DNV·GL

KEMA INSPECTION REPORT

3191-15

Object	Three-phase power transformer		
Designation	SFZ-26000/132	**Serial No.**	1522043
	132 / 11,5 kV – 113,7 / 1305,3 A - 50 Hz		
Client	Shandong Dachi Electric Co. Ltd., Chengwu City, China		
Manufacturer	Shandong Dachi Electric Co. Ltd., Chengwu City, China		
Inspected by	KEMA Nederland B.V., Arnhem, The Netherlands		
Test location	Shandong Dachi Electric Co. Ltd., Chengwu City, China		
Date of tests	26 to 28 October 2015		
Test specification	The tests have been carried out in accordance with IEC 60076-1 (2011), IEC 60076-2 (2011), IEC 60076-3 (2013), IEC 60076-10 (2001) and client's requirements.		
Conclusion	The object passed the tests.		

This report applies only to the object tested. The responsibility for conformity of any object having the same type references as that tested rests with the Manufacturer.

This report consists of 63 pages in total.

KEMA Nederland B.V.

J.P. Fonteijne
Executive Vice President
KEMA Laboratories

KEMA Laboratories

Arnhem, 17 November 2015

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1 IDENTIFICATION OF THE OBJECT TESTED

1.1 Ratings/characteristics of the object tested

Rated voltages	132/11,5	kV
Rated frequency	50	Hz
Rated current	113,7/1305,3	A

1.2 Description of the object tested

Manufacturer	Shandong Dachi Electric Co. Ltd.,	
Type	SFZ-26000/132	
Serial number	1522043	
Year of manufacture	2015	
Insulation	Paper/oil	
Tapping range	132 (+11/-11 x 1,2kV) / 11,5 kV	
Highest voltages HV / LV / LV-N	145 / 12 kV	
	LI / LIC	Separate Source
High voltage winding (HV)	650 / 715 kV	275 kV
Low voltage winding (LV)	110 / 121 kV	38 kV
Low voltage neutral (LV-N)	110 / - kV	38 kV
Rated power ONAF/ONAN	26 / 20 MVA	
Vector Group	Dyn11	
Cooling type	ONAN/ONAF	
Terminals	HV: A, B, C	
	LV: a, b, c	
	LV-N: O	

The transformer was tested with radiators and conservator.
Photographs of the transformer under test are presented in chapter 7.

1.3 List of drawings

The manufacturer has guaranteed that the object submitted for tests has been manufactured in accordance with the following drawings and/or documents. KEMA has verified that these drawings and/or documents adequately represent the object tested. The manufacturer is responsible for the correctness of these drawings and/or documents and the technical data presented.

The following drawings and/or documents have been included in this report:

Drawing no./document no.	Date / Revision
8DB.860.6753.1	2015.03 / 01
1DB.710.6753	2014.03 / 01

2 GENERAL INFORMATION

2.1 Persons attending the inspection

Name	Company
Chen Guozhen	Shandong Dachi Electric Co. Ltd., Chengwu City, China
Wang Maosong	Shenyang Senmao Electric Co. Ltd., Shenyang, China

2.2 The inspection was carried out by

Name	Company
Richard Houtepen	KEMA Nederland B.V., Arnhem, The Netherlands

2.3 Purpose of test

Purpose of the test was to verify whether the test object complies with the specified requirements.

2.4 Inspection of the test set-up

The tests were carried out in the laboratory of the manufacturer, who is therefore jointly responsible for the correctness of the results obtained. The measuring devices and the test set-up were checked by KEMA and were calibrated when necessary.

Result
The inspection did not give rise to remarks.

3 DIELECTRIC EXAMINATIONS

3.1 Dielectric tests

3.1.1 Applied voltage test

Standard and date

Standard IEC 60076-3, clauses 10
Test date 26 October 2015

Voltage supplied to	Earthed	Voltage (kV)	Frequency (Hz)	Duration (s)
HV winding	remaining winding and frame	275	50	60
LV winding and neutral	remaining winding and frame	38	50	60

Result

The test object passed the tests.

3.1.2 Induced voltage withstand test (IVW) with partial discharge measurement (IVPD)

Standard and date

Standard	IEC 60076-3, clause 11.2 and 11.3
Test date	26 Octobeer 2015

The induced voltage withstand test (IVW) was incorporated in the induced voltage with partial discharge measurement (IVPD).
The induced voltage withstand test was carried out by applying a three-phase AC voltage of 200 Hz across three terminals of the low voltage winding. In this way voltage is induced on the HV terminals in accordance with the voltage levels and for the duration as per the requirements of the standard.
These levels were:

- 0,4 U_r
- 1,2 U_r during 1 minute
- 1,58 U_r during 5 minutes
- test voltage U1 during 30 seconds
- 1,58 U_r during 60 minutes
- 1,2 U_r during 1 minute
- 0,4 U_r.

U_r is 132 kV. Test voltage for the HV terminal was 264 kV, which corresponds with the test voltage U1.
During the test the tapping selector for HV winding was in position 12.
The test voltage was measured at the low voltage terminals.
The neutral terminal for LV winding was connected to ground.
Throughout the tests neither flashover nor breakdown occurred.
The partial discharges were measured during this test.
The circuit was calibrated with a pulse generator. The tests were carried out subsequently with the required voltage levels and duration.
The results are presented in the following table.

Power supply three phase, 200 Hz to LV terminals, tapping position 12

U / Ur phase-to-phase	U phase-to-phase	Duration	After calibration with 500 pC for all phases		
			Phase A	Phase B	Phase C
			HV	HV	HV
%	kV		pC	pC	pC
40	52,8	0 min.	10	10	10
120	158,4	0 min.	20	30	20
120	158,4	1 min.	20	30	20
158	208,6	0 min.	20	30	40
158	208,6	5 min.	20	30	40
Utest	264	30 sec.	-	-	-
158	208,6	0 min.	50	50	50
158	208,6	5 min.	50	50	50
158	208,6	10 min.	50	50	50
158	208,6	15 min.	50	50	50
158	208,6	20 min.	50	50	50
158	208,6	25 min.	50	50	50
158	208,6	30 min	50	50	50
158	208,6	35 min.	50	50	50
158	208,6	40 min.	50	50	50
158	208,6	45 min.	50	50	50
158	208,6	50 min.	50	50	50
158	208,6	55 min.	50	50	50
158	208,6	60 min.	50	50	50
120	158,4	0 min.	20	20	20
120	158,4	1 min.	20	20	20
40	52,8	0 min.	10	10	10

Result

The test object passed the test.

3.1.3 Lightning impulse test

Standard and date

Standard IEC 60076-3, clause 13
Test date 26 October 2015

The lightning impulse tests were carried out on all terminals, including the neutral terminal.
The specified test voltage for the HV terminal was 650 kV for full wave (715 kV for chopped wave).
The tests were carried out in tapping position 1, 12 and 23 for phase A, B and C separately. The current was measured over a 0,5 Ω shunt, connected between the HV terminal and earth.
For the LV terminal the specified test voltage was 110 kV full wave (121 kV for chopped wave).
The current was measured over a 0,2 Ω shunt, connected between the other LV neutral terminal and earth.
The test sequence for HV, LV line terminals consisted of one reduced full wave, one full wave, one reduced chopped wave, two full chopped waves and two full waves. The test sequence on the LV neutral terminal consisted of one reduced full wave and three full waves. All waves were with negative polarity.

The 1st test sequence for LV neutral terminal consisted of one reduced full wave and three full waves all with negative polarity without an additional resistance of 250 Ω but the required waveshape was not achieved. Then, the 2nd test sequence for LV neutral terminal consisted of one reduced full wave and three full waves all with negative polarity with an additional resistance of 250 Ω and the required waveshape was achieved.
The wave shape was within the requirements of the standard. The front and tail times (first full wave) are given in the table below. The oscillograms are presented in appendix A.

Performed on winding	Terminal	BIL (Full) (kV)	Tapping position	Wave shape (front / tail) (µs)	Polarity
HV	A B C	644 649 645	1 12 23	1,25 / 48,3 1,23 / 47,5 1,23 / 46,3	- - -
LV	a b c	110 111 110	- - -	1,02 / 53,2 1,10 / 52,2 1,11 / 55,0	- - -
LV neutral without an additional resistance of 250 Ω	O	113	-	0,92 / 12,7	-
LV neutral with an additional resistance of 250 Ω	O	108	-	1,01 / 50,4	-

Result

The impulse waves, recorded before and after the 100% full waves, have been compared and they are identical in shape.
Neither flashover, nor breakdown occurred.

3.2 Dielectric measurements

3.2.1 Measurement of dissipation factor and system capacitances

Standard and date

Standard IEC 60076-1, clause 11.1.2.2.c
Test date 26 October 2015

Measured were the dissipation factor (tan δ) and the capacitances of the mutual insulation between the windings and ground.
The results are presented in the table below.

Dissipation factor and capacitances at 22,5 °C

Measurement between	kV	Capacitance (pF)	Tan delta (%)
HV / (LV+E)	10	7596	0,223
LV / (HV+E)	10	13520	0,278
(HV+LV) / E	10	12160	0,279

Requirement
Tan delta ≤ 0,5%.

Result
The test object passed the test.

3.2.2 Measurement of insulation resistances

Standard and date

Standard IEC 60076-1, clause 11.1.2.2.b.
Test date 26 October 2015

Measured, before the dielectric tests, were the insulation resistances between the combinations mutual windings and ground, between core and clamp, between core and earth, and between clamp and earth.
The measured values are presented in the table below.

Measurement of insulation resistance in MΩ at 22,5 °C

Measurement between at (kV)	15 (s)	60 (s)	600 (s)
HV / (LV+E)-5	-	42100	69900
LV / (HV+E)-5	-	30300	59400
(HV+LV) / (E)-5	-	35200	64400
Core / clamp+E-2,5	-	14600	-
Core / clamp -2,5	-	14500	-

Result

The test object passed the test.

3.2.3 Check of core and frame insulation

Standard and date

Standard IEC 60076-1, clause 11.12

Test date 26 October 2015

Voltage applied at	Earthed	Test voltage (DC) (kV)	Duration (s)
Core	Remaining windings and frame	2,5	60
Frame	Remaining windings and frame	2,5	60
Core	Frame	2,5	60

Result

The test object passed the test.

4 BEHAVIOUR UNDER NORMAL CONDITIONS

4.1 Measurement of winding resistances

Standard and date

Standard IEC 60076-1, clause 11.2

Test date 26 October 2015

The winding resistances were measured for all windings and in all positions of the tapping changer. The results are presented in the table below.

Winding	Tapping position	Resistance in mΩ at 22,5 °C		
HV		A – B	B – C	C – A
	1	2,568	2,574	2,569
	2	2,541	2,544	2,536
	3	2,512	2,514	2,507
	4	2,480	2,484	2,476
	5	2,451	2,454	2,447
	6	2,422	2,424	2,417
	7	2,391	2,394	2,388
	8	2,360	2,365	2,358
	9	2,332	2,338	2,324
	10	2,304	2,306	2,300
	11	2,274	2,277	2,271
	12	2,243	2,247	2,242
	13	2,276	2,278	2,273
	14	2,306	2,309	2,303
	15	2,336	2,339	2,333
	16	2,365	2,368	2,363
	17	2,396	2,398	2,392
	18	2,427	2,431	2,423
	19	2,454	2,459	2,452
	20	2,483	2,488	2,482
	21	2,511	2,515	2,510
	22	2,541	2,544	2,540
	23	2,564	2,573	2,569
LV		Resistance in mΩ at 22,5 °C		
		a – 0	b – 0	c – 0
	-	6,265	6,254	6,300

Result

The test object passed the test.

4.2 Measurement of voltage ratios and check of phase displacement

Standard and date

Standard IEC 60076-1, clause 11.3
Test date 26 October 2015

The measurement was done with a ratio bridge for all tapping positions HV/LV. The measured values, compared with the theoretical ones, are given in the table below.
The connection symbol was checked together with the determination of the voltage ratio. Balance of the bridge can be attained only if the voltages connected to the bridge from the primary and secondary side have the same phase and sense.
The results of the tests are presented in the table below.

Measurement of voltage ratio

HV tapping position	HV / LV (kV / kV)	Calculated ratio	Measured difference (%)		
			AB // ab	BC // bc	CA // ca
1	145,213 / 11,500	21,871	0,13	0,13	0,13
2	144,012 / 11,500	21,690	0,12	0,12	0,12
3	142,811 / 11,500	21,509	0,11	0,11	0,11
4	141,610 / 11,500	21,328	0,11	0,11	0,11
5	140,408 / 11,500	21,147	0,09	0,09	0,09
6	139,207 / 11,500	20,966	0,09	0,09	0,09
7	138,006 / 11,500	20,786	0,08	0,07	0,08
8	136,805 / 11,500	20,605	0,07	0,07	0,07
9	135,604 / 11,500	20,424	0,06	0,05	0,06
10	134,402 / 11,500	20,243	0,05	0,05	0,05
11	133,201 / 11,500	20,062	0,04	0,04	0,04
12	132,000 / 11,500	19,881	0,03	0,02	0,03
13	130,799 / 11,500	19,700	0,02	0,02	0,02
14	129,598 / 11,500	19,519	0,00	0,00	0,00
15	128,396 / 11,500	19,338	0,00	0,00	0,00
16	127,195 / 11,500	19,157	0,00	0,00	0,00
17	125,994 / 11,500	18,976	0,00	0,00	0,00
18	124,792 / 11,500	18,795	-0,02	-0,02	-0,02
19	123,592 / 11,500	18,615	-0,03	-0,03	-0,02
20	122,390 / 11,500	18,434	-0,04	-0,04	-0,03
21	121,189 / 11,500	18,253	-0,05	-0,05	-0,04
22	119,988 / 11,500	18,072	-0,06	-0,06	-0,06
23	118,787 / 11,500	17,891	-0,08	-0,08	-0,07

Result

The measured values, compared with the theoretical values, are within the standard tolerances.
The connection symbol matched the specification.

4.3 Measurement of load loss and short-circuit impedance

Standard and date

Standard IEC 60076-1, clause 11.4
Test date 26 October 2015

The short-circuit impedance and load losses of the transformer were measured as follows:

- The combination HV to LV at the HV rated and extreme tapping positions with the LV short circuited and currents based for 26 MVA.

The measuring results were recalculated for 75 °C winding temperature.
The results of the tests are presented in the following tables.

Load loss and impedance measurement based on 26 MVA

HV tapping position		1	12	23
Ratio	kV	145,2	132,0	118,8
	kV	11,5	11,5	11,5
Rated currents at 26 MVA	A	103,4	113,7	126,4
	A	1305,3	1305,3	1305,3
Resistance at 22,4 °C				
Average HV (phase to phase)	mΩ	2570,0	2244,0	2570,0
Average LV (phase to phase)	mΩ	6,27	6,27	6,27
Joules loss at 26 MVA				
A at Tm [224/22,4/22,4] °C	kW	73,3	75,6	93,1
B at 75 °C	kW	88,3	91,0	112,8
Load loss at 26 MVA				
C measured value at Tm °C	kW	94,9	93,7	109,5
D stray losses at Tm °C = C – A	kW	21,7	18,1	16,4
E stray losses at 75 °C =D.(235 + Tm) / (235 + 75)	kW	18,0	15,0	13,6
F load loss at 75 °C = B + E	kW	106,2	106,4	125,8
guaranteed load-loss	kW	-	-	-
Tolerance	%	-	-	-
Impedance voltage				
Measured at 26 MVA	$\%U_n$	13,75	13,07	12,96
Guaranteed value at 26 MVA	$\%U_n$	-	14,0	-
Tolerance	%	-	± 10,0	-

Result

The measured values were within the specified tolerance and within the guaranteed value.

4.4 Measurement of zero-sequence impedance

Standard and date

Standard IEC 60076-1, clause 11.6
Test date 26 October 2015

The test was performed for LV to HV, with HV in open condition in tap position 1.

Zero-sequence impedance before dielectric tests

Supply	Tap position	Open terminal	Voltage (V)	Current (A)	Z0 (Ω/phase)
LV	1	HV	27,0	105,1	0,77

Result

The measured values do not give rise to remarks.

4.5 Measurement of no-load loss and current

Standard and date

Standard IEC 60076-1, clause 11.5
Test date 26 October 2015

The no-load loss and no-load current were measured before the dielectric tests mentioned under 3.1.1 to 3.1.4, at 90%, 100% and 110% of the rated voltage at tapping position 12 for HV winding, supplied to the low voltage winding terminals.
The results are presented in the following table.

