standards and commission requirements. The sample has passed the above tests. Signing and issuing date: 2024-10-24 Note: the conclusion is valid only for the inspected and tested sample.		
Remarks	/		

Compiled by:

Proofread by:

Checked by:

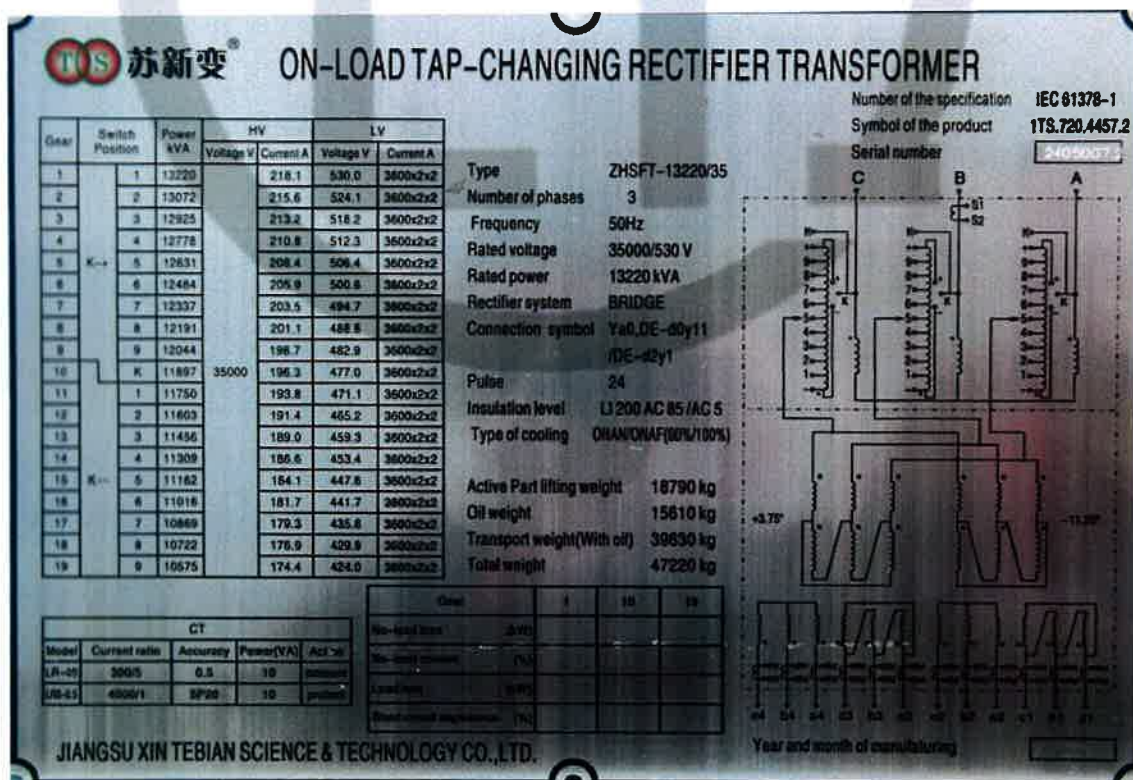
Approved by:

Test Report	Suzhou Electrical Apparatus Science Research Institute Co., Ltd.	№: 24M1159-S Total 13 Page 02								
1. Sample parameters Rated power: 13220kVA Rated voltage: 35/0.530-0.530-0.530-0.530kV Rated current: 218.1/4×3600A Rated frequency: 50Hz Number of phases: 3 Tapping ranges: / Connection symbol: Ya0,DE-d0y11/DE-d2y1 Cooling method: ONAF Thermal class of insulation: A <table><tr><td>Insulation level:</td><td>HV</td><td>U_m/LI/LIC/AC</td><td>40.5/200/220/85kV</td></tr><tr><td></td><td>LV</td><td>U_m/AC</td><td>≤1.1/5kV</td></tr></table> 2. Test standards GB/T 1094.2—2013 <i>Power transformers—Part 2: Temperature rise for liquid-immersed transformers</i> GB/T 18494.1—2014 <i>Converter transformers—Part 1: Transformers for industrial applications</i> IEC 60076-2:2011 <i>Power transformers—Part 2: Temperature rise for liquid-immersed transformers</i> IEC 61378-1:2011 <i>Converter transformers—Part 1: Transformers for industrial applications</i> Commission requirements 3. Sample description The on-load tap-changing rectifier transformer is for outdoor use. External photos of the sample have been attached.			Insulation level:	HV	U_m /LI/LIC/AC	40.5/200/220/85kV		LV	U_m /AC	≤1.1/5kV
Insulation level:	HV	U_m /LI/LIC/AC	40.5/200/220/85kV							
	LV	U_m /AC	≤1.1/5kV							

