

SIEMENS



LAB N° 0935 L



TEST REPORT

N° RP LS 19/164A

	TEST REPORT	
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CLIENT: ELCON MEGARAD S.p.A.
Via Amoretta, 6/E
Parco San Nicola 83100 – Avellino (Italy)

DEVICES UNDER TEST: Shrinkable indoor/outdoor terminations for cables

TYPES: ELCOTERM TIS – 2482X/W-3X1-NL-03
ELCOTERM TES – 2484X/W-3X1-NL-03

PURPOSE OF THE TEST: Type test

TEST PERFORMED ACCORDING TO: IEC 61442: 2005 item 10 - 11

TEST PERFORMED AT: Power Test Section of SVEPPI Laboratory
Via Alessandro Volta, 34/A - 30037 Scorzè (VE)
ITALY

LIST OF TESTS PERFORMED: Thermal short-circuit test (screen)
Thermal short-circuit test (conductor)

RECEIPT'S DATE OF TEST OBJECT: 26th June 2019

PERIOD OF TEST: 04th - 05th July 20169

TEST WITNESSED BY: Mr. G. De Simone ELCON MEGARAD

Siemens S.p.A.
Laboratorio SVEPPI


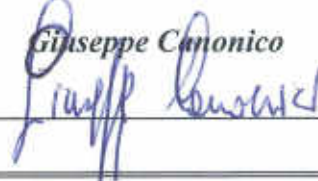
THIS TEST REPORT IS COMPOSED BY:





Nr. total pages 24

Nr. oscillograms 09

Nr. Drawings 02: see page 2

The data necessary to permit repetition of the tests are contained in the document marked
“TEST'S DOCUMENTATION” n. LS 19/164.

Issue	Charged of test	Laboratory's manager
July 2019		

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MANUFACTURER: ELCON MEGARAD S.p.A.
Via Nazionale, 110
83030- Montefredane (AV) – Loc. Arcella (AV)

SERIAL NUMBER OF DEVICE UNDER TEST: Indoor terminals AT036-19, AT037-19, AT038-19
Outdoor terminals AT051-19, AT052-19, AT053-19

The sampling has been carried out by the customer





RATINGS ASSIGNED BY MANUFACTURER OF DEVICE UNDER TEST

Rated voltage U_0/U 12/20 kV

IDENTIFICATION OF DEVICE UNDER TEST





The drawings listed on following table have been verified by SVEPPI Laboratory. The drawings have attached to the test report.

<i>Title</i>
ELCOTERM TES – 2484X EXTERNAL DIMENSION
ELCOTERM TIS – 2482X EXTERNAL DIMENSION

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1. TESTS PERFORMED

1.1. Thermal short-circuit test on screen/armour

On two test sets of three cables type YMeKrvaslqwd Fca 12/20 kV, were fitted with outdoor terminals type “ELCOTERM TIS – 2482X/W-3X1-NL-03” first test sets under test and indoor terminals type “ELCOTERM TES – 2484X/W-3X1-NL-03” second test sets under test.

On the screen of (35mm²) copper were performed two three-phase thermal short-circuit test of 5 kA for 1 second for test sets indoor terminal and outdoor terminal.





Before the tests the cables were heated to a stabilized temperature on main conductor of extruded cables of 95 – 97°C and kept for two hours at this temperature. The corresponding temperature on sheath at above cable temperature was 73 °C with ambient temperature of 28-30 °C (to see photo nr. 1 and photo no. 12). The setting of temperature was determined by one thermocouple applied in the sheath of the cable, at 0,5 meter of the terminals under test.

1.2. Thermal short-circuit test on conductor

On two test sets of three cables type YMeKrvaslqwd Fca 12/20 kV, were fitted with outdoor terminals type “ELCOTERM TIS – 2482X/W-3X1-NL-03” first test sets under test and indoor terminals type “ELCOTERM TES – 2484X/W-3X1-NL-03” second test sets under test.

On the conductors of 240 mm² (aluminum) were performed two three-phase thermal short-circuit test of 27,8 kA for 1 seconds for test sets indoor terminal and outdoor terminal.

Before first thermal short-circuit test, the test loop was at ambient temperature of 31-32°C.

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2. TEST ARRANGEMENT

2.1. Thermal short-circuit test on screen/armour of outdoor terminals ELCOTERM TES – 2484X/W-3X1-NL-03

The cables of test sets were fixed to the supporting structure by means some anchor systems. The three-phase power supply was applied between the three terminals of the screen, the screen terminals under test were connected to the short-circuit at ground point. For test arrangement see photo nr. 2.

2.1.1. Oscillogram table

<i>Oscillogram No.</i>	<i>Peak value [kA]</i>	<i>Test current rms value ⁽¹⁾ [kA]</i>	<i>I^2t [(kA)²s]</i>	<i>Duration [s]</i>	<i>Note</i>
188982	11,8	5,5	3	0,118	Calibration current
188984	12,1	5,5	30	1,008	Outdoor terminals
188985	13,0	5,5	30	1,011	Outdoor terminals

(1) mean value on three phases





2.1.2. Measurement of resistance

The resistance measurement was carried out at ambient temperature with 100A_{dc}.

Note		Measured phase			External air temperature °C
		AT051-19	AT052-19	AT053-19	
Before test	Resistance [μΩ]	3107	3007	3104	28,0
After test	Resistance [μΩ]	3077	2981	3078	28,5

2.1.3. Conditions of test object after tests

A visual inspection did not show deteriorations on terminals screen (to see photos nr. 8 to 11).

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2.2. Thermal short-circuit test on screen/armour of indoor terminals ELCOTERM TIS – 2482X/W-3X1-NL-03

The cables of test sets were fixed to the supporting structure by means some anchor systems. The three-phase power supply was applied between the three terminals of the screen, the screen terminals under test were connected to the short-circuit at ground point. See photo nr. 13.

2.2.1. Oscillogram table

<i>Oscillogram No.</i>	<i>Peak value [kA]</i>	<i>Test current rms value ⁽¹⁾ [kA]</i>	<i>I^2t [(kA)²s]</i>	<i>Duration [s]</i>	<i>Note</i>
188986	11,9	5,5	30	1,010	Indoor terminals
188987	11,9	5,5	30	1,009	Indoor terminals

(1) mean value on three phases





2.2.2. Measurement of resistance

The resistance measurement was carried out at ambient temperature with 100A_{dc}.

Note		Measured phase			External air temperature °C
		AT036-19	AT037-19	AT038-19	
Before test	Resistance [μΩ]	3214	3204	3150	28,0
After test	Resistance [μΩ]	3144	3127	3098	28,5

2.2.3. Conditions of test object after tests

A visual inspection did not show deteriorations on terminals screen (to see photos nr.18 to 20).

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2.3. Thermal short-circuit test on conductor indoor terminals ELCOTERM TIS – 2482X/W-3X1-NL-03

The cables of test sets were fixed to the supporting structure by means some anchor systems. The three-phase power supply was applied between the three terminals of the conductor, the conductor terminals under test were connected to the short-circuit at ground point. See photos nr. 21

2.3.1. Oscillogram table

<i>Oscillogram No.</i>	<i>Peak value [kA]</i>	<i>Test current rms value⁽¹⁾ [kA]</i>	<i>I^2t [(kA)²s]</i>	<i>Duration [s]</i>	<i>Note</i>
188990	53,8	28,0	786	1,003	Indoor terminals
188991	52,9	27,9	782	1,003	Indoor terminals

(1) mean value on three phases





2.3.2. Measurement of resistance

The resistance measurement was carried out at ambient temperature with 100A_{dc}.

Note		Measured phase			External air temperature °C
		AT036-19	AT037-19	AT038-19	
Before test	Resistance [μΩ]	769	763	753	28,0
After test	Resistance [μΩ]	752	756	742	28,5

2.3.3. Conditions of test object after tests

A visual inspection did not show deteriorations on terminals conductor (to see photos nr.25 to 27).