No-load loss and no-load current before dielectric tests

U/ Ur (%)	RMS voltage (kV)	Average voltage (kV)	Average current (A)	Average current (%)	Measured loss (kW)	Corrected loss (kW)
90	10,367	10,350	0,740	0,057	10,288	10,271
100	11,515	11,500	0,917	0,070	13,040	13,023
110	12,657	12,651	1,474	0,113	17,052	17,044

Guaranteed maximum no-load loss at 100% voltage: 14,0 kW +0%.
Guaranteed maximum no-load current at 100% voltage: 0,1% +0%.

Result

The measured no-load loss and current at 100% of the rated voltage were within the specified tolerance and within the guaranteed value.

4.6 Measurement of the harmonics of the no-load current

Standard and date

Standard	Client's instruction
Test date	26 October 2015

The fundamental and the 3rd up to the 9th harmonics on the no-load current were measured at 100% of rated voltage, supplied to the LV winding terminals.

Result

The measured values do not give rise to remarks.

4.7 Determination of acoustic sound pressure levels

Standard and date

Standard IEC 60076-10
Test date 28 October 2015

The acoustic sound level was measured at the selected locations, around the transformer, at two different heights (one third and two-thirds of the height) at no-load condition.
The test was performed in ONAN and ONAF situation with rated voltage and the tap changer in position 12. The measuring points were measured at 0,3 meter from the principal radiating surface (2 meters in ONAF situation). The measured value is calculated to the sound pressure level.

Acoustic sound level

Location		Indoor	Indoor
Rated voltage	(% Ur)	100	100
Rated current	(% In)	-	-
Cooling method		ONAN	ONAF
Measured points			
1/3 of height		29	39
2/3 of height		29	39
Distance	(m)	0,3	2,0
Exponential average of:			
Measured sound pressure	(dB(A))	56,7	65,2
Background sound pressure before / after	(dB(A))	38,9 / 38,6	38,9 / 38,6
Correction	(dB(A))	1,1	2,1
Corrected result	(dB(A))	55,6	63,1
Guaranteed sound pressure	(dB(A))	70,0	70,0
Tolerance	(dB(A))	0,0	0,0

Result

The measured values do not give rise to remarks.

4.8 Temperature-rise test

Standard and date

Standard IEC 60076-2
Test date 27-28 October 2015

Temperature rise test for ONAN and ONAF condition was carried out.
Twelve temperature sensors were placed on various spots. Two were placed on inlet and four on the outlet of the cooler banks on each side of the transformer, two were placed in top-oil pockets and four were placed for ambient temperature.
The tapping changer was set to tapping 23 for HV winding. A total loss of 87,2 kW (ONAN) / 138,4 kW (ONAF) was injected to the HV winding first, the LV winding was short-circuited. When the temperature stabilized after about three hours, the top oil temperature could be measured. The test current was reduced to rated current of 126,4 A and maintained for 1 hour. Then, the transformer was switched off and the resistances for the cool down curve calculation for HV B-C and LV b-O were measured during 30 minutes. By extrapolating both winding temperatures at switch off time were calculated, using the measured cold temperature resistances.
The calculated results are presented in the following table and the measurements and cool-down curve calculations are presented in appendix A.

Temperature rise results

Temperature-rise test for a rating of:	(MVA)	20	26
Cooling method		ONAN	ONAF
HV tapping position		23	23
Losses supplied at 50 Hz	(kW)	87,2	138,4
Measured current at HV side	(A)	108,2	133,2
Results of temperature-rise test			
Temperature-rise of:			
Top oil (≤ 55 K)	(K)	40,5	38,8
HV winding (≤ 65 K)	(K)	38,2	34,2
LV winding (≤ 65 K)	(K)	41,2	38,8
Measured temperatures			
Ambient temperature total losses	(°C)	22,8	19,2
Ambient temperature rated current	(°C)	22,8	19,2
Temperature rise mean oil	(K)	34,4	28,3
Gradient copper-oil			
HV winding	(K)	3,8	5,9
LV winding	(K)	6,8	10,5

Result

The test object passed the test.

4.9 Dissolved gas analysis

Standard and date

Standard IEC 60076-1, clause 11.2.2.d
Test date 28 Octobere 2015

Oil samples were taken before all the tests, before dielectric tests, after dielectric tests, after temperature-rise test and after all the tests. The samples of the oil were taken for dissolved gas analysis (DGA).
The results after all tests are presented in in the following table.

Gas components (µL/L)	Dissolved gas analysis						
	H_2	CO	CO_2	CH_4	C_2H_4	C_2H_6	C_2H_2
After all the tests	0,47	2,27	34,05	0,27	0,00	0,00	0,00

Result

No excessive CO and/or CO_2 contents have been detected in the DGA's, proving the cooling of the transformer windings is sufficient. Also no excessive carbon hydro gasses content have been detected, proving the dielectric design is sufficient.

4.10 Tightness test

Standard and date

Standard	IEC 60076-1, clause 11.8
Test date	28 October 2015

The transformer including its radiators and conservator were given a top oil pressure of 30 kPa during 24 hours.

Result

No leakage was detected.

5 FUNCTIONAL TESTS OF COMPONENTS AND AUXILARY INSTRUMENTS

5.1 Bushings

Standard and date

Standard Client's requirement
Test date 26 October 2015

This test was carried out in accordance with client requirement.
For the test of the transformer, HV bushings made by Trench Electric Co., Ltd., China were installed.
Before the dielectric tests the capacitances and dissipation factor were measured.
The results are presented in the following table.

Bushing dissipation factor and capacitances at 22,4 °C

Bushing	Applied voltage (kV)	Capacitance (pF)	Tan delta (%)
A	10	302,6	0,230
B	10	302,7	0,262
C	10	301,8	0,235

Requirement
Tan delta ≤ 0,5%.

Result
The results don't give rise to remarks.

5.2 Test on on-load tap changer

Standard and date

Standard	IEC 60076-1, clause 11.7
Test date	26-29 October 2015

The tap changer is from the series VVIII-250D-145-12231W from Maschinenfabrik Rheinhausen.
The serial number is 1593670.
The following tests were carried out:

- With the transformer un-energized, eight complete cycles of operation.
- With the transformer un-energized, and with the auxiliary voltage reduced to 85% of its rated value (343 V), one complete cycle of operation.
- With the transformer energized at rated voltage and frequency at no load, one complete cycle of operation.
- With one winding short-circuited and, as far as practicable, rated current in the tapped winding, 10 cycles of tap-change operations across the range of two steps on each side from reversing changeover selector at tapping position 12.

Result

The results don’t give rise to remarks.

5.3 Power taken by the fans

Standard and date

Standard IEC 60076-1, clause 11.1.3
Test date 28 October 2015

De power taken by the fans was measured. The results are presented in the table below.

Power taken by fans

Serial Number	Voltage (V)	Current (A)	Power (W)
15070	400	0,83	355
15076	400	0,87	410
15078	400	0,94	437
15077	400	0,91	439
15066	400	0,83	361
15074	400	0,91	431
15071	400	0,93	447
15073	400	0,83	366

Result

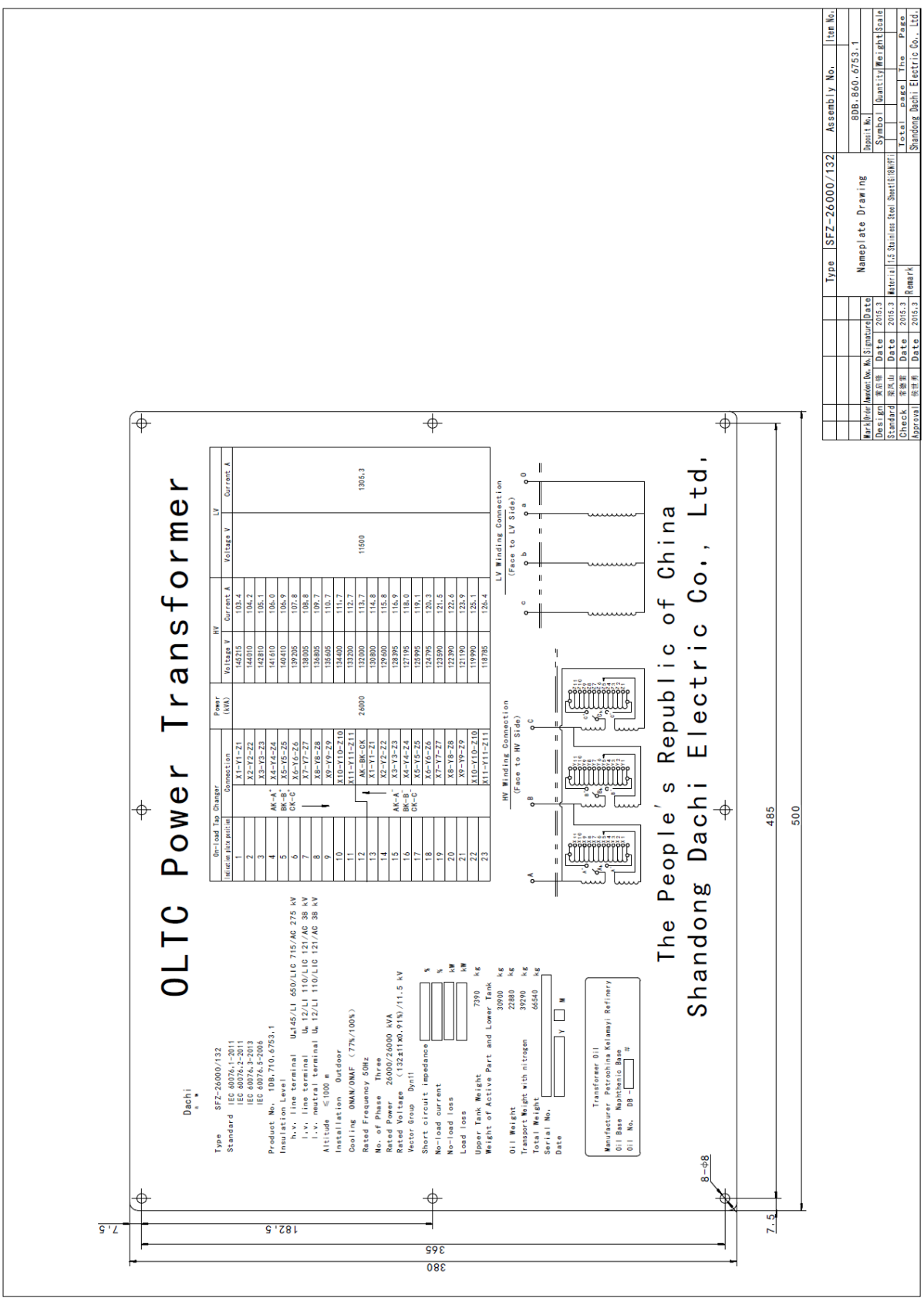
The results don’t give rise to remarks.

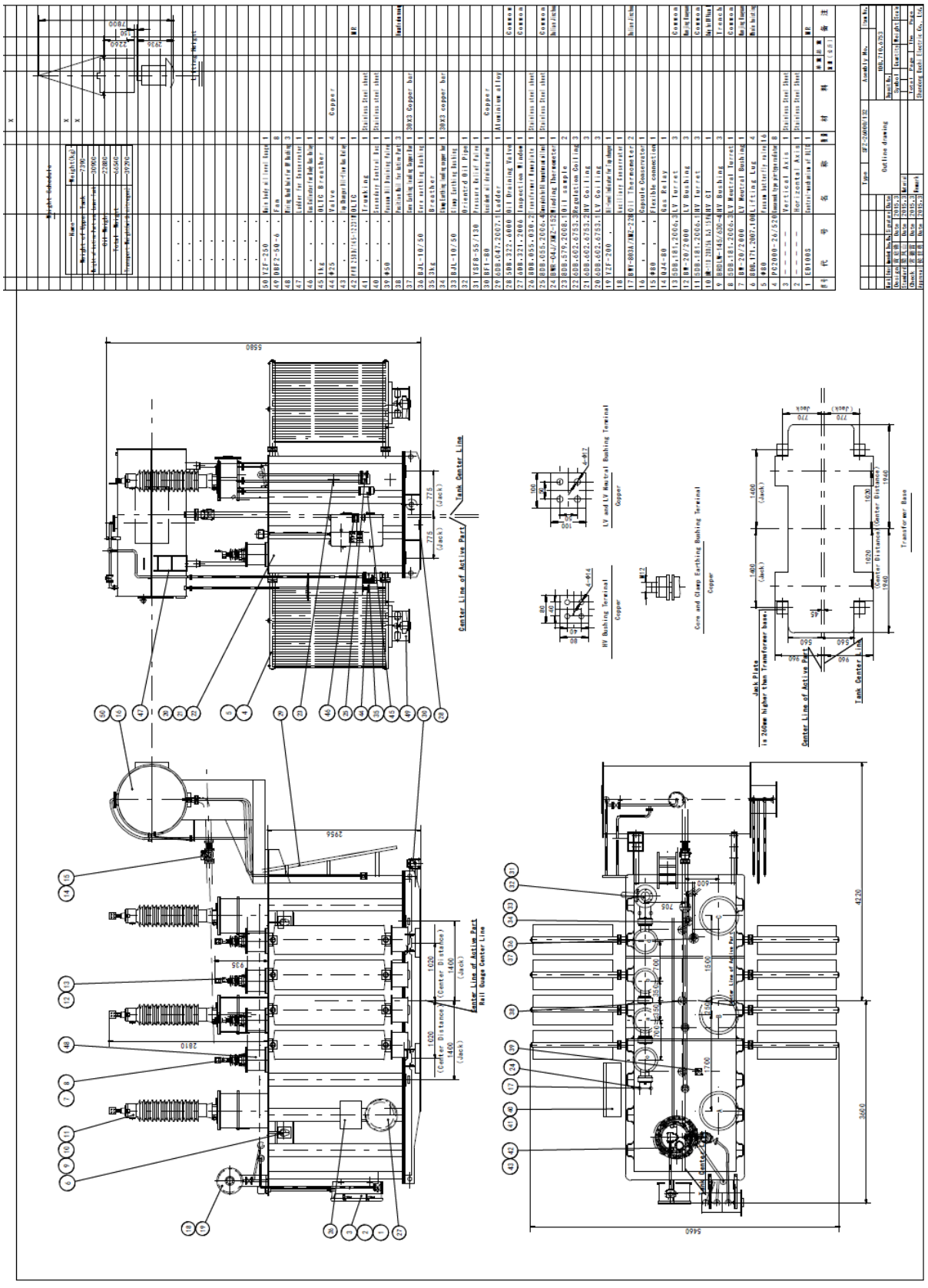
5.4 Rating plate

The drawing of the rating plate was checked. The drawing is presented in chapter 6, page 1.
Further the general outline drawing is presented in chapter 6, page 2.

Result
The check does not give rise to remarks.

