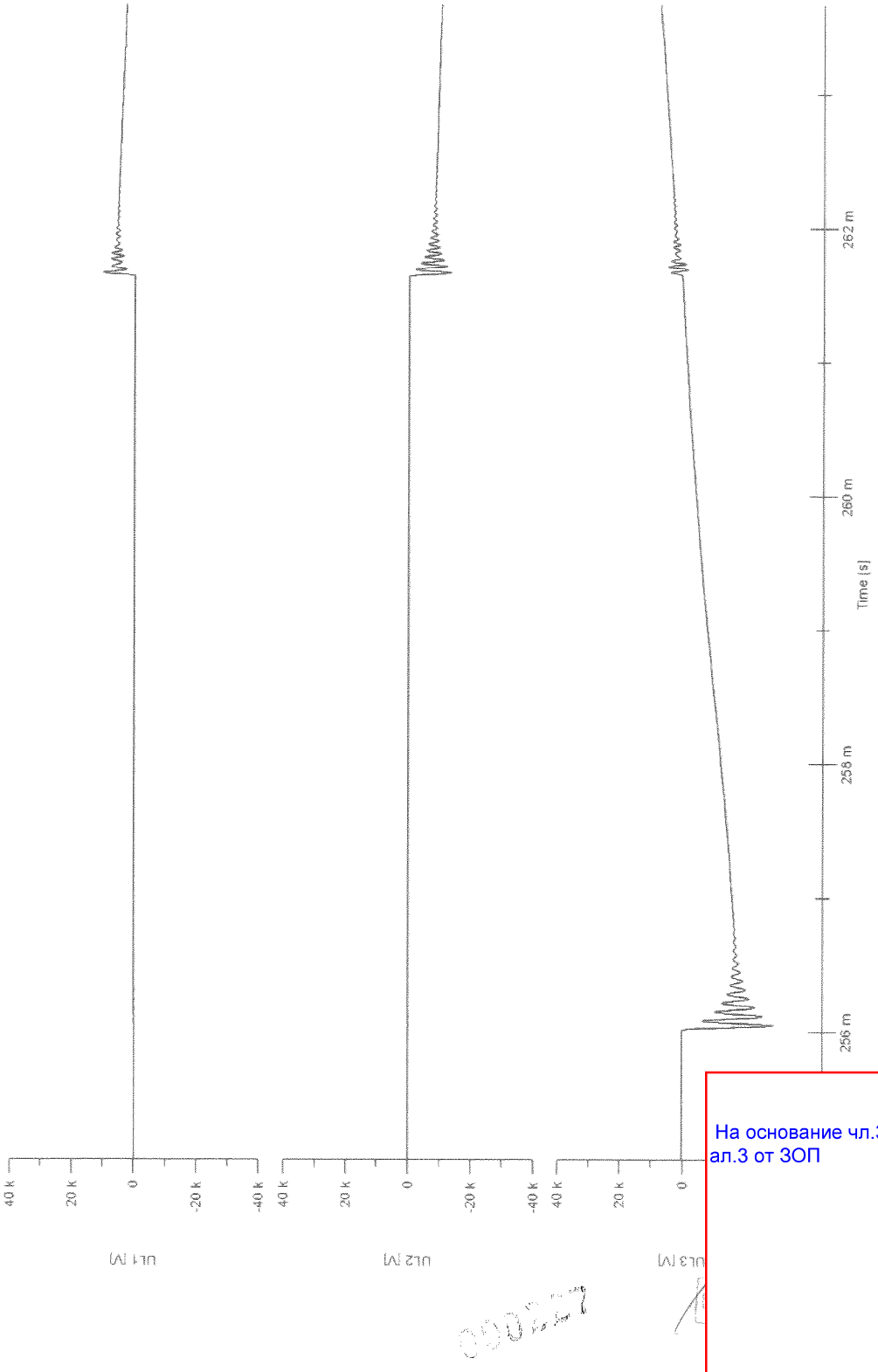
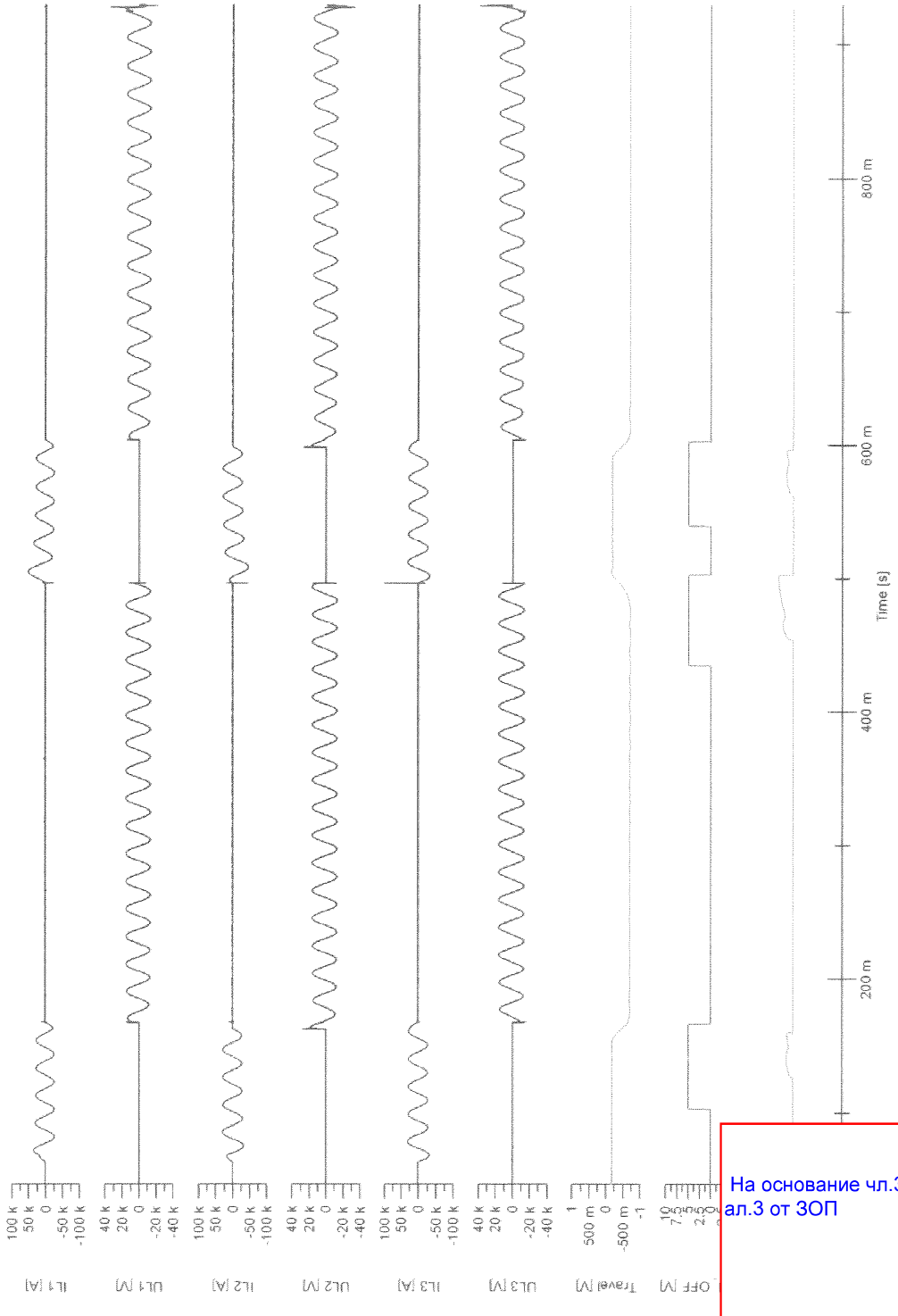
Oscillogram No. PEHLA 09137Ra / 06
Test Duty T30: CO (TRV)



На основание чл.36а ал.3 от ЗОП

18PE0402

Oscillogram No. PEHLA 09137Ra / 10
Test Duty T60: O-0.3s-CO

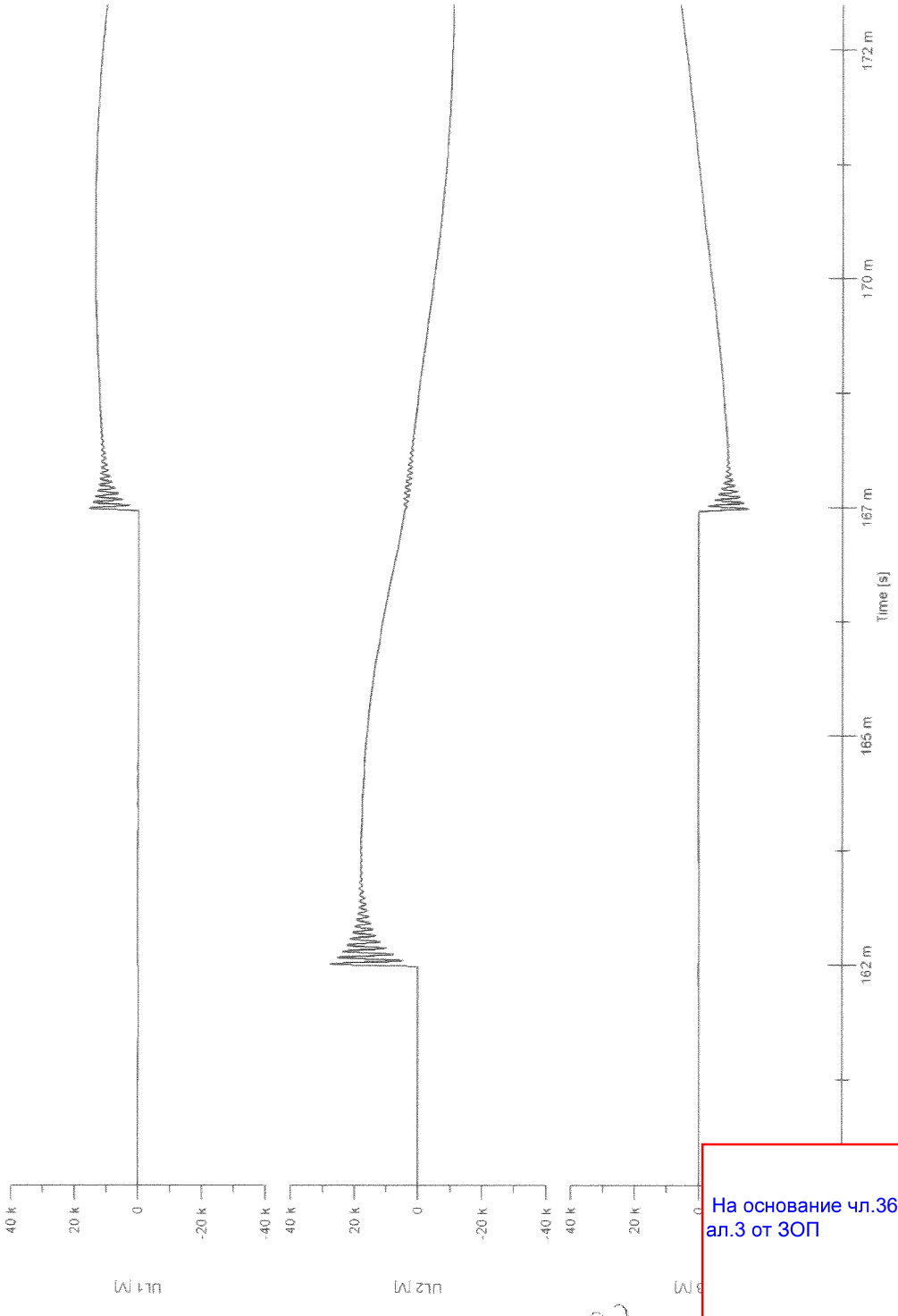


На основание чл.36а ал.3 от ЗОП

18PE0402

Oscillogram No. PEHLA 09137Ra / 10

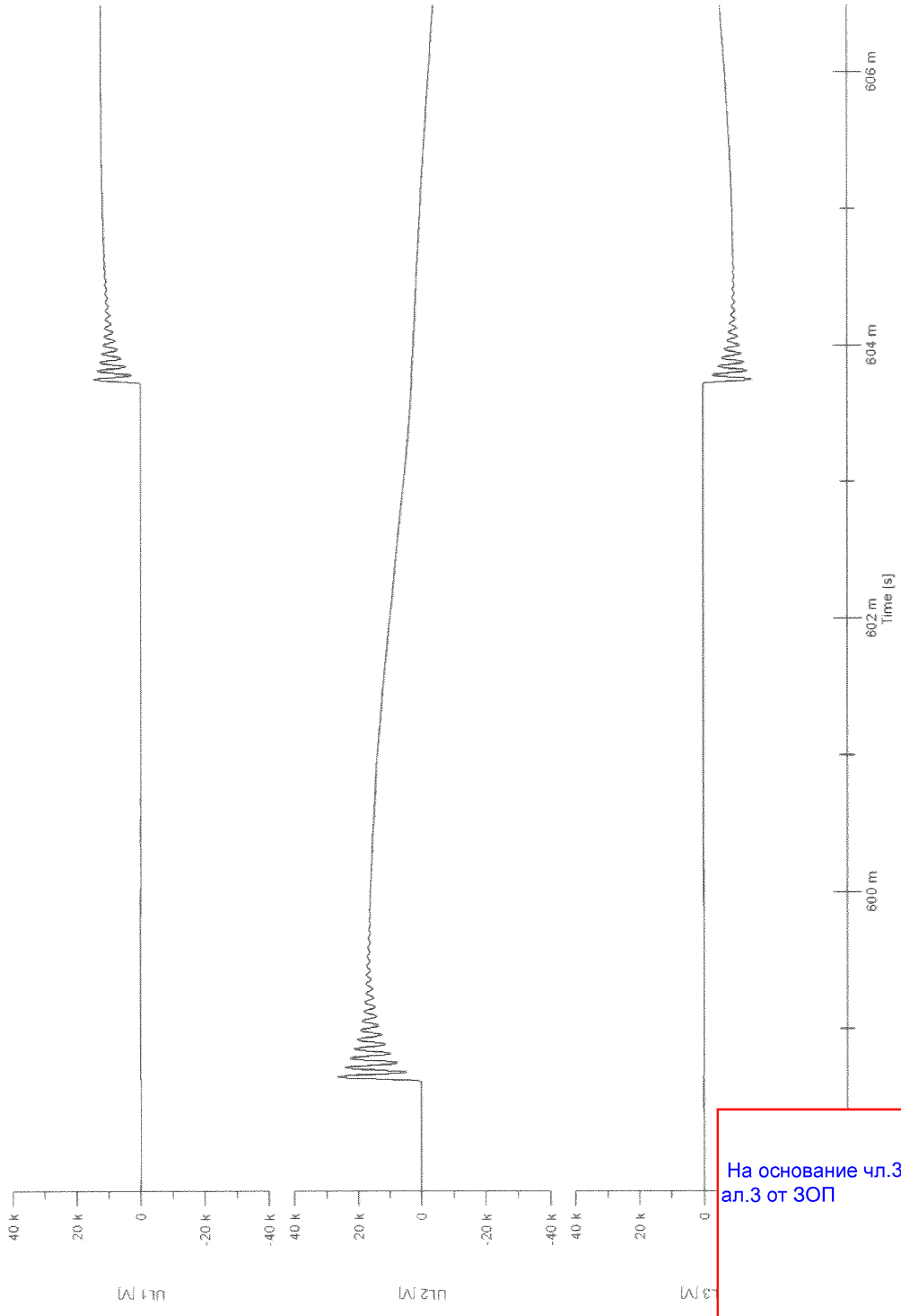
Test Duty T60: O-0.3s-CO (TRV, 1st O)



На основание чл.36а ал.3 от ЗОП

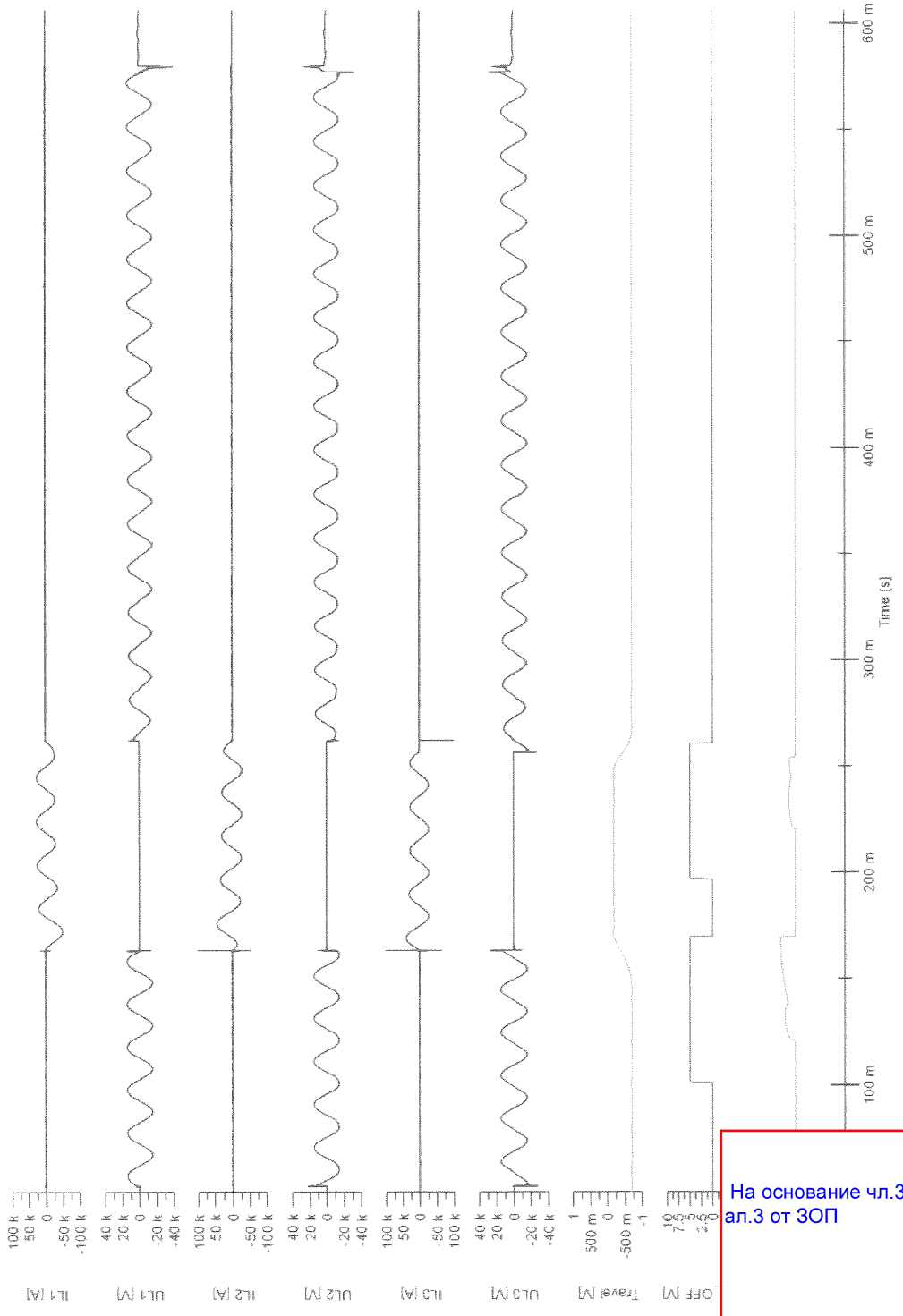
Oscillogram No. PEHLA 09137Ra / 10

Test Duty T60: O-0.3s-CO (TRV, 2nd O)



На основание чл.36а ал.3 от ЗОП

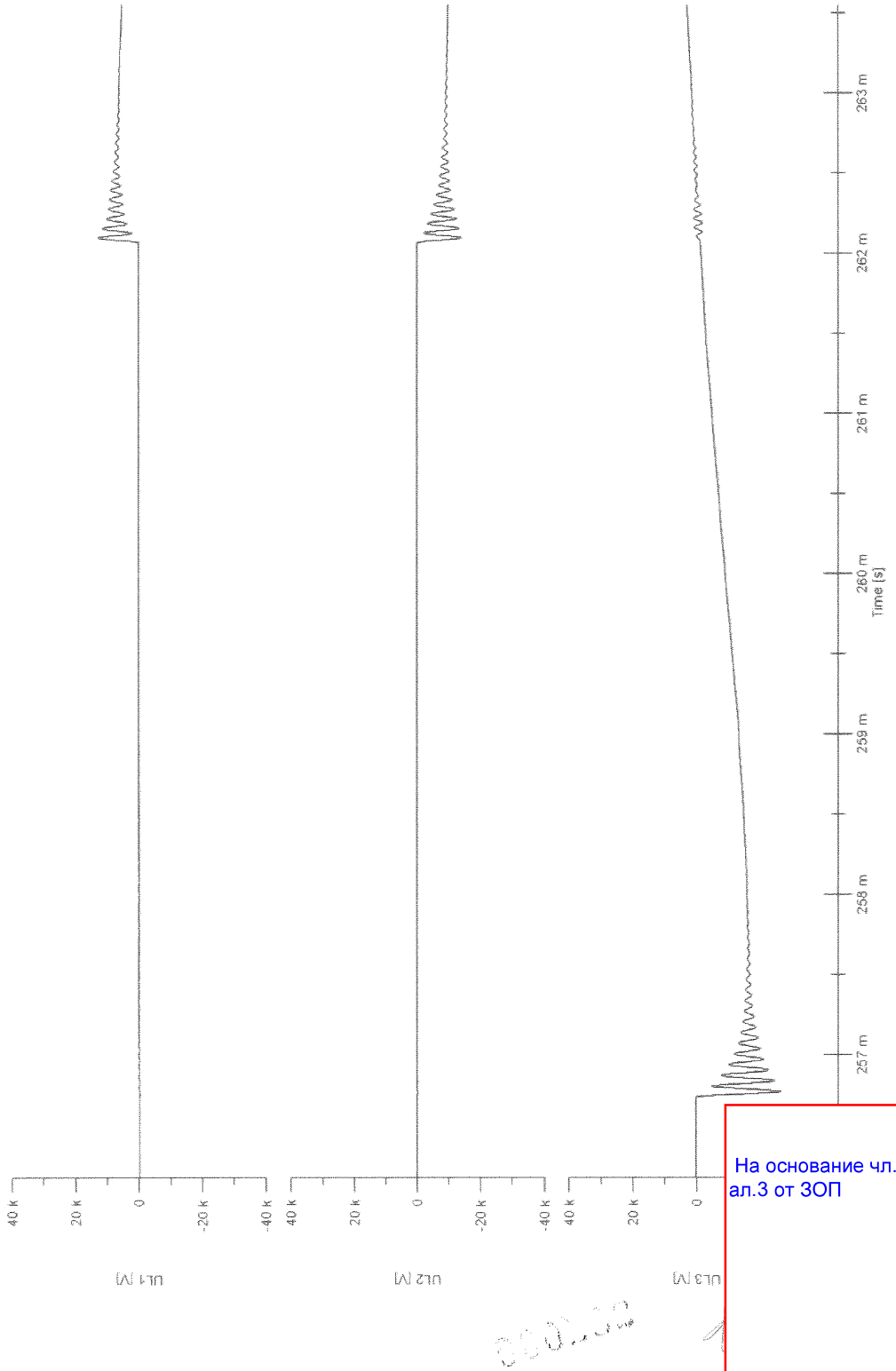
Oscillogram No. PEHLA 09137Ra / 11
Test Duty T60: CO



На основание чл.36а ал.3 от ЗОП

18PE0402

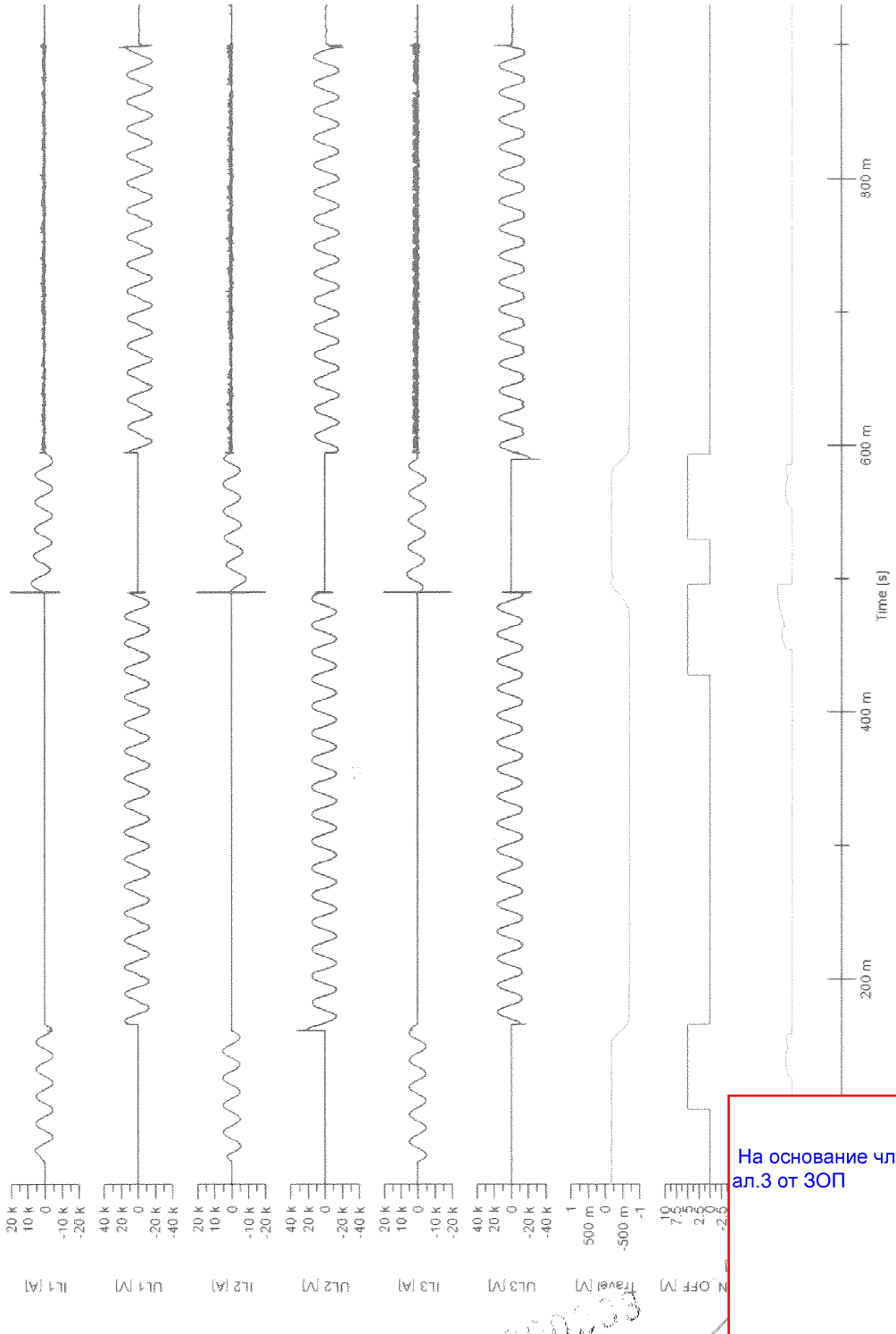
Oscillogram No. PEHLA 09137Ra / 11
Test Duty T60: CO (TRV)