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Photos of the sample



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Summary of test results					
No	Test items	Specified value		Measured value	Conclusion
		Standards (commission requirements)			
1	Measurement of short-circuit impedance and load loss (routine test)	t: 75°C Z(%): P _k (kW):	measured measured	See 4.1	/
2	Temperature-rise test (type test)	Top oil temperature-rise limit (K): 60 Winding temperature-rise limit (K): 65		Top oil temperature-rise: 27.6 HV winding temperature-rise: 43.2 LV 1 winding temperature-rise: 37.8 LV 2 winding temperature-rise: 37.6 LV 3 winding temperature-rise: 41.2 LV 4 winding temperature-rise: 40.0	PASS
Remarks: a1b1c1 side is LV 1, a2b2c2 side is LV 2, a3b3c3 side is LV 3, a4b4c4 side is LV 4. Blank below					

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4. Test items and results									
4.1 Measurement of short-circuit impedance and load loss (routine test)									
						Test date: Oct. 24, 2024 Oil temperature: 18.2℃			
Winding	Tapping position	Applied current I		Measured voltage (kV)	Measured load loss (kW)	Short-circuit impedance (for each phase)		Load loss (kW)	Total loss (kW)
		(A)	I/Ir (%)			HV impedance (Ω)	(%)	Corrected value	Corrected value
						t=75℃ I=Ir	t=75℃ I=Ir	t=75℃ I=Ir	t=75℃ I=Ir
HV LV 1, LV 2, LV 3, LV 4,	1	217.83	99.89	2.732	99.944	7.25	7.83	113.6412	131.6092
	10	196.11	99.90	2.889	92.378	8.52	8.27	103.2931	117.2781
	19	174.26	99.92	3.410	101.005	11.30	9.76	109.3320	120.6000
Remarks: 1. the harmonic power loss is derived from harmonic current of the rectifier provided by client, harmonic power loss is 6.6223kW; 2. the sum of no-load loss, load loss and harmonic power loss is the total loss.									

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4.2 Temperature-rise test (type test)											
Test date: from Oct. 24, 2024 to Oct. 25, 2024											
The method of temperature-rise is the equivalent test in short-circuit connection. The tapping position is 1. Test duration is 9h of which the stabilization time is 3h.											
Measurement of top oil temperature rise: During the test, it is required to apply 138.2315kW of total loss and 140.153kW of total loss is actually applied.											
Measurement of winding temperature-rise: During the test, 218.1A current is required, 218.133A is actually applied during measurement LV1 and LV2, 216.697A is actually applied during measurement LV3 and LV4.											
Measured data											
Measurement of top oil temperature-rise and average oil temperature-rise			Measurement of average temperature-rise of windings to oil						Ambient temperature (°C)		
Top oil temperature (°C)	Average oil temperature (°C)	Total loss injection/specified total loss (%)	Current injection/rated current (%)	Cold resistance (Ω)		Average oil temperature (°C)		Average winding temperature (°C)		Total loss	Measurement of cold resistance
59.8	48.4	101.39	100.02	HV	0.5149	At the instant of shutdown	48.9	HV	75.7	31.8	16.2
				LV1	0.5062×10^{-3}	At the end of cooling curve	48.5	LV1	70.4		
				LV2	0.5316×10^{-3}			LV2	70.2		
/	/	/	99.36	LV3	0.5066×10^{-3}	At the instant of shutdown	46.3	LV3	70.9		
				LV4	0.5317×10^{-3}	At the end of cooling curve	46.1	LV4	69.7		
Calculations of temperature-rise											
Top oil temperature-rise (K)				27.6							
Winding temperature-rise (K)				HV		43.2					
				LV 1		37.8					
				LV 2		37.6					
				LV 3		41.2					
				LV 4		40.0					
Remarks: the calculated results of temperature-rise are the corrected value under specified total loss and rated current.											