6 DRAWINGS


OLTC Power Transformer
The People's Republic of China
Shandong Dachi Electric Co., Ltd.
Dachi
Type SFZ-26000/132
Standard IEC 60076.1-2011
IEC 60076.2-2011
IEC 60076.3-2013
IEC 60076.5-2006
Product No. 10B.710.6753.1
Insulation Level
h.v. line terminal LI 650/LIC 715/AC 275 kV
i.v. line terminal LI 325/LI 110/LIC 121/AC 38 kV
i.v. neutral terminal LI 325/LI 110/LIC 121/AC 38 kV
Altitude ≤1000 m
Installation Outdoor
Cooling ONAN/ONAF (77%/100%)
Rated Frequency 50Hz
No. of Phase Three
Rated Power 26000/26000 kVA
Rated Voltage (132±11X0.91%)/11.5 kV
Vector Group Dyn11
Short circuit Impedance %
No-load current %
No-load loss kW
Load loss kW
Upper Tank Weight 7390 kg
Weight of Active Part and Lower Tank 30900 kg
Oil Weight 22880 kg
Transport Weight with nitrogen 39290 kg
Total Weight 66540 kg
Serial No.
Date
Transformer Oil
Manufacturer Petrochina Kelamayi Refinery
Oil Base Naphthenic Base
Oil No. 0B-
On-load Tap Changer
Power (kVA)
HV
LV
Voltage V
Current A
Connection
Nameplate Drawing
Assembly No.
10B.860.6753.1
SFZ-26000/132
Item No.
Quantity
Weight
Scale
Material 1Cr5 Stainless Steel Sheet(GB/T4237)
Remark
Total page
The Page
Shandong Dachi Electric Co., Ltd.
Mark
Alter
Amender No.
Signature
Date
Design
Standard
Check
Approval
2015.3
8-φ8
182.5
365
380
485
500
7.5



7 PHOTOGRAPHS OF TEST OBJECT

Transformer during the temperature rise test (ONAF)

Appendix A Manufacturer's test report

达 驰

试验报告

TEST REPORT

试品名称：有载调压电力变压器
Product:On Load Tap Changer Power Transformer
试品型号： **SFZ-26000/132**
Product type: SFZ-26000/132
试品编号： **1522043**
Product number: 1522043
试验日期： **2015-10**
Test date: Oct. 2015

DNV·GL
Richard Houtepen
Date: 28/10/2015
KEMA Laboratories

中国.山东达驰电气有限公司

Shandong Dachi Electric Co.,Ltd of China

1. 试品参数 Parameter of product

额定容量
Rated power 26000 / 26000 kVA
额定电压
Rated voltage: 132 / 11.5 kV
额定电流
Rated current: 113.7 / 1305.3 A
额定频率
Rated frequency 50 Hz
相 数
Phase 3
联结组标号
Connection group Dyn11
分接范围
Tapping range 132± 11×0.91% / 11.5 kV
冷却方式
Method of cooling ONAN / ONAF
绝缘水平
Insulating level h.v. 线路端子
h.v. Line terminal Um 145/LI 650/LIC 715/AC 275 kV
l.v. 线路端子
l.v. Line terminal Um 12/LI 110/LIC 121/AC 38 kV

2. 试验标准Standards of test

IEC 60076-1：2011 《电力变压器 第1部分 总则 Power transformer Part 1：General》

IEC 60076-3：2013 《电力变压器 第3部分 绝缘水平、绝缘试验和外绝缘空气间隙 Power transformer-Part3：Insulation levels，dielectric tests and external clearances in air》

IEC 60076-4：2002 《电力变压器 第4部分：电力变压器和电抗器的雷电冲击和操作冲击试验导则 Power transformer-Part 4：Guide to the lighting impule and switching impule testing-Power transformer and reactor》

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3. 试验项目及结果Test item and result

3.1 密封试验
Leakage test

方 法 Method	施加压力 (kPa) Applied pressure	持续时间 h Duration	结 果 Result
气 压 法 Atmospherci pressure (normal pressure=101kPa)	30	24	合 格 Passed

3.2 绝缘电阻及极化指数测量 Measurement of insulation resistance and polarisation index

油温 Temprature of oil(℃)： 22.5

测定部位 Measurement position	绝缘电阻GΩ Insulation resistance		极化指数 polarisation index	结 果 Results
	R_{60}	R_{600}	R_{600}/R_{60}	
高压—低压壳体及地 h.v.-l.v.&E	42.1	69.9	1.66	合 格 Passed
低压—高压壳体及地 l.v.-h.v.&E	30.3	59.4	1.96	合 格 Passed
高低压—壳体及地 h.v.&l.v.--E	35.2	64.4	1.83	合 格 Passed
铁心—壳体及地 Core-tank&E	14.6	---	---	合 格 Passed
夹件—壳体及地 Clamps-tank&E	14.5	---	---	合 格 Passed

3.3 介质损耗(tgδ%)的测量
Measurement of dielectric loss (tgδ%)

油温 Temprature of oil (℃)： 22.5

加 压 部 位 Applied voltage position	施加电压 (KV) Applied voltage	测量电容 (nF) Measured capacitance	实测值 % Measured value	校正值20℃ % Emended value	结 果 Results
高压--低压及地 h.v.-l.v.&E	9.993	7.596	0.223	0.209	合 格 Passed
低压--地及高压 l.v.-h.v.&E	9.988	13.52	0.278	0.260	合 格 Passed
高压低压--地 h.v.&l.v.--E	9.988	12.16	0.279	0.261	合 格 Passed

3.4 变压器绕组变形试验 Transformer winding deformation test

武汉高压研究所 BRTCII 变压器绕组特征测试仪

WuHan High Voltage Institute BRTCII Transformer winding feature tester

波形附后 Wave Shape is attached

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3.5 电压比测量及电压矢量关系的校定

Measurement of voltage ratio and check of connection

高压绕组 h.v. winding		低压绕组 l.v. winding	测量偏差 % Measured deviation			连接组标号 Connection group symbol
分接Tap	电压kV Voltage		AB/ab	BC/bc	CA/ca	
1	145.2132		0.13	0.13	0.13	
2	144.0120		0.12	0.12	0.12	
3	142.8108		0.11	0.11	0.11	
4	141.6096		0.11	0.11	0.11	
5	140.4084		0.09	0.09	0.09	
6	139.2072		0.09	0.09	0.09	
7	138.0060		0.08	0.07	0.08	
8	136.8048		0.07	0.07	0.07	
9	135.6036		0.06	0.05	0.06	
10	134.4024		0.05	0.05	0.05	
11	133.2012		0.04	0.04	0.04	
12	132.0000	11.5000	0.03	0.02	0.03	Dyn11
13	130.7988		0.02	0.02	0.02	
14	129.5976		0.00	0.00	0.00	
15	128.3964		0.00	0.00	0.00	
16	127.1952		0.00	0.00	0.00	
17	125.9940		0.00	0.00	0.00	
18	124.7928		-0.02	-0.02	-0.02	
19	123.5916		-0.03	-0.03	-0.02	
20	122.3904		-0.04	-0.04	-0.03	
21	121.1892		-0.05	-0.05	-0.04	
22	119.9880		-0.06	-0.06	-0.06	
23	118.7868		-0.08	-0.08	-0.07	

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3.6 绕组电阻测量

Measurement of winding resistance

油温 **Tempratureof oil (℃) :22.5**

绕组 winding	分接位置 Tap position	实测值 Measured value (Ω)			不平衡率 Unbalanced %
		AB	BC	CA	
高压 h.v. winding	1	2.568	2.574	2.569	0.23
	2	2.541	2.544	2.536	0.31
	3	2.512	2.514	2.507	0.28
	4	2.480	2.484	2.476	0.32
	5	2.451	2.454	2.447	0.29
	6	2.422	2.424	2.417	0.29
	7	2.391	2.394	2.388	0.25
	8	2.360	2.365	2.358	0.30
	9	2.332	2.338	2.329	0.39
	10	2.304	2.306	2.300	0.26
	11	2.274	2.277	2.271	0.26
	12	2.243	2.247	2.242	0.22
	13	2.276	2.278	2.273	0.22
	14	2.306	2.309	2.303	0.26
	15	2.336	2.339	2.333	0.26
	16	2.365	2.368	2.363	0.21
	17	2.396	2.398	2.392	0.25
	18	2.427	2.431	2.423	0.33
	19	2.454	2.457	2.452	0.20
	20	2.483	2.488	2.482	0.24
	21	2.511	2.515	2.510	0.20
	22	2.541	2.544	2.540	0.16
	23	2.569	2.573	2.569	0.16
低压 l.v. winding		ao	bo	co	
		0.006265	0.006254	0.006300	0.73

3.7 空载损耗及空载电流测量

Measurement of no-load loss and current

电压百分数% Percent of rated voltage	平均值电压 kV Average voltage	有效值电压 kV Virtual value voltage	空载电流 No-load current		空载损耗(kW) No-load loss
			A	%	
90	10.350	10.367	0.740	0.057	10.271
100	11.500	11.515	0.917	0.070	13.023
110	12.651	12.657	1.474	0.113	17.044

3.8 空载电流谐波测量(100%)

no-load current harmonic wave measurement (100%)

谐波次数 number of harmonic wave	H01 %		
1	100.0000	100.0000	100.0000
3	11.9115	43.9481	17.5180
5	23.3345	25.9398	21.5738
7	10.9277	13.7833	10.5168
9	0.9396	2.1654	0.0000

3.9 工频耐压试验

Power freqency with stand voltage test

施加电压端 Applied terminal	试验电压（kV） AC test voltage	试验时间（s） Test time	结 果Results
高压—低压及地 h.v. —l.v.&E	275	60	合 格 Passed
低压—高压及地 l.v. —h.v.&E	38	60	合 格 Passed

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3.10 带局部放电的感应耐压试验（IVPD）　　频率 **frequency：200 Hz**

Induced voltage withstand test with parts discharge measurement

施加电压Applied Voltage		持续时间 Duration	局部放电量 pc		
倍数 multiple	相对相电压（kV） phase to phase		Partial discharge capacity		
			A	B	C
0.4Ur	52.8	记录背景PD值 Background value of PD	10	10	9
1.2Ur	158.4	1 min	20	30	20
1.58Ur	208.6	5 min	20	30	40
2Ur	264	30 S	70	80	80
1.58Ur	208.6	5 min	50	50	50
		10 min	50	50	50
		15 min	50	50	50
		20 min	50	50	50
		25 min	50	50	50
		30 min	50	50	50
		35 min	50	50	50
		40 min	50	50	50
		45 min	50	50	50
		50 min	50	50	50
		55 min	50	50	50
		60 min	50	50	50
1.2Ur	158.4	1 min	20	20	20
0.4Ur	52.8	记录背景PD值 Background value of PD	10	10	10

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3.11负载损耗及阻抗电压测量

Measurement of load loss and short impedance voltage

油温 **Temprature of oil (℃)**：23.4

测量绕组 **Windings**	分接位置 **Tap position**	施加电流（A） **Current**	测量电压（kV） **Voltage**	负载损耗（kW）75℃ **Load loss**	短路阻抗 75℃ % **Impedance voltage**	
					20.0MVA	26.0MVA
高压-低压 **H.V.- L.V.**	1	69.441	13.408	105.756	10.58	13.75
	12	75.187	11.406	105.604	10.05	13.07
	23	82.361	10.027	125.400	9.96	12.95

3.12 零序阻抗测量 Measurement of zero-sequence impedance

测量端子 **Measurement terminal**	电 压 （V） **Voltage**	电 流 （A） **Current**	Z_O （Ω / 相 **phase**）
o-abc	27.0	105.1	0.77

3.13 雷电冲击试验 Lightning impulse test

记录见附页 **Test oscillogram records are shown in the last pages.**

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3.14 声级测量 Noise level measurement:

油箱高度tank height(m)h =2.72　　测量高度Measure height(m)：1/3h=0.91

测量高度Measure height(m)：2/3h=1.81

3.14.1 测量数据measurement data

背景噪声sound leveldB (A)			平均 Average (dB)	变压器合成噪声(dB) combined noise
冷却器状态 Radiator condition	测量前 before measured	测量后after measured		
ONAN	38.9	38.6	38.8	56.7
ONAF	38.9	38.6	38.8	65.2

3.14.2 修正系数correction factor

测量室总表面积 total superficial area of measurement room (m^2)	平均吸声系数 average sound-absorbing factor (a)	吸声量 sound-absorbing (A)	距离基准发射面 distance to reference emitting surface (m)	测量表面积 measuring superficial area (m^2)	环境修正值k correction value of enviromrnt (dB)
7920	0.15	1188	0.3	90.100	1.15
7920	0.15	1188	2.0	189.272	2.14

3.14.3 测量结果measurement result

A计权表面声压级 Aweighting acoustic pressure level (dB)	0.3m	55.6
	2.0m	63.1

3.15 风机吸收功率测量 Measurement of power taken by the fan motors

温度temperature(℃)：22.4

型号：DBF2-506　　Supplier：Xi'an NoKo Electric Company Limited

Type：DBF2-506

型号 Serial No.	电压（V）Voltage	电流（A）Current	功率 Power (W)
15070	400	0.83	355
15076	400	0.87	410
15078	400	0.94	437
15077	400	0.91	439
15066	400	0.83	361
15074	400	0.91	431
15071	400	0.93	447
15073	400	0.83	366

3.16 电容式套管试验

Oil paper capacitor type bushing test 温度temperature(℃)：22.4

套管型号 **type**	BRDLW4-145/800-4 （A、B、C PHASE BUSHING）		
产地 **maufacturer**	传奇电气（沈阳）有限公司 **TRENCH ELECTRIC CO.,LTD**		
套管编号 **Product serial Number**	1504636	1504633	1504634
施加电压 **applied voltage**（kV）	9.992	9.994	9.992
tgδ% （实测值**measured value**）	0.230	0.262	0.235
Cx （pF）	302.6	302.7	301.8
标称电容 **nominal capacitance** （pF）	306	307	306

3.17 有载开关试验

Test of on-load tap changer

开关型号 **Tap changer type**	制造单位 **Manufacturer**	出厂序号 **Serial number**
VVIII2500-145-12231W	**MR**	**1593670**

a. 变压器不激磁，在额定辅助电压下分接开关完成8个完全操作循环.
At rated auxiliary voltage and no excitation,tap changer run eight complete cycles of

b. 变压器在额定激磁条件下，空载试验时，分接开关完成1个操作循环.
At rated excitation and no-load test condition,tap changer run one cycle of operation.

c. 变压器不激磁，在85%额定辅助电压下分接开关完成1个操作循环.
At 85% rated auxiliary voltage and no excitation,tap changer be run one cycle of operation.

d. 变压器负载试验时，在主分接两侧±2级间完成10次分接变换.
At load test,tap-changer run ten times at ±2 step side of principal tap.

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4. 试验结论：Test conclusion

SFZ-26000/132 1522043 号有载调压电力变压器上述例行试验及部分特殊试验
SFZ-26000/132 1522043 On load tap change power transformer routine test and
的试验项目、方法及结果符合IEC60076-1：2011、IEC60076-3：2013、IEC60076-4：2002、
partial special test result with IEC60076-1:2011、IEC60076-3:2013、IEC60076-4:2002、
等标准及技术协议要求。
standards and technical agreements requirements.