На основание чл.36а ал.3 от ЗОП

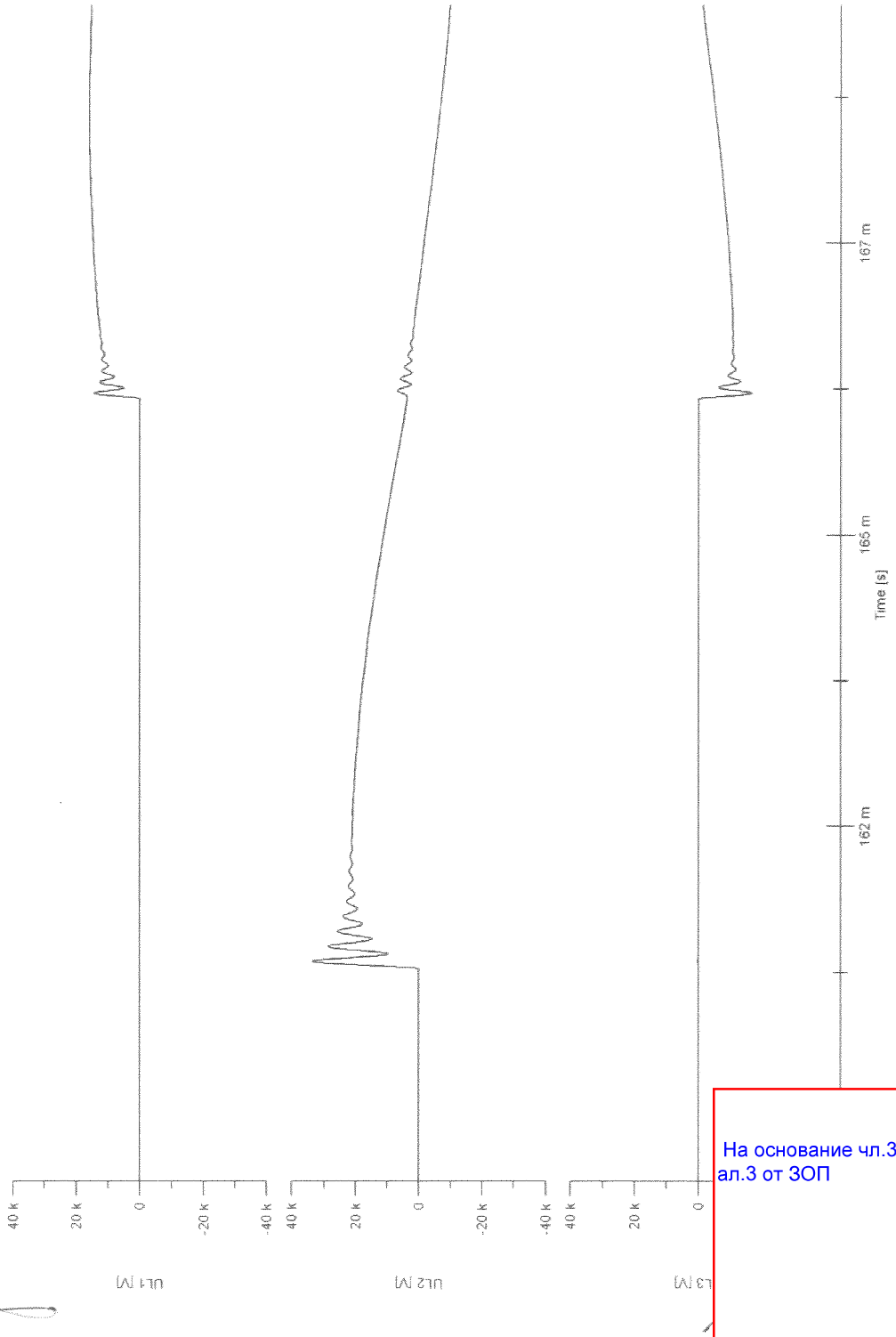
18PE0402

Oscillogram No. PEHLA 09137Ra / 12
Test Duty T10: O-0.3s-CO



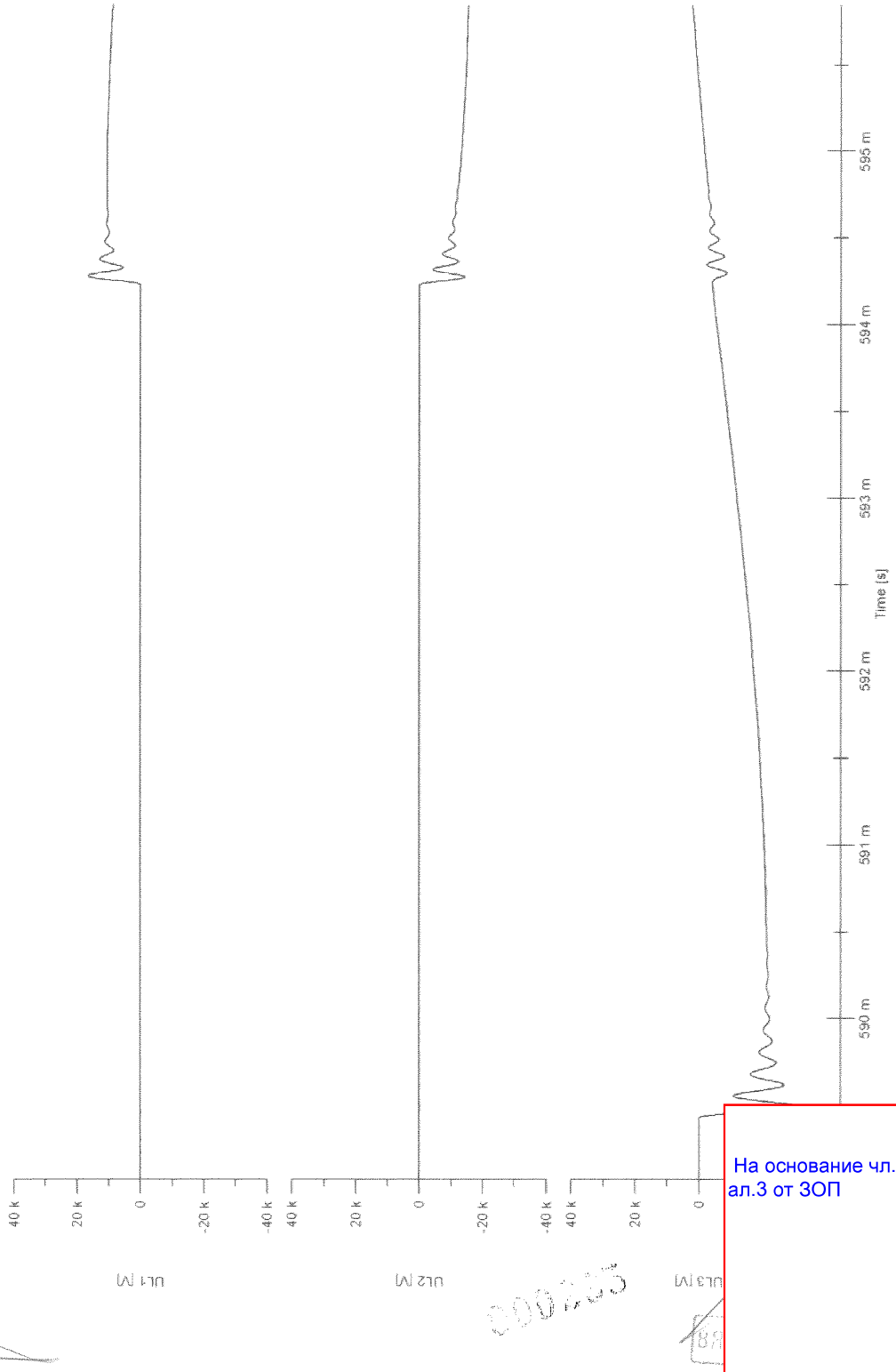
На основание чл.36а ал.3 от ЗОП

Oscillogram No. PEHLA 09137Ra / 12
Test Duty T10: O-0.3s-CO (TRV, 1st O)



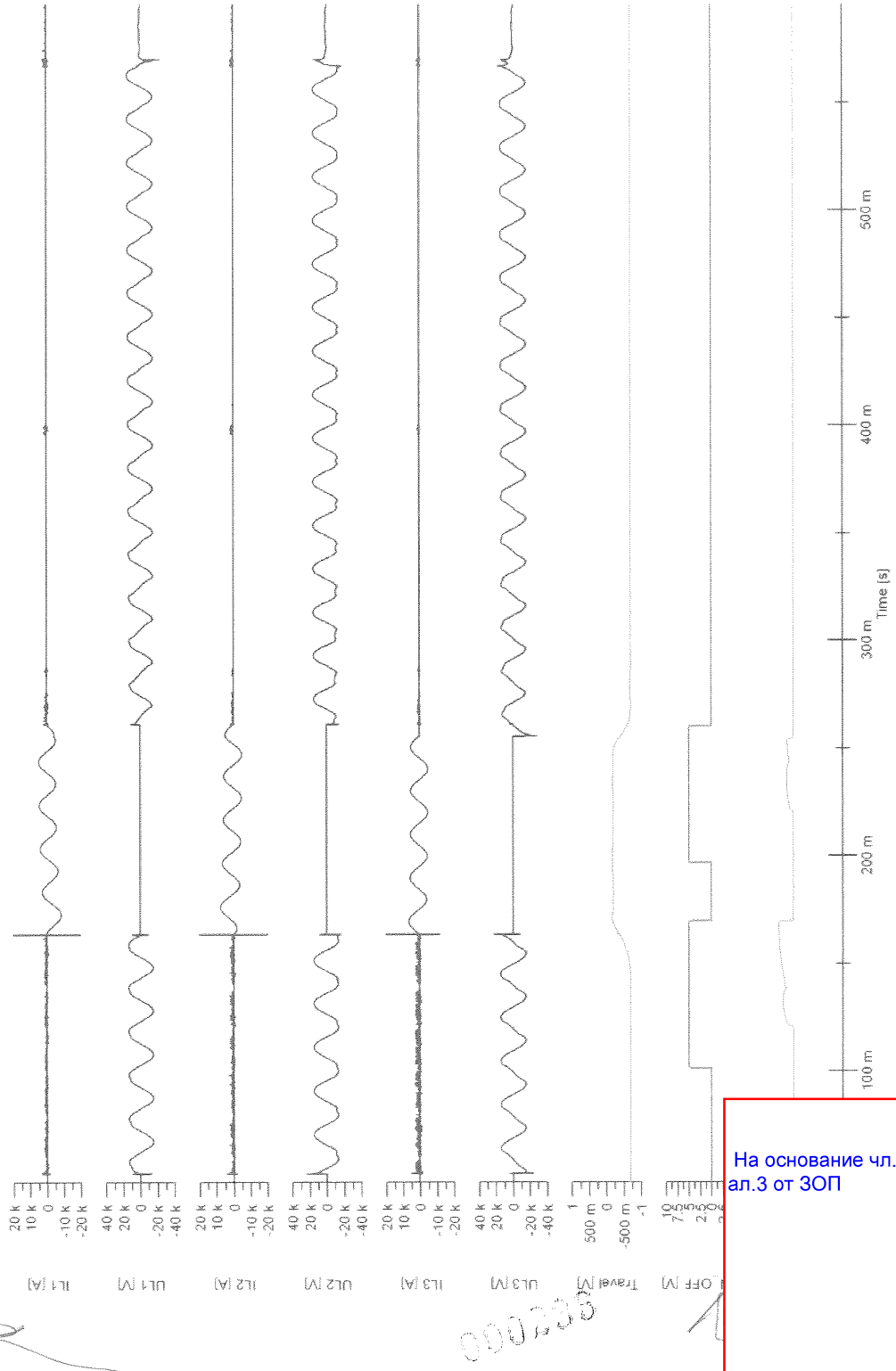
На основание чл.36а ал.3 от ЗОП

Oscillogram No. PEHLA 09137Ra / 12
Test Duty T10: O-0.3s-CO (TRV, 2nd O)



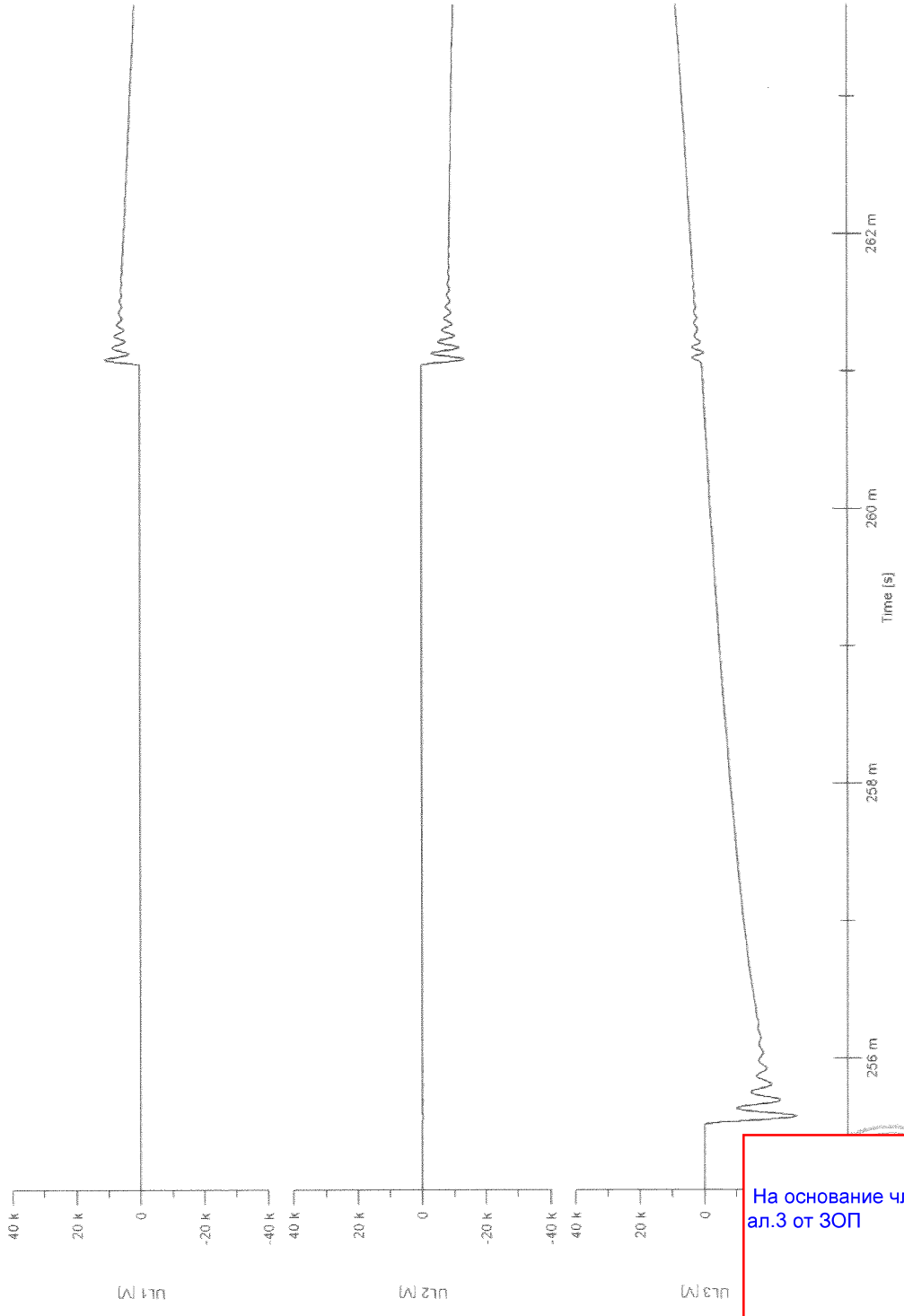
На основание чл.36а ал.3 от ЗОП

Oscillogram No. PEHLA 09137Ra / 13
Test Duty T10: CO



На основание чл.36а ал.3 от ЗОП

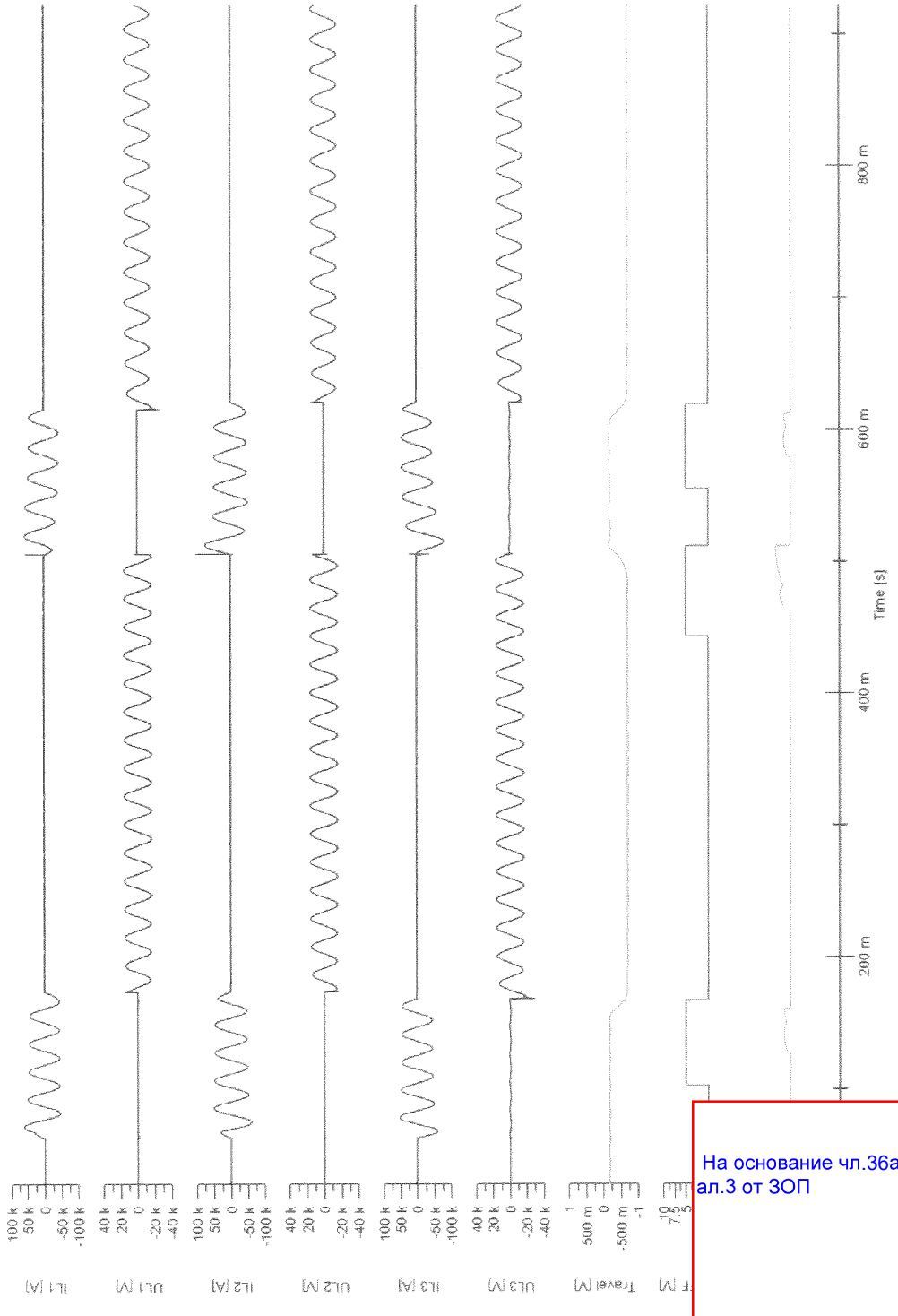
Oscillogram No. PEHLA 09137Ra / 13
Test Duty T10: CO (TRV)



На основание чл.36а ал.3 от ЗОП

18PE0402

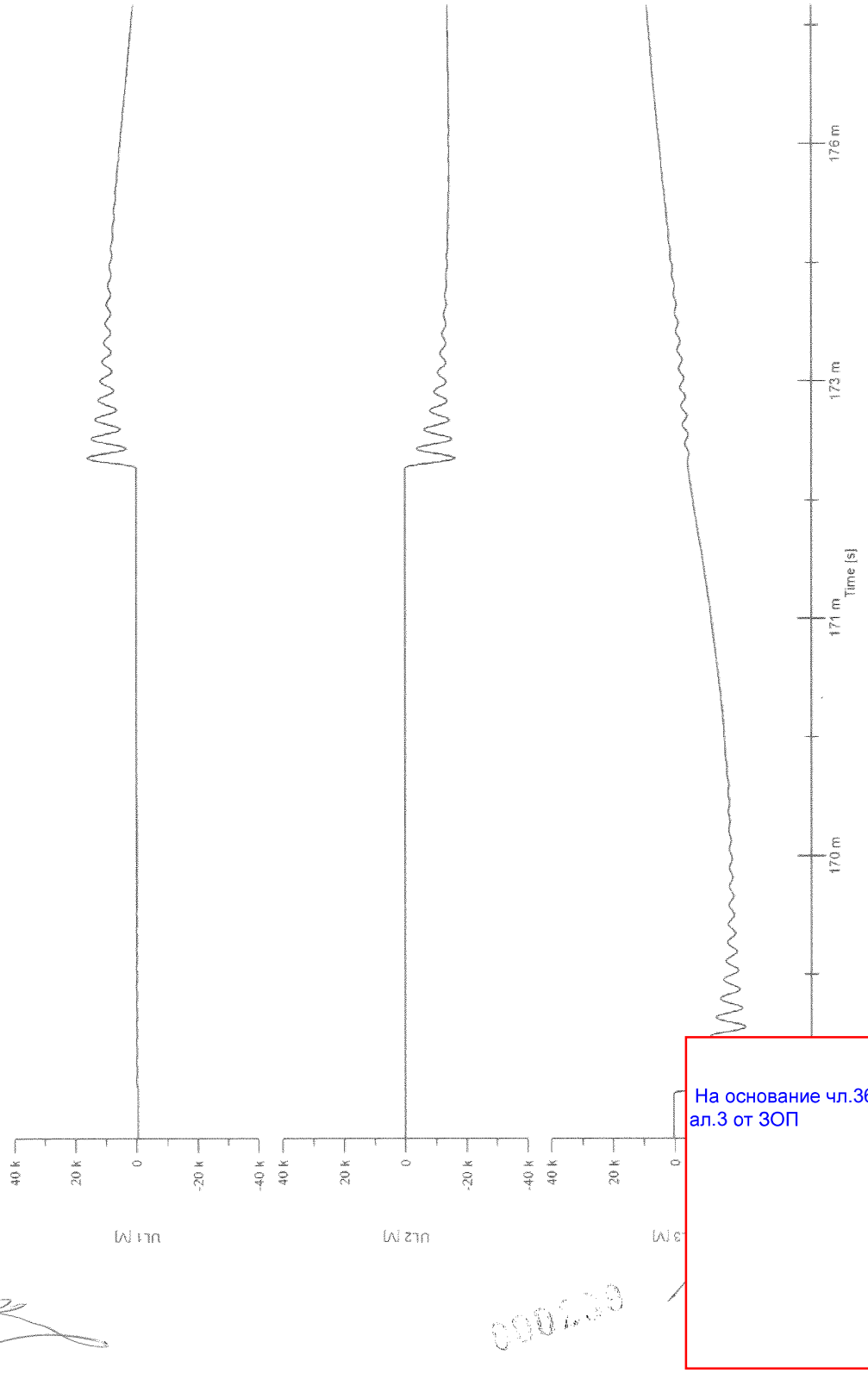
Oscillogram No. PEHLA 09137Ra / 22
Test Duty T100s: O-0.3s-CO



На основание чл.36а ал.3 от ЗОП

18PE0402

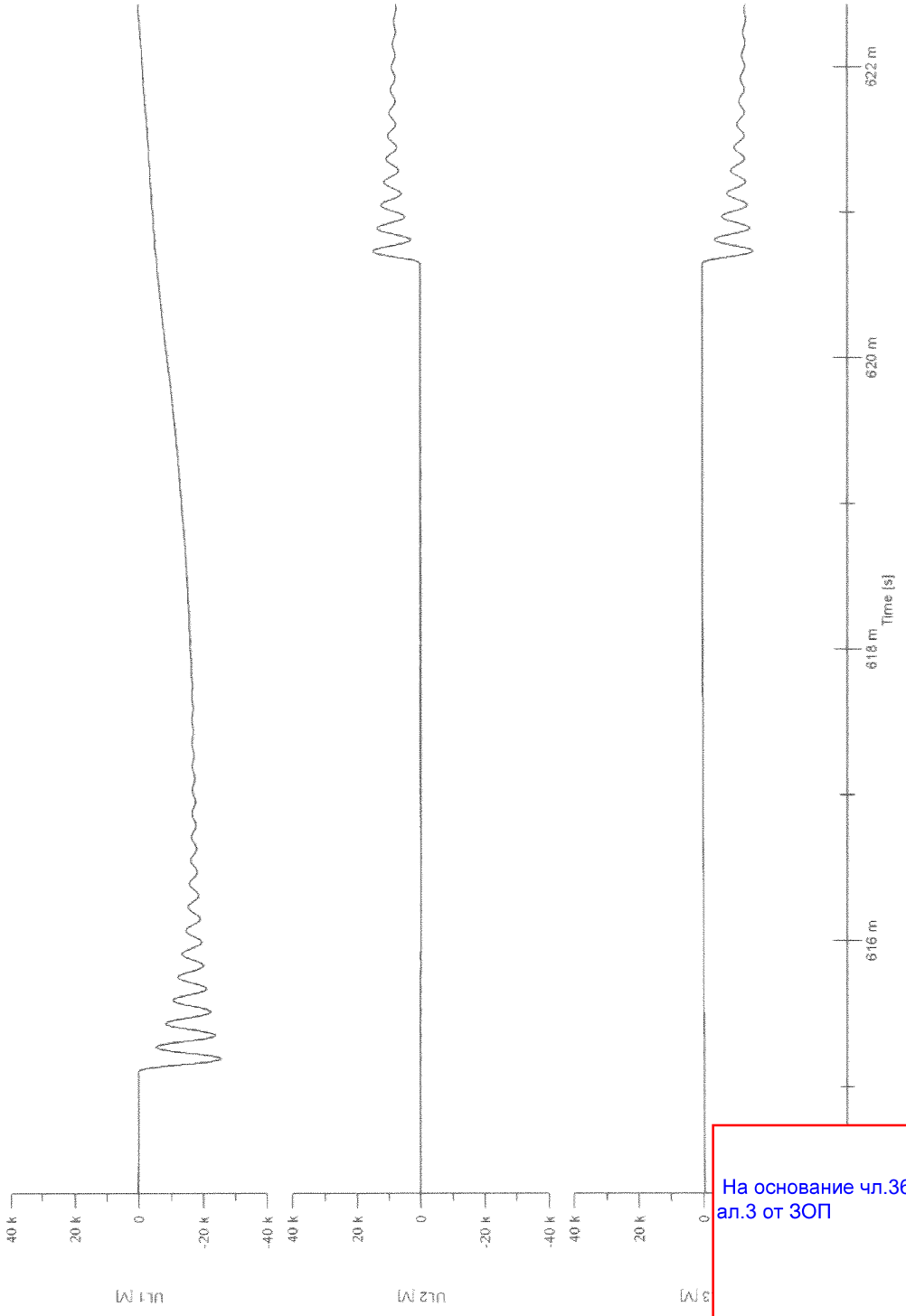
Oscillogram No. PEHLA 09137Ra / 22
Test Duty T100s: O-0.3s-CO (TRV, 1st O)



На основание чл.36а ал.3 от ЗОП

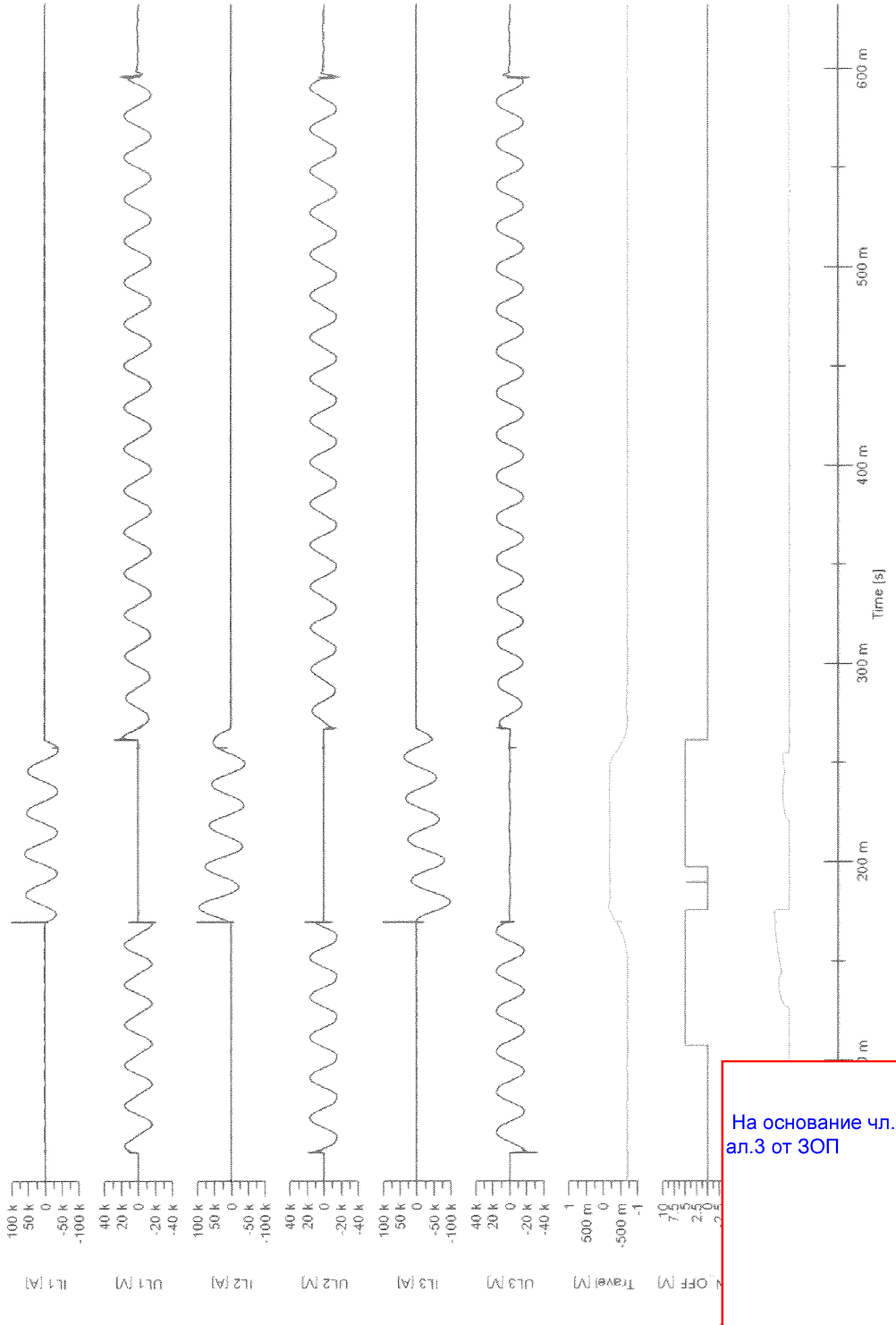
Oscillogram No. PEHLA 09137Ra / 22

Test Duty T100s: O-0.3s-CO (TRV, 2nd O)