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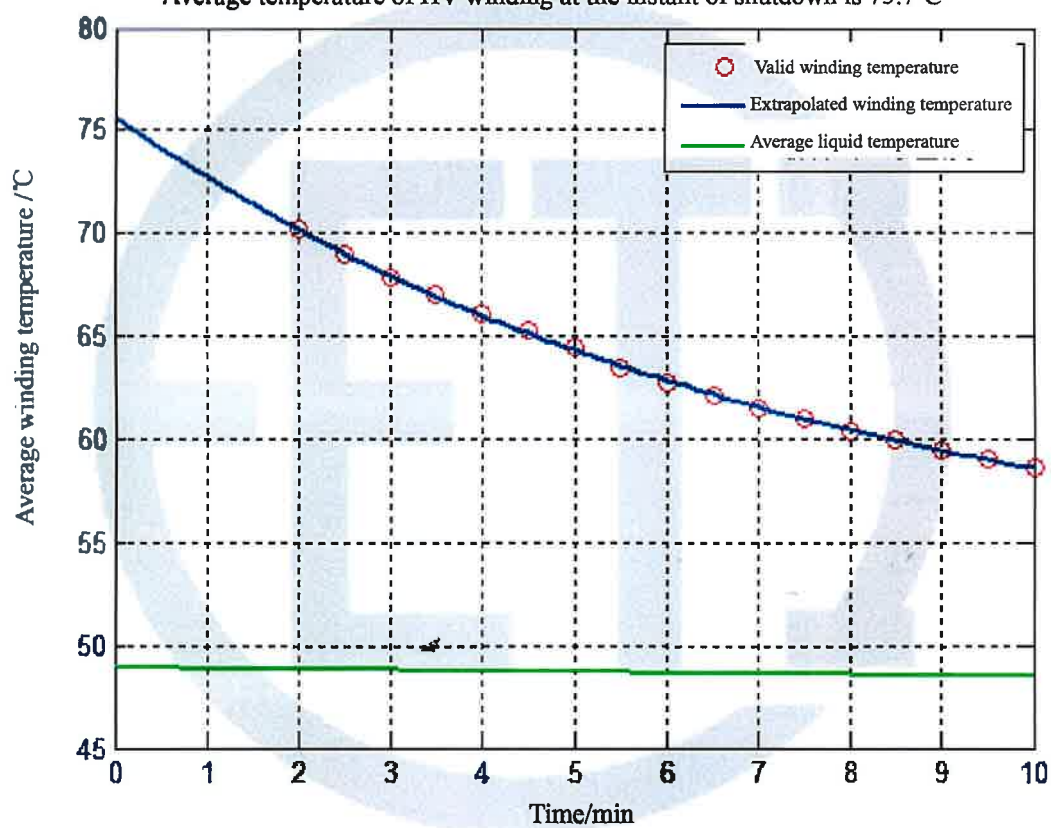
Winding temperature curve