试品试验Test：　　合格Passed

编制 Edited by：

校核Inspected by：

审核Examined by：

审定Authorized by：

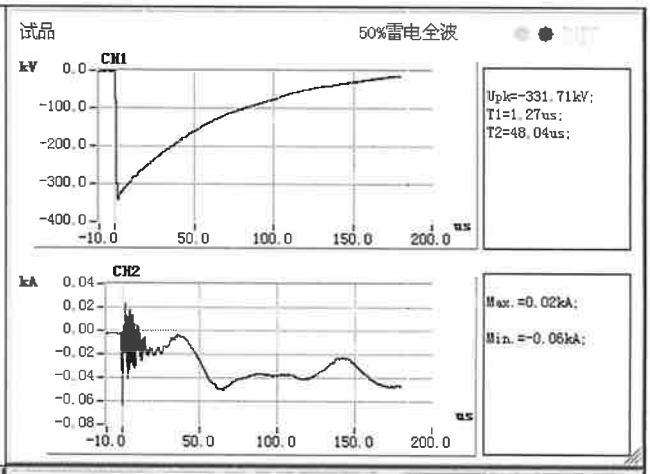
A 相

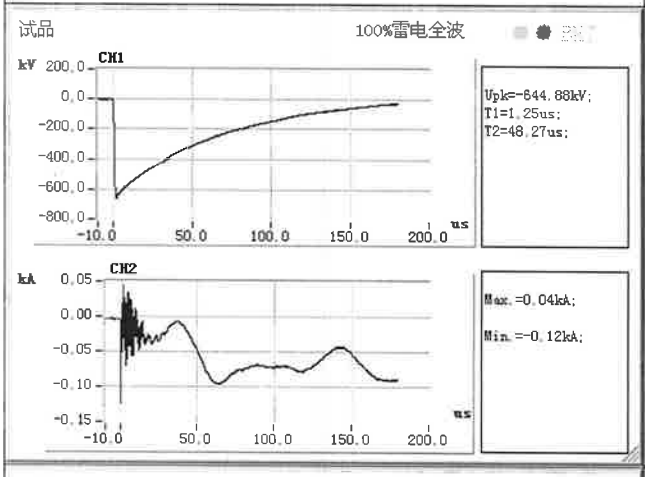
试验极性：负；

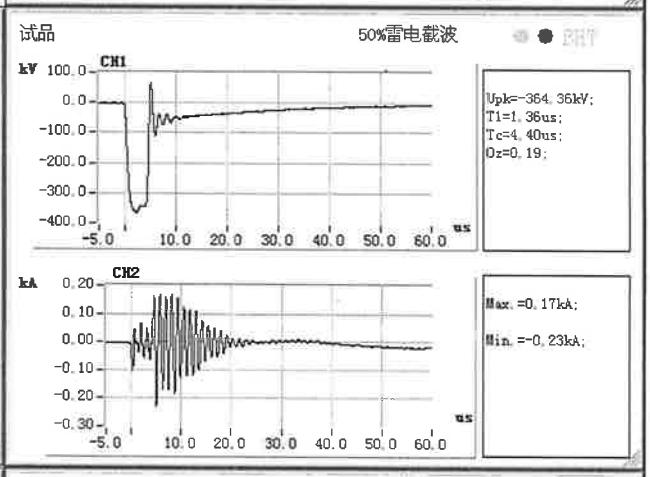
通道 1：电压波；

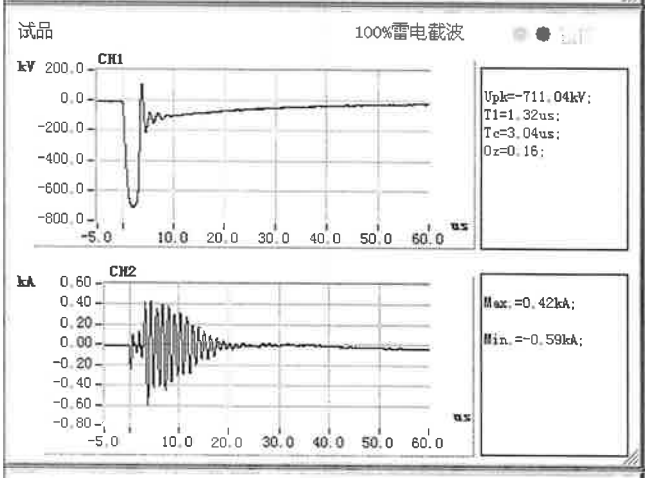
通道 2：中性点电流波；

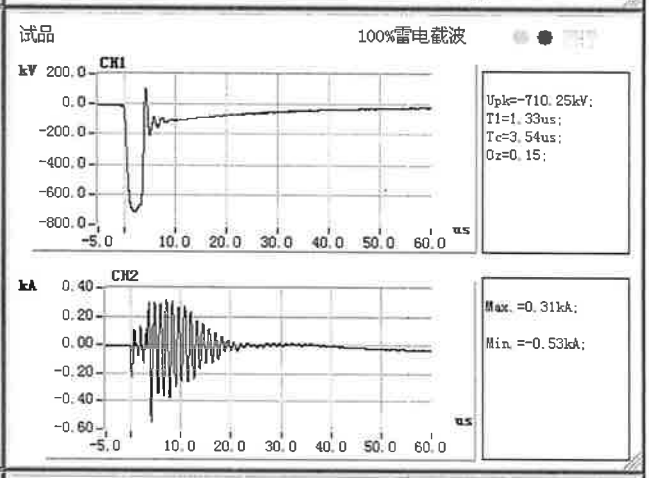
高压绕组分接位置：1

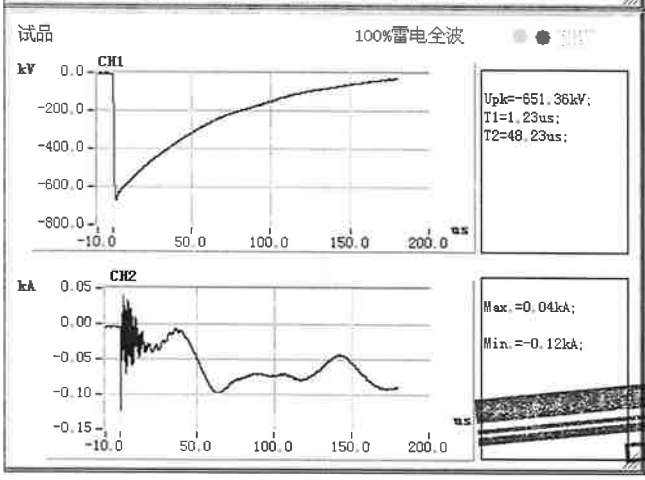


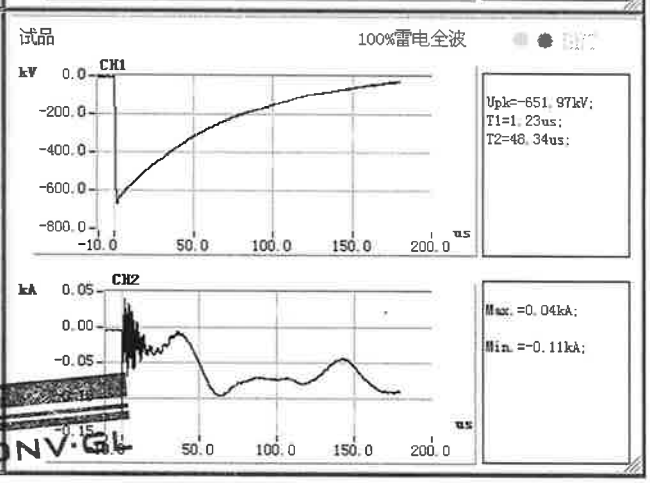












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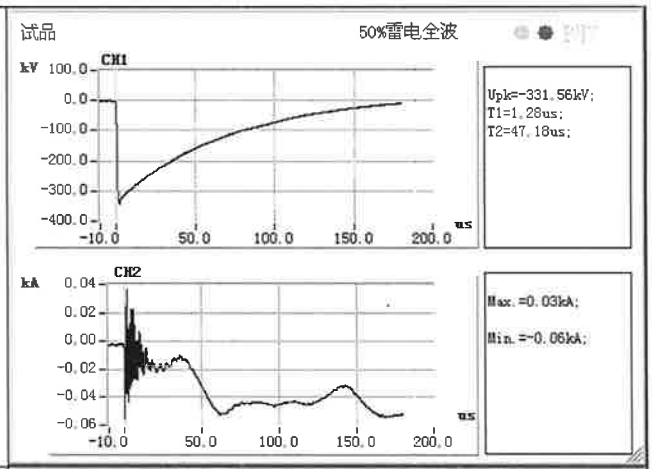
B 相

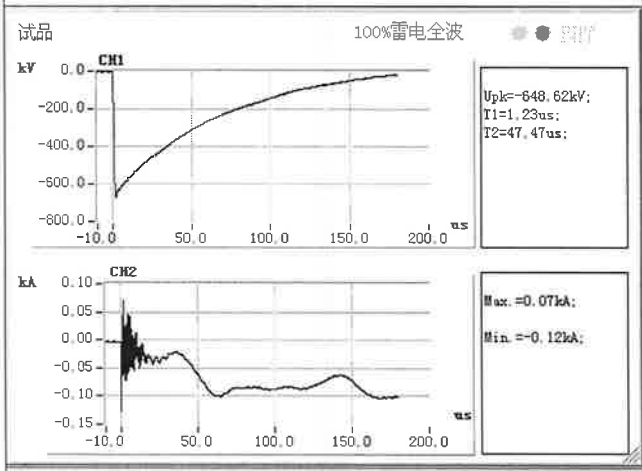
试验极性：负；

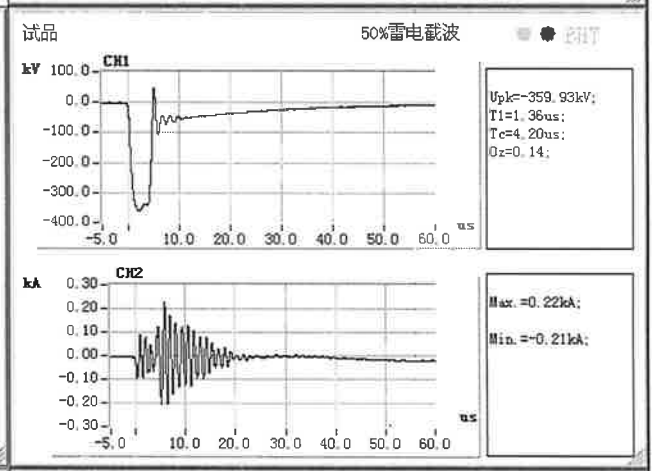
通道 1：电压波；

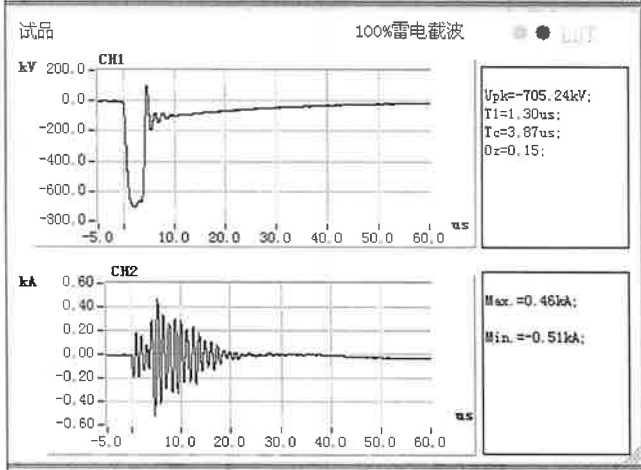
通道 2：中性点电流波；

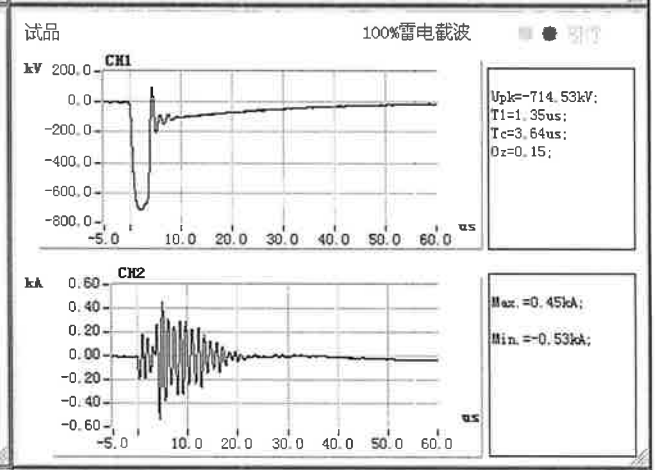
高压绕组分接位置：12

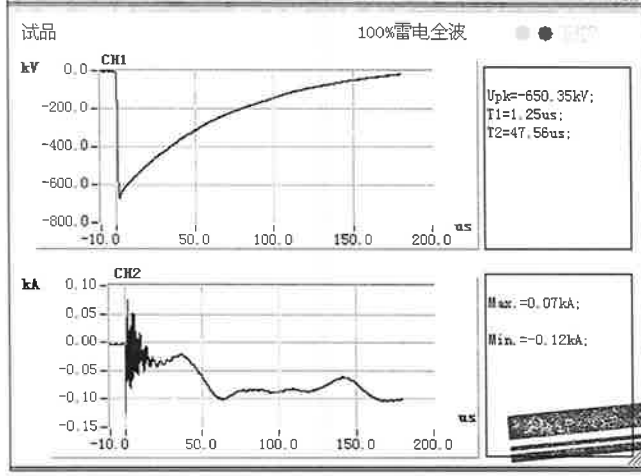


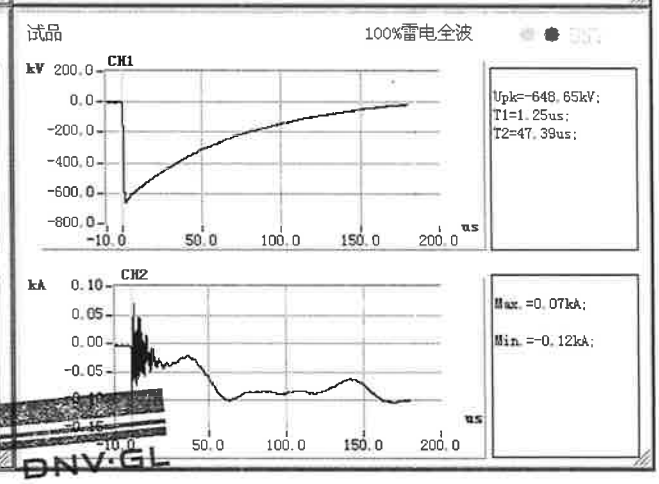












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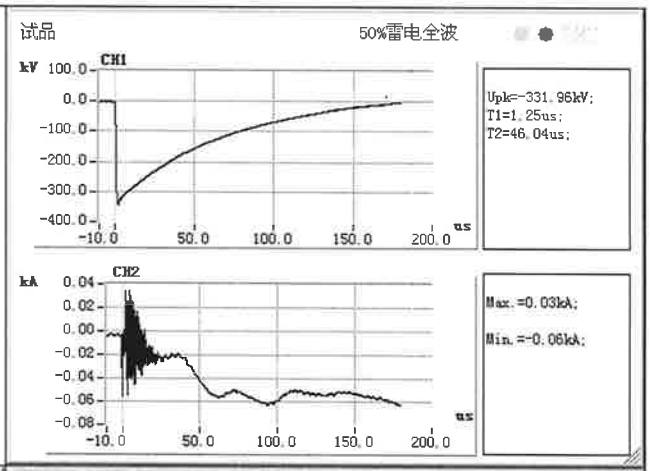
C 相