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2.4. Thermal short-circuit test on conductor outdoor terminals ELCOTERM TES – 2484X/W-3X1-NL-03

The cables of test sets were fixed to the supporting structure by means some anchor systems. The three-phase power supply was applied between the three terminals of the conductor, the conductor terminals under test were connected to the short-circuit at ground point. See photos nr. 28.

2.4.1. Oscillogram table

<i>Oscillogram No.</i>	<i>Peak value [kA]</i>	<i>Test current rms value⁽¹⁾ [kA]</i>	<i>I^2t [(kA)²s]</i>	<i>Duration [s]</i>	<i>Note</i>
188992	51,8	28,0	786	1,003	Outdoor terminals
188993	51,7	28,0	785	1,003	Outdoor terminals

(2) mean value on three phases





2.4.2. Measurement of resistance

The resistance measurement was carried out at ambient temperature with 100A_{dc}.

Note		Measured phase			External air temperature °C
		AT051-19	AT052-19	AT053-19	
Before test	Resistance [μΩ]	744	718	743	28,0
After test	Resistance [μΩ]	738	712	741	28,5

2.4.3. Conditions of test object after tests

A visual inspection did not show deteriorations on terminals conductor (to see photos nr.32 to 34).

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3. LIST OF INSTRUMENTS USED

3.1. Short-circuit tests on screen





<i>Quantities</i>	<i>Symbol used on oscillogram</i>	<i>Symbol used on circuit diagram</i>	<i>Instrument's tag</i>	<i>Uncertainty</i>
Test current phase R	I_R	I_R	CM 850	4,2% screen
Test current phase R	I_R	I_R	CM 862	4,2% conductor
Voltage phase R	U_R	U_R	CM 865V	3,5%
Test current phase S	I_S	I_S	CM 851	4,2% screen
Test current phase S	I_S	I_S	CM 863	4,2% conductor
Voltage phase S	U_S	U_S	CM 866	3,5%
Test current phase T	I_T	I_T	CM 852	4,2% screen
Test current phase T	I_T	I_T	CM 864	4,2% conductor
Voltage phase T	U_T	U_T	CM 881	3,5%

Note: Expanded uncertainty with coverage factor $K=2$, confidence level = 95 %

3.2. Measurement of the resistance

<i>Quantities</i>	<i>Measure chain tag</i>	<i>Uncertainty</i>
Current generator	MI 850	2,0%
Voltage drop	MU 082	0,5%
Resistance	-	2,1%
Environmental Temperature	TT 850	2,0°C

Note: Expanded uncertainty with coverage factor $K=2$, confidence level = 95 %

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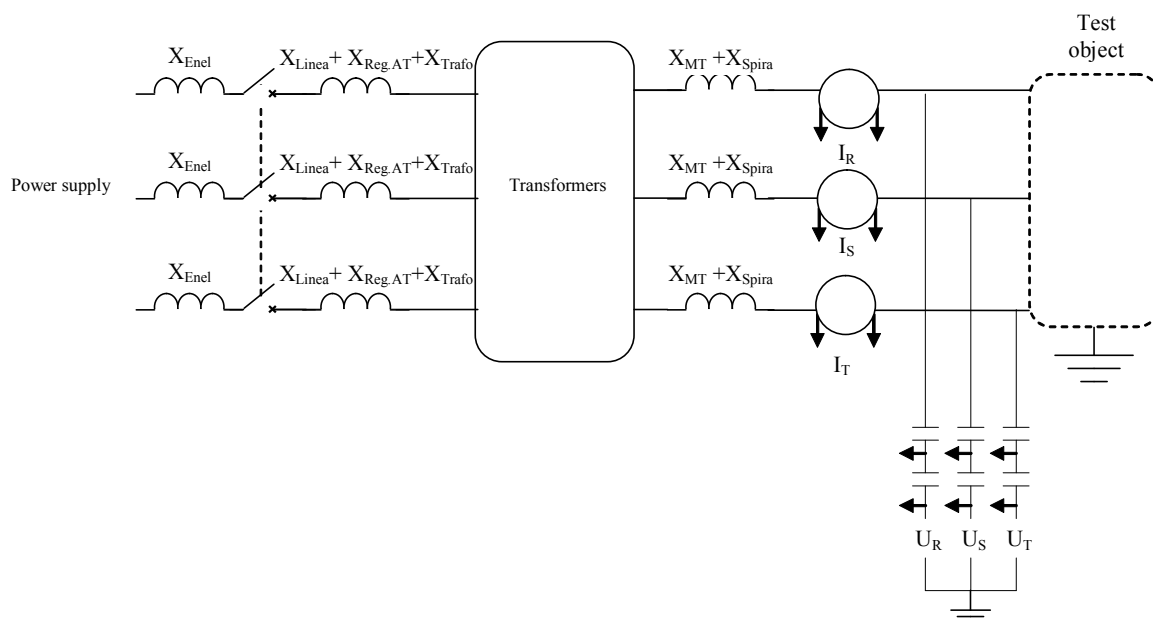
3.3. Measurement of temperature

<i>Measure chain tag</i>	<i>Uncertainty</i>
TE 015	$\pm 2,5\text{ }^{\circ}\text{C}$

Note: Expanded uncertainty with coverage factor $K=2$, confidence level = 95 %

4. CIRCUIT DIAGRAM

4.1. Test on screen/armour



Power supply

230 kV 50Hz

Transformers

Primary 132 +66 Star with neutral point (windings)

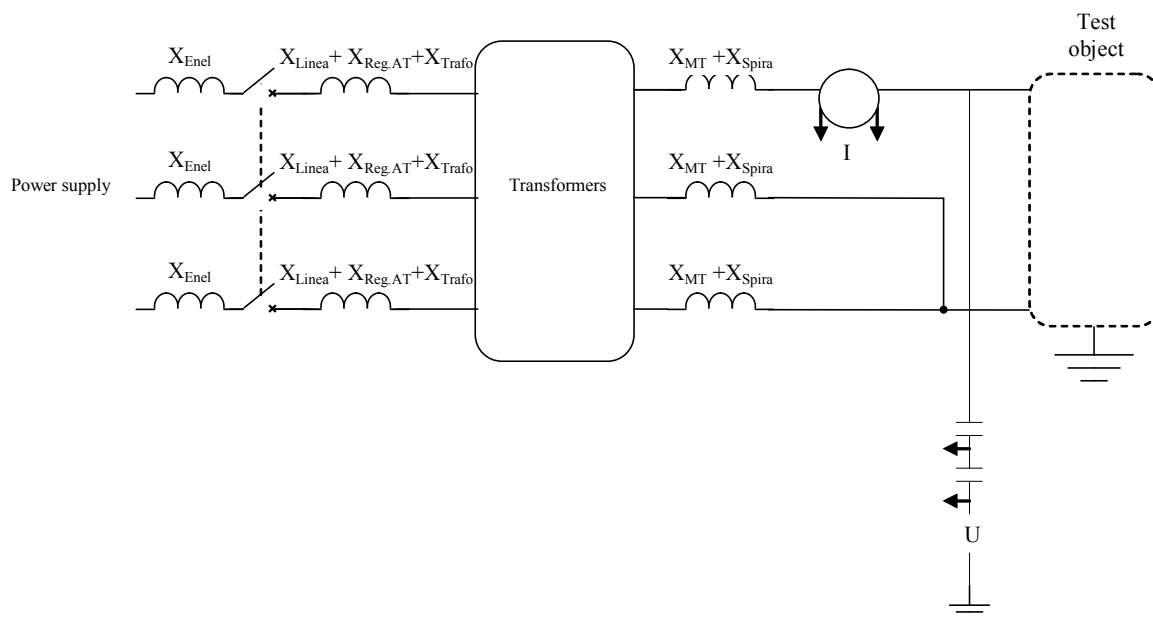
Secondary 11 Star (windings)