Average winding temperature data

Average HV winding
temperature

75.7°C

Average temperature of HV winding at the instant of shutdown is 75.7°C



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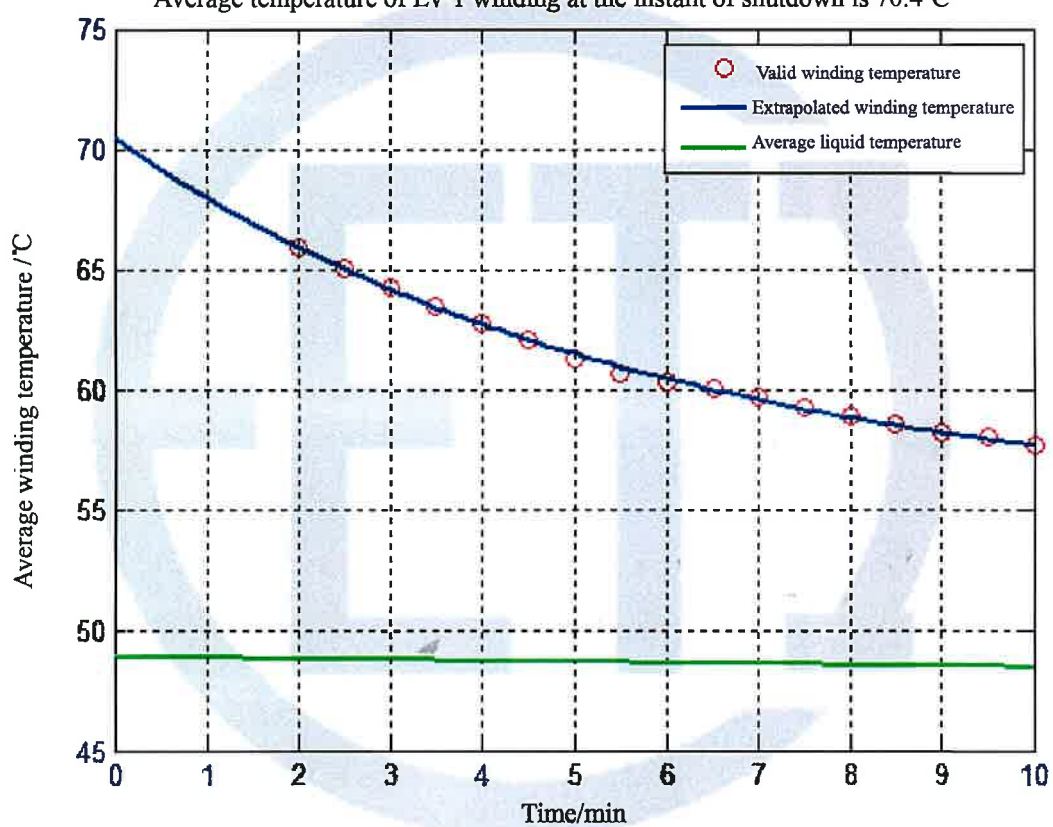
Winding temperature curve

Average winding temperature data

Average LV 1 winding
temperature

70.4°C

Average temperature of LV 1 winding at the instant of shutdown is 70.4°C



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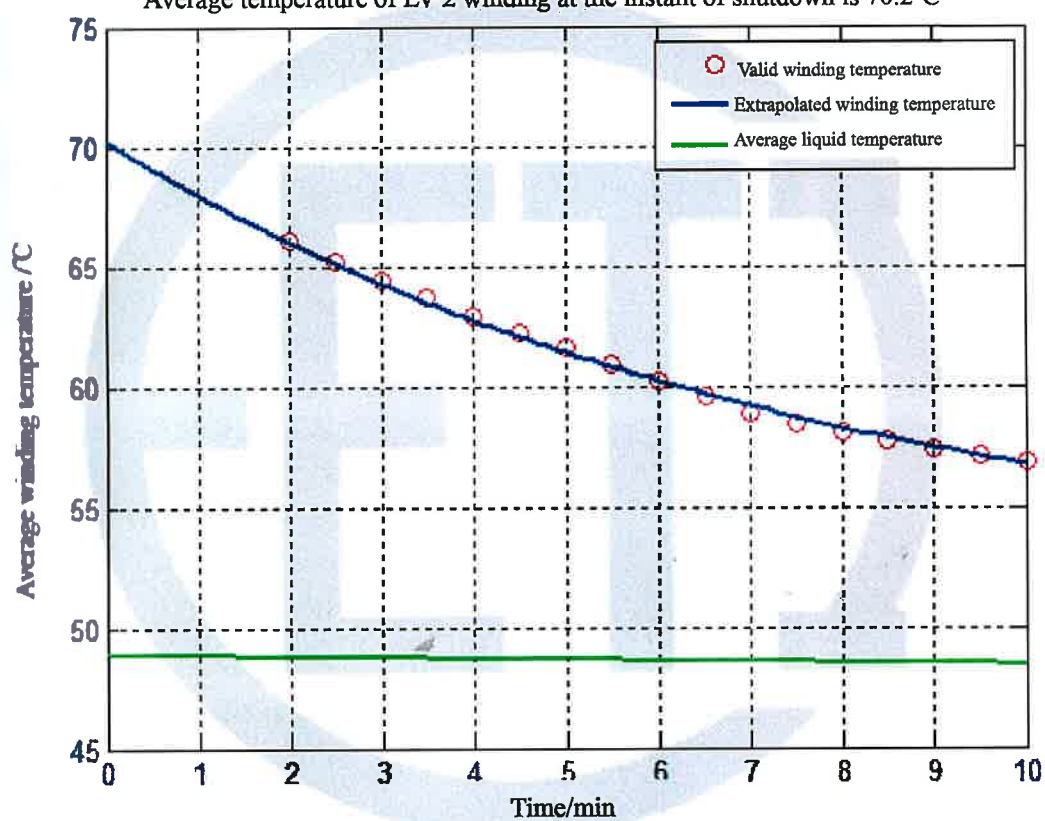
Winding temperature curve