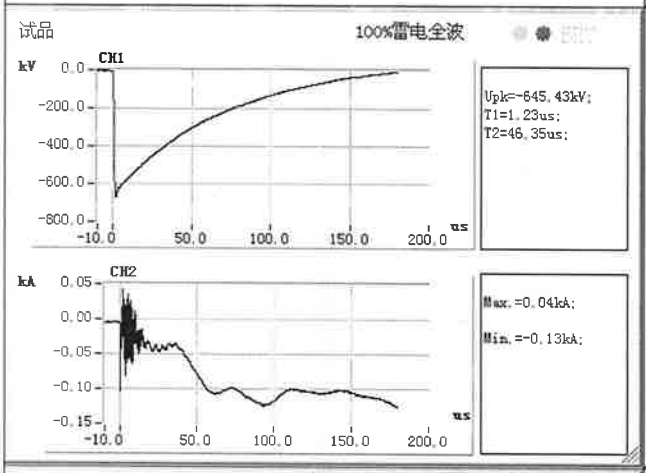
试验极性：负；

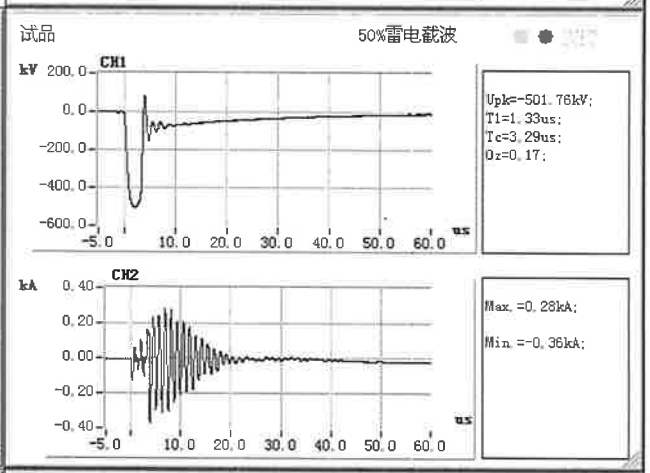
通道 1：电压波；

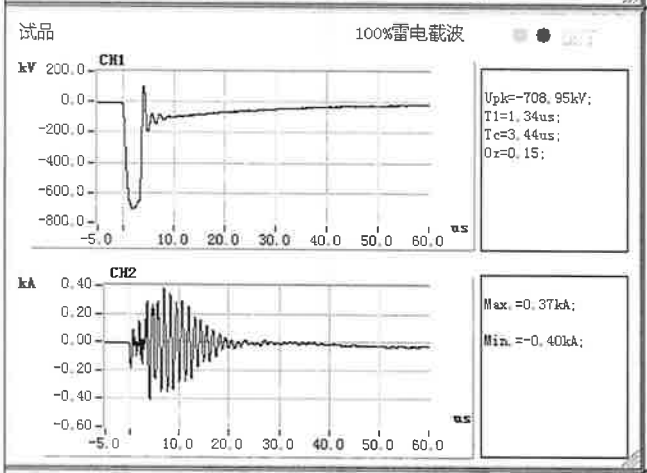
通道 2：中性点电流波；

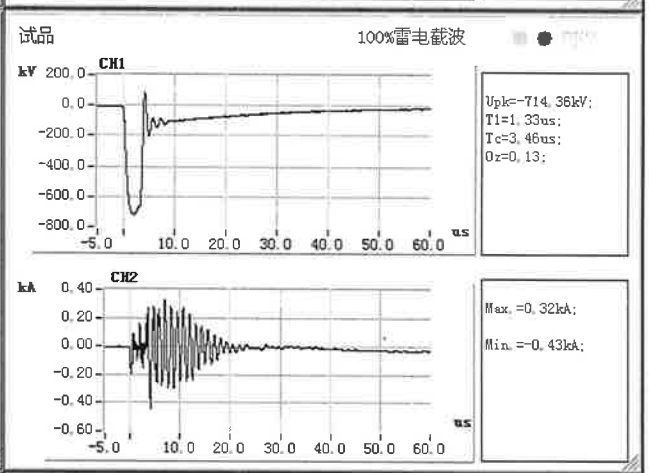
高压绕组分接位置：23

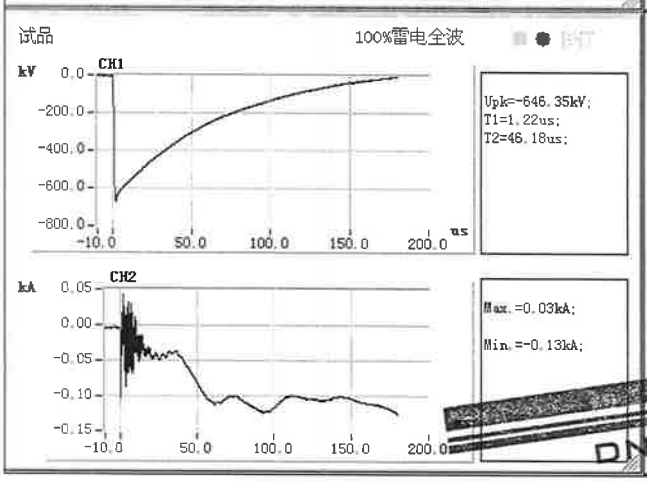


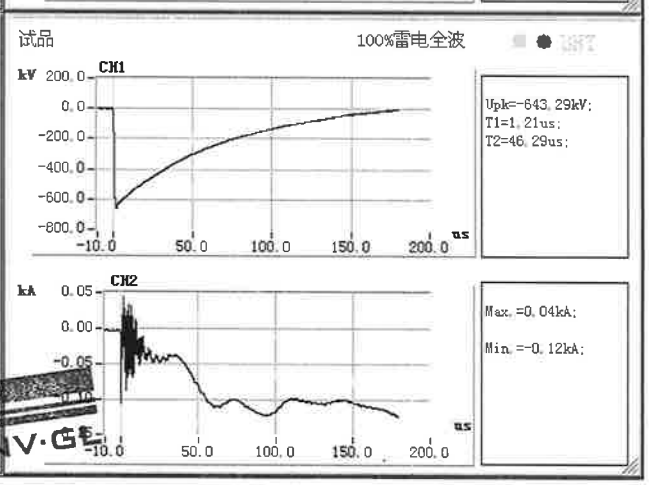












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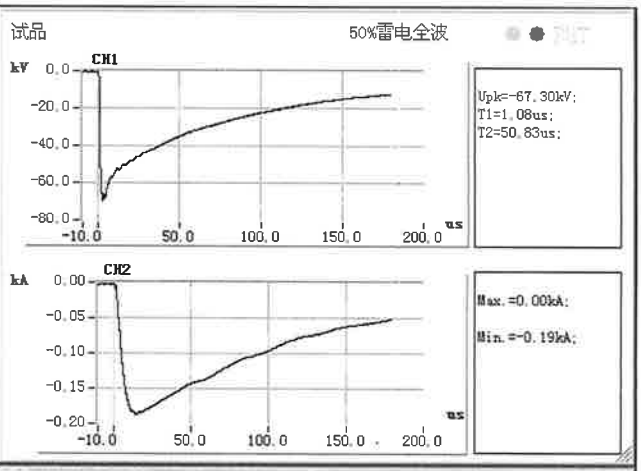
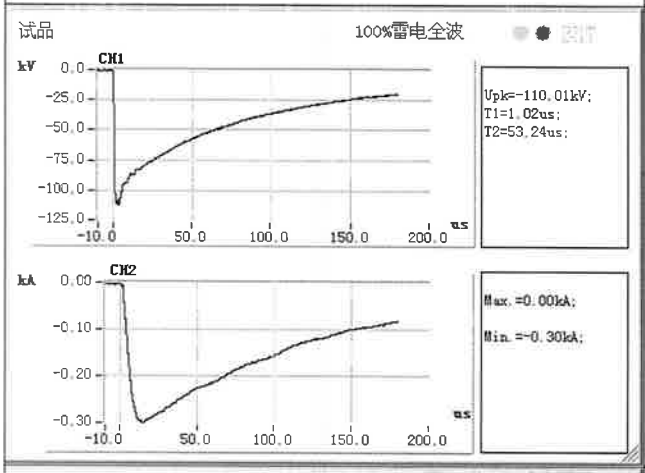
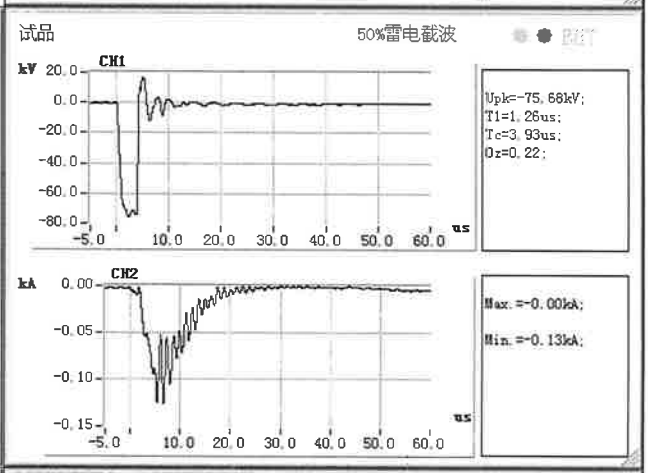
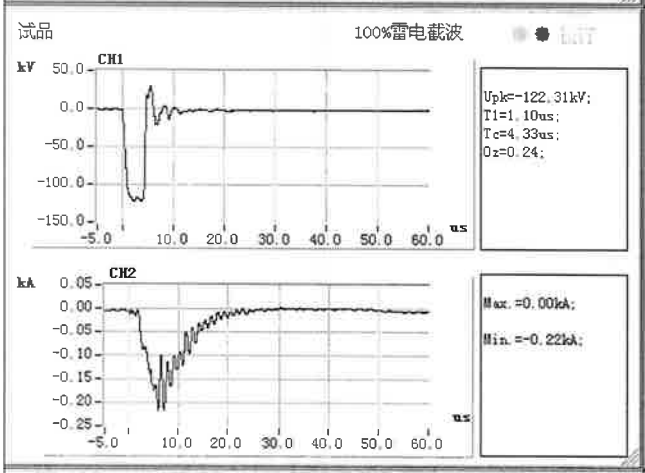
Richard Houtepen
Date: 28/10/2015
KEMA Laboratories

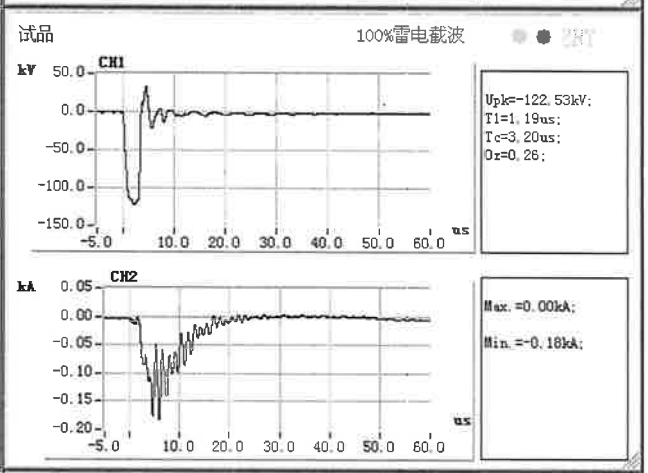
a 相
试验极性：负;
通道 1：电压波;
通道 2：中性点电流波

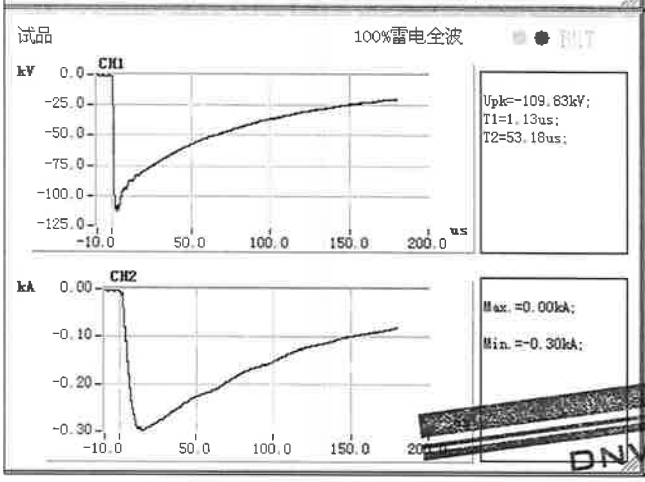


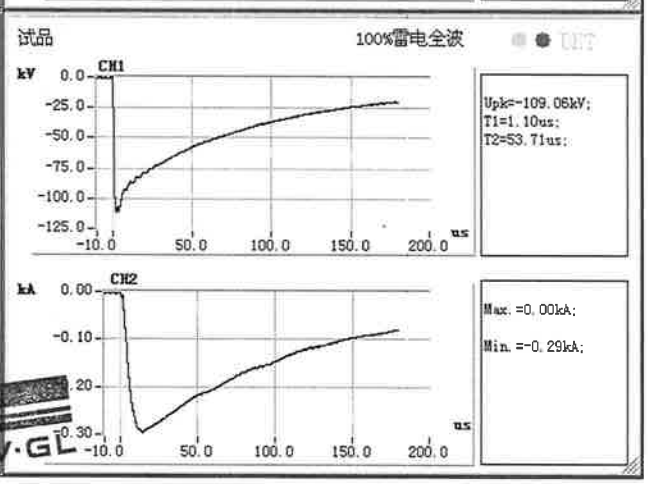












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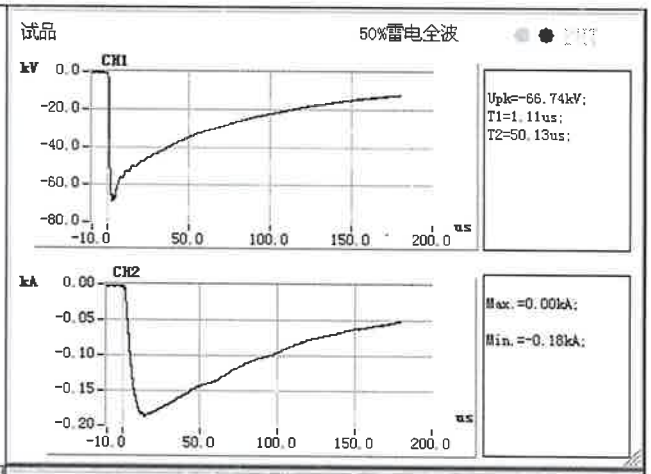
Richard Houtepen
Date: 28/10/2015
KEMA Laboratories