Ratio 18

Test voltage 12,7 kV

X_{Enel} [Ω]	X_{Linea} [Ω]	$X_{Reg.AT}$ [Ω]	X_{Trafo} [Ω]	X_{MT} [Ω]	X_{Spira} [Ω]	Note
5,5	25	6 x 5,2	10,25	1,115	0,01	

4.2. Test on conductor



Power supply

230 kV 50Hz

Transformers





Primary 132 +66 Star with neutral point (windings)

Secondary 11 Star (windings)

Ratio 18

Test voltage 12,7 kV

X_{Enel} [Ω]	X_{Linea} [Ω]	$X_{Reg.AT}$ [Ω]	X_{Trafo} [Ω]	X_{MT} [Ω]	X_{Spira} [Ω]	Note
5,5	25	6 x 5,2	10,25	0,031	0,01	

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5. PHOTOS

5.1. Thermal short-circuit test (screen/armour) outdoor terminals



Photo 1: arrangement for heating cables



Photo 2: arrangement for thermal short-circuit test on screen/armour



Photo 3: serial number



Photo 4: before test



Photo 5: before test



Photo 6: before test



Photo 7: before test



Photo 8: after test







Photo 9: after test



Photo 10: after test



Photo 11: after test

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5.2. Thermal short-circuit test (screen/armour) indoor terminals



Photo 12: arrangement for heating cables



Photo 13: arrangement for thermal short-circuit test on screen/armour



Photo 14: serial number



Photo 15: before test



Photo 16: before test



Photo 17: before test







Photo 18: after test



Photo 19: after test



Photo 20: after test

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5.3. Thermal short-circuit test (conductor) indoor terminals

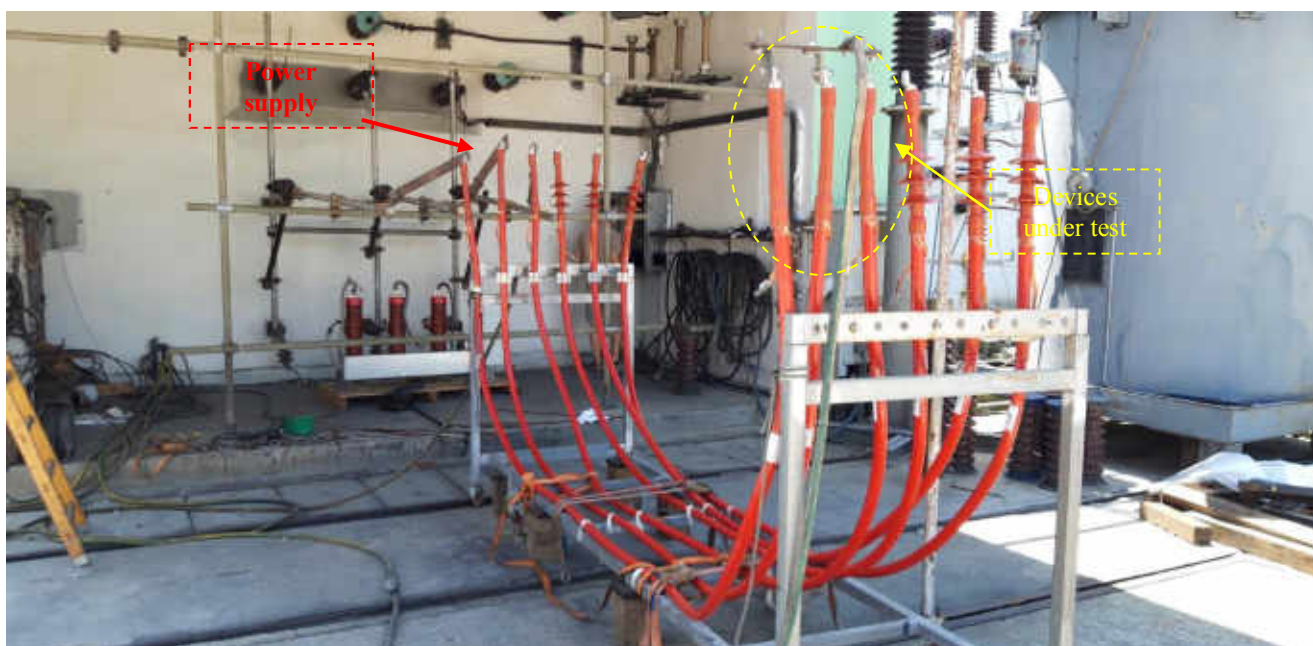


Photo 21: arrangement test



Photo 22: before test

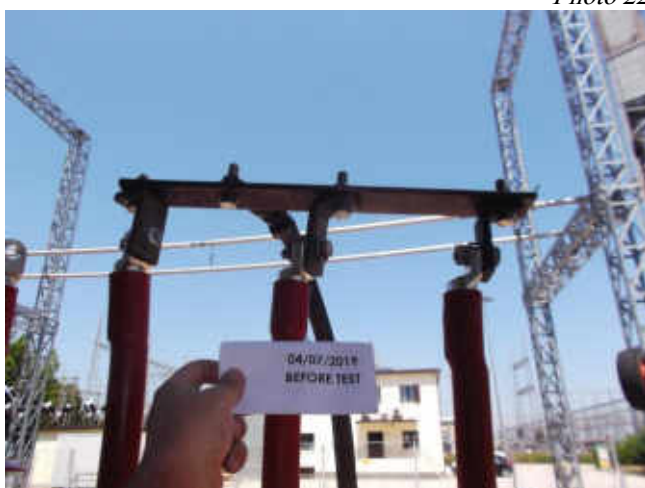


Photo 23: before test



Photo 24: before test







Photo 25: after test



Photo 26: after test



Photo 27: after test

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5.1. Thermal short-circuit test (conductor) outdoor terminals