Average winding temperature data

Average LV 2 winding
temperature

70.2°C

Average temperature of LV 2 winding at the instant of shutdown is 70.2°C



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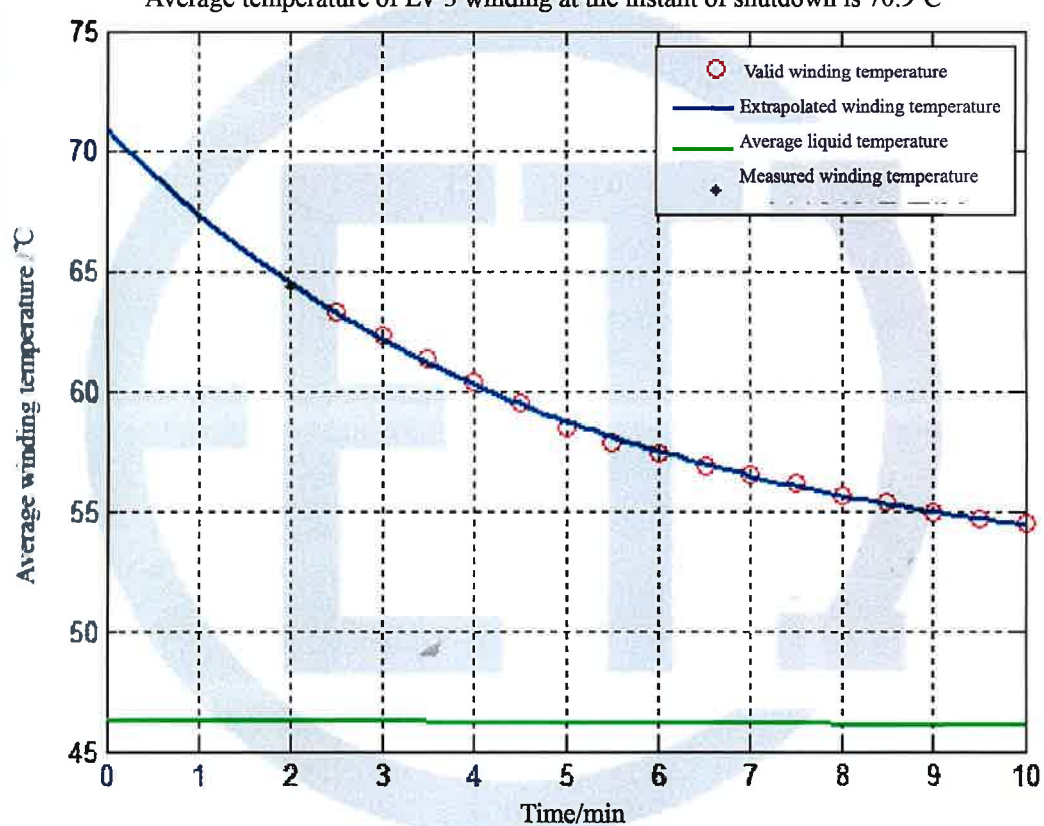
Winding temperature curve