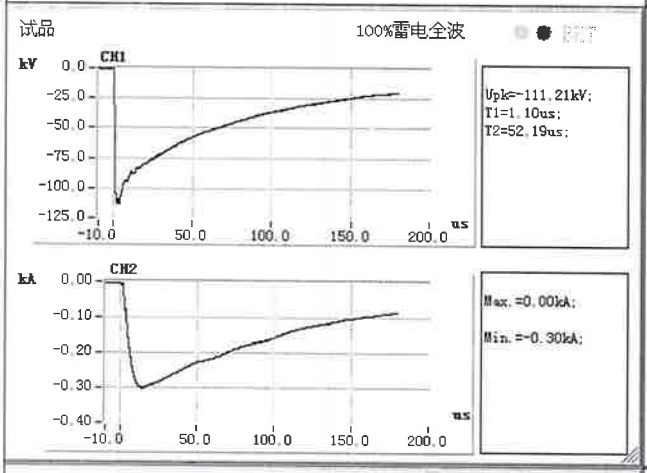
b 相

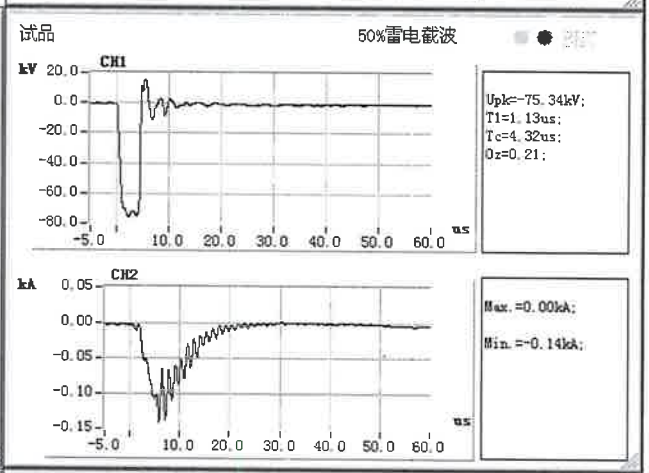
试验极性：负；

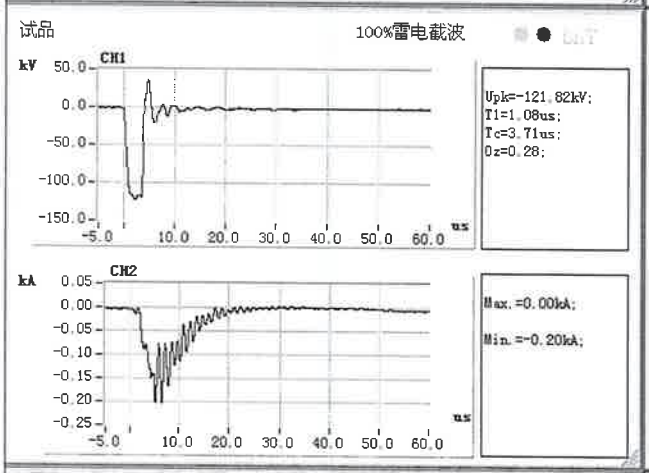
通道 1：电压波；

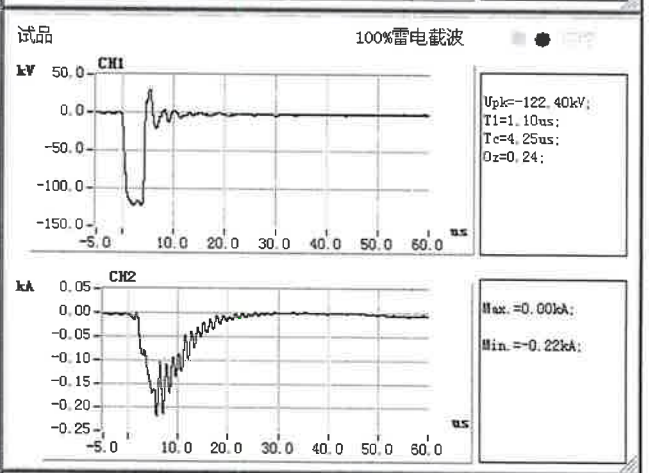
通道 2：中性点电流波

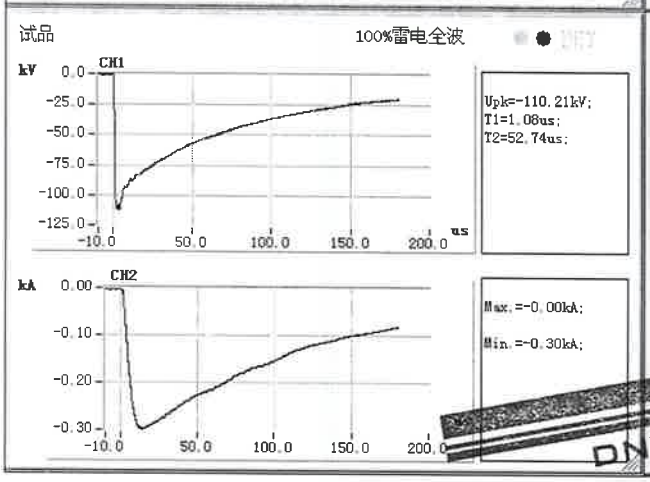


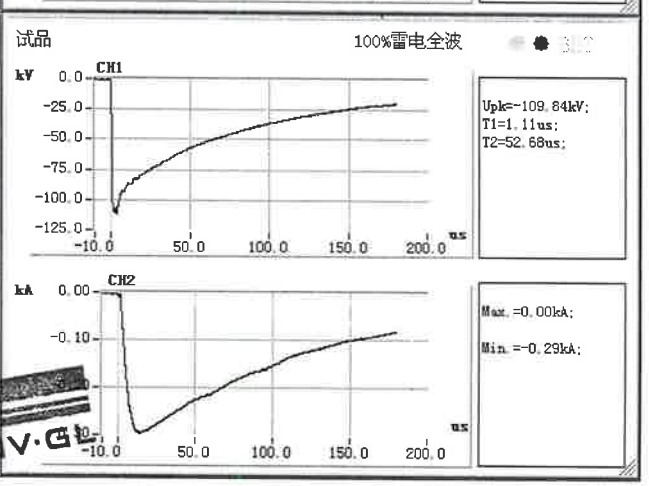












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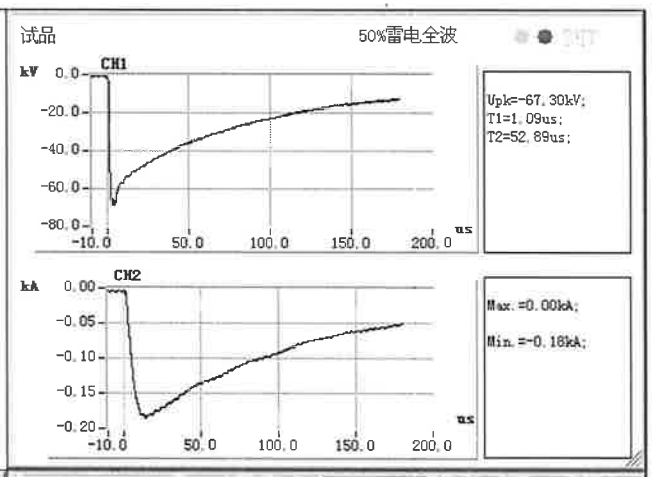
Richard Houtepen
Date: 28/10/2015
KEMA Laboratories

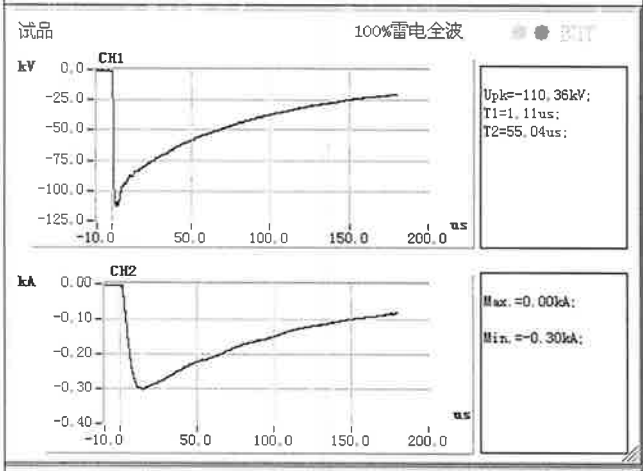
c 相

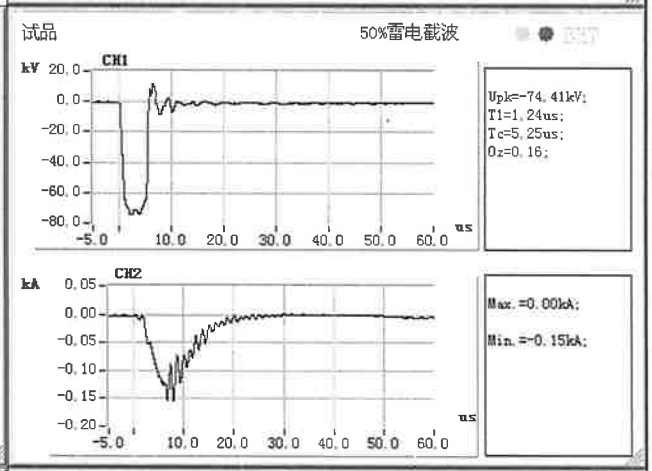
试验极性：负；

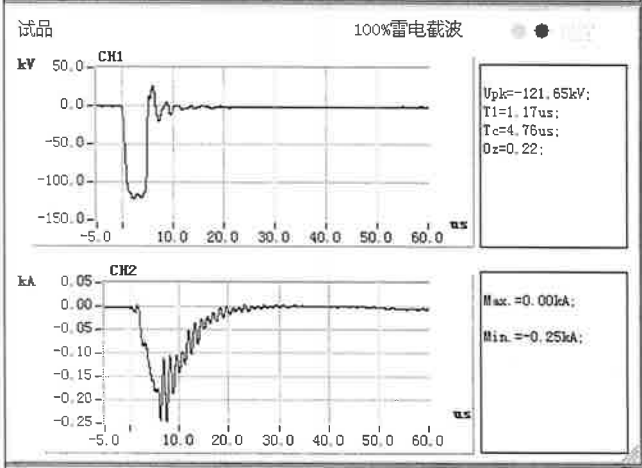
通道 1：电压波；

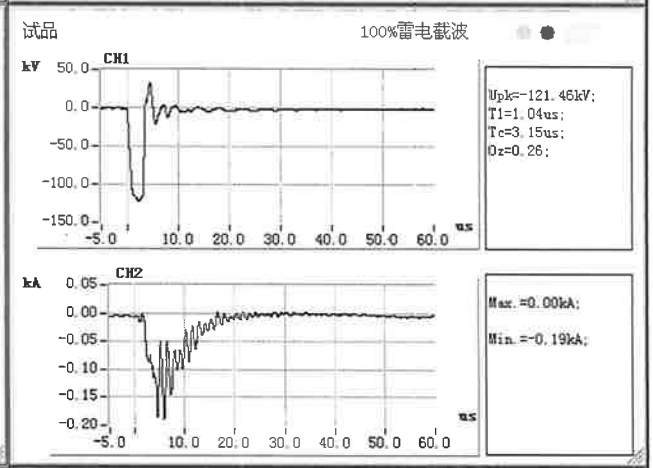
通道 2：中性点电流波

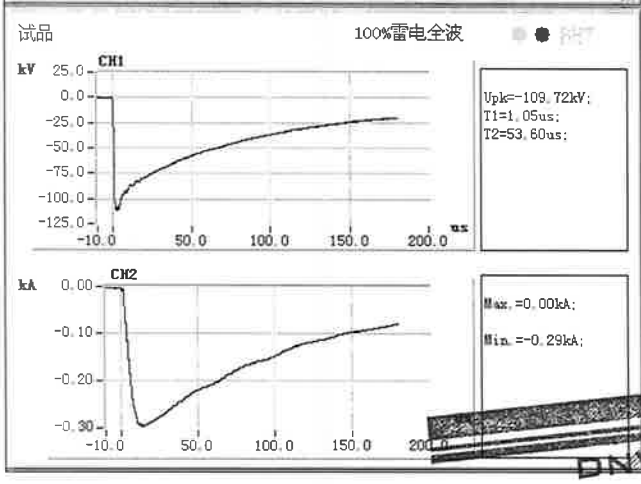


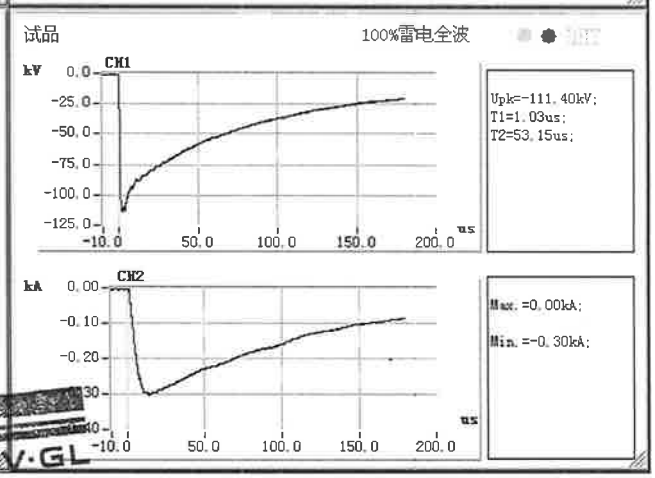












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Richard Houtepen

Date: 28/10/2015

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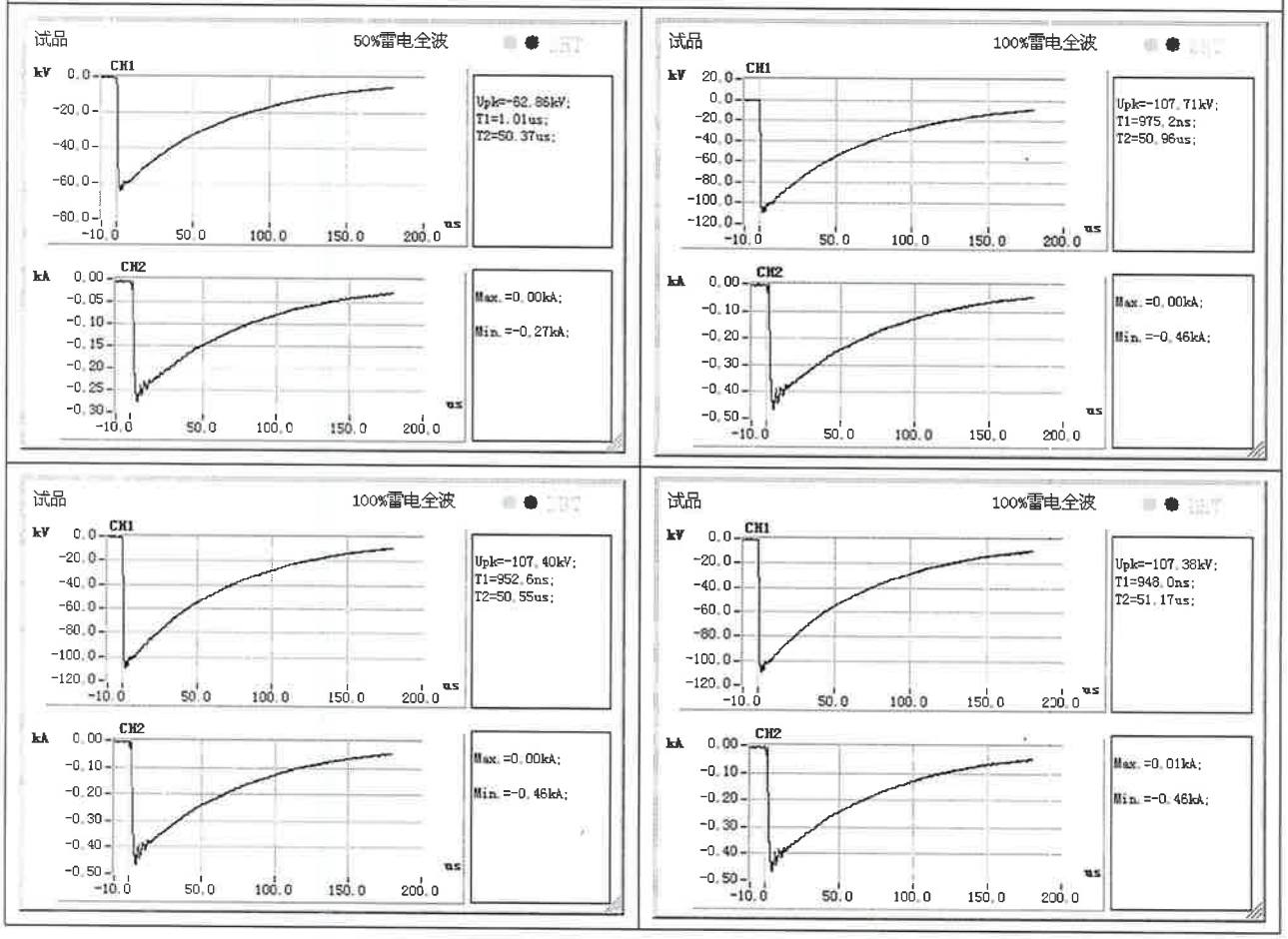
O 相

试验极性：负;

通道 1：电压波;

通道 2：中性点电流波



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Richard Houtepen

Date: 28/10/2015

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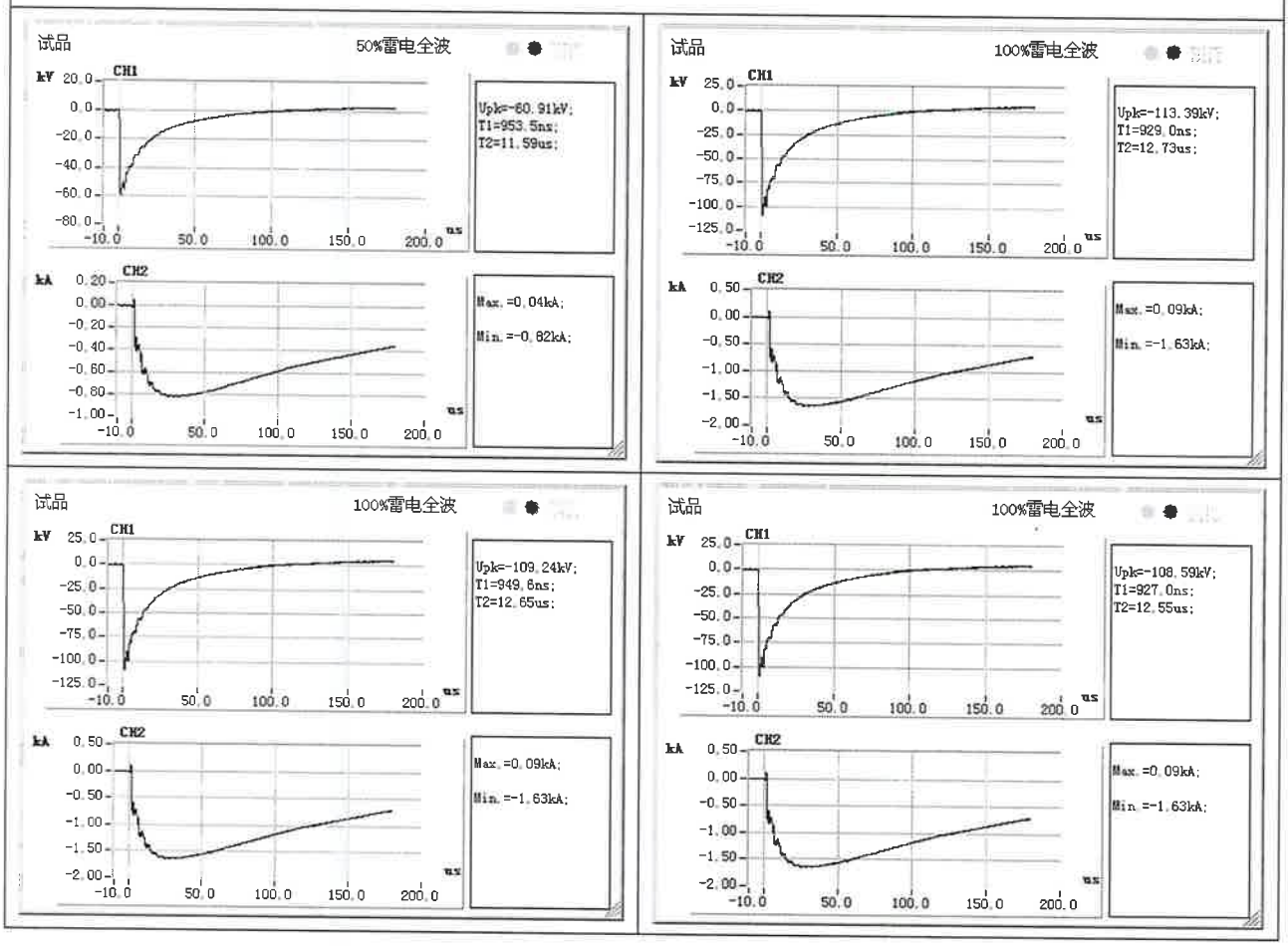
O 相