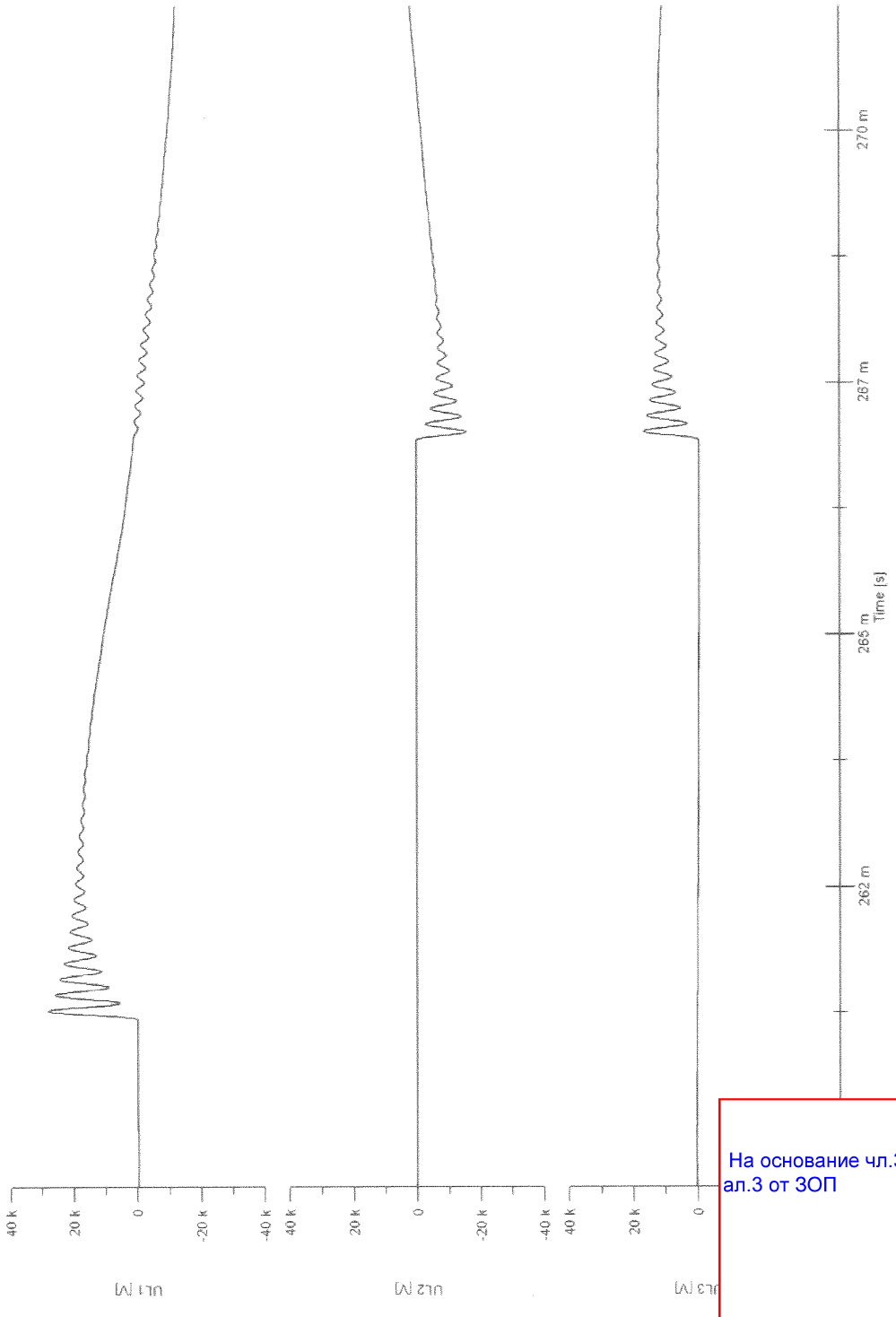
На основание чл.36а ал.3 от ЗОП

Oscillogram No. PEHLA 09137Ra / 23
Test Duty T100s: CO



На основание чл.36а ал.3 от ЗОП

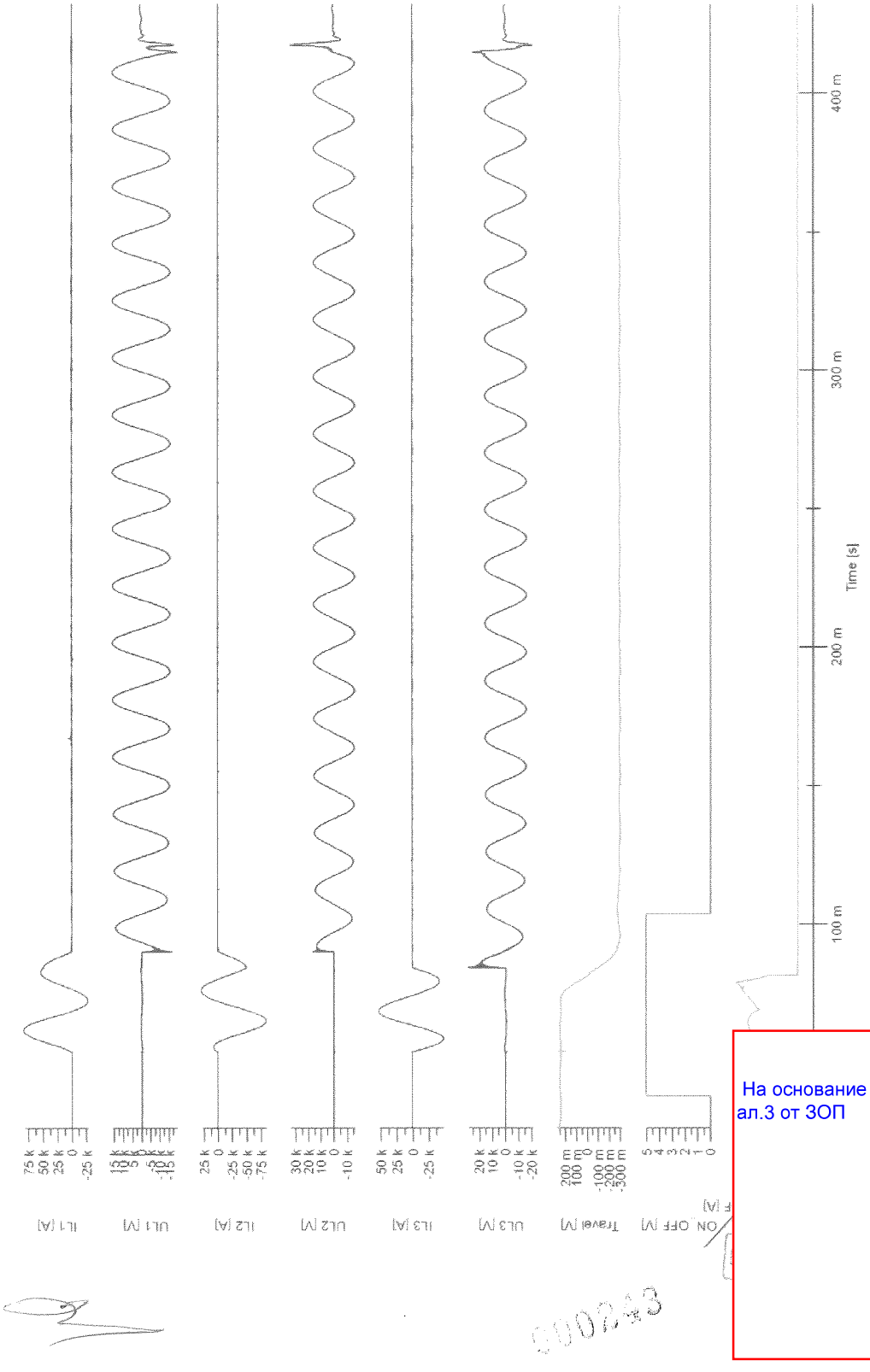
Oscillogram No. PEHLA 09137Ra / 23
Test Duty T100s: CO (TRV)



На основание чл.36а ал.3 от ЗОП

Oscillogram No. PEHLA 09137Ra / 27

Test Duty T100a: $O_{asym.}$ L1

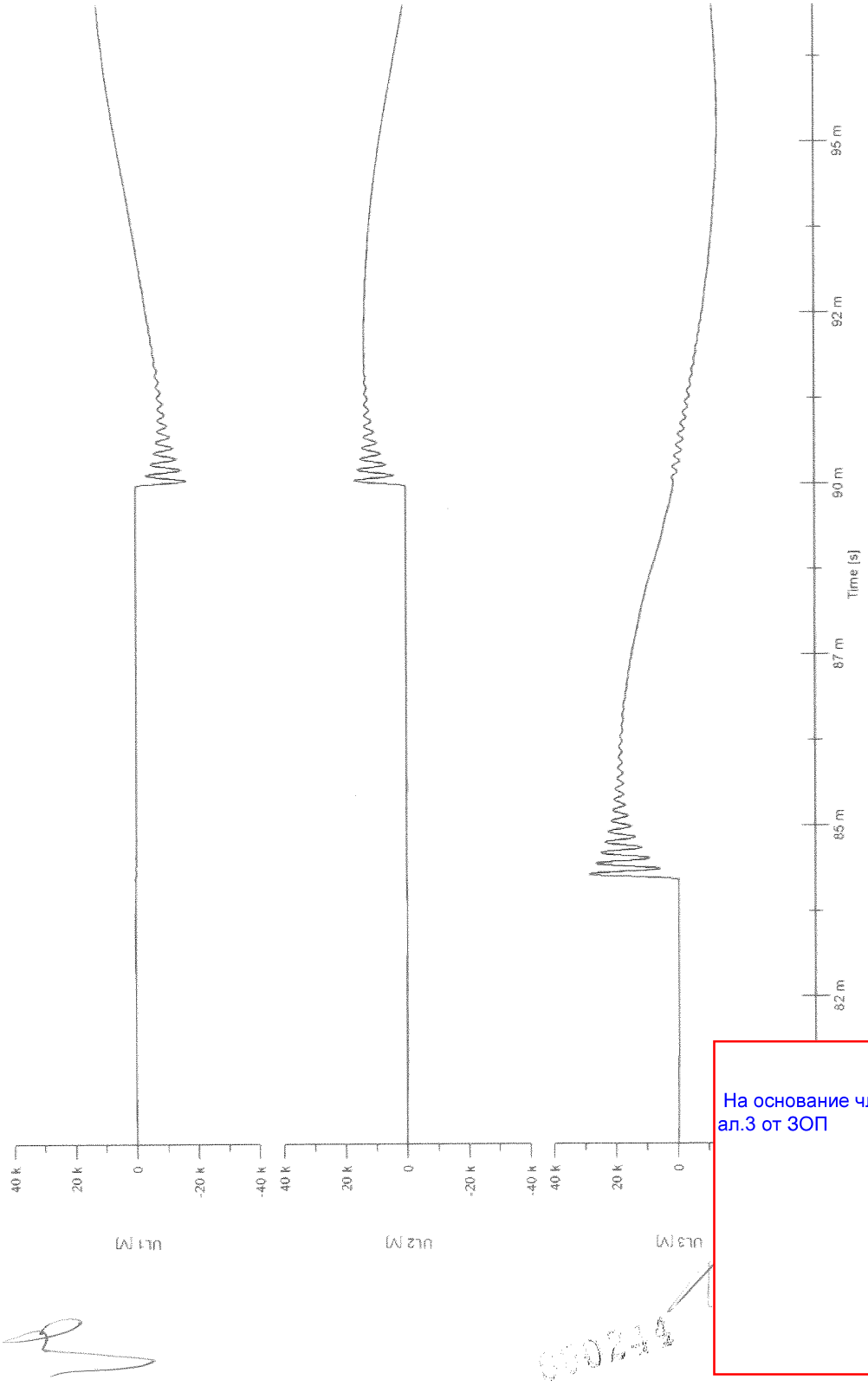


На основание чл.36а ал.3 от ЗОП

18PE0402

Oscillogram No. PEHLA 09137Ra / 27

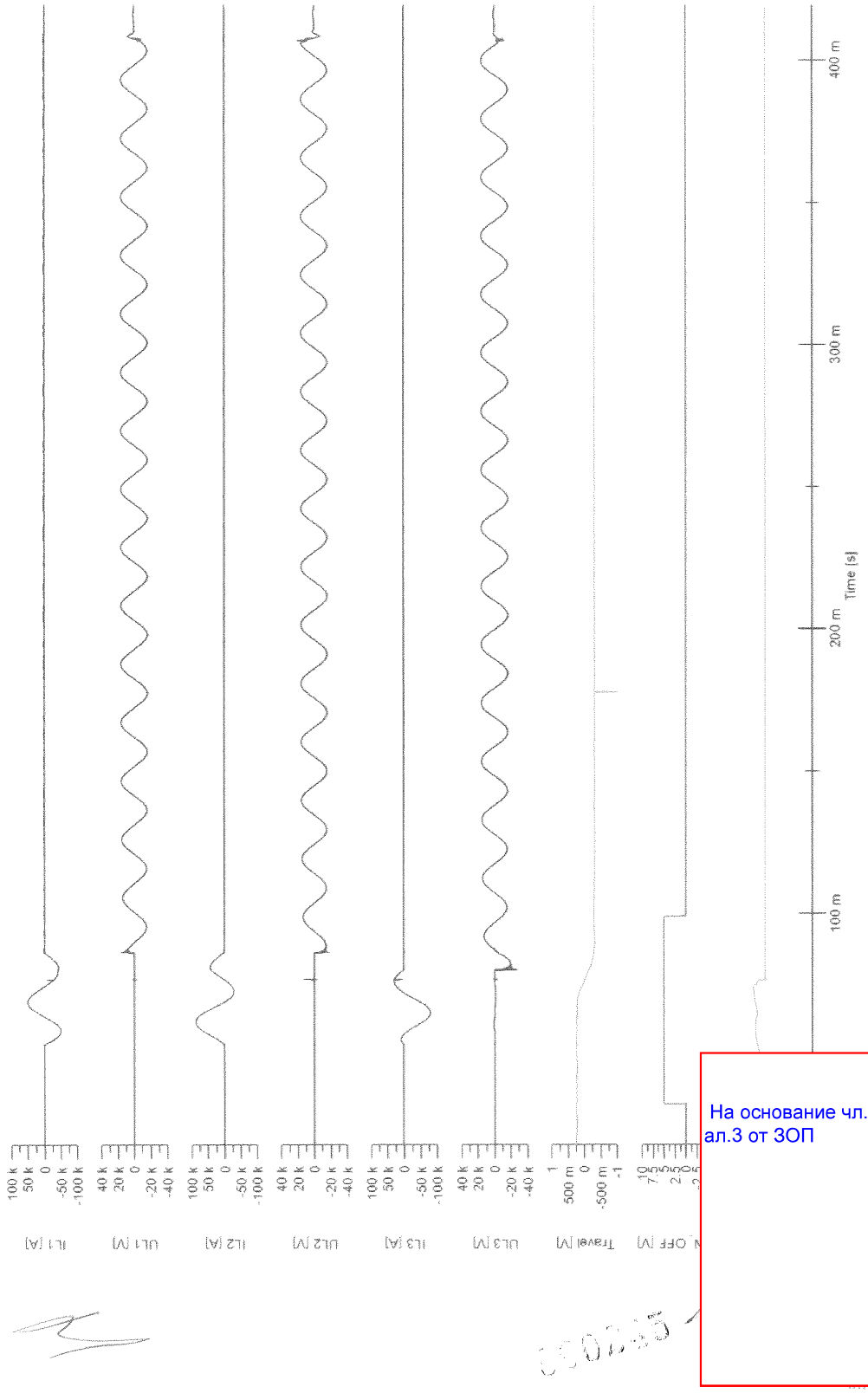
Test Duty T100a: $O_{asym.}$ L1 (TRV)



На основание чл.36а ал.3 от ЗОП

Oscillogram No. PEHLA 09137Ra / 28

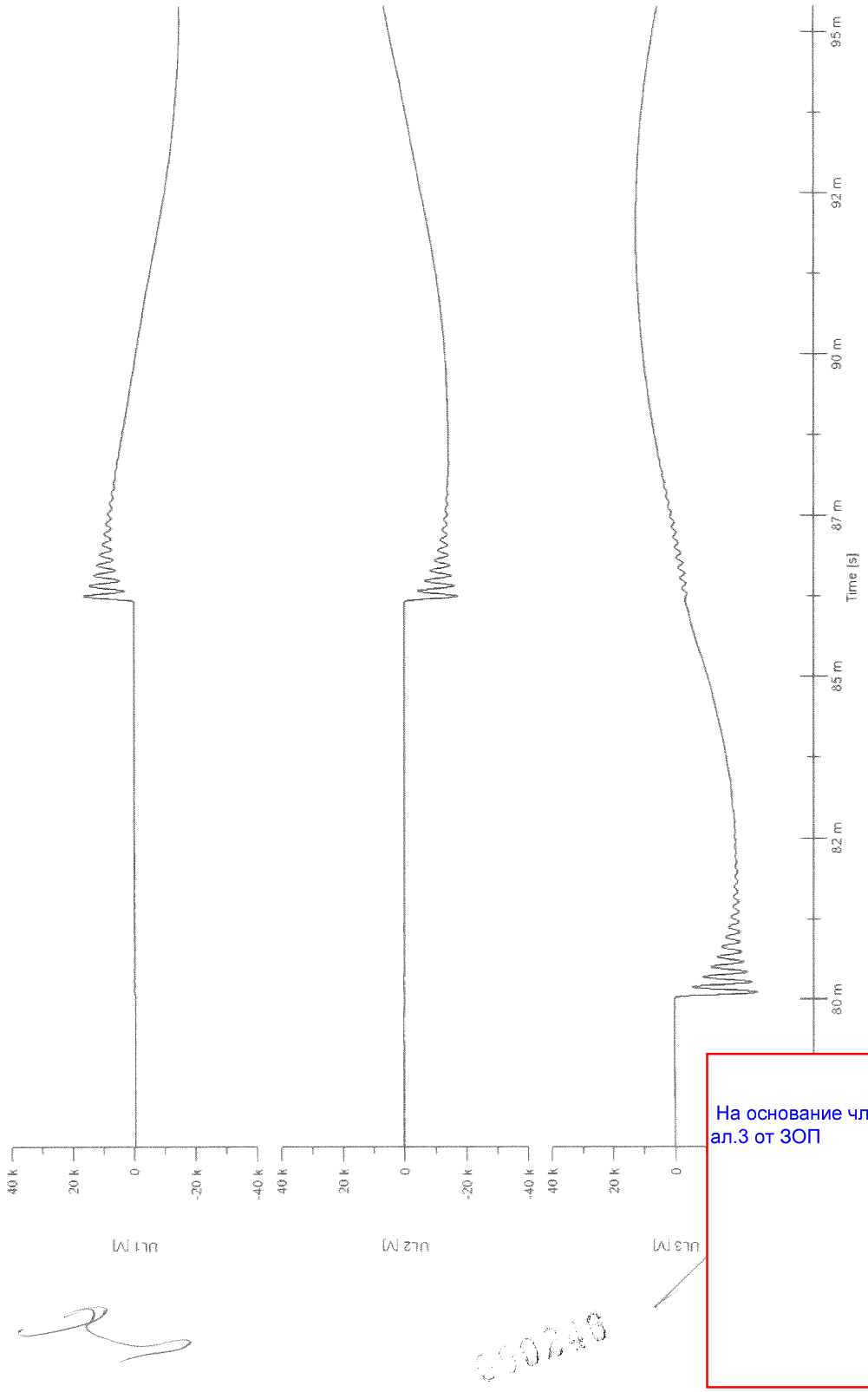
Test Duty T100a: $O_{asym.}$ L2



На основание чл.36а ал.3 от ЗОП

Oscillogram No. PEHLA 09137Ra / 28

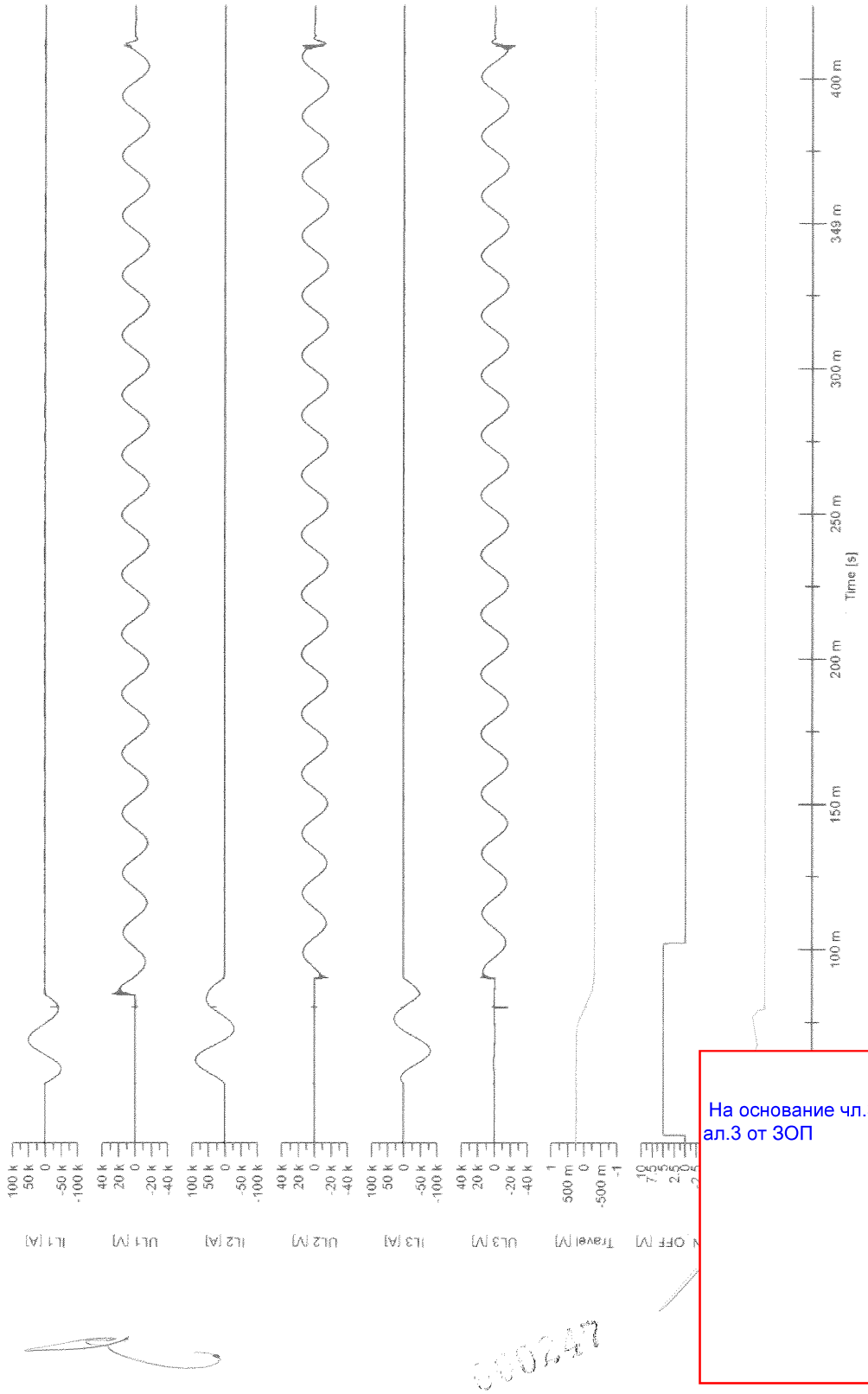
Test Duty T100a: $O_{asym.}$ L2 (TRV)