Photo 28: arrangement test



Photo 29: before test



Photo 30: before test



Photo 31: before test



Photo 32: after test

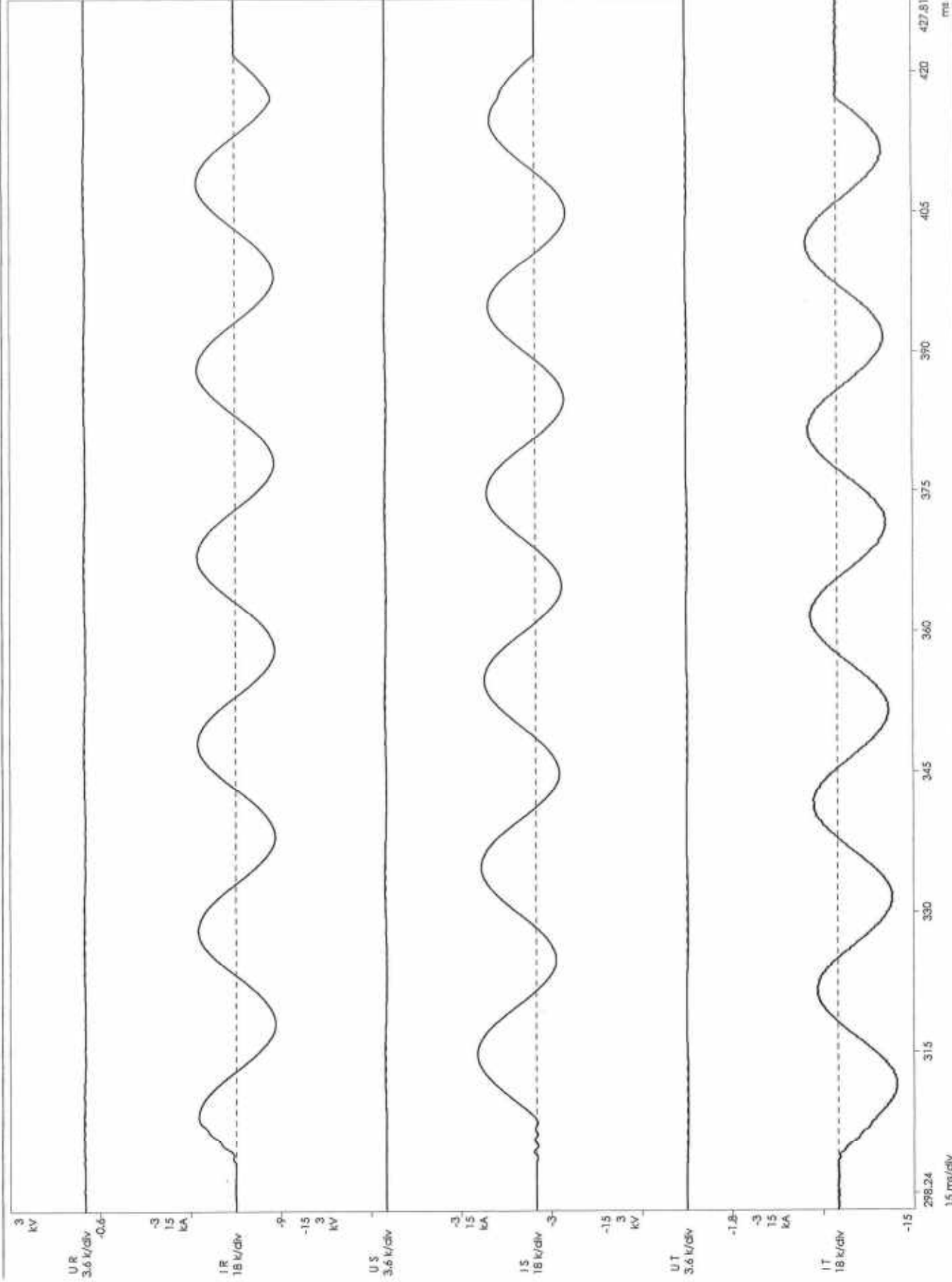


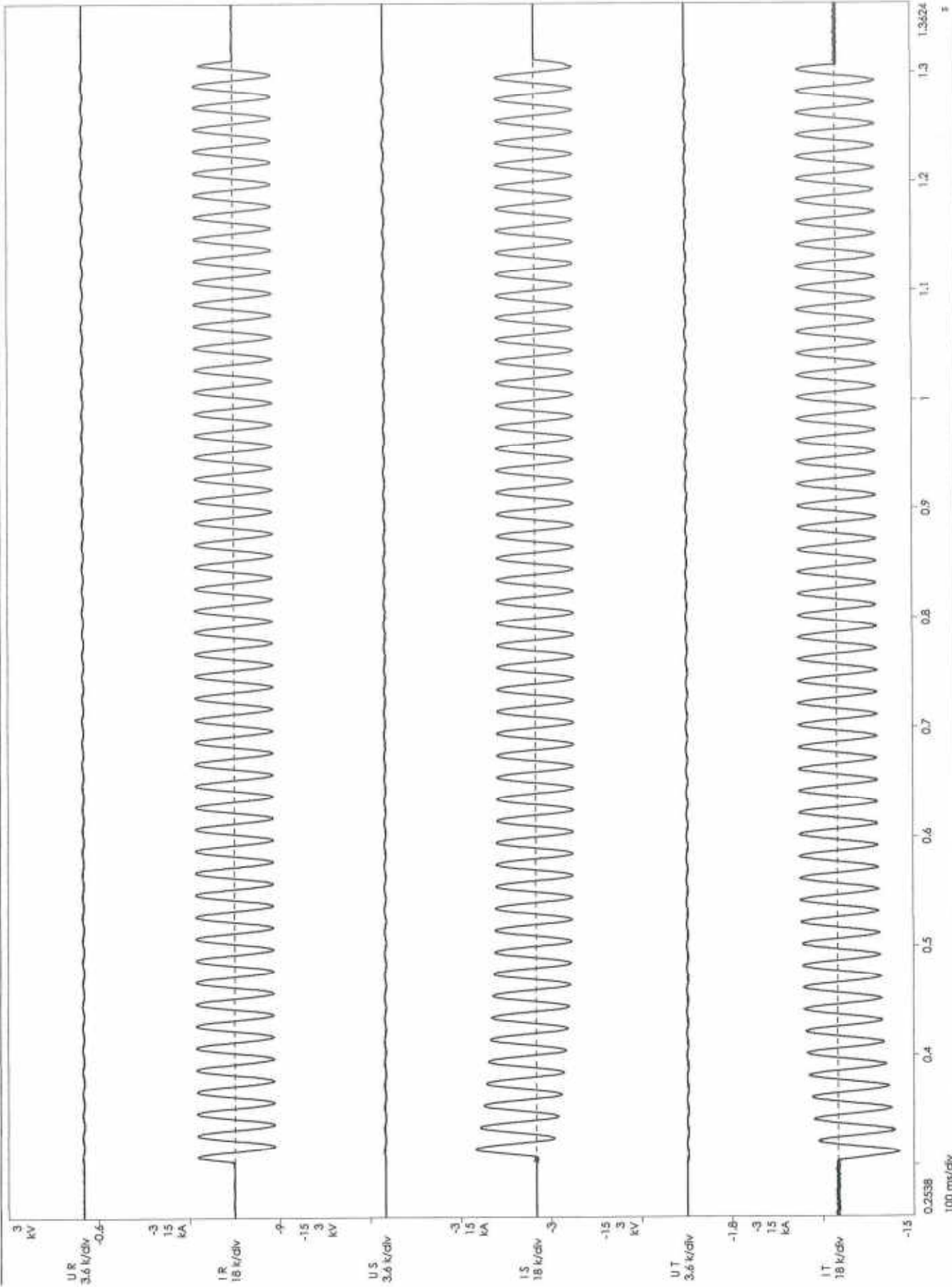
Photo 33: after test

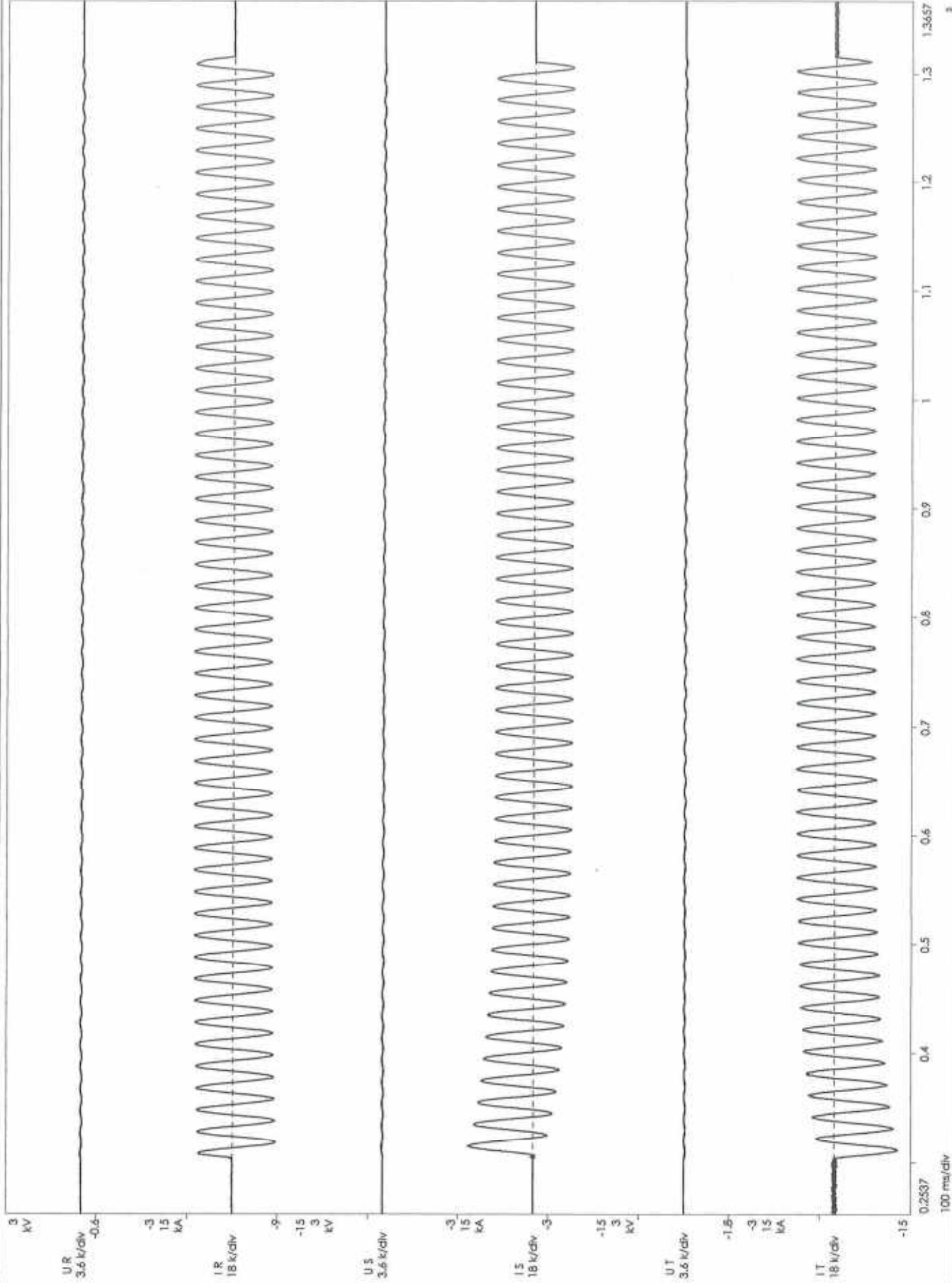