试验极性：负;

通道 1：电压波;

通道 2：中性点电流波



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Date: 28/10/2015

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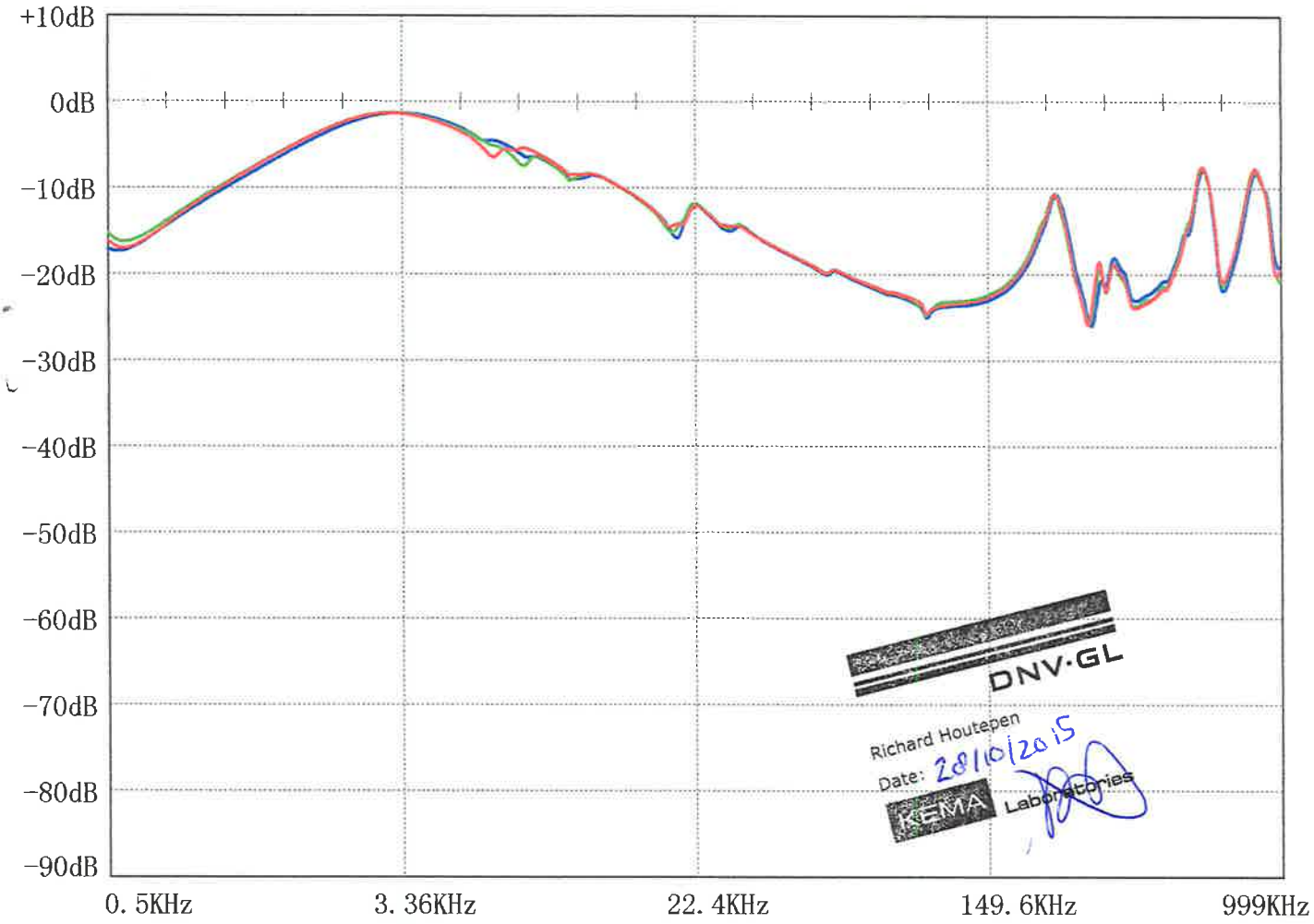
变压器绕组变形测试报告

打印于2015-10-28 10:54:14



变压器编号：1522043

变压器型号：SFZ-26000/132

曲线1：SF0L0A00.DAT　信号注入点:低压绕组之0点，测量点:A点　测于2015-10-28

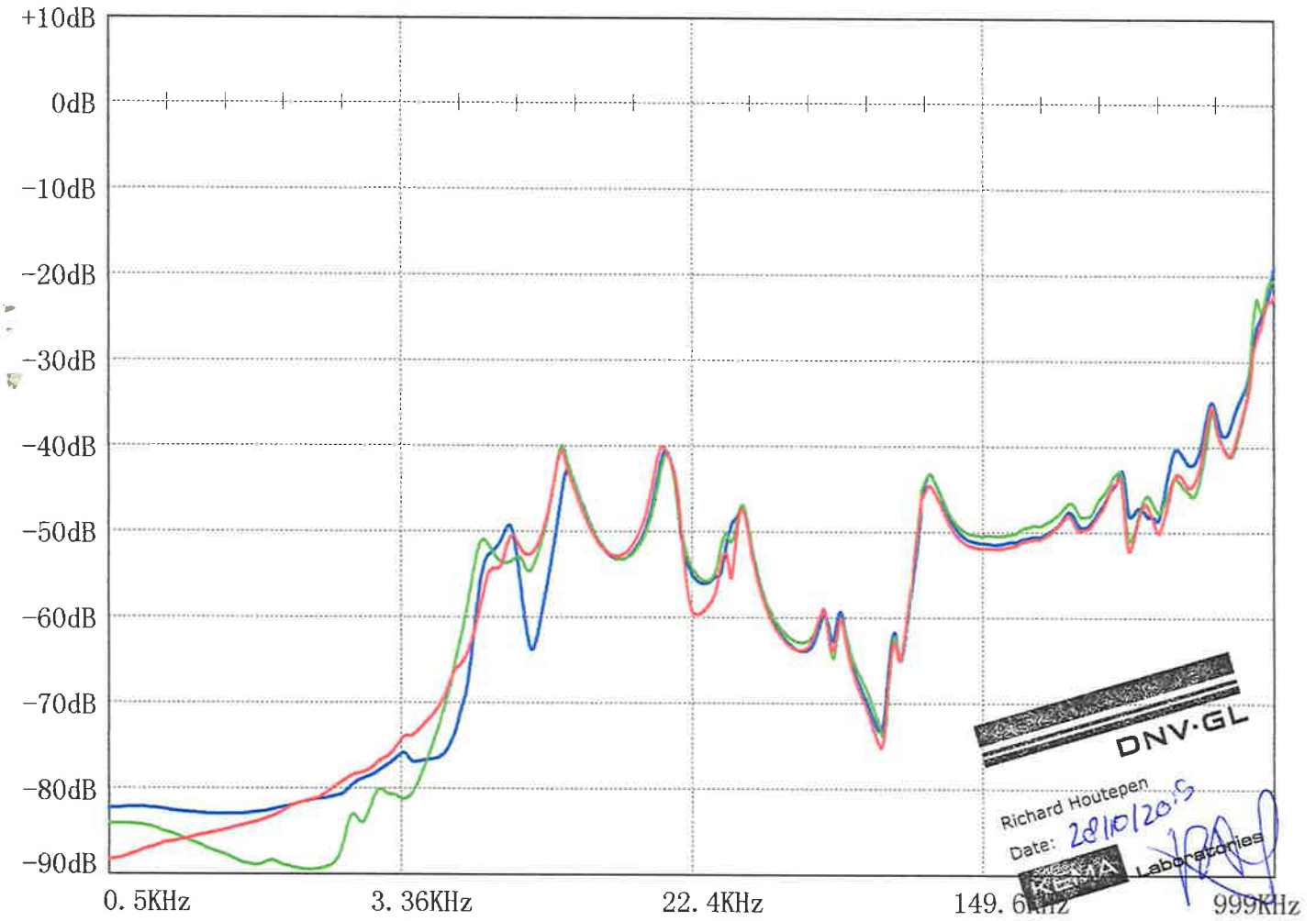
曲线2：SF0L0B00.DAT　信号注入点:低压绕组之0点，测量点:B点　测于2015-10-28

曲线3：SF0L0C00.DAT　信号注入点:低压绕组之0点，测量点:C点　测于2015-10-28

相关系数	0.5k--30k	30k--300k	300k--1000k	0.5k--1000k
R12	0.99	0.99	0.99	0.99
R13	0.99	0.99	0.99	0.99
R23	0.99	0.99	0.99	0.99

变压器绕组变形测试报告

打印于2015-10-28 10:54:35



变压器编号：1522043

变压器型号：SFZ-26000/132

曲线1：SF0HCA00.DAT	信号注入点:高压绕组之C点，	测量点:A点	测于2015-10-28
曲线2：SF0HAB00.DAT	信号注入点:高压绕组之A点，	测量点:B点	测于2015-10-28
曲线3：SF0HBC00.DAT	信号注入点:高压绕组之B点，	测量点:C点	测于2015-10-28

相关系数	0.5k--30k	30k--300k	300k--1000k	0.5k--1000k
R12	0.96	0.99	0.97	0.98
R13	0.96	0.99	0.99	0.98
R23	0.98	0.99	0.99	0.99

达 驰

试验报告

TEST REPORT

试品名称：有载调压电力变压器

Product: On Load Tap Change power Transformer

试品型号：SFZ-26000/132

Test object type: SFZ-26000/132

试验项目：温升试验

Test items: Temperature rise test

试品编号：1522043

Product number: 1522043

试验日期：2015.10

Test date: Oct. 2015

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Richard Houtepen

Date: 28/10/2015

KEMA Laboratories

中国.山东达驰电气有限公司

Shandong Dachi Electric Co.,Ltd of China

1. 试品参数 Test object parrameters

额定容量

Rated power: 26000/26000 kVA

额定电压

Rated voltage: 132 /11.5 kV

额定电流

Rated current: 113.7 / 1305.3 A

额定频率

Rated frequency: 50 Hz

相数

Number of phases: 3

连接组标号

Connection group: Dyn11

分接范围

Tap range: 132 ± 11×0.91% / 11.5 kV

冷却方式

Cooling method: ONAN/ONAF(20MVA/26MVA)

绝缘耐热等级

Temperature class of insulation: A

2. 试验标准 Standards

IEC60076.1:2011《电力变压器 第1部分 总则 Power transformers Part1: General 》

IEC60076.2:2011《电力变压器 第 2 部分 温升 Power transformers Part2: Temperature rise 》

3.温升试验 Temperature rise test

3.1 温升试验 Temperature rise test(ONAF)

本试验是通过短路电流的方法实现的，试验持续时间 7 小时，稳定时间 3 小时。确定施加总损耗 138.423 kW,试验期间实际施加总损耗 138.423 kW;确定施加电流为 126.4 A，实际施加电流 126.4 A;

The test is conducted by means of short-circuit method, the test duration is 7h, stability duration is 3h. Specified total loss is 138.423**kW,infected total loss of** 138.423 **kW, Specified current is** 126.4**A,injected test current of** 126.4 **A, during measurement of winding resistance。**

高压绕组在 23 分接. HV winding **Tap 23.**

测量值

Measurement

绕组 Win-ding	油顶层温度 Top Tank Temp.（℃）		散热器底部温度 Bottom Temp. of The Radiator（℃）		环境温度 Ambient temperature（℃）		电阻测量 Measurement of resistance（Ω）	
	总损耗时 Total losses	测量电流时 Measurement current	总损耗时 Total losses	测量电流时 Measurement current	总损耗时 Total losses	冷态电阻时 Cold R	冷态电阻 OB/ab Cold R	热态电阻 OB/ab Hot R
H.V.	57.8	57.5	25.4	25.6	19.1	22.5	2.573	2.8854
L.V.		57.5		25.6		22.5	0.006254	0.007111

温升结论 **Conclusion of temperature-rise**

顶层油温升 Top oil temperature rise(K)		38.7
绕组温升 Winding temp-rise（K）	H.V.	34.7
	L.V.	38.7

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Date: 28/10/2015

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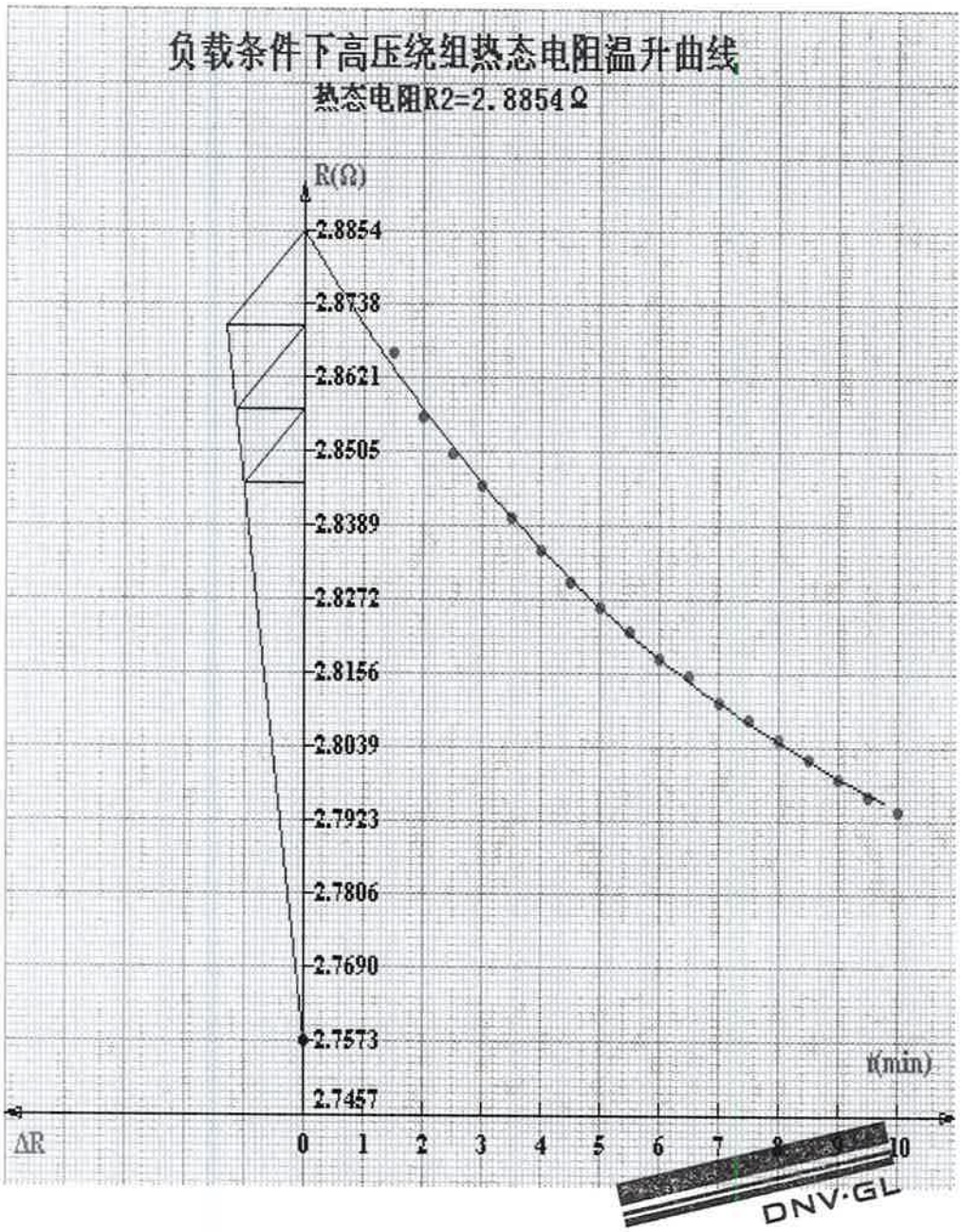
风冷高压热态电阻测量