Average winding temperature data

Average LV 3 winding
temperature

70.9°C

Average temperature of LV 3 winding at the instant of shutdown is 70.9°C



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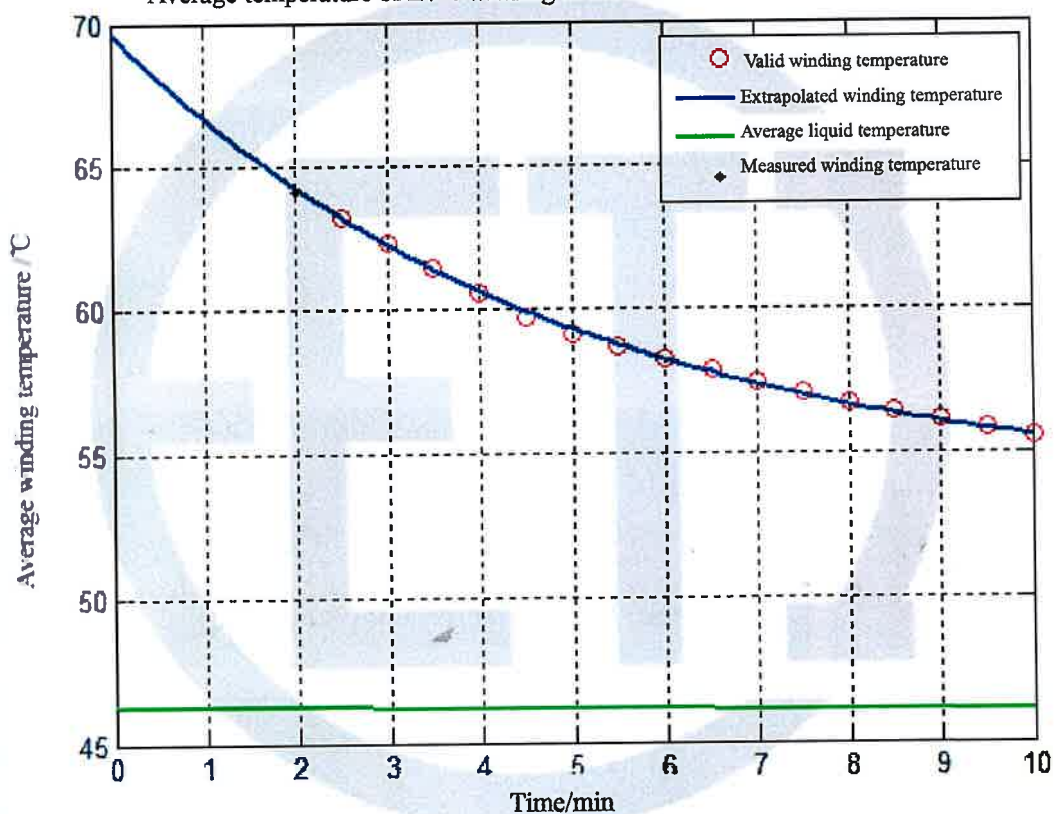
Winding temperature curve