Photo 34: after test

END OF REPORT





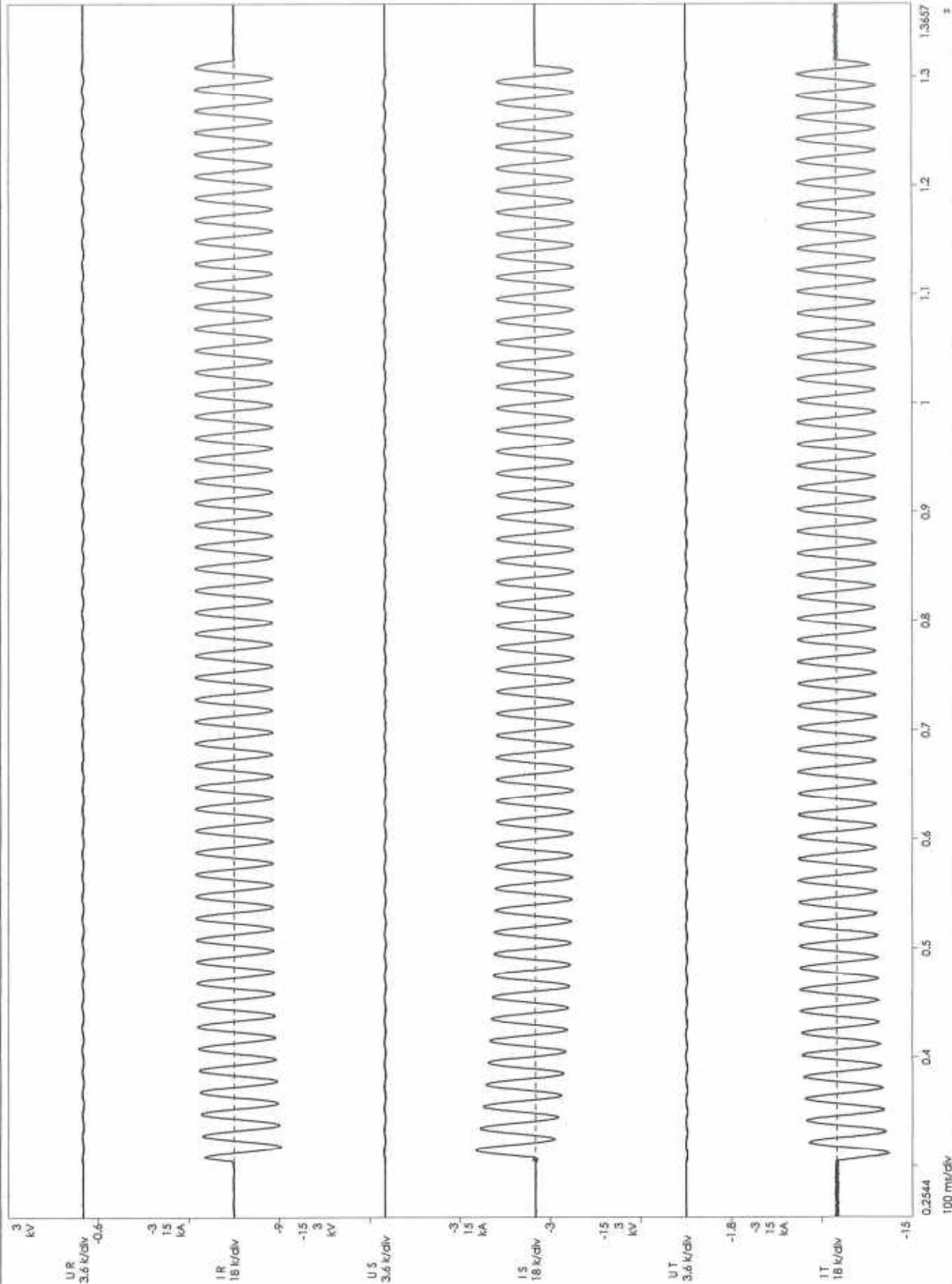


test current

phase R	
R.M.S. value	5.5 kA
peak value	8.6 kA
phase S	
R.M.S. value	5.4 kA
peak value	13.0 kA
phase T	
R.M.S. value	5.5 kA
peak value	12.5 kA
mean value	5.5 kA
duration	1.011 s
i^2t	30 (kA) ² s