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Date: 28/10/2015

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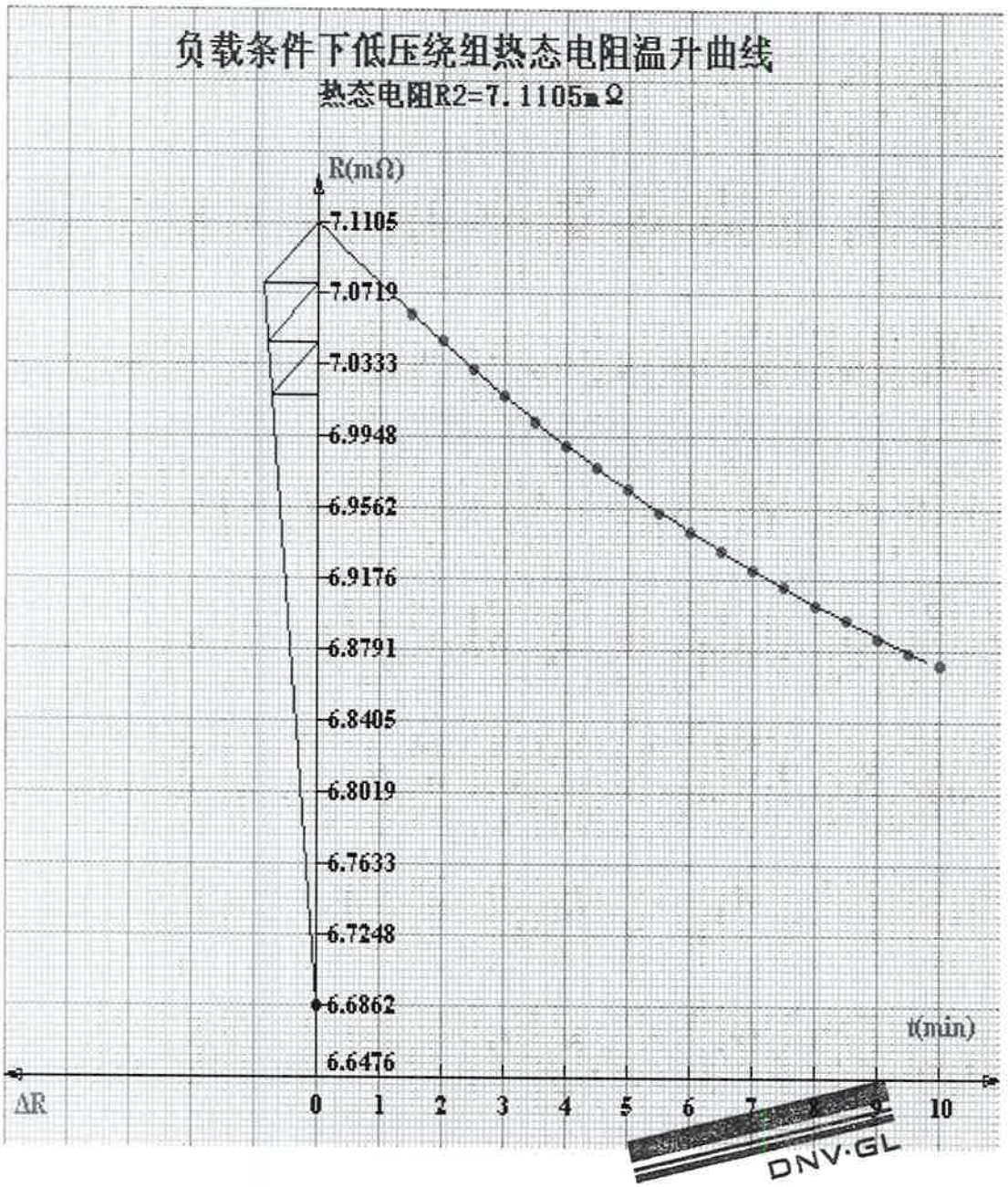
风冷低压绕组热态测量



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Date: 28/10/2015
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3.2 温升试验 **Temperature rise test(ONAN)**

本试验是通过短路电流的方法实现的，试验持续时间 8 小时，稳定时间 3 小时。确定施加总损耗 87.2kW,试验期间实际施加总损耗 87.2kW; 确定施加电流为 97.2A，实际施加电流 97.2A;

The test is conducted by means of short-circuit method, the test duration is 8h, stability duration is 3h. Specified total loss is87.2**kW,infected total loss of** 87.2**kW, Specified current is** 97.2**A,injected test current of** 97.2**A, during measurement of winding resistance。**

高压绕组在 23 分接. HV winding **Tap 23**

测量值
Measurement

绕组 Win-ding	油顶层温度 Top Tank Temp.（℃）		散热器底部温度 Bottom Temp. of The Radiator（℃）		环境温度 Ambient temperature（℃）		电阻测量 Measurement of resistance（Ω）	
	总损耗时 Total losses	测量电流时 Measurement current	总损耗时 Total losses	测量电流时 Measurement current	总损耗时 Total losses	冷态电阻时 Cold R	冷态电阻 AB/ob Cold R	热态电阻 AB/ob Hot R
H.V.	63.3	62.8	40.5	40.2	22.8	22.5	2.573	2.9557
L.V.		62.8		40.2		22.5	0.006254	0.007252

温升结论 Conclusion of temperature-rise

顶层油温升 Top oil temperature rise(K)		40.5
绕组温升 Winding temp-rise（K）	H.V.	38.4
	L.V.	41.2

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Date: 28/10/2015
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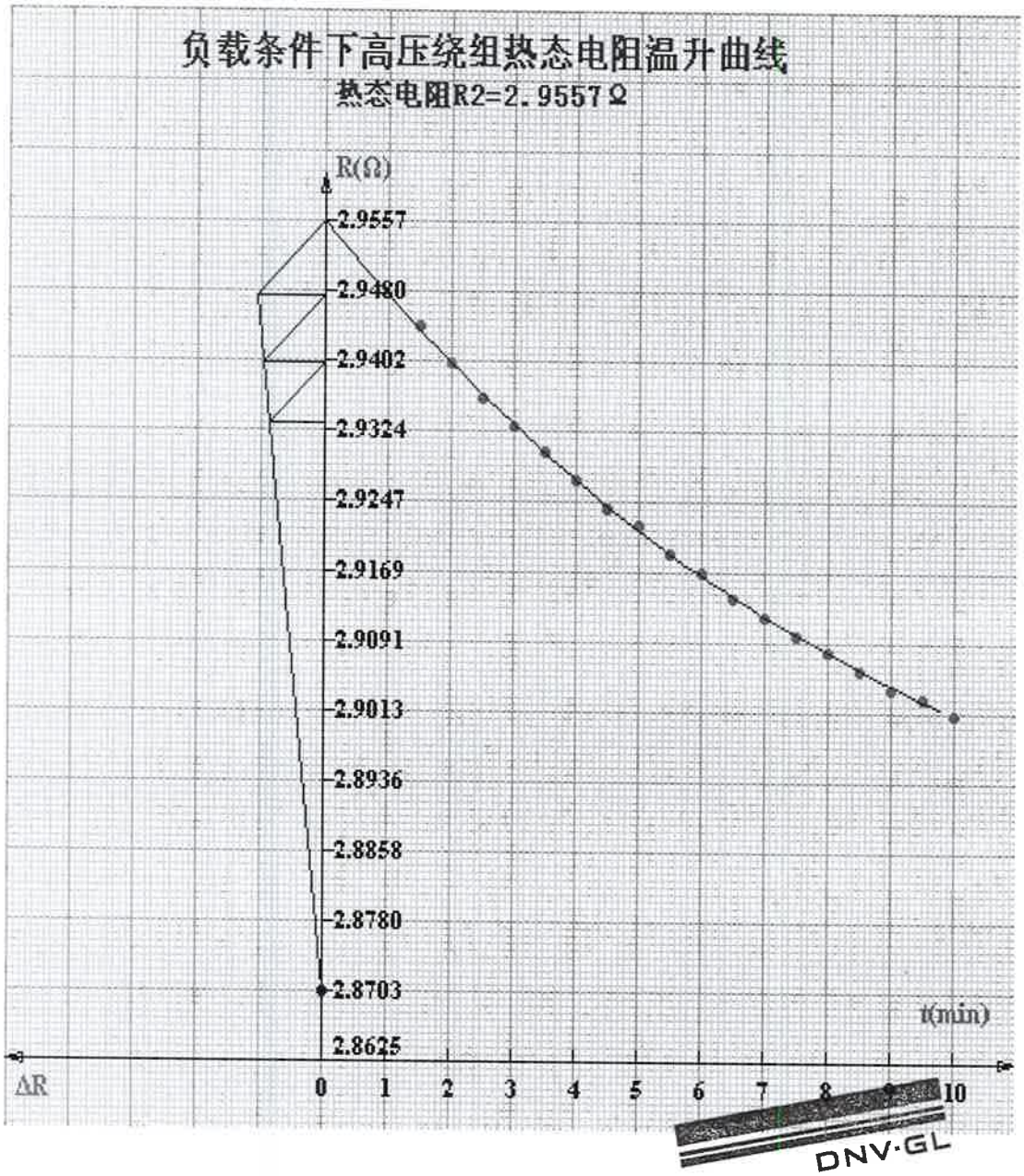
自冷高压绕组热态测量



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Date: 28/10/2015
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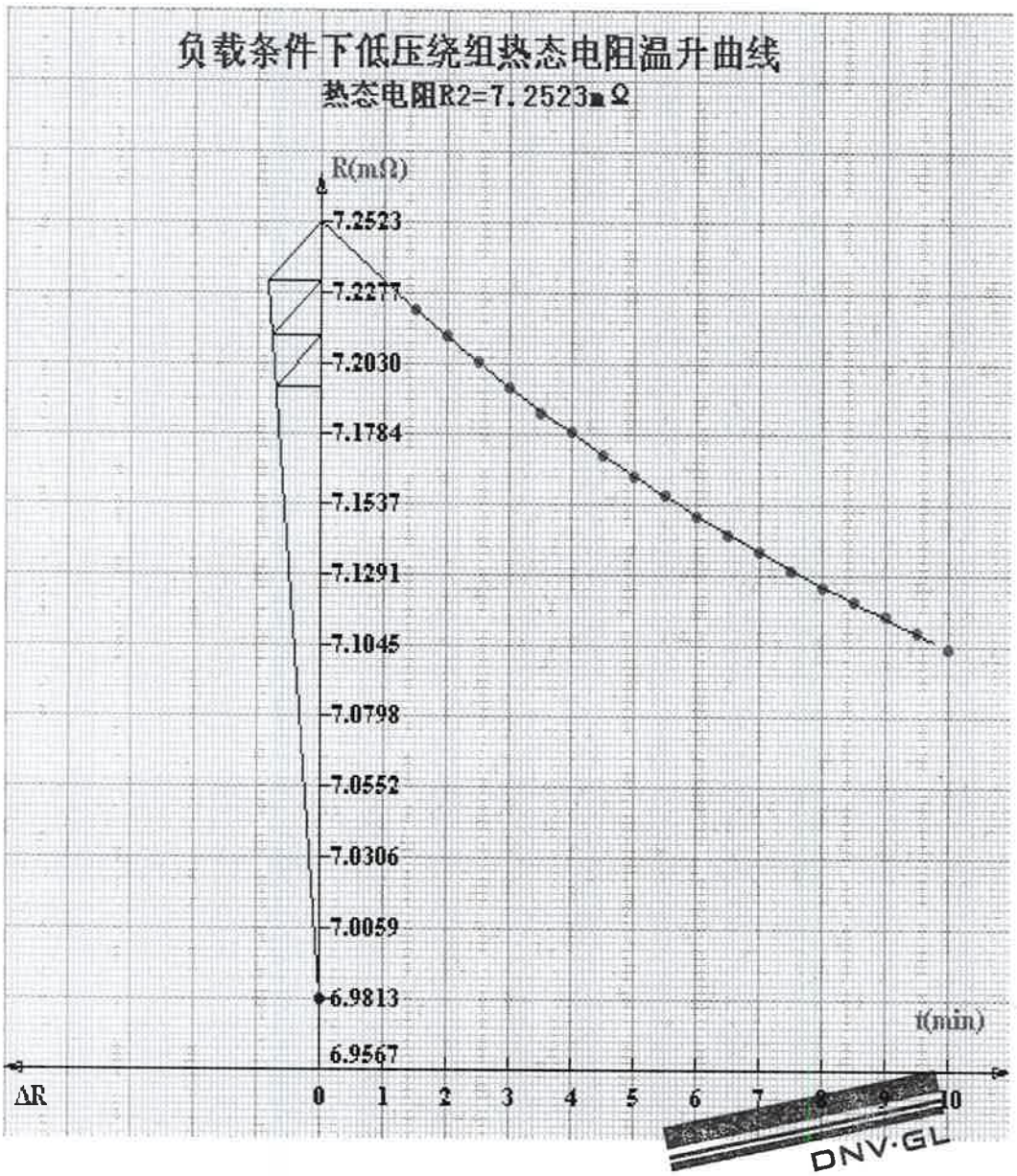
自冷低压热态电阻测量



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Date: 28/10/2015
KEMA Laboratories

4.试验结论：Test conclusion

SFZ-26000/132　1522043　号电力变压器温升试验的试验项目、方法及结果符合 IEC 60076-1: 2011、IEC60076-2: 2011 等标准及技术协议要求。

The test results of temperature rise test of SFZ-26000/132　1522043# power transformer are in accordance with IEC 60076-1:2011、IEC60076-2:2011 standards and technical agreements requirements.

试品试验 Test：

合格 Passed

编制 Edited by：　　审核 Examined by：

校核 Inspected　　审定 Authorized by：

Richard Houtepen
Date: 28/10/2015
KEMA Laboratories

达 驰

山东达驰电气有限公司
Shandong Dachi Electric Co., Ltd.
变压器油检验报告
Analysis Report of Transformer Oil

变压器型号 Transformer Type	SFZ-26000/132	报告编号 Report No.	1522043
使用单位 User Unit	/	油 号 Oil No.	25#
检验环境温度/相对湿度 Test Environment Temperature/Relative Humidity	19（℃）/58(%)	检验日期 Test Date	20151025

检验项目及结果 Test Items and Results
（试验前 Before the test）

检验项目 Test Item	检验结果 Test Result	检验方法 Test Method
外观 Appearance	透明，无沉淀物和机械杂质 Transparent, No Sediment and Mechanical Impurities	目测 Visula Measurement
介质损失角正切（90℃），% Dielectric Loss AngleTangent	0.077	IEC60274/IEC61620
击穿电压 kV Breakdown Voltage	60.6	IEC60156
含水量 mg/L Water Content	5.22	IEC60814

色谱分析组份（μl/l） Chromatographic Analysis	检验结果 Test Result	检验方法 Test Method
甲烷CH4	0.27	IEC60599:1999
乙烯 C2H4	0	
乙烷C2H6	0	
乙炔C2H2	0	
总烃C1+C2	0.27	
氢气H2	0.47	
一氧化碳CO	2.27	
二氧化碳CO2	34.05	

DNV·GL
Richard Houtepen
Date: 28/10/2015
KEMA Laboratories

结 论：
Conclusion:

以上检验项目及结果
The above test items and results

合格

Passed

试验人：祝佳霞
Inspector:

批 准：
Ratification:

达 驰

山东达驰电气有限公司
Shandong Dachi Electric Co., Ltd.
变压器油检验报告
Analysis Report of Transformer Oil

变压器型号 Transformer Type	SFZ-26000/132	报告编号 Report No.	1522043
使用单位 User Unit	/	油 号 Oil No.	25#
检验环境温度/相对湿度 Test Environment Temperature/Relative Humidity	18（℃）/58(%)	检验日期 Test Date	20151028

检验项目及结果 Test Items and Results
（试验后 After the test ）

检验项目 Test Item	检验结果 Test Result	检验方法 Test Method
外观 Appearance	透明，无沉淀物和机械杂质 Transparent, No Sediment and Mechanical Impurities	目测 Visula Measurement
介质损失角正切（90℃），% Dielectric Loss AngleTangent	0.058	IEC60274/IEC61620
击穿电压 kV Breakdown Voltage	61.5	IEC60156
含水量 mg/L Water Content	4.65	IEC60814

色谱分析组份（μl/l） Chromatographic Analysis	检验结果 Test Result	检验方法 Test Method
甲烷CH4	0.41	IEC60599:1999
乙烯 C2H4	0	
乙烷C2H6	0	
乙炔C2H2	0	
总烃C1+C2	0.41	
氢气H2	0.97	
一氧化碳CO	6.2	
二氧化碳CO2	42.77	

结 论：
Conclusion:

以上检验项目及结果
The above test items and results

合格

Passed

试验人：祝佳霞 Inspector:

批 准： Ratification:

DNV·GL
Richard Houtepen
Date: 28/10/2015
KEMA Laboratories