На основание чл.36а ал.3 от ЗОП

Oscillogram No. PEHLA 09137Ra / 29

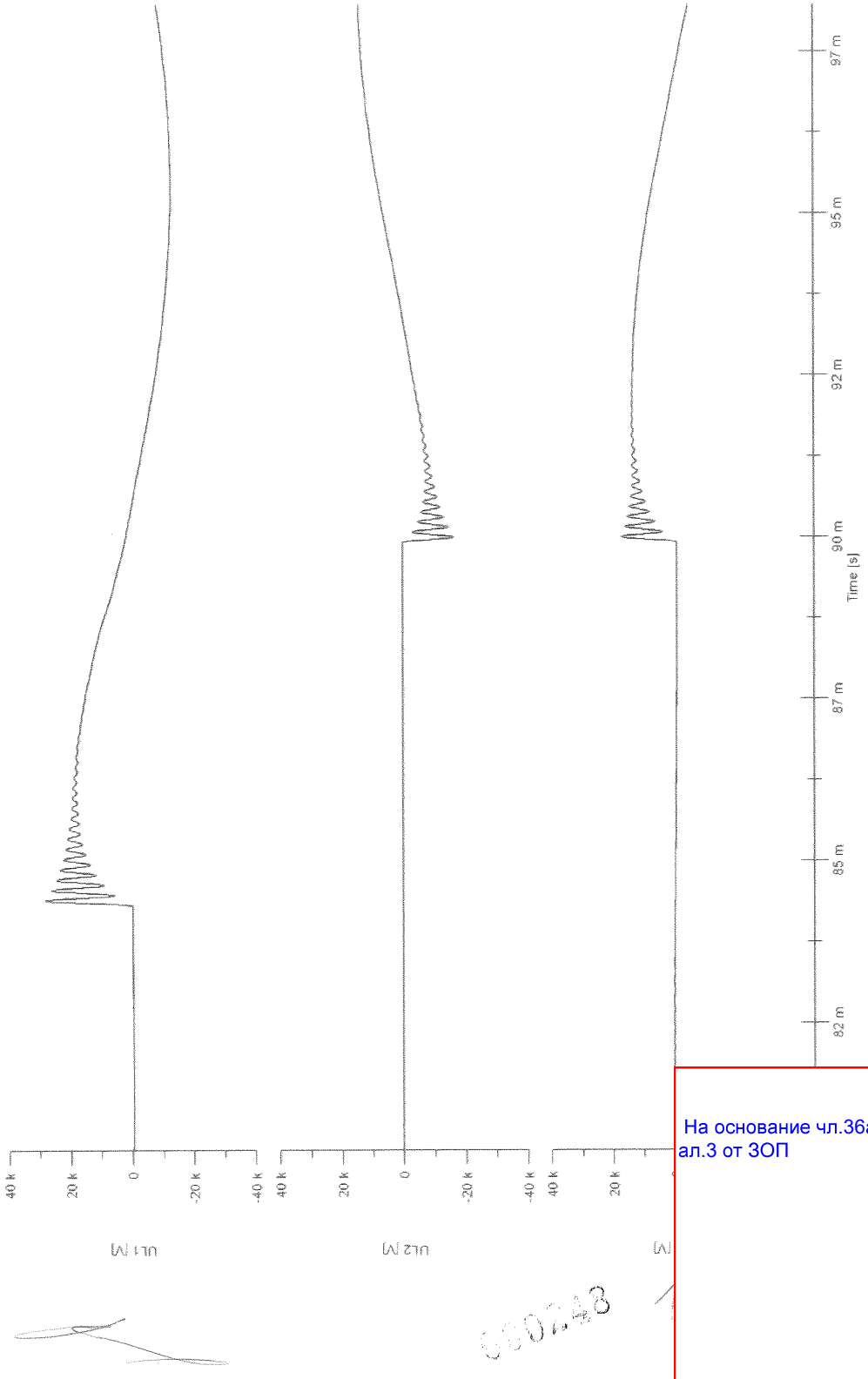
Test Duty T100a: $O_{asym.}$ L2



На основание чл.36а ал.3 от ЗОП

Oscillogram No. PEHLA 09137Ra / 29

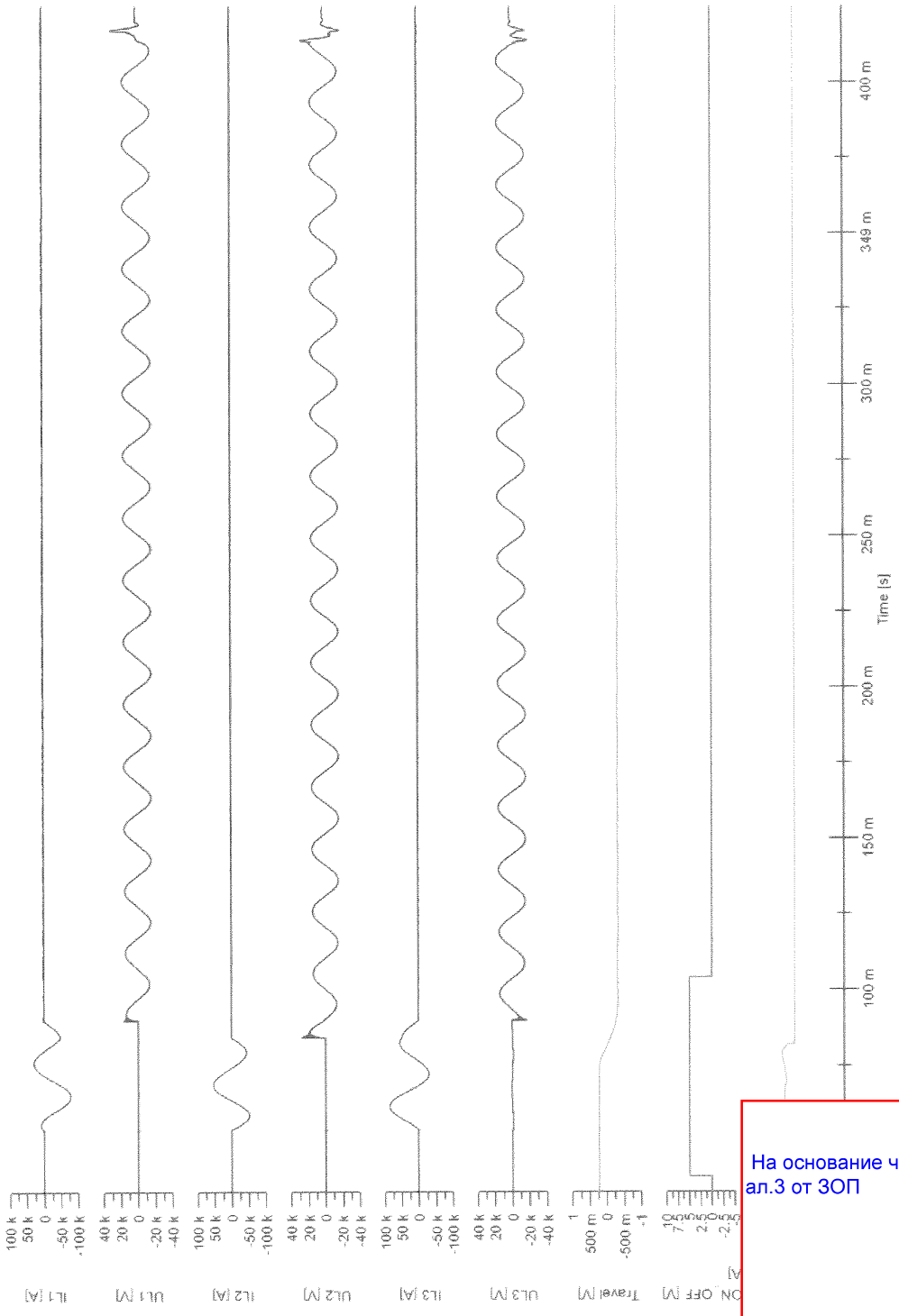
Test Duty T100a: $O_{asym.}$ L2 (TRV)



На основание чл.36а ал.3 от ЗОП

Oscillogram No. PEHLA 09137Ra / 30

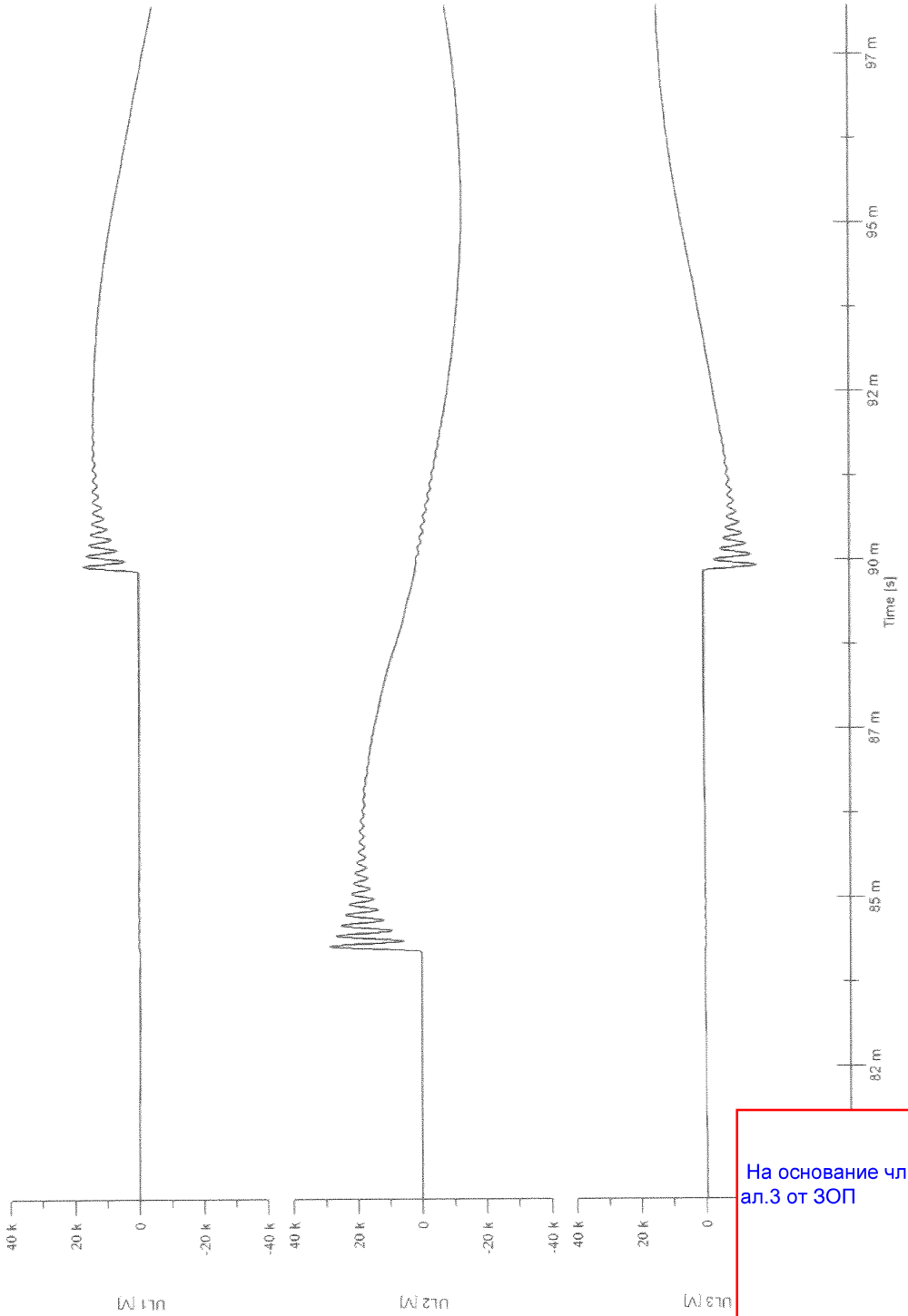
Test Duty T100a: $O_{asym.}$ L3



На основание чл.36а ал.3 от ЗОП

Oscillogram No. PEHLA 09137Ra / 30

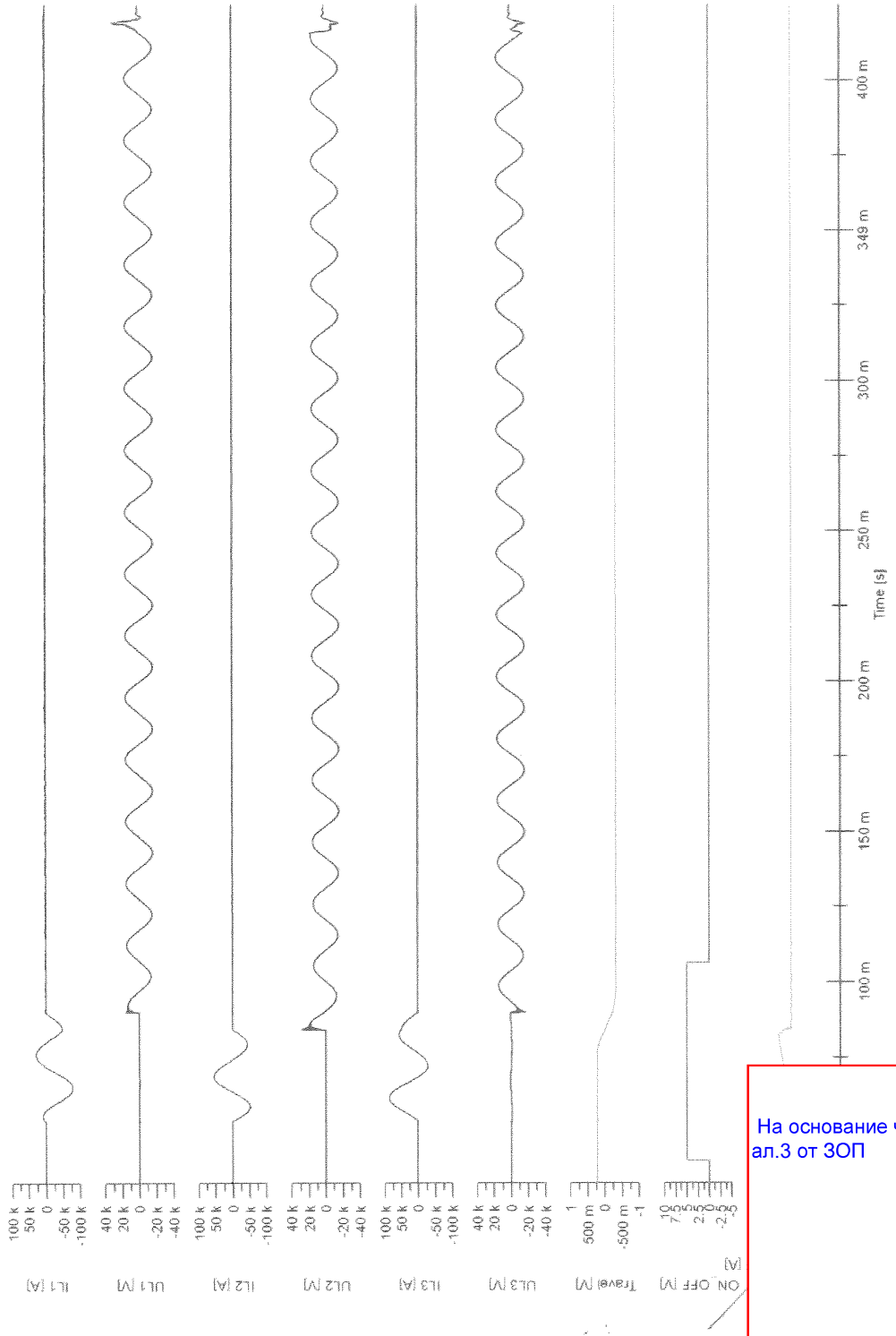
Test Duty T100a: $O_{asym.}$ L3 (TRV)



На основание чл.36а ал.3 от ЗОП

Oscillogram No. PEHLA 09137Ra / 31

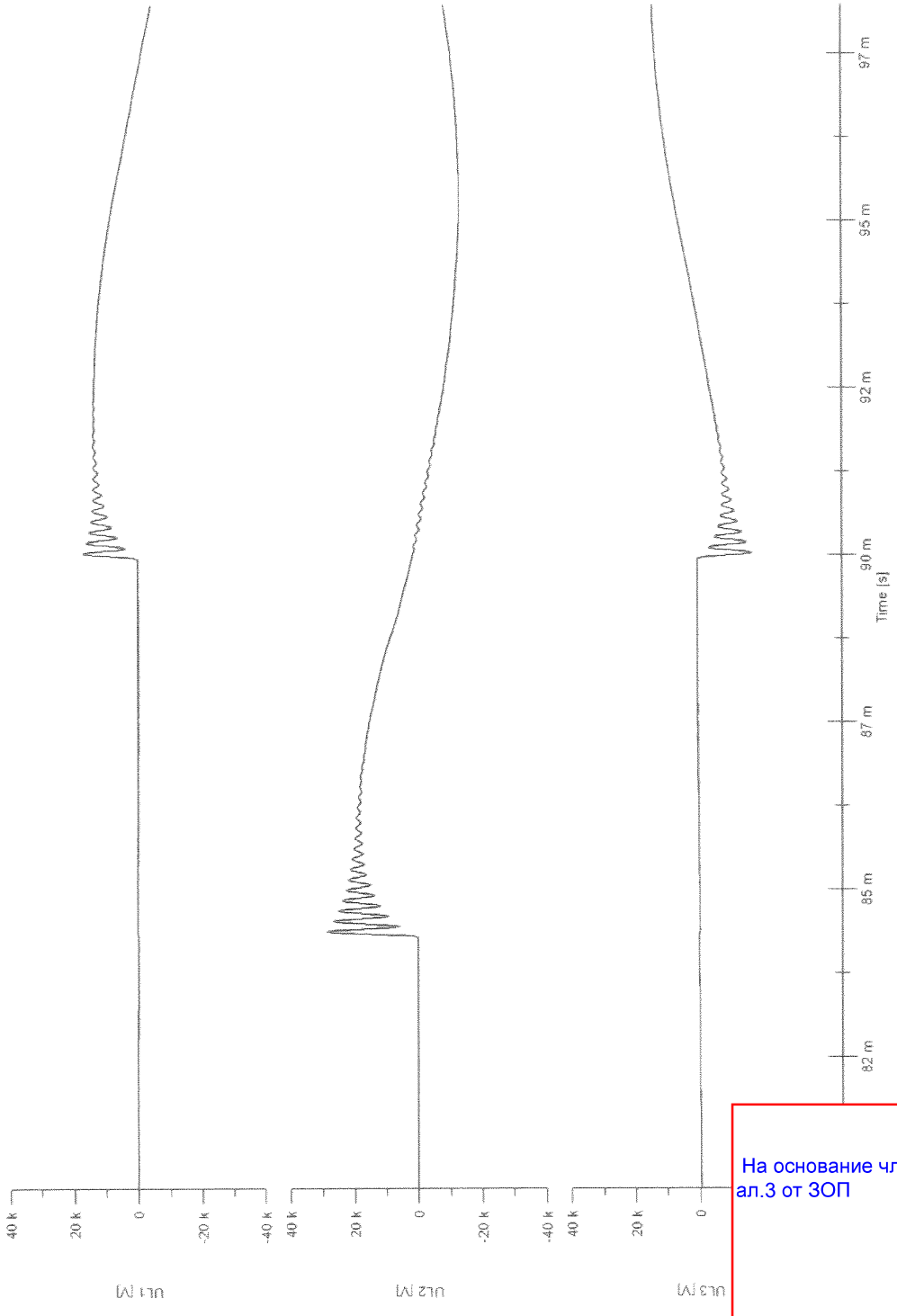
Test Duty T100a: $O_{asym.}$ L3



На основание чл.36а ал.3 от ЗОП

Oscillogram No. PEHLA 09137Ra / 31

Test Duty T100a: $O_{asym.}$ L3 (TRV)

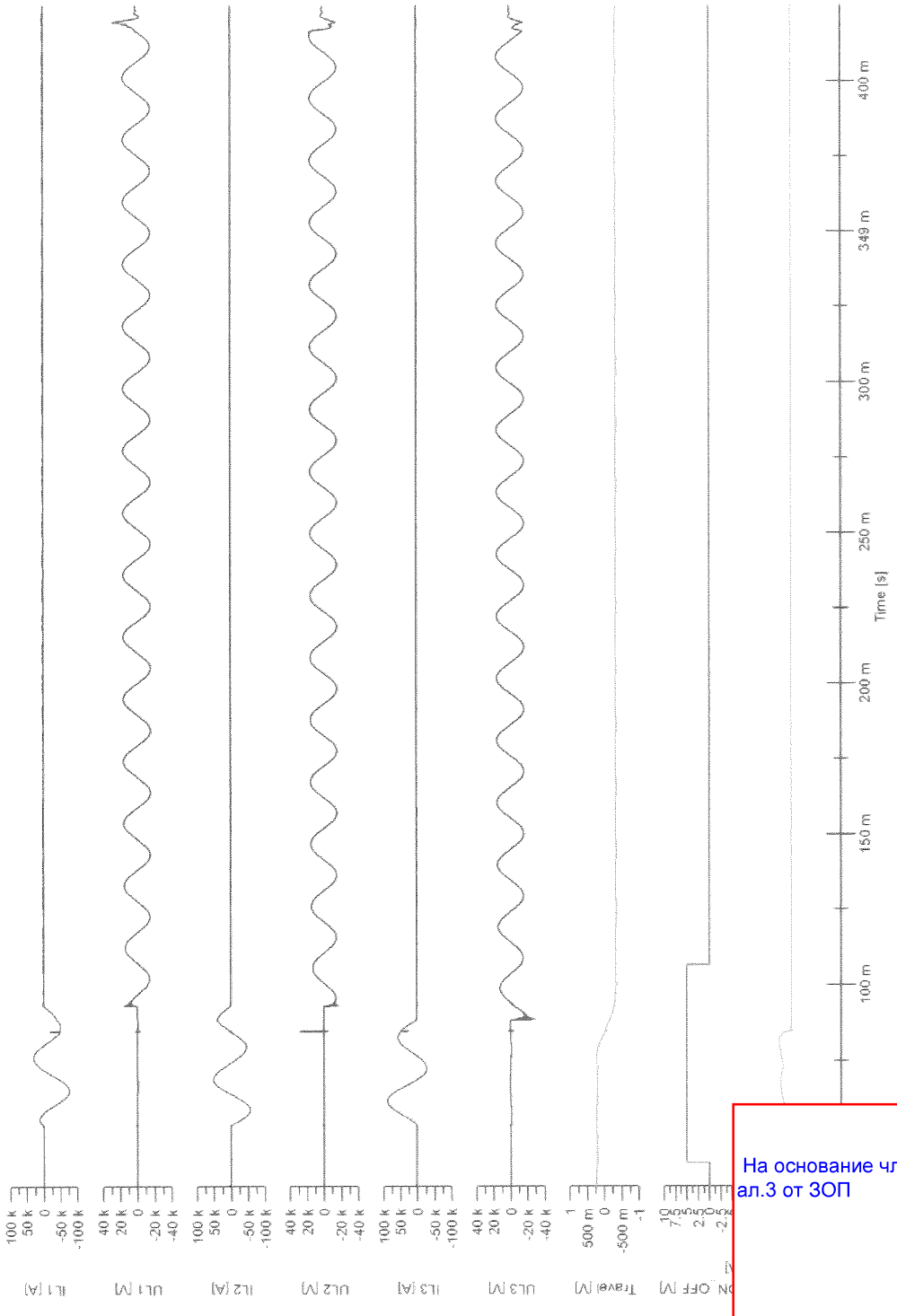


На основание чл.36а ал.3 от ЗОП

18PE0402

Oscillogram No. PEHLA 09137Ra / 32

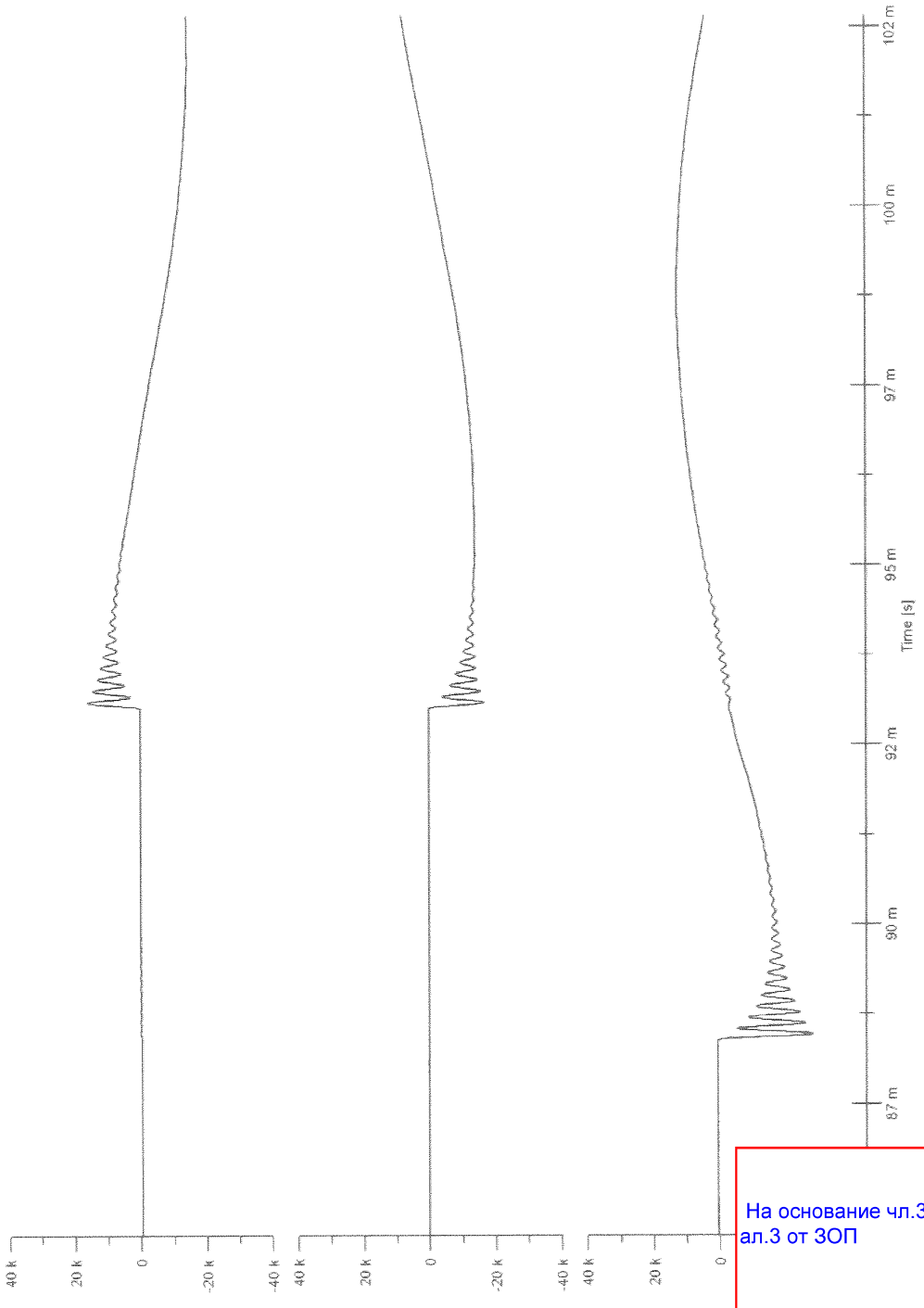
Test Duty T100a: $O_{asym.}$ L3



На основание чл.36а ал.3 от ЗОП

Oscillogram No. PEHLA 09137Ra / 32

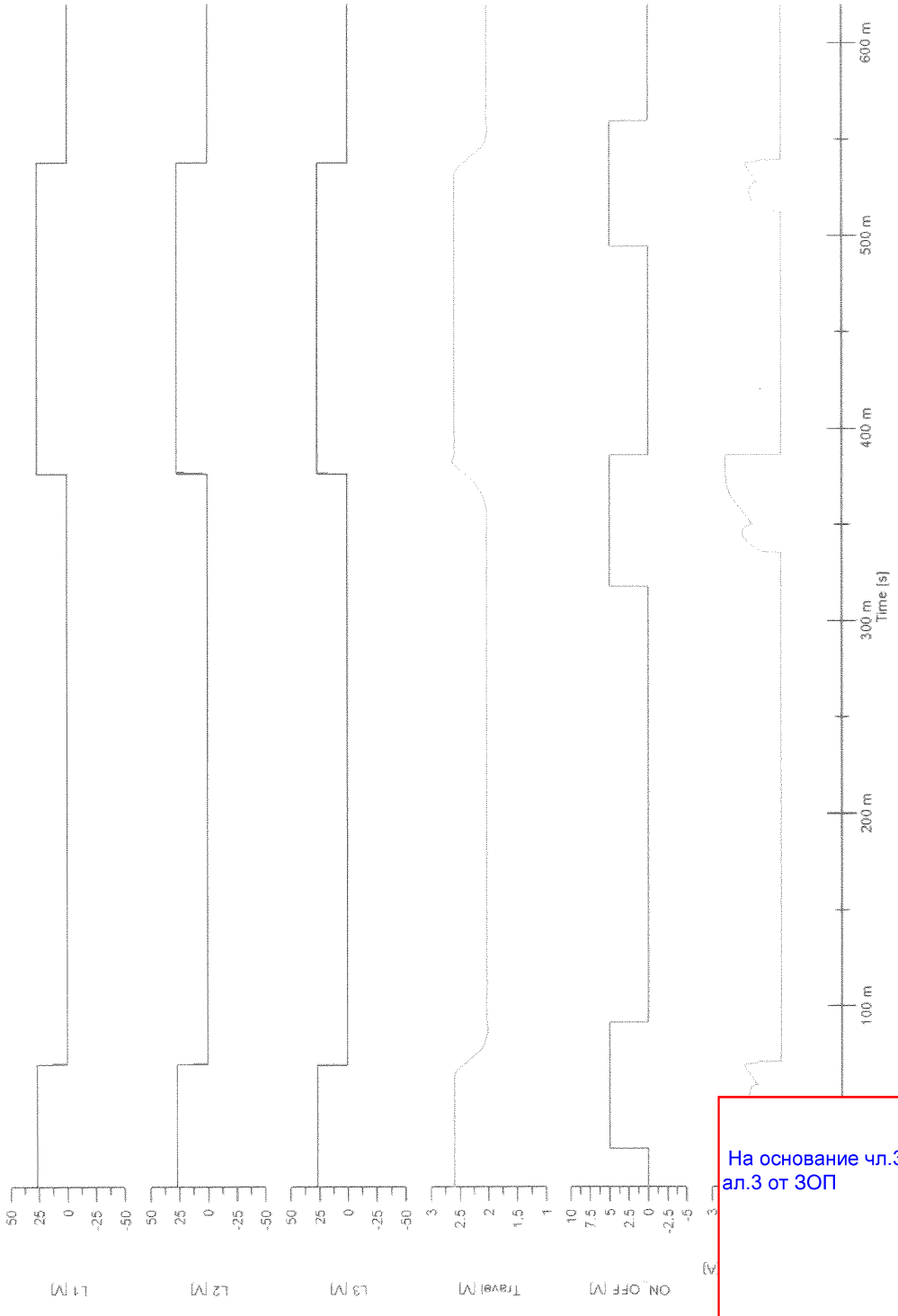
Test Duty T100a: $O_{asym.}$ L3 (TRV)



На основание чл.36а ал.3 от ЗОП

Oscillogram No. PEHLA 09137Ra / 33

No-Load Operation (Rated Auxiliary Voltage)