Average winding temperature data

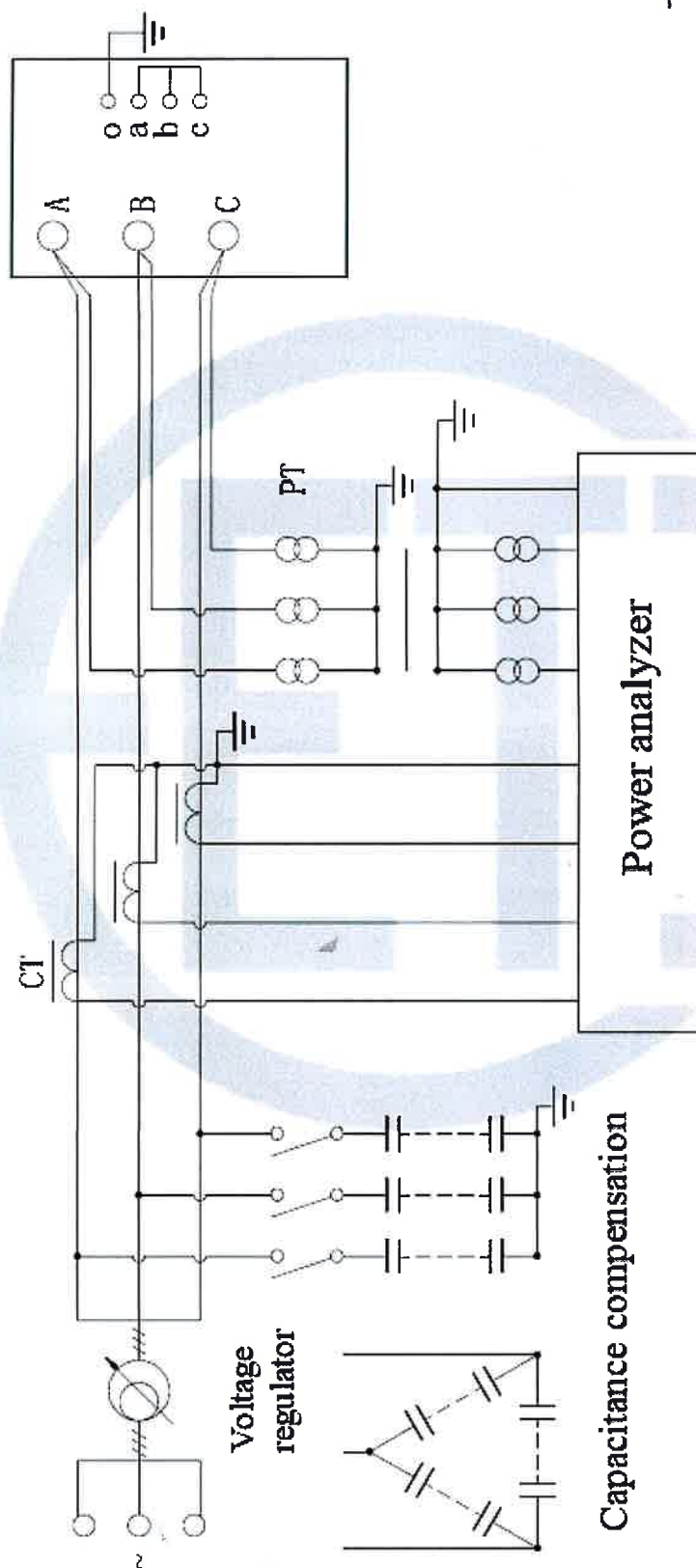
Average LV 4 winding
temperature

69.7°C

Average temperature of LV 4 winding at the instant of shutdown is 69.7°C



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CT-current transformer PT-voltage transformer

Schematic diagram of measurement of short-circuit impedance and load loss

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Instruments used in the tests				
No	Test items	Name & type of instrument	Number & validity	Accuracy class
1	Measurement of short-circuit impedance and load loss	Transformer power loss test system TMS580-200-4000	749-1237 2025-06-21	Voltage range: 100V~200kV, accuracy; 0.12% Current range: 1A~4000A, accuracy; 0.15%
2	Temperature-rise test	Transformer power loss test system TMS580-200-4000	749-1237 2025-06-21	Voltage range: 100V~200kV, accuracy; 0.12% Current range: 1A~4000A, accuracy; 0.15%
		Data acquisition/switch unit 34970A	TT11-158 2025-07-25	DC V $\pm$ 0.01%, A $\pm$ 0.11% AC V $\pm$ 5.25%, A $\pm$ 1.5% T $\pm$ 1 $^{\circ}$ C Ω $\pm$ 0.81%
		Thermocouple Type T	TT33-467/468/469 2025-07-25	/
		DC resistance tester JYR(50C)	ER16-101 2025-10-11	0.2% $\pm$ 0.2 $\mu\Omega$
		DC resistance tester JYR(50C)	ER16-102 2025-10-11	0.2% $\pm$ 0.2 $\mu\Omega$
		DC resistance tester JYR(50C)	ER16-079 2025-05-07	0.2% $\pm$ 0.2 $\mu\Omega$
		Electronic stopwatch PC396	HT15-010 2025-02-01	/
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4. The report is valid only for the inspected and tested samples.
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本试验报告共 13 页	其中图 6 幅	照片 1 张
The test report is in total 13 pages	including 6 figures	and 1 photo

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