Note

1 amb = 29.4 °C

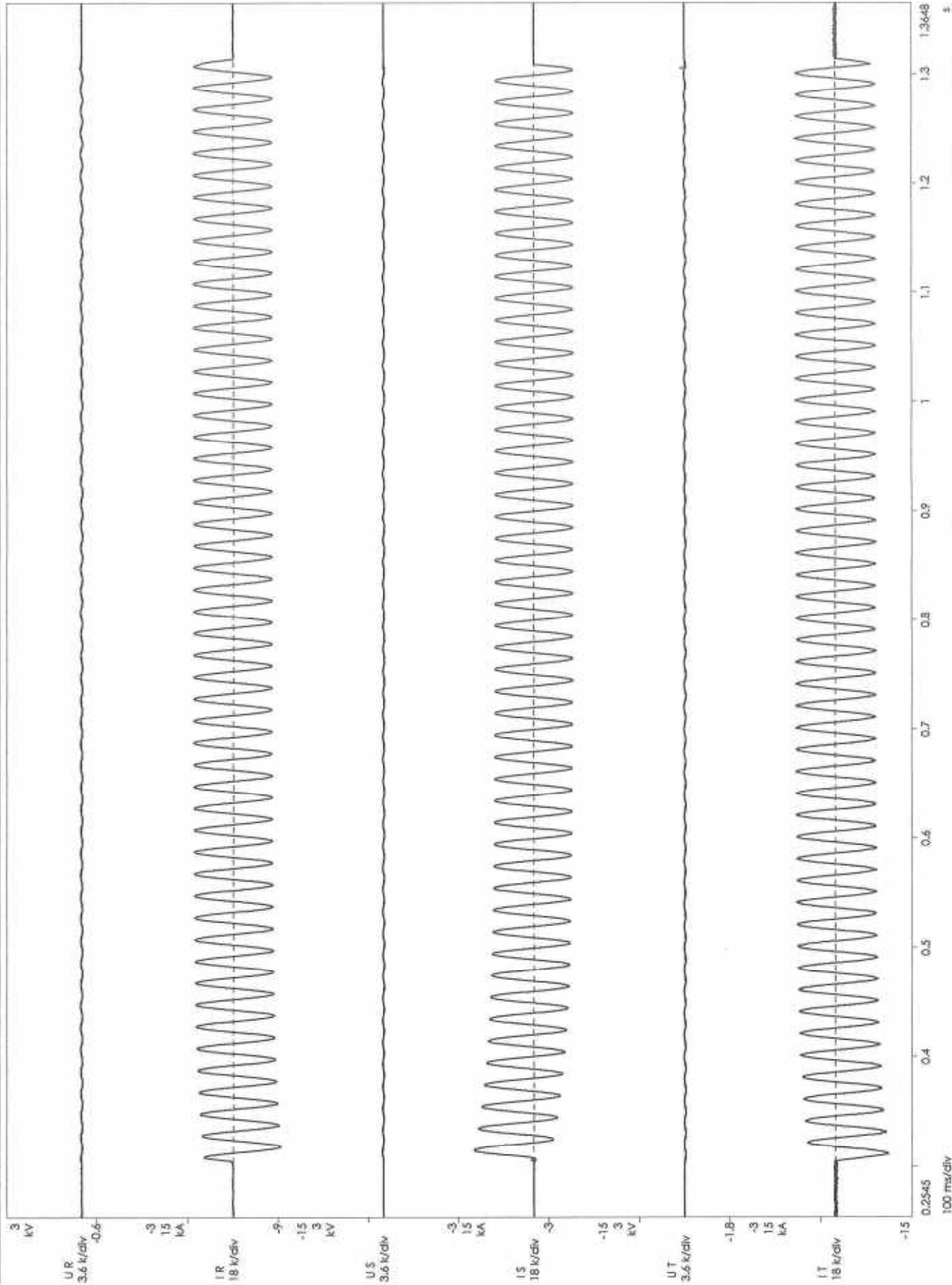


test current

phase R	
R.M.S. value	5.5 kA
peak value	9.4 kA
phase S	
R.M.S. value	5.4 kA
peak value	11.9 kA
phase T	
R.M.S. value	5.5 kA
peak value	10.4 kA
mean value	5.5 kA
duration	1.010 s
I^2t	30 (kA) ² s

Note

$t_{amb} = 30.0 ^\circ\text{C}$

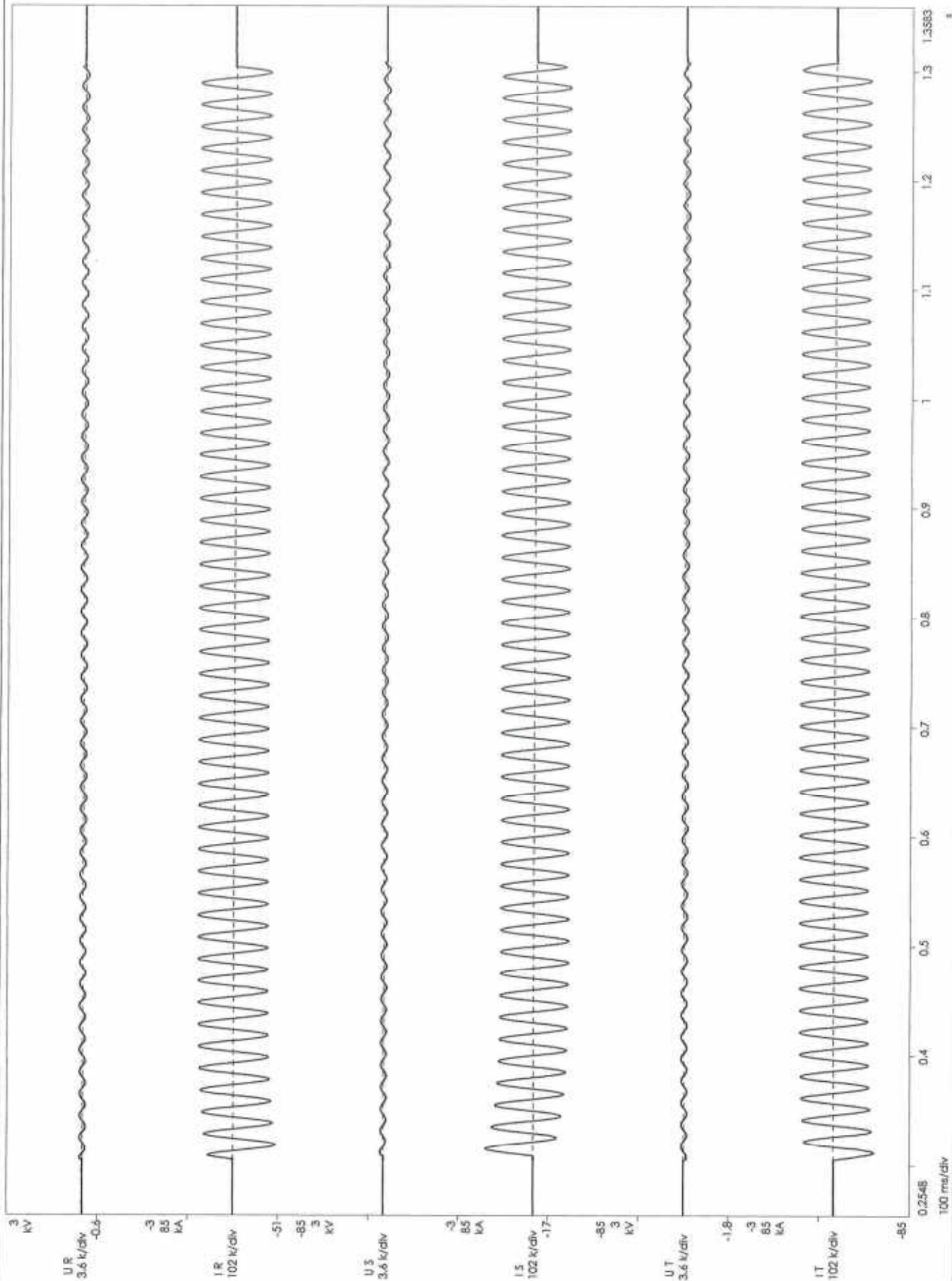


test current

phase R	
R.M.S. value	5.5 kA
peak value	9.5 kA
phase S	
R.M.S. value	5.4 kA
peak value	11.9 kA
phase T	
R.M.S. value	5.6 kA
peak value	10.4 kA
mean value	5.5 kA
duration	1.009 s
i_2	30 (kA) ² s