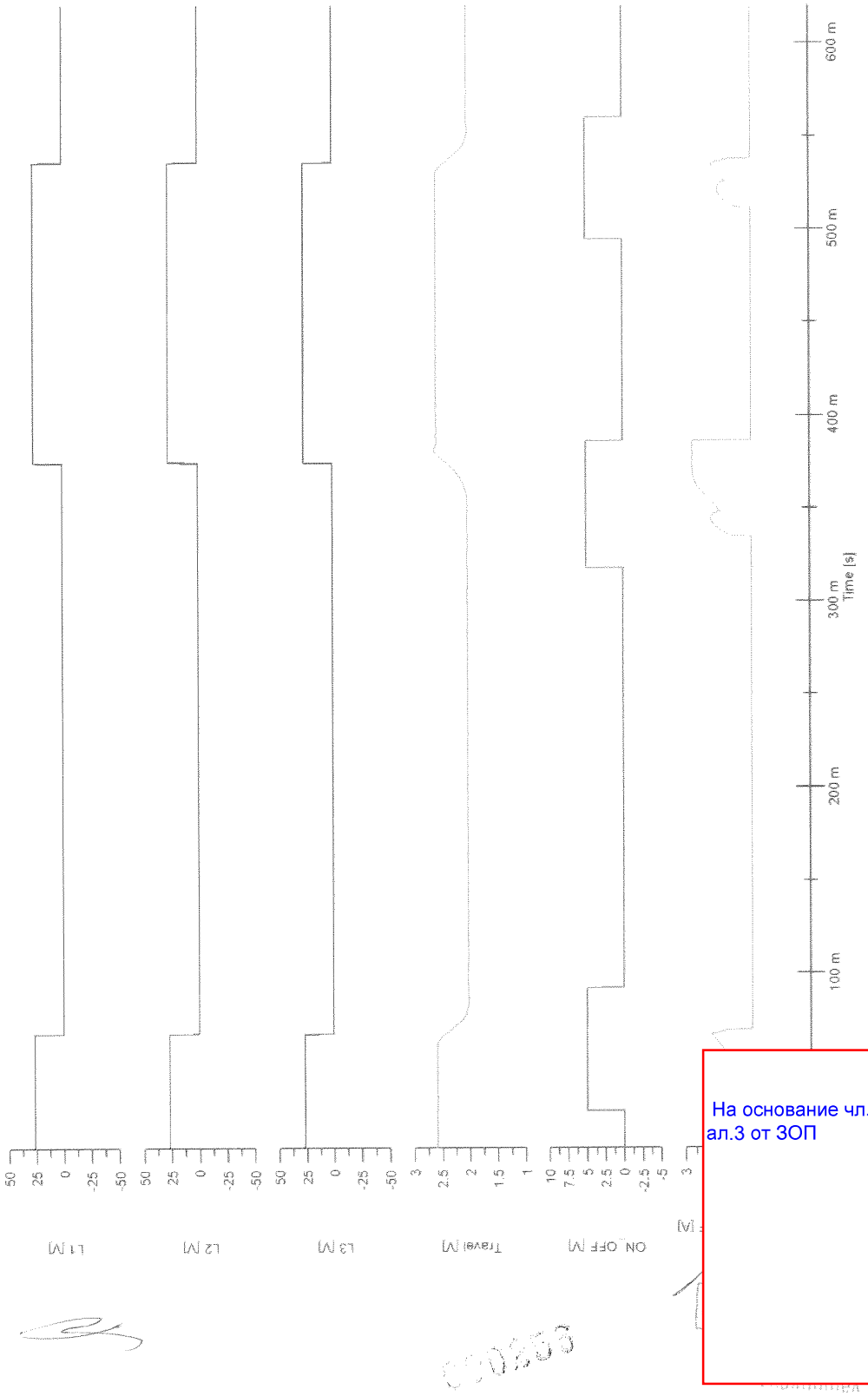


На основание чл.36а ал.3 от ЗОП

18PE0402

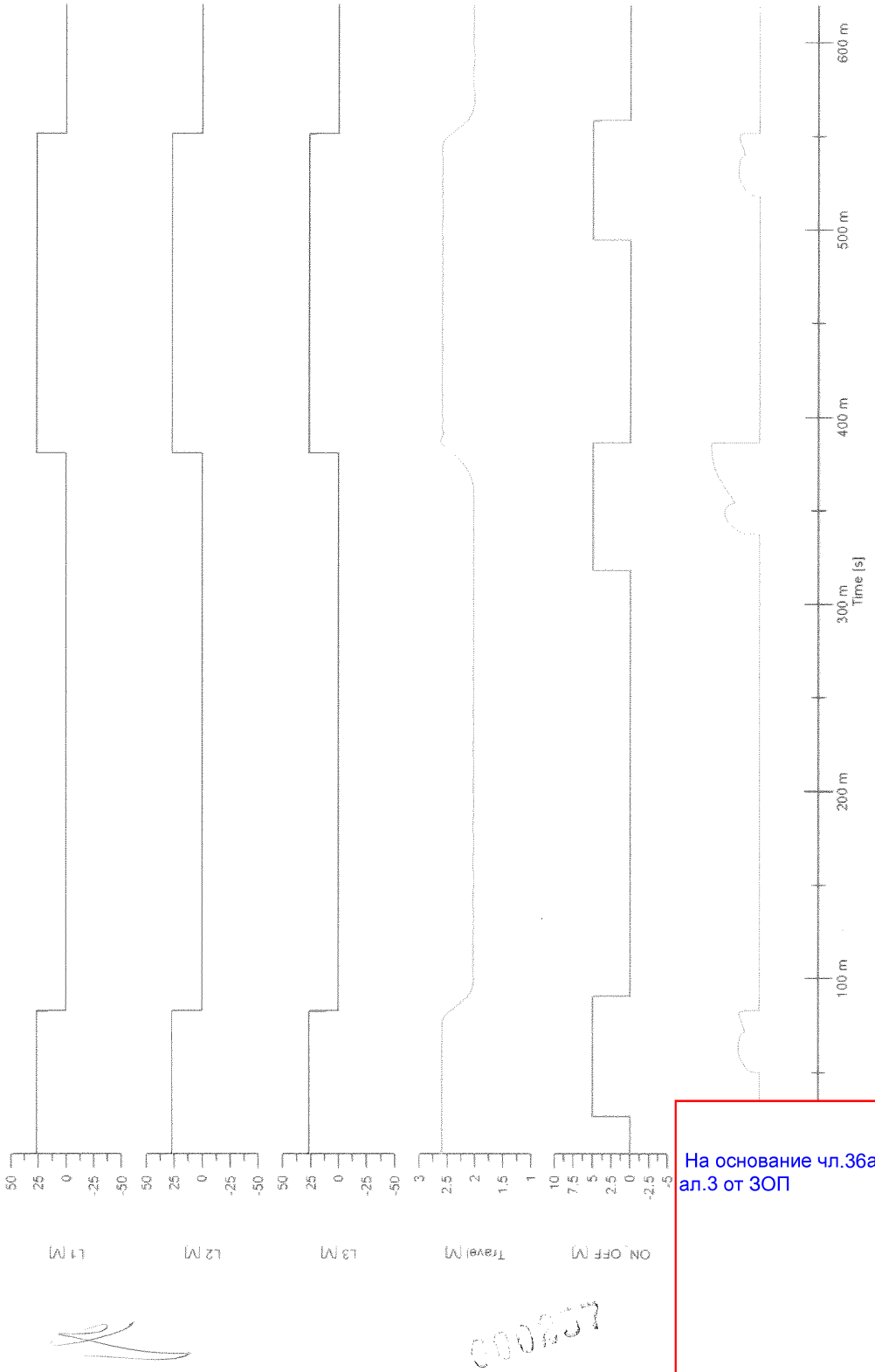
Oscillogram No. PEHLA 09137Ra / 34

No-Load Operation (Maximum Auxiliary Voltage)



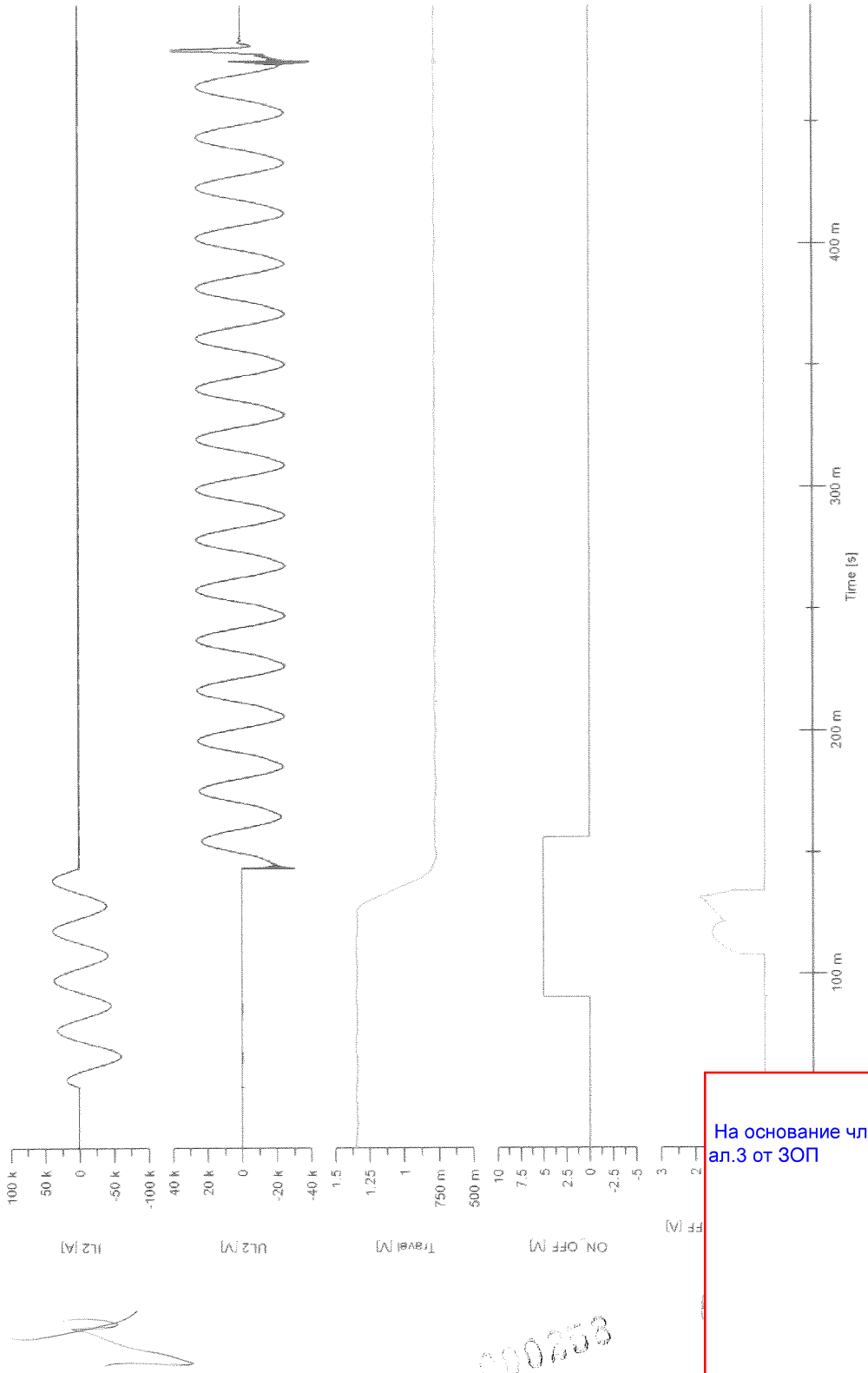
На основание чл.36а ал.3 от ЗОП

Oscillogram No. PEHLA 09137Ra / 35
No-Load Operation (Minimum Auxiliary Voltage)



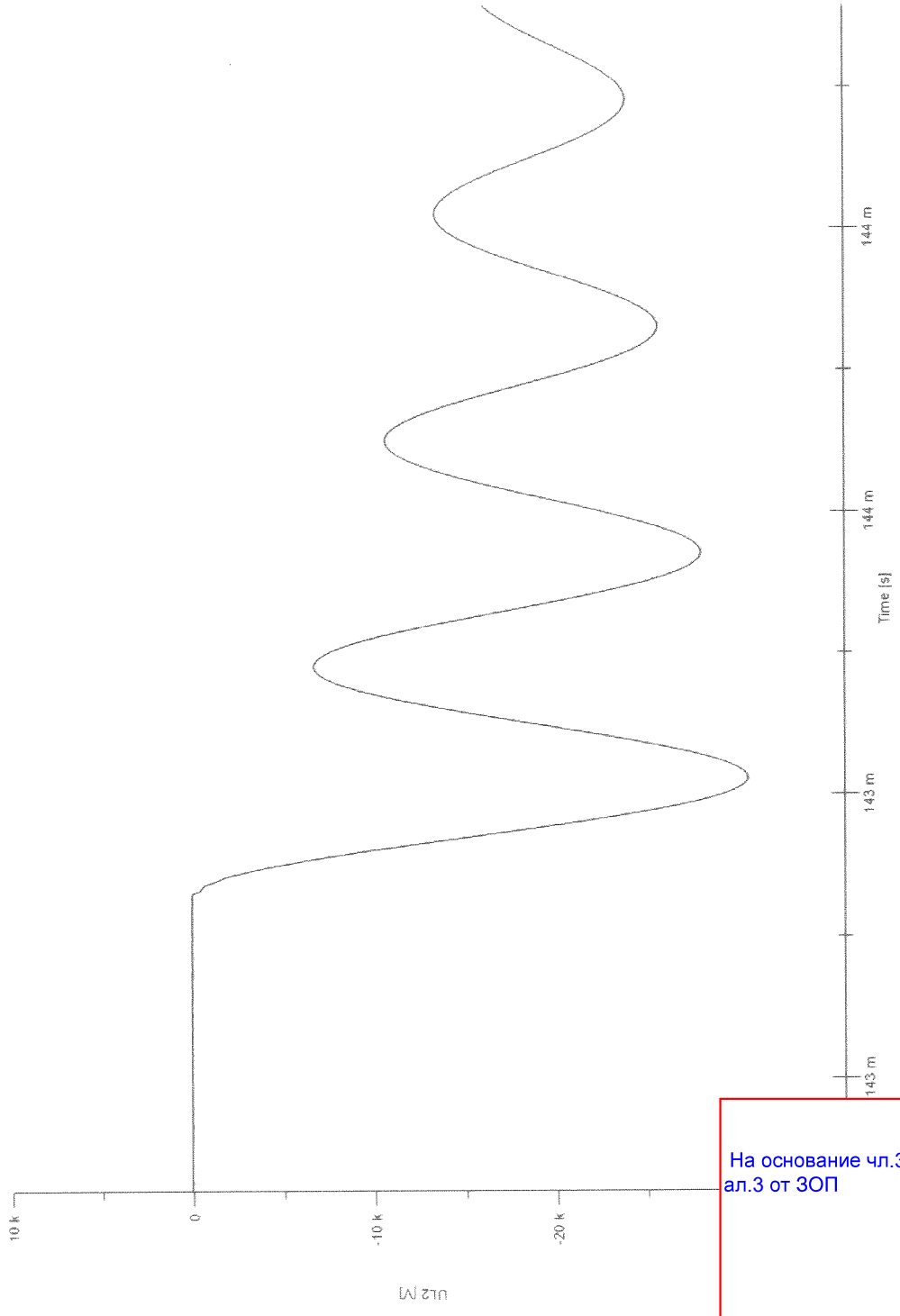
На основание чл.36а ал.3 от ЗОП

Oscillogram No. PEHLA 09137Ra / 39
Double-Earth Fault: O



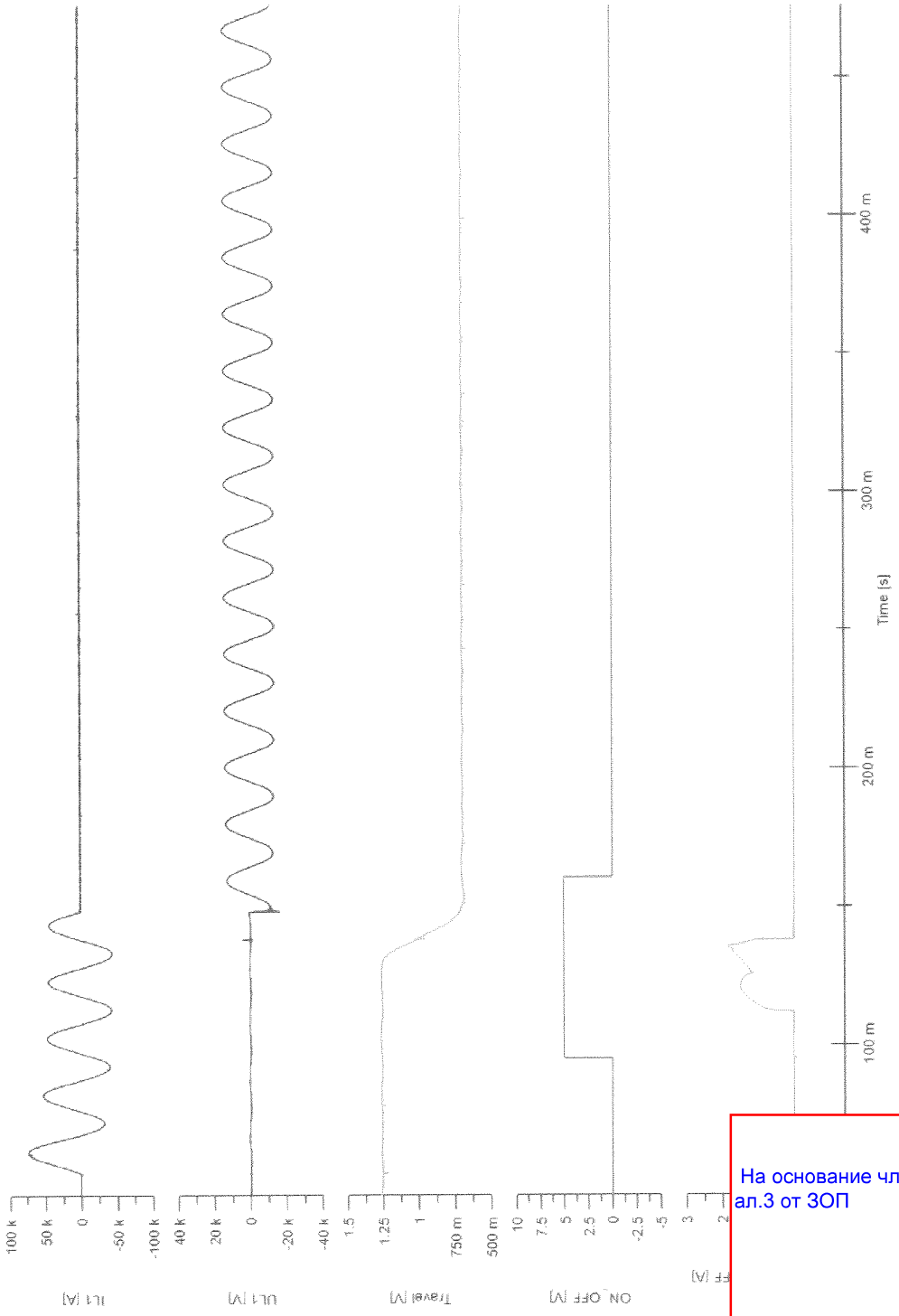
На основание чл.36а ал.3 от ЗОП

Oscillogram No. PEHLA 09137Ra / 39
Double-Earth Fault: O (TRV)



На основание чл.36а ал.3 от ЗОП

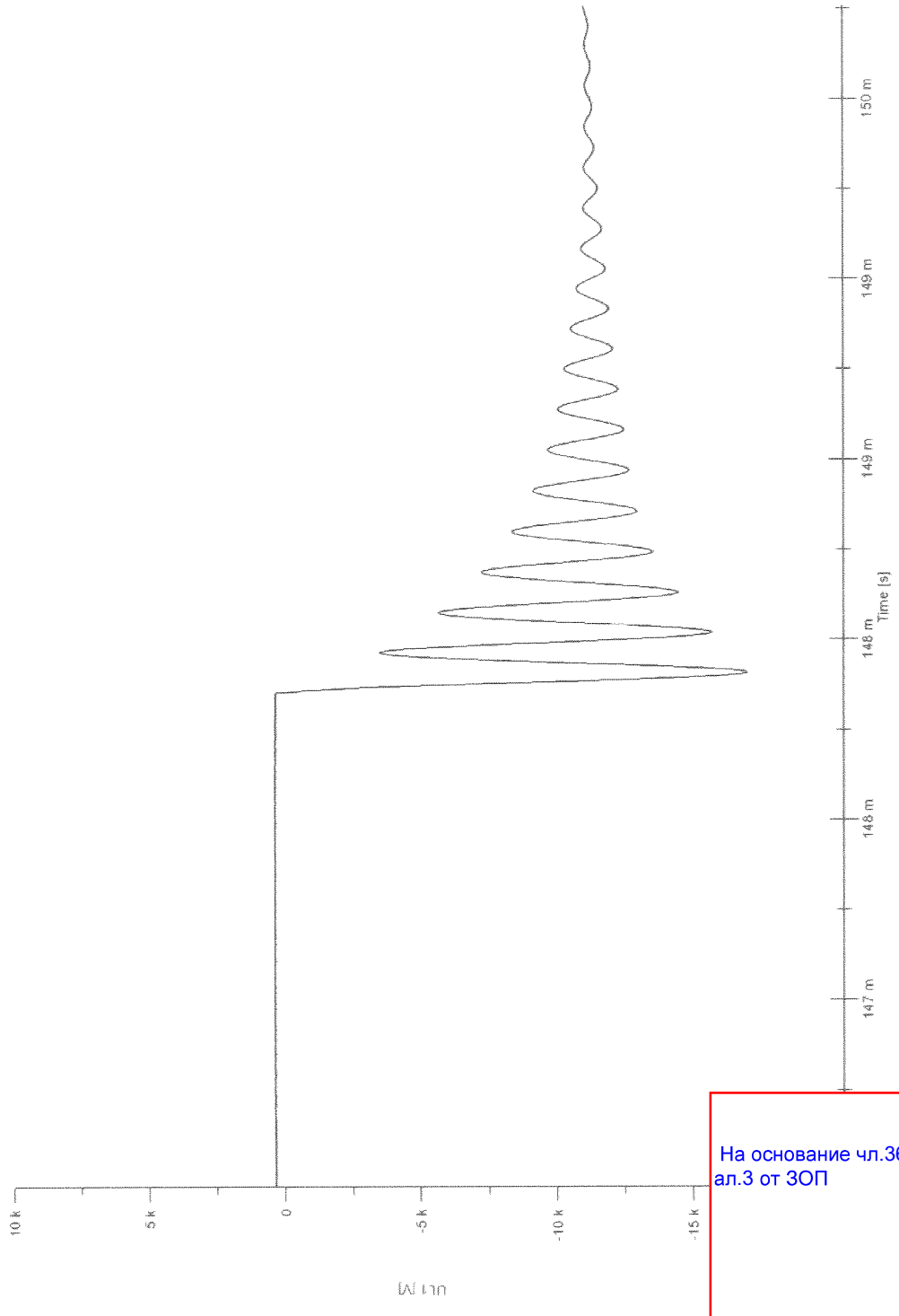
Oscillogram No. PEHLA 09137Ra / 41
Single-Phase Fault: O



На основание чл.36а ал.3 от ЗОП

Oscillogram No. PEHLA 09137Ra /41

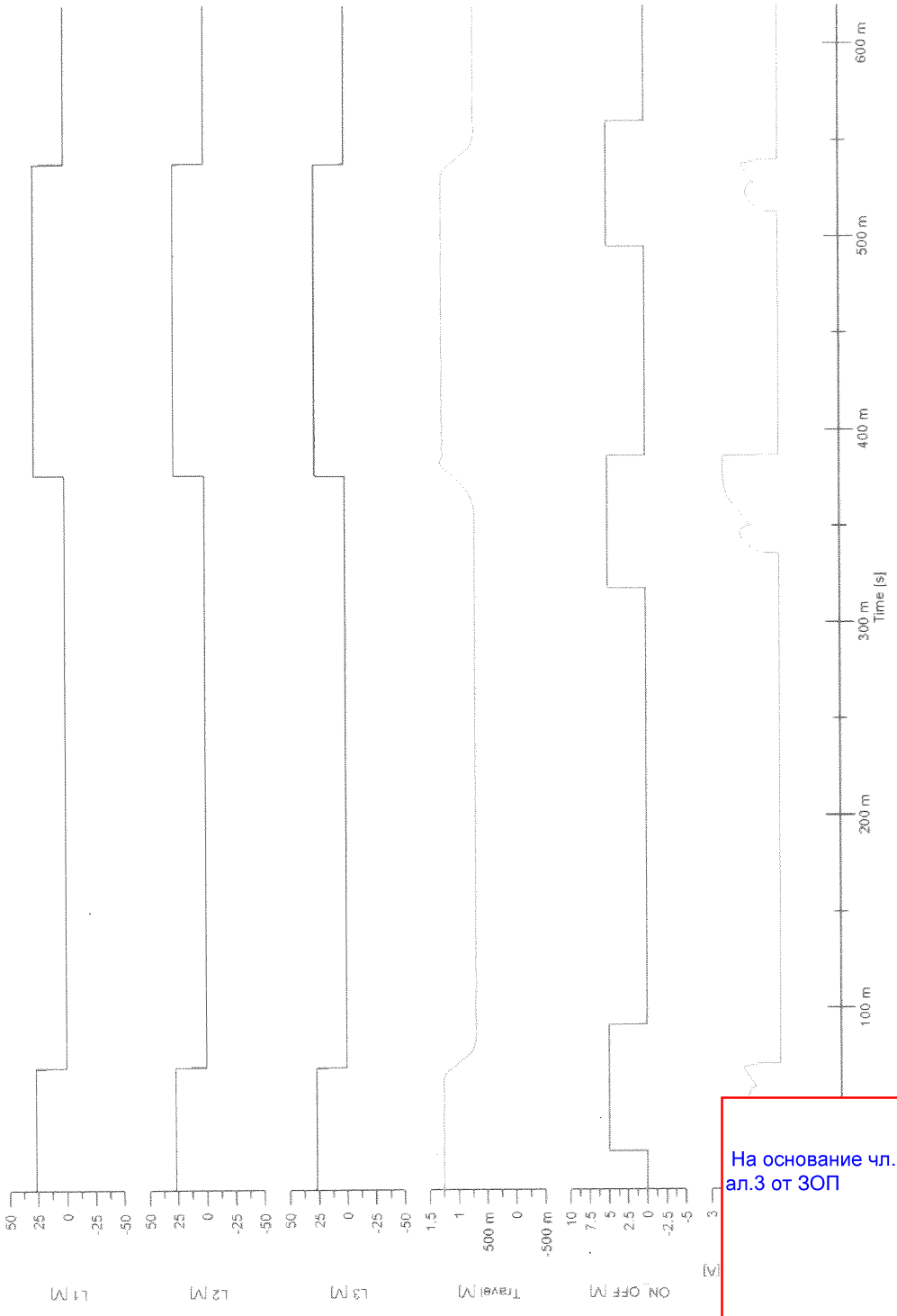
Single-Phase Fault: O (TRV)



На основание чл.36а ал.3 от ЗОП

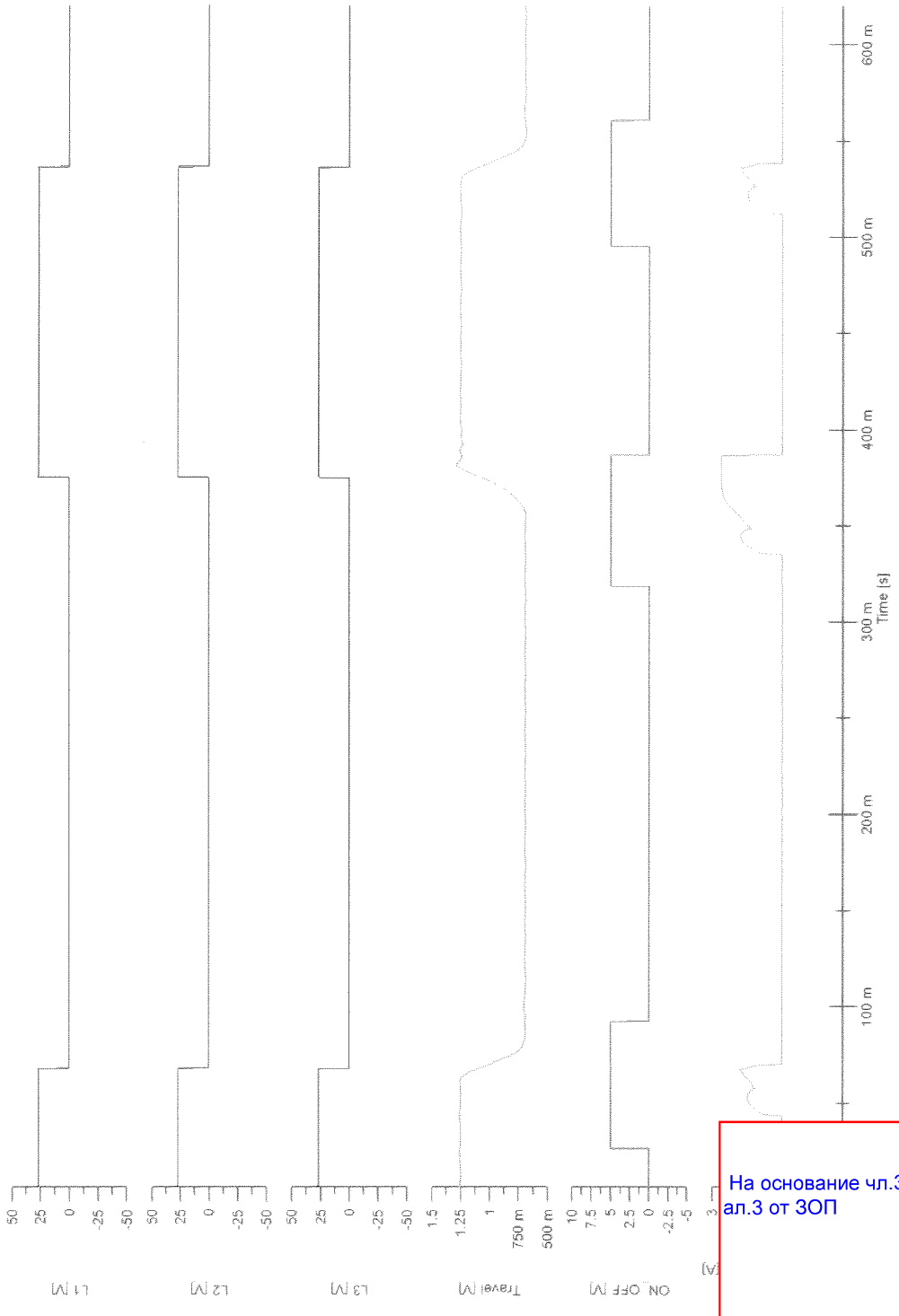
090201

Oscillogram No. PEHLA 09137Ra / 42
No-Load Operation (Rated Auxiliary Voltage)



На основание чл.36а ал.3 от ЗОП

Oscillogram No. PEHLA 09137Ra / 43
No-Load Operation (Maximum Auxiliary Voltage)

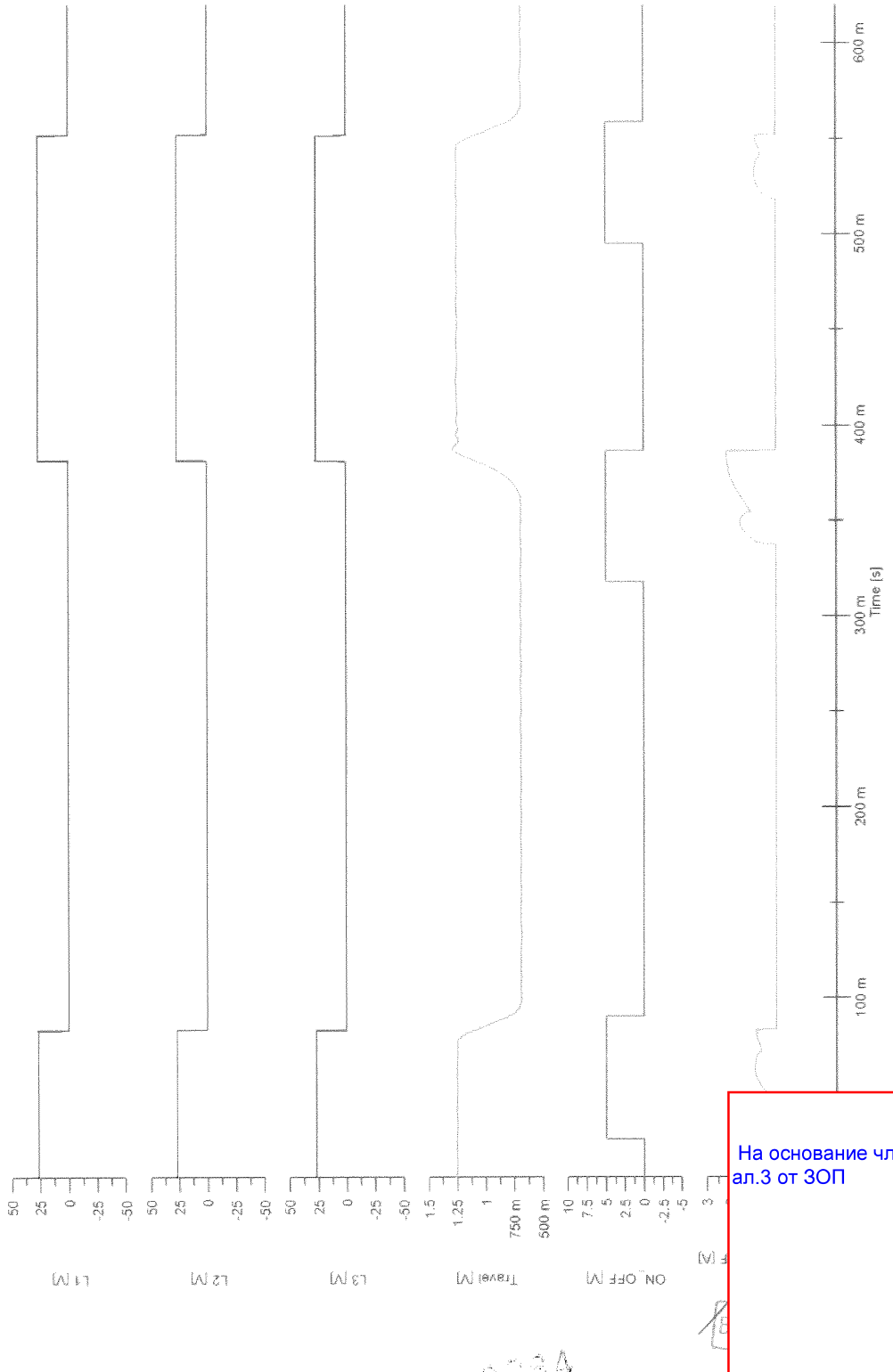


На основание чл.36а ал.3 от ЗОП

18PE0402

Oscillogram No. PEHLA 09137Ra / 44

No-Load Operation (Minimum Auxiliary Voltage)



На основание чл.36а ал.3 от ЗОП

PEHLA

GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Report

Report No.: 09148Ra **Copy No.:** 0 **Contents:** 24 **Sheets**

Test object: Vacuum circuit-breaker in metal-enclosed, air-insulated switchgear

Designation: VM1/P 17.12.32 in PowerCube PB1/M
Rated voltage: 17.5 kV Rated normal current: 1250 A Rated frequency: 50 / 60 Hz

Manufacturer: ABB P.T. S.p.A., Dalmine, Italy (circuit-breaker and switchgear)
ABB AG, Calor Emag Medium Voltage Products, Ratingen, Germany (pole part)
both under license of ABB Technology Ltd., Zurich, Switzerland

Client: ABB Technology Ltd., Zurich, Switzerland

Testing station: PEHLA-Testing Laboratory Ratingen, Germany

Date of test: 13th August 2009

Applied test specifications:

The tests have been carried out in accordance with client's instructions based on:
IEC 62271-100 / Ed. 2.0 / 2008-04, Clause 6.6
IEC 62271-200 / 1st Ed. / 2003-11, Clause 6.6
IEC 62271-1 / Ed. 1.0 / 2007-10, Clause 6.6

Tests performed:

Type tests 'Short-time withstand current and peak withstand current test on the main circuit'.
Three-phase short-time withstand current and peak withstand current test of the main circuit with a peak current of 83.5 kA and a short-time current of 32.0 kA – 4.14 s equivalent to 31.5 kA – 4.28 s at 50 Hz.
No-load operations and measurement of the resistance of the main circuit before and after the tests.

Test results:

The test object passed the tests performed in accordance with the applied test specifications.

GE На основание чл.36а ал.3 от ЗОП E

На основание чл.36а ал.3 от ЗОП

DA

Mannheim, 22nd April 2010

Notes

Accreditation

The PEHLA-Testing Laboratory Ratingen has been approved by the TGA GmbH (German accreditation body) according to EN ISO/IEC 17025 for tests in the field of high-voltage switchgear and controlgear and power engineering equipment (Registration-No. DAT-PL-032/93-63).

STL-Member

PEHLA is founder member of the SHORT-CIRCUIT TESTING LIAISON (STL) which has been established in 1969. STL is a forum for the international cooperation of the testing organisations with the further full members ASTA (UK), CESI (IT), CPRI (IND), ESEF (FR), KEMA (NL), SATS (NO, SE, FI), STLNA (US, CA) and JSTC (JP). In the frame-work of EC, STL (EU) has been recognised in 1992 by EOTC as agreement group.

PEHLA-Documents

A Type Test Certificate

is issued for type tests which have successfully been carried out in full compliance with the relevant specifications or standards and STL Guides valid at the time of the test. For these tests the test object must be clearly identified by technical description, drawings and additional specifications.

A Test Document

is issued for parts of type tests which have successfully been carried out in full compliance with the relevant specifications or standards and STL Guides valid at the time of test. For these tests the test object must be clearly identified by technical description, drawings and additional specifications.

A Test Report

is issued for all other tests which have been carried out according to specifications, standards or "PEHLA-Richtlinien" (PEHLA Guides) and/or clients' instructions. Similarly, this test report contains all test results, details of the conditions under which the tests were carried out, also details relating to the behaviour of the test object, and its condition after the tests.

A Test Confirmation

is issued immediately after the tests. It confirms that the tests have been conducted and is valid only until publishing the detailed results in an entire document.

Uncertainty of the measurement systems

The PEHLA - Testing Laboratories apply the PEHLA Guide No. 12 for determining the uncertainties of measurement, based on ENV 13005 (Guide to the expression of uncertainty in measurement). As long as no explicit statements are made, the uncertainties required by the relevant standards have been complied with.

Addresses

Office:	PEHLA-Geschäftsstelle Hallenweg 40 68219 Mannheim Germany Internet: www.pehla.com	
Testing Station:	PEHLA-Testing Laboratory Ratingen Oberhausener Str. 33 40472 Ratingen Germany	
Manufacturer:	ABB P.T. S.p.A. Via Friuli, 4 24044 Dalmine (BG) Italy under licence of ABB Technology Ltd., Zurich, Switzerland	Circuit-breaker and switchgear
	ABB AG, Calor Emag Medium Voltage Products, Oberhausener Str. 33 40472 Ratingen, Germany under licence of ABB Technology Ltd., Zurich, Switzerland	Pole parts
Client:	ABB Technology Ltd. Affolternstrasse 44 8050 Zurich Switzerland	

На основание чл.36а ал.3 от ЗОП

Table of Contents

List of Test Participants

Representatives of Technical Committee:

Mr. André Schuermann	PEHLA-Testing Laboratory Ratingen, Germany
Mr. Herbert Feld	PEHLA-Testing Laboratory Berlin-Marzahn , Germany

Test Engineer / Test Operator:

Mr. André Schuermann (Test Engineer)	PEHLA-Testing Laboratory Ratingen, Germany
Mr. Frank Idaszek (Measurement and Machine Operator)	PEHLA-Testing Laboratory Ratingen, Germany

Representatives of Client:

-

Further Participants:

-

На основание чл.36а ал.3 от ЗОП

000203

Technical Data of Test Object
Circuit-Breaker

Test object:	Vacuum circuit-breaker
Designation:	VM1/P 17.12.32
Manufacturer:	ABB P.T. S.p.A., Dalmine, Italy
Serial No.:	1VC1AM00012973
Year of manufacture:	2009
Serial No. of drive:	-
Drawing No.:	See sheet 7

Ratings assigned by the manufacturer:

Rated voltage	17.5	kV	
Rated normal current	1250	A	
Rated frequency	50/60	Hz	
Rated lightning impulse withstand voltage	95	kV	
Rated switching impulse withstand voltage	-	kV	
Rated power-frequency withstand voltage	38	kV	
Rated peak withstand current	80/82	kA	
Rated short-time withstand current	31.5	kA	
Rated duration of short-circuit	3	s	
Rated short-circuit breaking current	31.5	kA	
DC component of the rated short-circuit breaking current	≤30	%	
Rated short-circuit making current	80/82	kA	
Rated transient recovery voltage	30	kV	
Rate of rise of transient recovery voltage	0.42	kV/µs	
First-pole-to-clear factor	1.5		
Rated operating sequence	O - 0.3 s - CO - 15 s - CO		
Arc extinguishing medium	Vacuum		
Rated filling pressure for interruption	-	MPa	abs. at 20 °C
Minimum functional pressure for interruption	-	MPa	abs. at 20 °C
Insulating medium	air		
Rated filling pressure for insulation	-	MPa	abs. at 20 °C
Minimum functional pressure for insulation	-	MPa	abs. at 20 °C
Driving mechanism (type)	Magnetic actuator		
Number of poles	3		
Number of units per pole	1		
Rated opening time	35 - 45	ms	
Rated closing time	50 - 80	ms	
Rated supply voltage of opening device	110 - 250	V	d.c.
	110 - 240	V	a.c.
Rated supply voltage of closing device	110 - 250	V	d.c.
	110 - 240	V	a.c.
Rated supply voltage of auxiliary circuits	110 - 250	V	d.c.
	110 - 240	V	
Rated frequency of supply voltage	-	Hz	
Rated line-charging breaking current	-	A	
Rated cable-charging breaking current	31.5	A	

На основание чл.36а ал.3 от ЗОП

Further data: -

Essential characteristics: Vacuum interrupters type VG4S, L1: 22-33, L2: 22-49, L

Technical Data of Test Object
Switchgear

Test object:	PowerCube
Designation:	PB1/M
Manufacturer:	ABB P.T. S.p.A., Dalmine, Italy
Serial No.:	1VC1AL00037993
Year of manufacture:	2009
Drawing No.:	See sheet 7

Ratings assigned by the manufacturer:

Rated voltage	17.5	kV	
Rated normal current	1250	A	
Rated frequency	50/60	Hz	
Rated lightning impulse withstand voltage	95	kV	
Rated switching impulse withstand voltage	-	kV	
Rated power-frequency withstand voltage	38	kV	
Rated peak withstand current	80/82	kA	
Rated short-time withstand current	31.5	kA	
Rated duration of short-circuit	3	s	
Insulating medium	air		
Rated filling pressure for insulation	-	MPa	abs. at 20 °C
Minimum functional pressure for insulation	-	MPa	abs. at 20 °C

Permissible values for internal arc faults:

Peak current	-	kA
Short-circuit current	-	kA
Duration of short-circuit	-	s

Further data: -

Essential characteristics and installed devices: -

На основание чл.36а ал.3 от ЗОП

List of Identified Drawings

The manufacturer has submitted to the testing laboratory drawings and other data containing sufficient information to unambiguously identify by type the essential details and parts of the test object presented for test.
The drawings have been stamped and signed by the manufacturer in order to guarantee that the drawings or data schedules truly represent the test object to be tested.
Further these drawings have been stamped and signed by PEHLA representatives and are kept

☐ at the client.

☒ with the test documents at the test laboratory.

The testing laboratory has checked that drawings and data schedules adequately represent the essential details and parts of the test object to be tested, but is not responsible for the accuracy of the detailed information.
The drawing(s) contained in this document are identical with the checked, stamped and signed drawings.

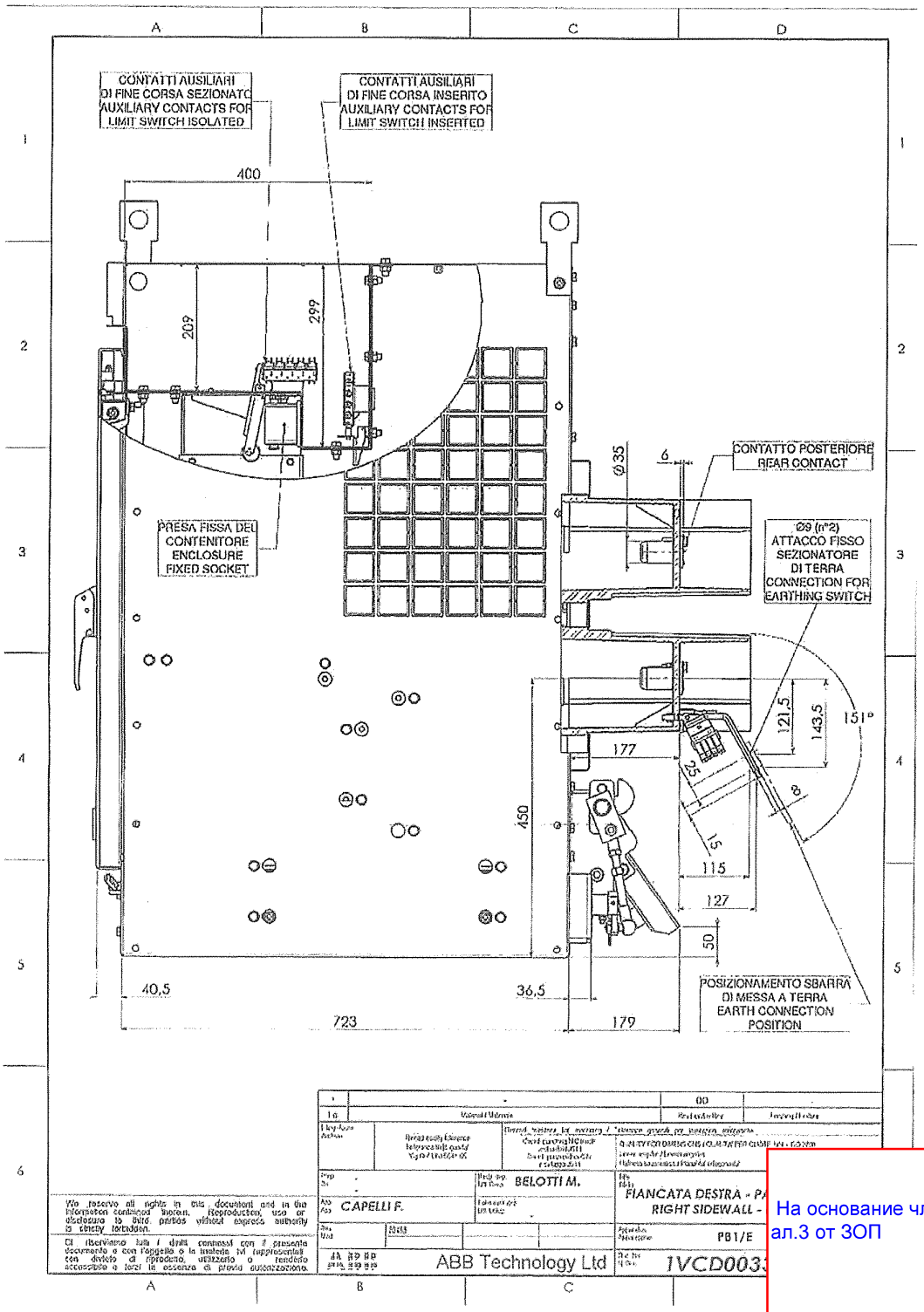
Drawing No.	Rev.	P/D *)	Title	Additional remarks
--	--	D	Overview picture of drawings VM1 17.12.32 for type test 09148Ra under PEHLA-Observation	date: 13.08.2009
1VCD003369/9	--	D	FIANCATA DESTRA - PARTICOLARI RIGHT SIDEWALL - DETAILS	Included in this test report sheet 9
1VCR000003	--	D	INTERRUTTORE BASE BASE BREAKER	G0039
1VCR000003G	--	P	Tabella materiali	0039
1VCR000006	--	D	STRUTTURA CON POLI FRAME WITH POLES	G0026
1VCR000006G	--	P	Tabella materiali	0026
GCE7004390	04	D	Aktuator vst. 31,5kA actuator compl. 31.5kA	R0111 sheet 2
GCE7004390	--	P	Actuator vollst. 31,5kA / 80V GS	R0111
1VB7006200	00	D	Polteil vollständig Pole Complete	R0102 sheet 2
1VB7006200	00	P	PT1 Pole complete with VG4S	R0102
GCE7003142	14	D	Antriebsstange vollst. Operation stud compl.	R0132 sheet 2
GCE7001851	08	D	Stromband VM1 1250A Flexible conductor VM1 1250A	P0106
1VB7003199	02	D	Abschirmplatte Shielding plate	P0130
1VB7006200	00	D	Eingießgruppe Mold Group	R0101
1VB7006200	00	P	PT1 mold group with VG4S	R0101
1VB7003128	02	D	VMTG PT1with VG4S	R0119 sheet 19
1VB7003128	02	P	PT1 VMTG with VG4S	R0119
GCE7005535	08	D	Assembly Group MTG	
509595	--	D	Mounting truck assembly	
GCE8385888	04	D	Kontaktsystem, vollst. CONTACT SYSTEM, COMPL.	
GCE7003133	07	D	Kontaktarm mit Schrumpfschlauch CONTACT ARM WITH SHRINKABLE TUBE	

*) P: Parts list, D: Drawing

Remarks: -

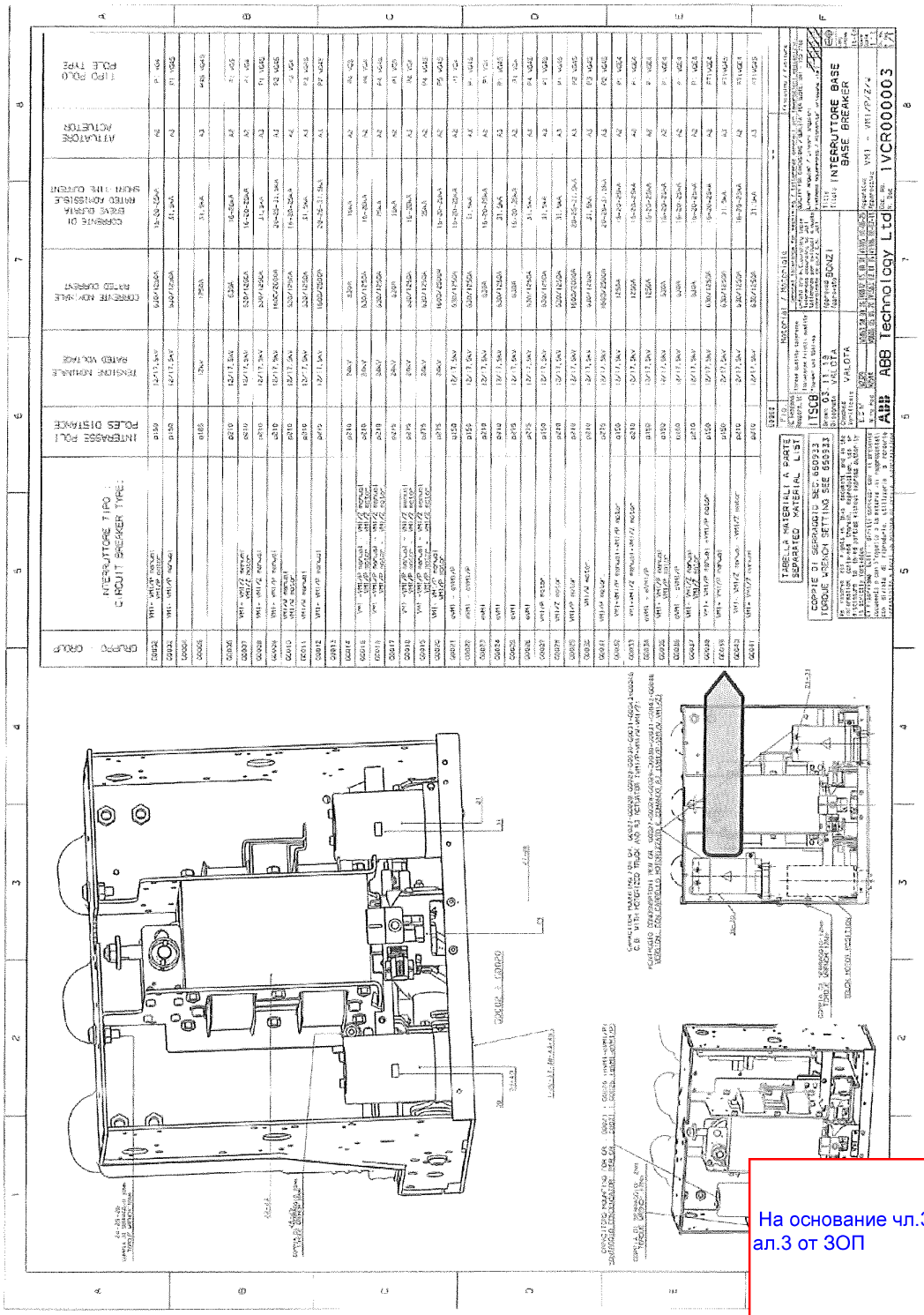
На основание чл.36а ал.3 от ЗОП

Drawing No.
1VCD003369/9



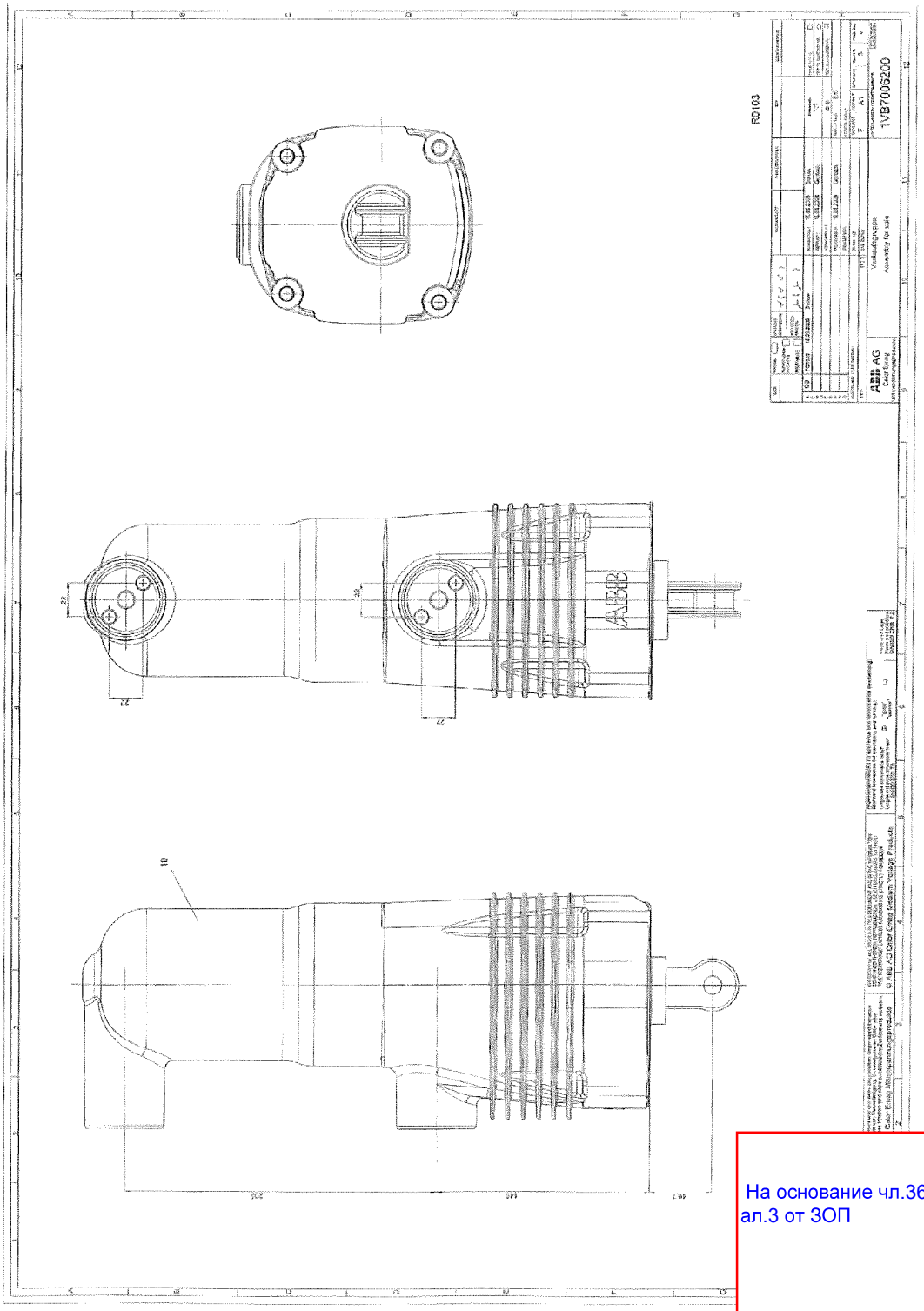
На основание чл.36а ал.3 от ЗОП

Drawing No.
1VCR000003



На основание чл.36а ал.3 от ЗОП

Drawing No.
1VB7006200



На основание чл.36а ал.3 от ЗОП

Technical Data of Test Circuit

Short-Time Withstand Current and Peak Withstand Current Test

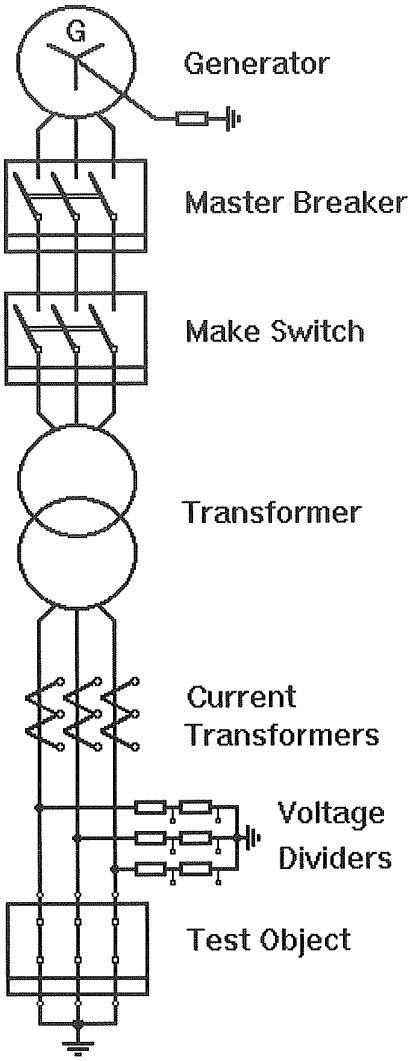
Test performed		STC	-
Test No.	PEHLA 09148Ra /	03 – 09	-
Test circuit			
Circuit diagram	Sheet No.	12	-
Current circuit			
Number of phases		3	-
Power frequency	Hz	50	-
Power factor		< 0.15	-
Earthing conditions			
Generator / System		earthed via 5 kΩ	-
Transformer		not earthed	-
Short-circuit point		earthed	-
Test object		earthed	-
Test object (test values)			
Number of phases	-	3	-
Measurement			
Voltage measurement		Voltage Dividers 80 kΩ / 1.1 kΩ	-
Current measurement		Current Transf. 50 kA / 5 A	-