Note

$t_{amb} = 30.0\text{ }^{\circ}\text{C}$

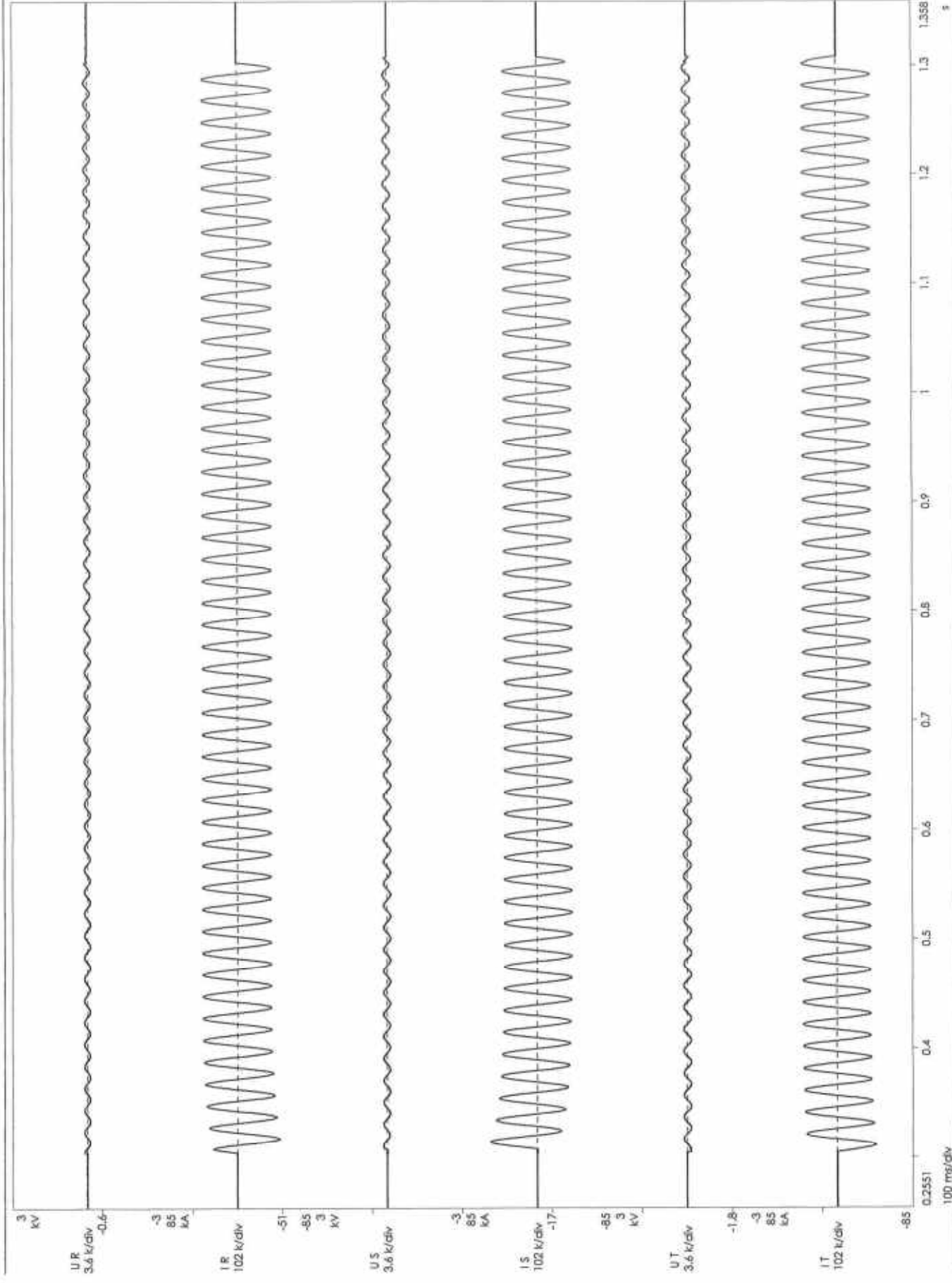


test current

phase R	
R.M.S. value	28.3 kA
peak value	47.9 kA
phase S	
R.M.S. value	27.8 kA
peak value	53.8 kA
phase T	
R.M.S. value	27.9 kA
peak value	45.2 kA
mean value	28.0 kA
duration	1.003 s
I_{R1}	786 (kA) ² s

Note

$T_{amb} = 31.0^{\circ}\text{C}$

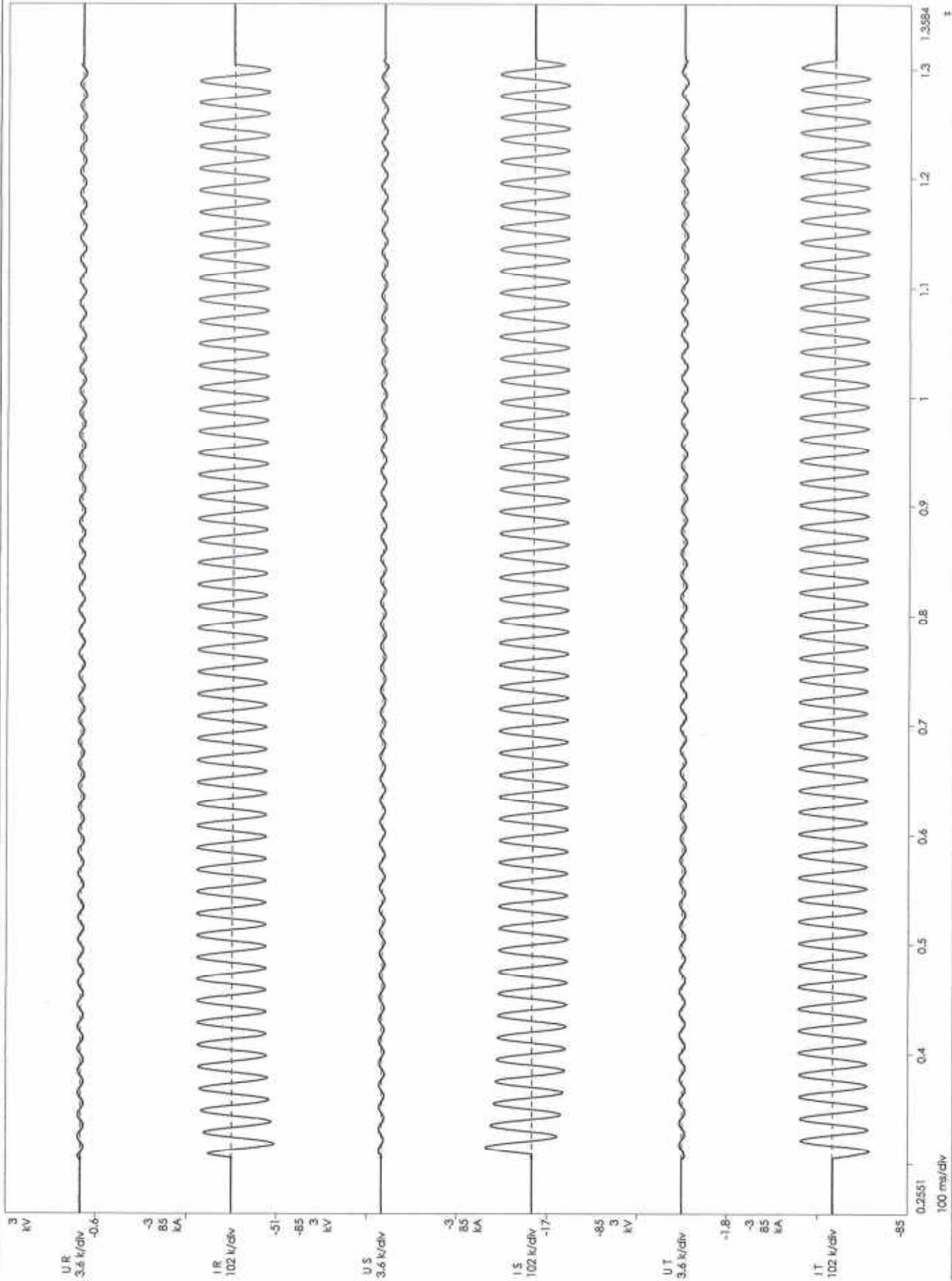


test current

phase R	
R.M.S. value	28.2 kA
peak value	48.2 kA
phase S	
R.M.S. value	27.8 kA
peak value	52.9 kA
phase T	
R.M.S. value	27.8 kA
peak value	43.6 kA
mean value	27.9 kA
duration	1.003 s
I^2t	782 (kA) ² s

Note

t amb = 32.0 °C

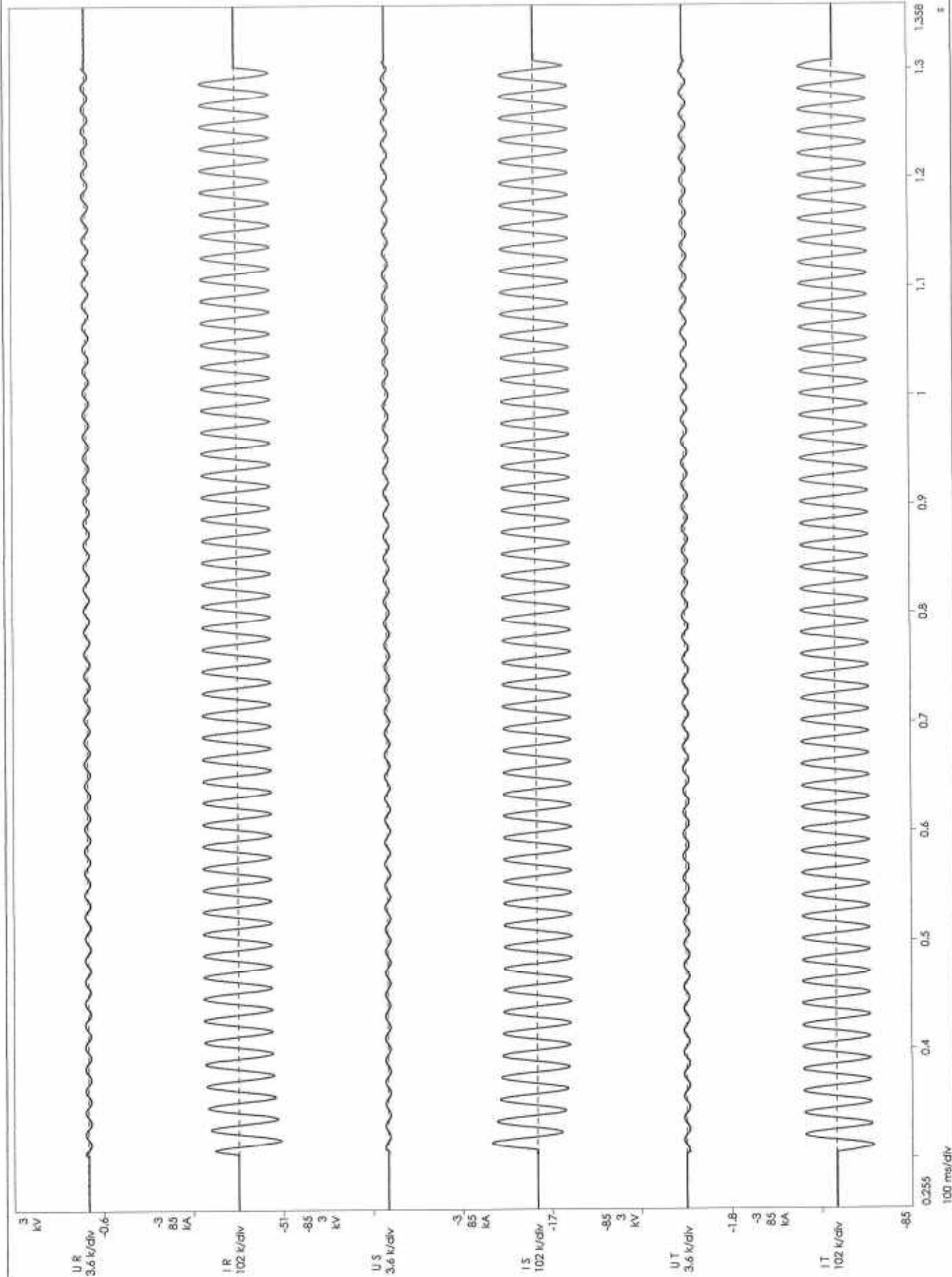


test current

phase R	
R.M.S. value	28.3 kA
peak value	48.8 kA
phase S	
R.M.S. value	27.9 kA
peak value	51.8 kA
phase T	
R.M.S. value	27.8 kA
peak value	41.9 kA
mean value	28.0 kA
duration	1.003 s
i^2t	786 (kA) ² s

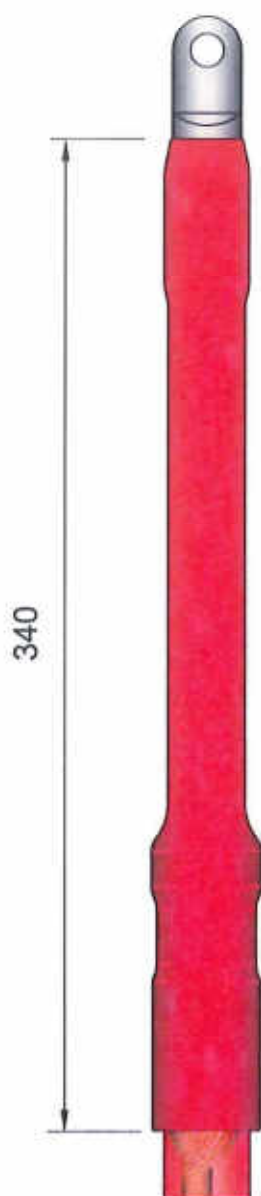
Note

$t_{amb} = 32.0 ^\circ C$



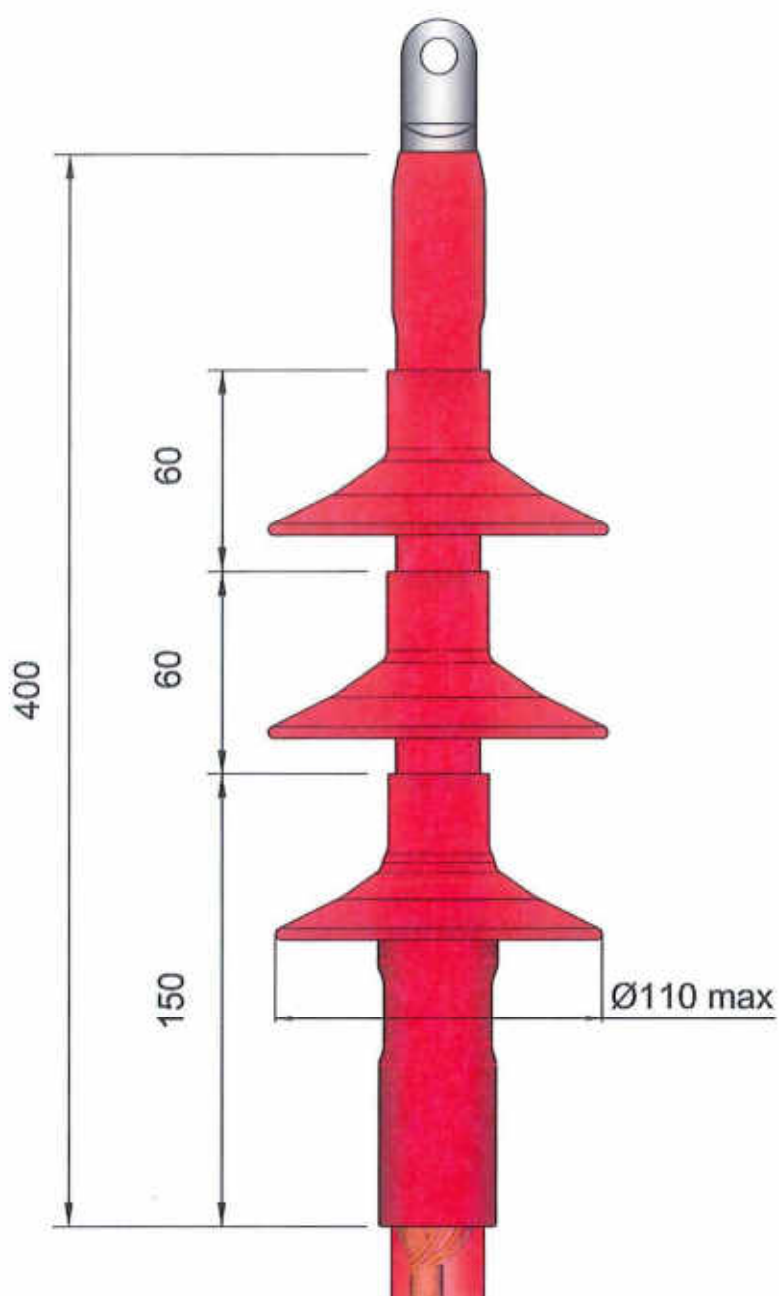
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EXTERNAL DIMENSION



ELCOTERM TES - 2484X

EXTERNAL DIMENSION





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