Remarks: -

На основание чл.36а ал.3 от ЗОП

Circuit Diagram

Short-Time Withstand Current and Peak Withstand Current Test



На основание чл.36а ал.3 от ЗОП

Test Results

Short-Time Withstand Current and Peak Withstand Current Test

Test performed: Short-time withstand current and peak withstand current tests
Date of test: 13th August 2009
Condition of test object before test: Factory new.
Test arrangement: Direct test circuit, vacuum circuit-breaker in PowerCube
Connections to test object: Infeed via copper bars to the upper connectors of the PowerCube. Short-circuited at the lower connectors of the PowerCube via copper bar, short-circuit point and PowerCube earthed via cable.
Gas pressure (abs. rel. to 20 °C): - MPa

Test No.			PEHLA 09148Ra /		06	07	08	09	-	-
Peak withstand current			L1	kA	81.5	83.5	58.6	58.8	-	-
			L2	kA	65.0	67.6	53.6	52.6	-	-
			L3	kA	64.6	64.5	67.0	66.2	-	-
Short-circuit current		First cycle	L1	kA	34.4	34.9	34.0	33.9	-	-
			L2	kA	32.7	33.3	33.2	33.1	-	-
			L3	kA	35.3	35.9	35.4	35.2	-	-
		Last cycle	L1	kA	32.2	32.6	32.3	32.5	-	-
			L2	kA	31.2	31.7	31.4	31.4	-	-
			L3	kA	33.2	33.7	33.3	33.5	-	-
	Equivalent current		L1	kA	32.0	32.5	32.2	32.0	-	-
			L2	kA	31.1	31.6	31.3	31.1	-	-
			L3	kA	33.0	33.5	33.1	33.0	-	-
		Average value		kA	32.0	32.5	32.2	32.0	-	-
	Duration of short-circuit			s	0.320	0.320	1.02	4.14	-	-
Short-time withstand current			L1	kA	-	-	32.4	32.6	-	-
			L2	kA	-	-	31.6	31.6	-	-
			L3	kA	-	-	33.5	33.6	-	-
		Average value		kA	-	-	32.5	32.6	-	-
	Related to rated duration of short-circuit			s	-	-	1	4	-	-
Duration of short-circuit				s	-	-	1.07	4.28	-	-
Related to rated short-time withstand current				kA	-	-	31.5	31.5	-	-
Emission of flame/gas/oil					no	no	no	no	-	-
Test result (P/N)					P	P	P	P	-	-

Resistance of the main circuit

	Before test	L1	µΩ	-	-	-	-	-	-
		L2	µΩ	-	-	-	-	-	-
		L3	µΩ	-	-	-	-	-	-
	After test	L1	µΩ	-	-	-	-	-	-
		L2	µΩ	-	-	-			
		L3	µΩ	-	-	-			

Legend: P: Passed in terms of the applied standard N: Not passed in terms of

Remarks: PEHLA 09148Ra / 01: Current calibration
PEHLA 09148Ra / 02 and 10: No-load operation
PEHLA 09148Ra / 03 to 05: Tests with reduced values
Measurement of the Resistance of the Main Circuit: see sheet 15

Condition of test object after test: No visible or functional change or damage. The resistance values are within the limits of the applied test specifications.

На основание чл.36а ал.3 от ЗОП

Test Results
No-Load Operations

Test performed: No-load operations before and after short-time withstand current and peak withstand current tests

Date of test: 13th August 2009

Condition of test object before test: Factory new / as after test PEHLA 09148Ra / 09.

Gas pressure (abs. rel. to 20 °C): -

Test No.	PEHLA 09148Ra /			02	10	-	-
Operating sequence				O	O	-	-
C-Operation	Voltage of closing device		V	-	-	-	-
	Closing time	L1	ms	-	-	-	-
		L2	ms	-	-	-	-
		L3	ms	-	-	-	-
O-Operation	Voltage of opening device		V	110	110	-	-
	Opening time	L1	ms	40.7	41.3	-	-
		L2	ms	40.9	43.6	-	-
		L3	ms	40.8	41.1	-	-

Legend: -

Remarks: The voltage value corresponds to 100% of the rated supply voltage. The circuit-breaker opened with its own mechanism at the first attempt.

На основание чл.36а ал.3 от ЗОП

Measurement of the Resistance of the Main Circuit

Test performed: Measurement of the resistance of the main circuit

Date of test: 13th August 2009

Condition of test object: Factory new.

Measurement before test PEHLA 09148Ra / 03.			
Ambient air temperature:		21	°C
Resistance measurement at direct current of:		100	A (d.c.)
Measurement between points (see sheet 15)	Resistance of the main circuit μΩ		
	L1	L2	L3
1 - 2	20.6	22.0	22.7
3 - 4	44.0	45.4	45.2
-	-	-	-

Remarks: -

Date of test: 13th August 2009

Condition of test object: As after test PEHLA 09148Ra / 09.

Measurement after test PEHLA 09148Ra / 10.			
Ambient air temperature:		21	°C
Resistance measurement at direct current of:		100	A (d.c.)
Measurement between points (see sheet 15)	Resistance of the main circuit μΩ		
	L1	L2	L3
1 - 2	22.8	22.1	22.9
3 - 4	46.2	45.3	45.4
-	-	-	-

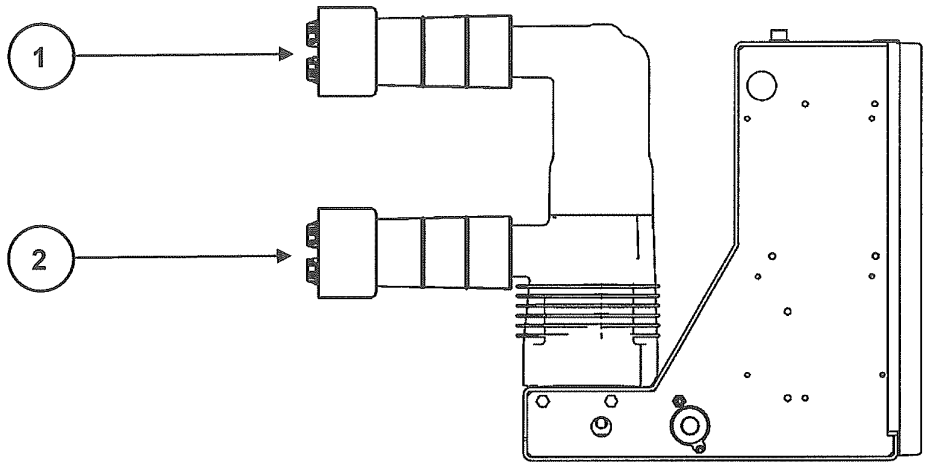
Remarks: -

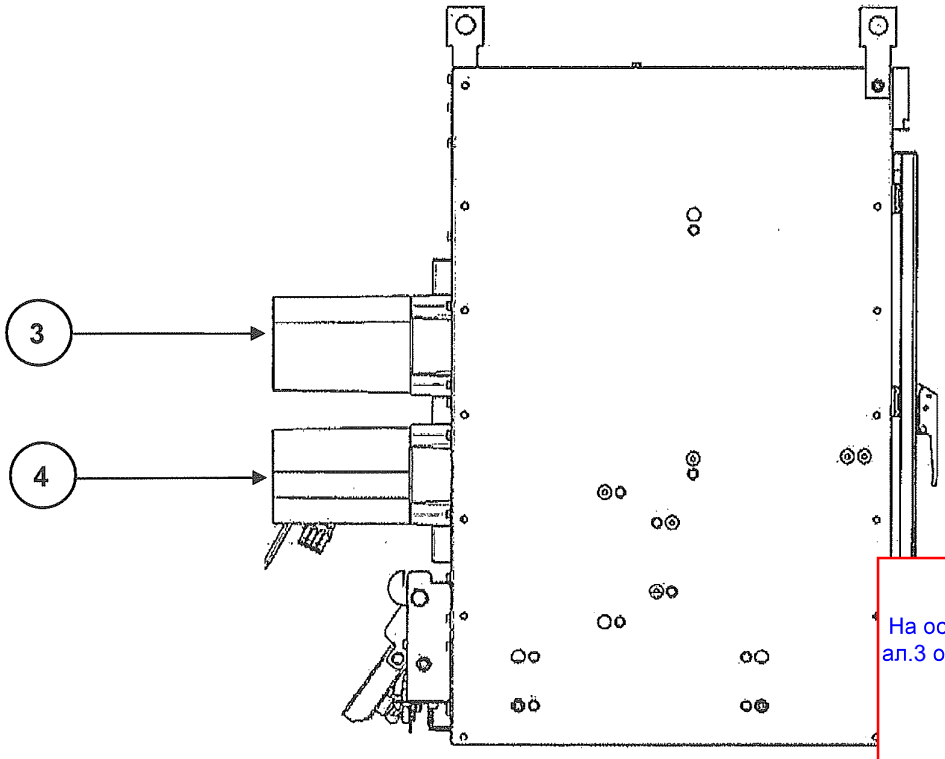
Result: The variation of the resistance of the main circuit is within the limits given in the applied test specifications.

На основание чл.36а ал.3 от ЗОП

Measurement of the Resistance of the Main Circuit

Measurement Points





На основание чл.36а ал.3 от ЗОП

Photos

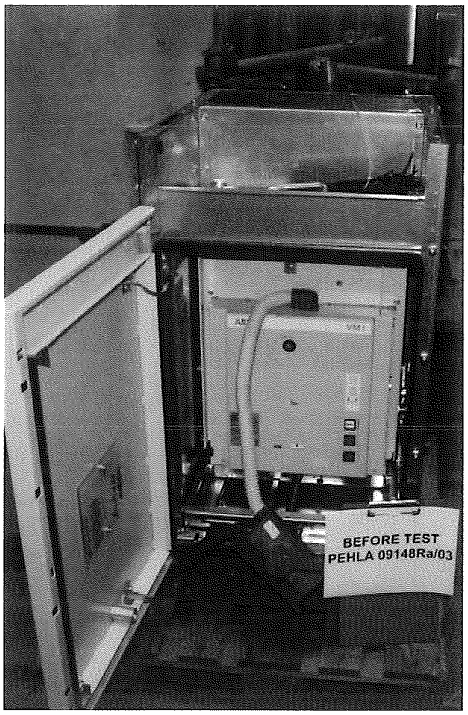


Photo No. 01:
Before test PEHLA 09148Ra / 03

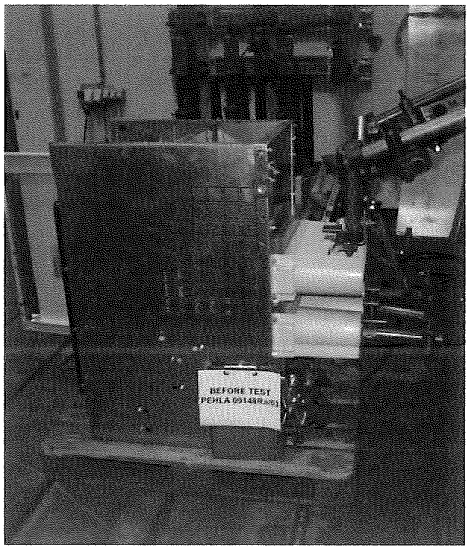


Photo No. 02:
Before test PEHLA 09148Ra / 03

На основание чл.36а ал.3 от ЗОП

Photos

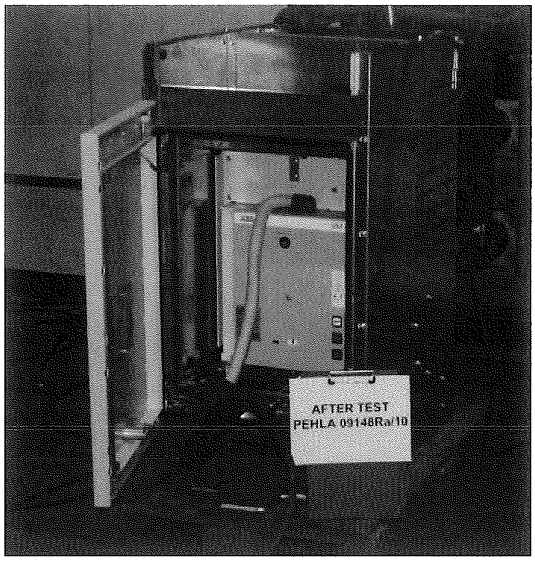


Photo No. 03:
After test PEHLA 09148Ra / 10

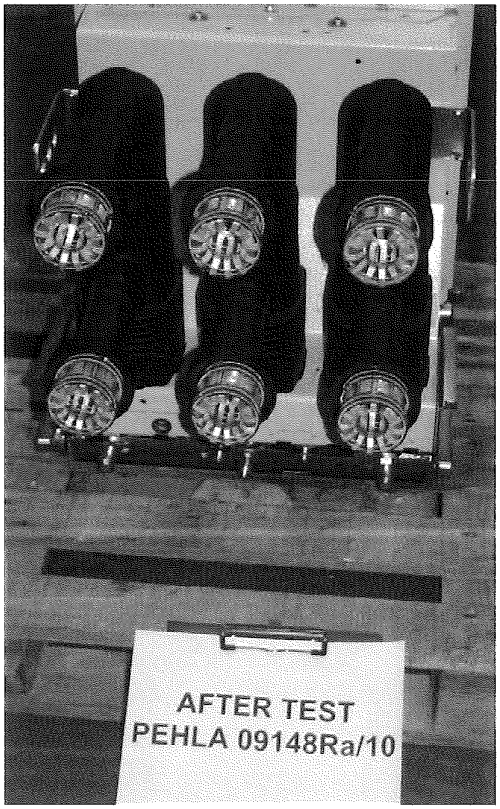
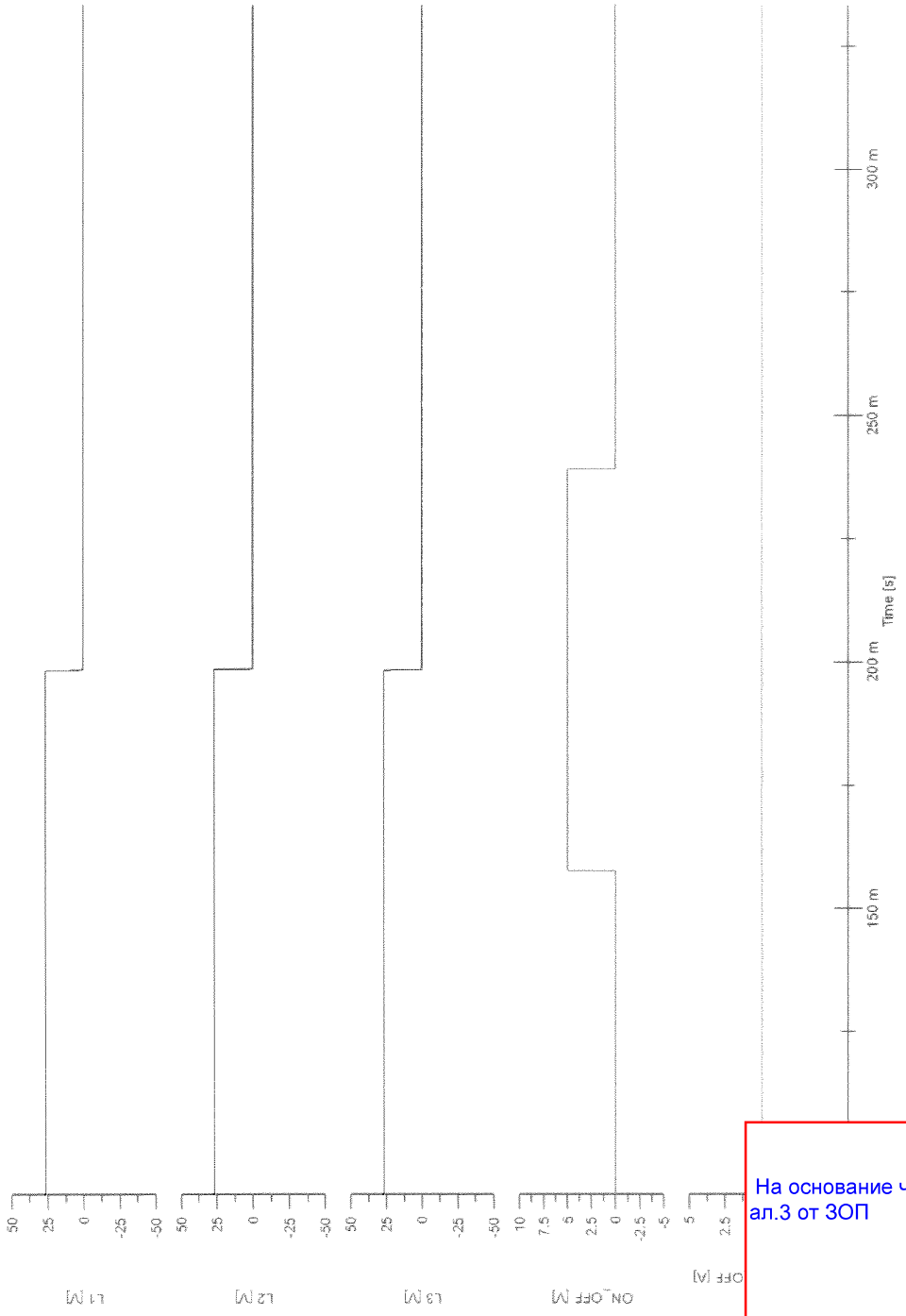


Photo No. 04:
After test PEHLA 09148Ra / 10

На основание чл.36а ал.3 от ЗОП

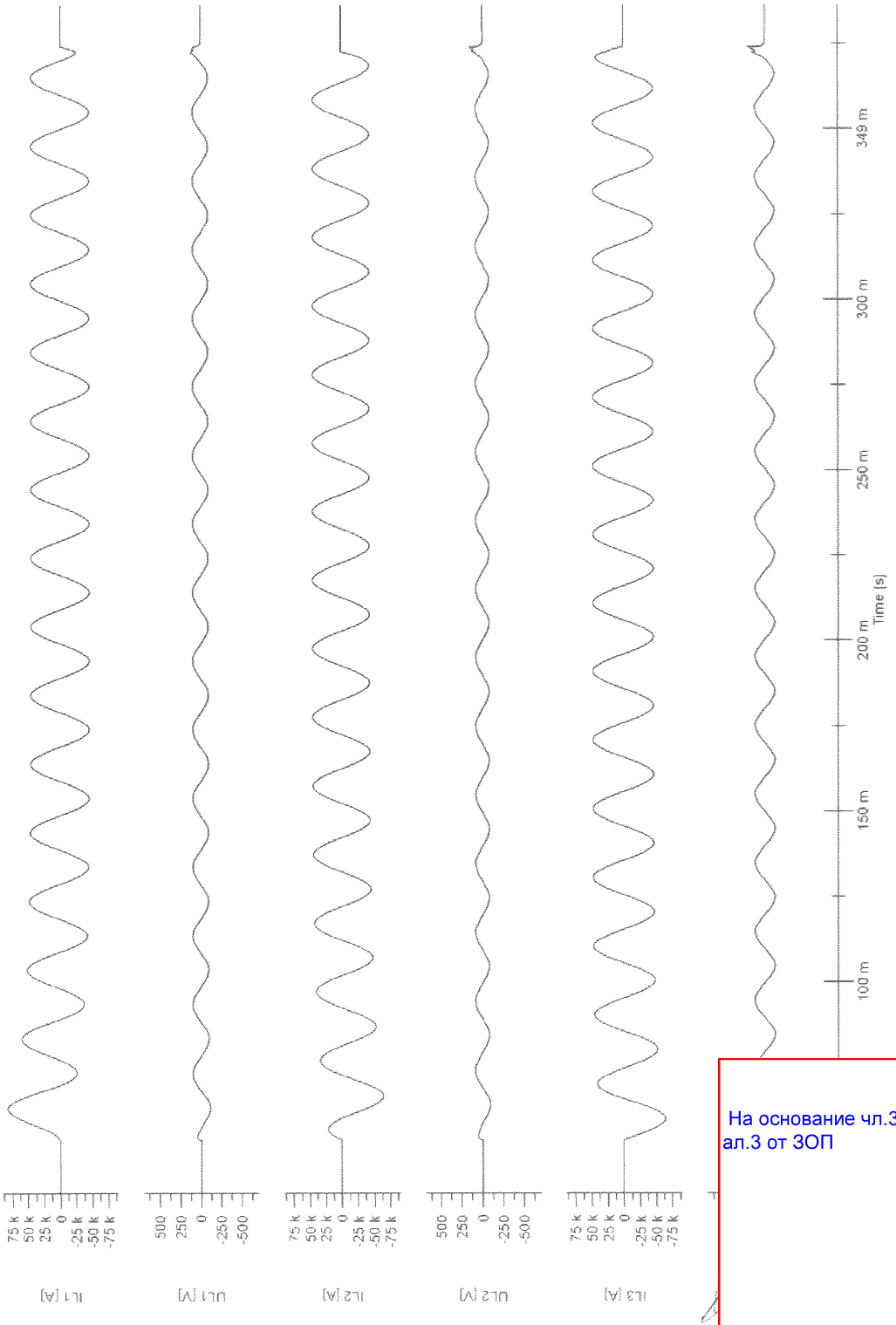
Oscillogram No. PEHLA 09148Ra / 02
No-Load Operation



На основание чл.36а ал.3 от ЗОП

18PE0402

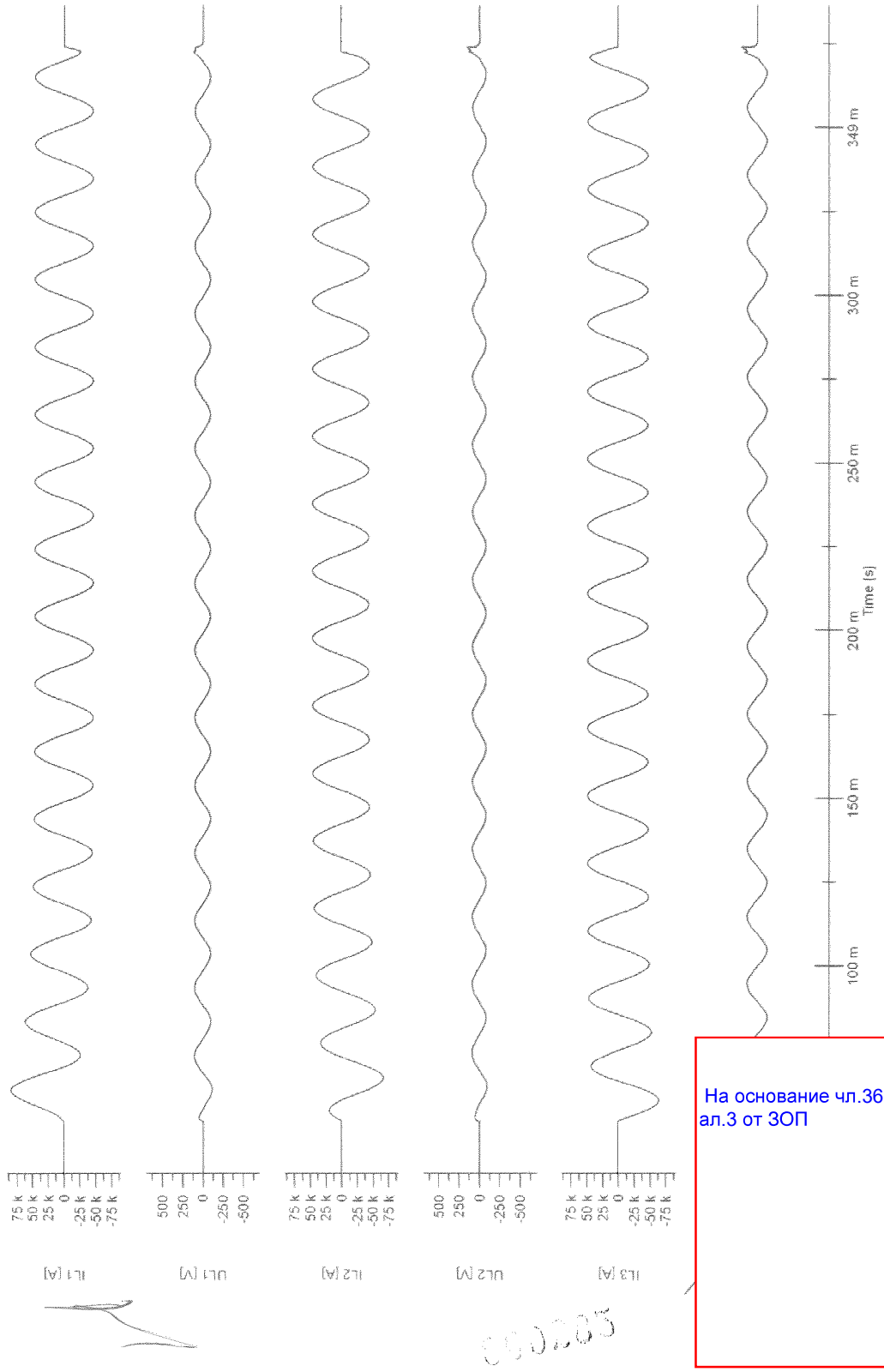
Oscillogram No. PEHLA 09148Ra / 06
Peak Withstand Current Test



На основание чл.36а ал.3 от ЗОП

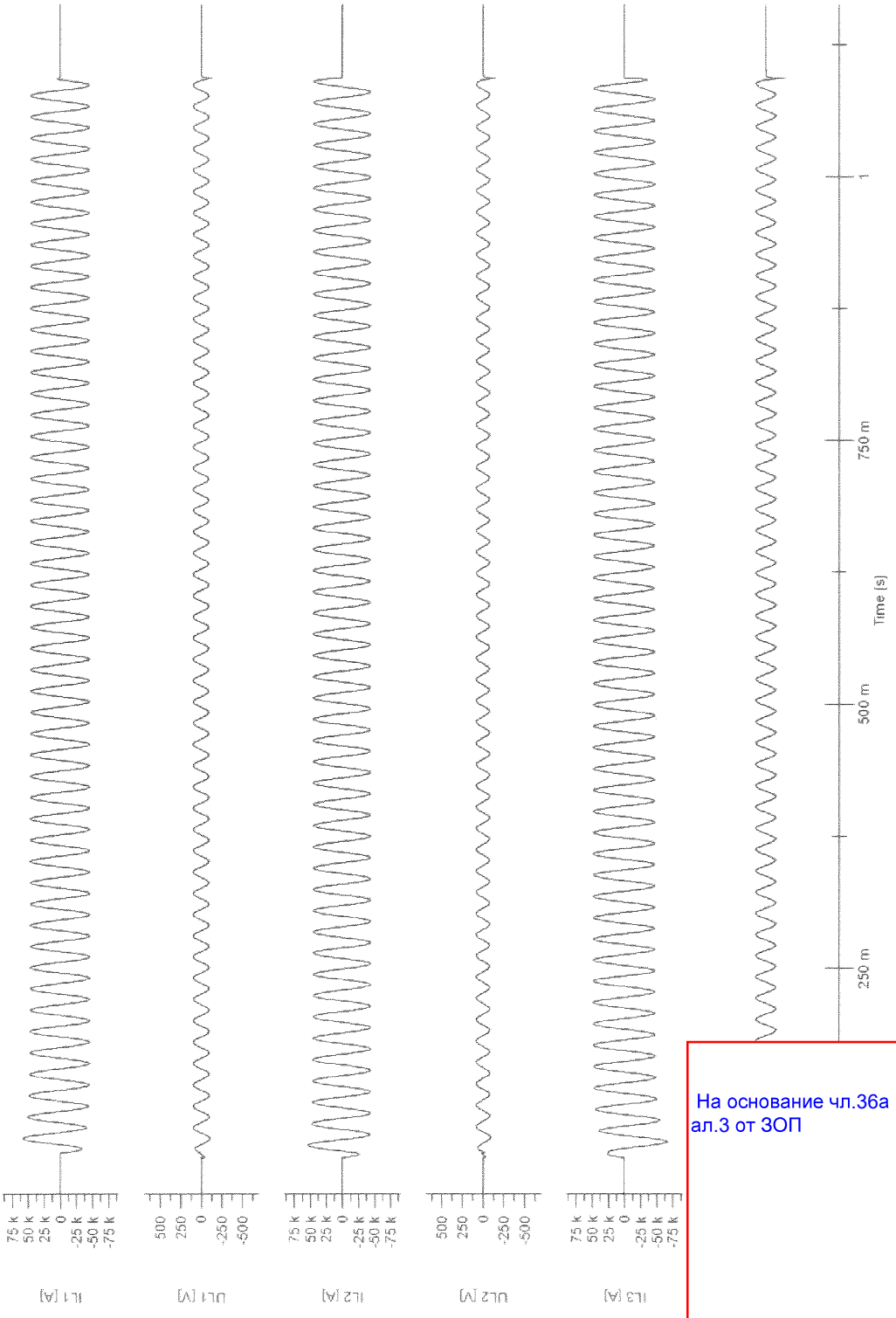
Oscillogram No. PEHLA 09148Ra / 07

Peak Withstand Current Test



На основание чл.36а ал.3 от ЗОП

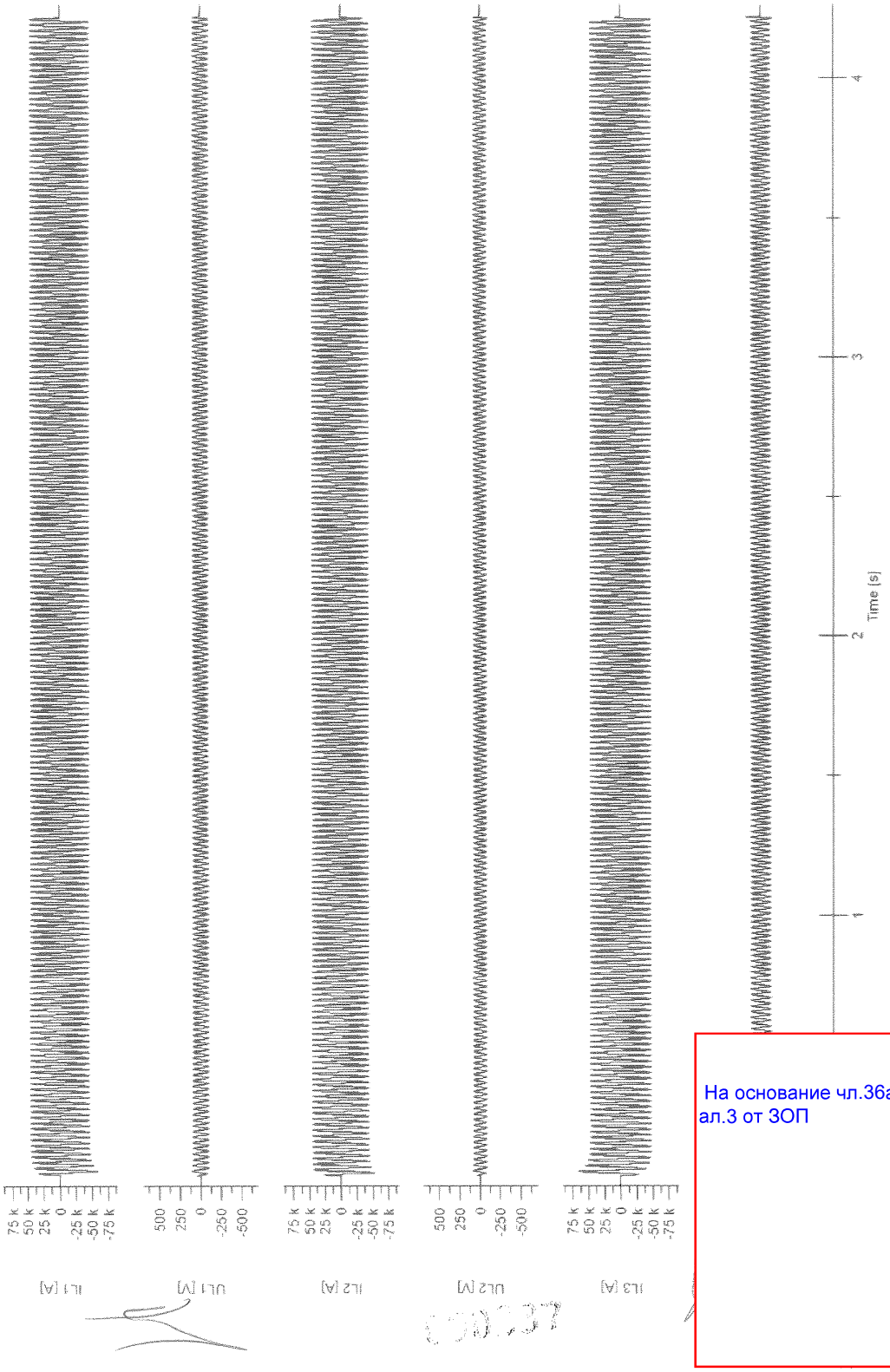
Oscillogram No. PEHLA 09148Ra / 08
Short-Time Withstand Current Test - 1s



На основание чл.36а ал.3 от ЗОП

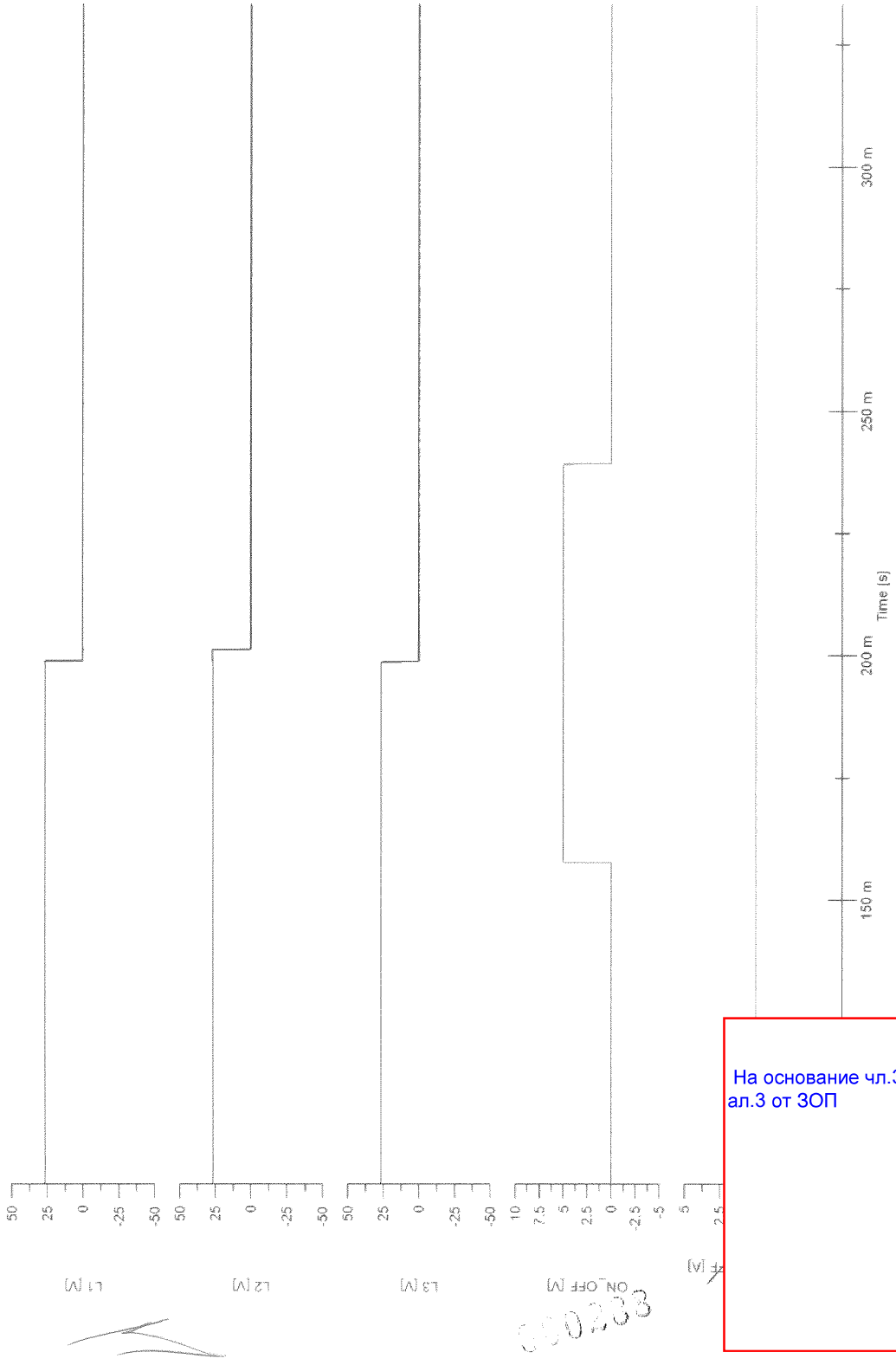
Oscillogram No. PEHLA 09148Ra / 09

Short-Time Withstand Current Test - 4s



На основание чл.36а ал.3 от ЗОП

Oscillogram No. PEHLA 09148Ra / 10
No-Load Operation



На основание чл.36а ал.3 от ЗОП

Test Report

Report No.: HZ 134 E 47 **Copy No.:** 1 **Contents:** 28 **Sheets**

Test object: Withdrawable vacuum circuit-breakers in metal-enclosed, air-insulated switchgear in a two-panel arrangement

Designation: VD4/P 17.12.25 and VM1 17.06.25 in UniGear ZS1
Rated voltage: 17.5 kV Rated normal current: 1250 / 630 A Rated frequency: 50 Hz

Manufacturer: ABB P.T. S.p.A., Dalmine, Italy (circuit-breaker)
ABB AG, Calor Emag Medium Voltage Products, Ratingen, Germany (pole part)
both under license of ABB Technology Ltd., Zurich, Switzerland

Client: ABB Technology Ltd., Zurich, Switzerland

Date of test: 27th November and 28th November 2009

Applied test specifications:

Test procedure and test parameters were in accordance with:
IEC 62271-1, Edition 1.0, 2007-10 cl. 6.4.1, 6.5.1 – 6.5.4 and 6.5.6,
IEC 62271-100, Edition 2.0, 2008-04 cl. 6.4, 6.5.1 – 6.5.4 and 6.5.6,
IEC 62271-200, 1st Ed., 2003-11 cl. 6.4.1, 6.5.1 – 6.5.4 and 6.5.6.

Tests performed:

Three-phase temperature-rise test at the rated normal currents of 1250 / 630 A at a power frequency of 50 Hz. Measurement of the resistance of the main circuit before and after the temperature-rise test.

Test results:

The test object passed the tests performed in accordance with the applied test specifications.

ABB Laboratories ABB Ratingen

На основание чл.36а ал.3 от ЗОП

На основание чл.36а ал.3 от ЗОП

Ratingen, 30th March 2010

Notes

Accreditation:

ABB AG – Calor Emag Medium Voltage Products is certified according to ISO 9001 and 14001 and BS OHSAS 18001 by DQS GmbH under Reg. No. 431509 QM08 UM BSOH.

ABB Laboratories Ratingen are accredited according to DIN EN ISO/IEC 17025 by TGA GmbH under Reg.No. DAT-PL-032/93-03.

Uncertainty of the measurement systems:

The method of presentation of measuring results does not indicate an accuracy. As long as no explicit statements are made, the uncertainties required by the relevant standards have been complied with.

Addresses:

Testing Laboratory: ABB AG – Calor Emag Medium Voltage Products
Temperature Rise Testing Laboratory
Oberhausener Straße 33
40472 Ratingen, Germany

Phone: + 49 (0) 21 02 12 1372
Fax: + 49 (0) 21 02 12 1713
e-mail: claus.loquingen@de.abb.com

Manufacturer: (circuit-breaker)
ABB S.p.A., Power Products Division
Via Friuli, 4,
I-24044 Dalmine
Italy

Manufacturer: (pole part)
ABB AG
Calor Emag Medium Voltage Products
Oberhausener Str. 33
40472 Ratingen
Germany

both under license of ABB Technology Ltd., Zurich, Switzerland

Client:
ABB Technology Ltd.
Affolternstrasse 44
8050 Zurich, Switzerland

На основание чл.36а ал.3 от ЗОП

Table of Contents

На основание чл.36а ал.3 от ЗОП

Technical Data of Test Object
Switchgear / Incoming Panel

Test object:	Metal-enclosed, air-insulated switchgear
Designation:	UniGear type ZS1, width 650 mm
Manufacturer:	ABB S.p.A., Power Products Division, Dalmine, Italy
Serial No.:	8090001451/01
Year of manufacture:	2009
Drawing No.:	GCE8010474R0102

Ratings assigned by the manufacturer:

Rated voltage	17.5	kV	
Rated normal current / busbar	1250	A	
Rated normal current / tee-off	1250	A	
Rated frequency	50	Hz	
Rated lightning impulse withstand voltage	95	kV	
Rated switching impulse withstand voltage	-	kV	
Rated power-frequency withstand voltage	38	kV	
Rated peak withstand current	63	kA	
Rated short-time withstand current	25	kA	
Rated duration of short-circuit	3	s	
Insulating medium	air		
Rated filling pressure for insulation	-	MPa	abs. at 20 °C
Minimum functional pressure for insulation	-	MPa	abs. at 20 °C

Permissible values for internal arc faults:

Peak current	63	kA
Short-circuit current	25	kA
Duration of short-circuit	1	s

Further data:

Current transformers:

Manufacturer	**Type**	**Year of manufacture**	**Insulation class**
ABB	TPU 43.13	2007	E
Voltages	**Frequency**	**Short-time withstand current**	**Peak withstand current**
17.5/38/95 kV	50 Hz	25 kA / 1 s	62.5 kA
Serial Nos.	**L1** 1VLT5107025799, **L2** 1VLT5107025800; **L3** 1VLT5107025803		
Core 1	1250 / 1 A, 1 VA, cl. 1 FS5		
Core 2	1250 / 1 A, 10 VA, cl. 5P20		

Essential characteristics and installed devices:

The power loss of the controlgear in the low voltage compartment was simulated by a heating resistor of 60 W.

Date of receipt of test object: 15th November 2009

На основание чл.36а ал.3 от ЗОП

Technical Data of Test Object
Switchgear / Outgoing Panel

Test object:	Metal-enclosed, air-insulated switchgear
Designation:	UniGear type ZS1, width 650 mm
Manufacturer:	ABB S.p.A., Power Products Division, Dalmine, Italy
Serial No.:	8090001451/02
Year of manufacture:	2009
Drawing No.:	GCE8010474R0101

Ratings assigned by the manufacturer:

Rated voltage	17.5	kV	
Rated normal current / busbar	1250	A	
Rated normal current / tee-off	630	A	
Rated frequency	50	Hz	
Rated lightning impulse withstand voltage	95	kV	
Rated switching impulse withstand voltage	-	kV	
Rated power-frequency withstand voltage	38	kV	
Rated peak withstand current	63	kA	
Rated short-time withstand current	25	kA	
Rated duration of short-circuit	3	s	
Insulating medium	air		
Rated filling pressure for insulation	-	MPa	abs. at 20 °C
Minimum functional pressure for insulation	-	MPa	abs. at 20 °C

Permissible values for internal arc faults:

Peak current	63	kA
Short-circuit current	25	kA
Duration of short-circuit	1	s

Further data:

Current transformers:

Manufacturer	**Type**	**Year of manufacture**	**Insulation class**
ABB	TPU 53.13	2007	E
Voltages	**Frequency**	**Short-time withstand current**	**Peak withstand current**
17.5/38/95 kV	50 Hz	25 kA / 1 s	62.5 kA
Serial Nos.	**L1** 1VLT5109013421, **L2** 11VLT5109013420; **L3** 1VLT5109013419		
Core 1	630 / 1 A, 1 VA, cl. 1 FS5		
Core 2	630 / 1 A, 10 VA, cl. 5P20		

Essential characteristics and installed devices:

The power loss of the controlgear in the low voltage compartment was simulated by a heating resistor of 60 W.

Date of receipt of test object: 15th November 2009

На основание чл.36а ал.3 от ЗОП

Technical Data of Test Object
Circuit-Breaker / Incoming Panel

Test object:	Vacuum circuit-breaker
Designation:	VD4/P 17.12.25
Manufacturer:	ABB S.p.A., Power Products Division, Dalmine, Italy
Serial No.:	1VC1AM00028403
Year of manufacture:	2009
Serial No. of interrupters:	VGE4
Drawing No.:	1VCR016097G0119 (circuit-breaker), 1VB7006200R0101 (pole part)

Ratings assigned by the manufacturer:

Rated voltage	17.5	kV	
Rated normal current	1250	A	
Rated frequency	50/60	Hz	
Rated lightning impulse withstand voltage	95	kV	
Rated switching impulse withstand voltage	-	kV	
Rated power-frequency withstand voltage	38	kV	
Rated peak withstand current	63/65	kA	
Rated short-time withstand current	25	kA	
Rated duration of short-circuit	3	s	
Rated short-circuit breaking current	25	kA	
DC component of the rated short-circuit breaking current	≤ 30	%	
Rated short-circuit making current	63/65	kA	
Rated transient recovery voltage	30	kV	
Rate of rise of transient recovery voltage	0.42	kV/µs	
First-pole-to-clear factor	1.5		
Rated operating sequence	O - 0.3 s - CO - 15 s - CO		
Arc extinguishing medium	vacuum		
Rated filling pressure for interruption	-	MPa	abs. at 20 °C
Minimum functional pressure for interruption	-	MPa	abs. at 20 °C
Insulating medium	air		
Rated filling pressure for insulation	-	MPa	abs. at 20 °C
Minimum functional pressure for insulation	-	MPa	abs. at 20 °C
Driving mechanism (type)	spring drive		
Number of poles	3		
Number of units per pole	1		
Rated opening time	33…60	ms	
Rated closing time	60…80	ms	
Rated supply voltage of opening device	110	V	d.c.
Rated supply voltage of closing device	110	V	d.c.
Rated supply voltage of auxiliary circuits	110	V	d.c.
Rated frequency of supply voltage	-	Hz	
Rated line-charging breaking current	-	A	
Rated cable-charging breaking current	31.5	A	

Further data: -

Essential characteristics:

-

Date of receipt of test object: 15th November 2009

На основание чл.36а ал.3 от ЗОП

Technical Data of Test Object
Circuit-Breaker / Outgoing Panel

Test object:	Vacuum circuit-breaker
Designation:	VM1 17.06.25
Manufacturer:	ABB S.p.A., Power Products Division, Dalmine, Italy
Serial No.:	1VC1AM00027690
Year of manufacture:	2009
Serial No. of interrupters:	Type VGE4
Drawing No.:	1VCR000003G0038 (circuit-breaker), 1VB7006201R0101 (pole part)

Ratings assigned by the manufacturer:

Rated voltage	17.5	kV	
Rated normal current	630	A	
Rated frequency	50/60	Hz	
Rated lightning impulse withstand voltage	95	kV	
Rated switching impulse withstand voltage	-	kV	
Rated power-frequency withstand voltage	38	kV	
Rated peak withstand current	63/65	kA	
Rated short-time withstand current	25	kA	
Rated duration of short-circuit	3	s	
Rated short-circuit breaking current	25	kA	
DC component of the rated short-circuit breaking current	≤ 30	%	
Rated short-circuit making current	63/65	kA	
Rated transient recovery voltage	30	kV	
Rate of rise of transient recovery voltage	0.42	kV/µs	
First-pole-to-clear factor	1.5		
Rated operating sequence	O - 0.3 s - CO - 15 s - CO		
Arc extinguishing medium	vacuum		
Rated filling pressure for interruption	-	MPa	abs. at 20 °C
Minimum functional pressure for interruption	-	MPa	abs. at 20 °C
Insulating medium	air		
Rated filling pressure for insulation	-	MPa	abs. at 20 °C
Minimum functional pressure for insulation	-	MPa	abs. at 20 °C
Driving mechanism (type)	actuator		
Number of poles	3		
Number of units per pole	1		
Rated opening time	33...60	ms	
Rated closing time	60...80	ms	
Rated supply voltage of opening device	110	V	d.c.
Rated supply voltage of closing device	110	V	d.c.
Rated supply voltage of auxiliary circuits	110	V	d.c.
Rated frequency of supply voltage	-	Hz	
Rated line-charging breaking current	-	A	
Rated cable-charging breaking current	31.5	A	

Further data: -

Essential characteristics:

-

Date of receipt of test object: 15th November 2009

List of Identified Drawings

The manufacturer has submitted to the testing laboratory drawings and other data containing sufficient information to unambiguously identify by type the essential details and parts of the test object presented for test.
The drawings have been stamped and signed by the manufacturer in order to guarantee that the drawings or data schedules truly represent the test object to be tested.
Further these drawings have been stamped and signed by PEHLA representatives and are kept
☐ at the client.
☒ with the test documents at the test laboratory.
The testing laboratory has checked that drawings and data schedules adequately represent the essential details and parts of the test object to be tested, but is not responsible for the accuracy of the detailed information.
The drawing(s) contained in this document are identical with the checked, stamped and signed drawings.

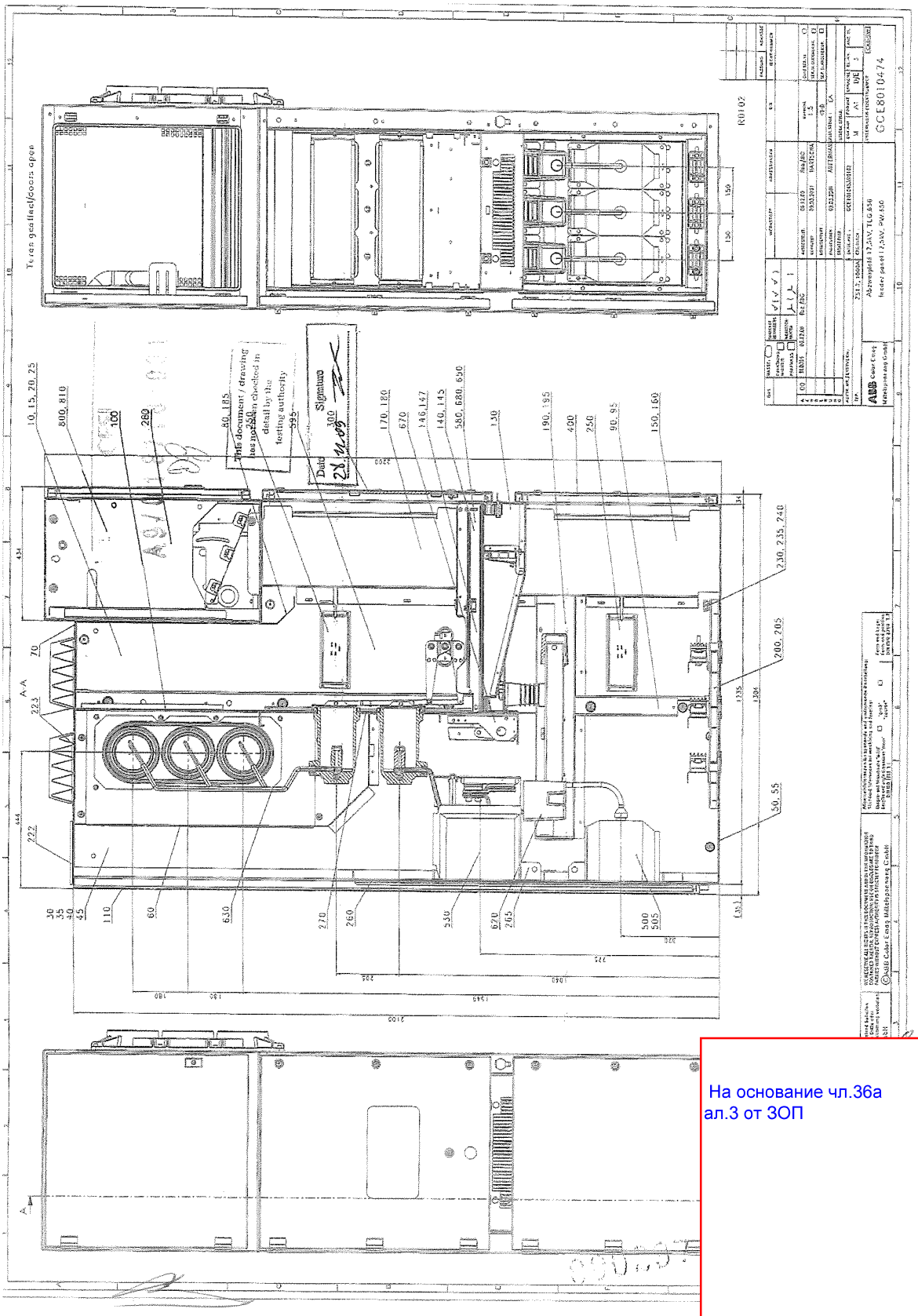
Drawing No.	Rev.	P/D *)	Title	Additional remarks
GCE8010474R0102	00	P	Feeder panel 17.5 kV, PW.650	Included in test report
GCE8010474R0101	00	D	Feeder panel 17.5 kV, PW.650	Included in test report
1VCR016097G0119	V2544 2009/ 04/14	D	VD4 base c.b. poles P1	Included in test report
1VCR000003G0038	V1906 2008/ 07/18	D	VM1 – VM1/P/Z/W base breaker	Included in test report
1VB7006201R0102	00	D	PT1 VGE4 pole complete	-
1VB7006201R0101	00	D	PT1 VG4 Mold group	-
1VB7003128R0118	00	D	VMTG PT1 mit VGE4	-
GCE7001738R0101	08	D	Assembly group MTG	-
GCE7001851P0102	08	D	Flexible conductor VM1 1250 A	-
1VCR017887	00 2009/ 09/28	D	Protection bush 12 7 17 kV 1250 A	
1VCR017878	00 2009/ 09/24	D	Bush 12 / 17 kV 630 A	-
1VCR016190	00 2009/ 05/08	D	Isolating tube VD4	-
GCE83885888R0101	04	D.	Contact system, compl	-

*) P: Parts list, D: Drawing

Remarks: -

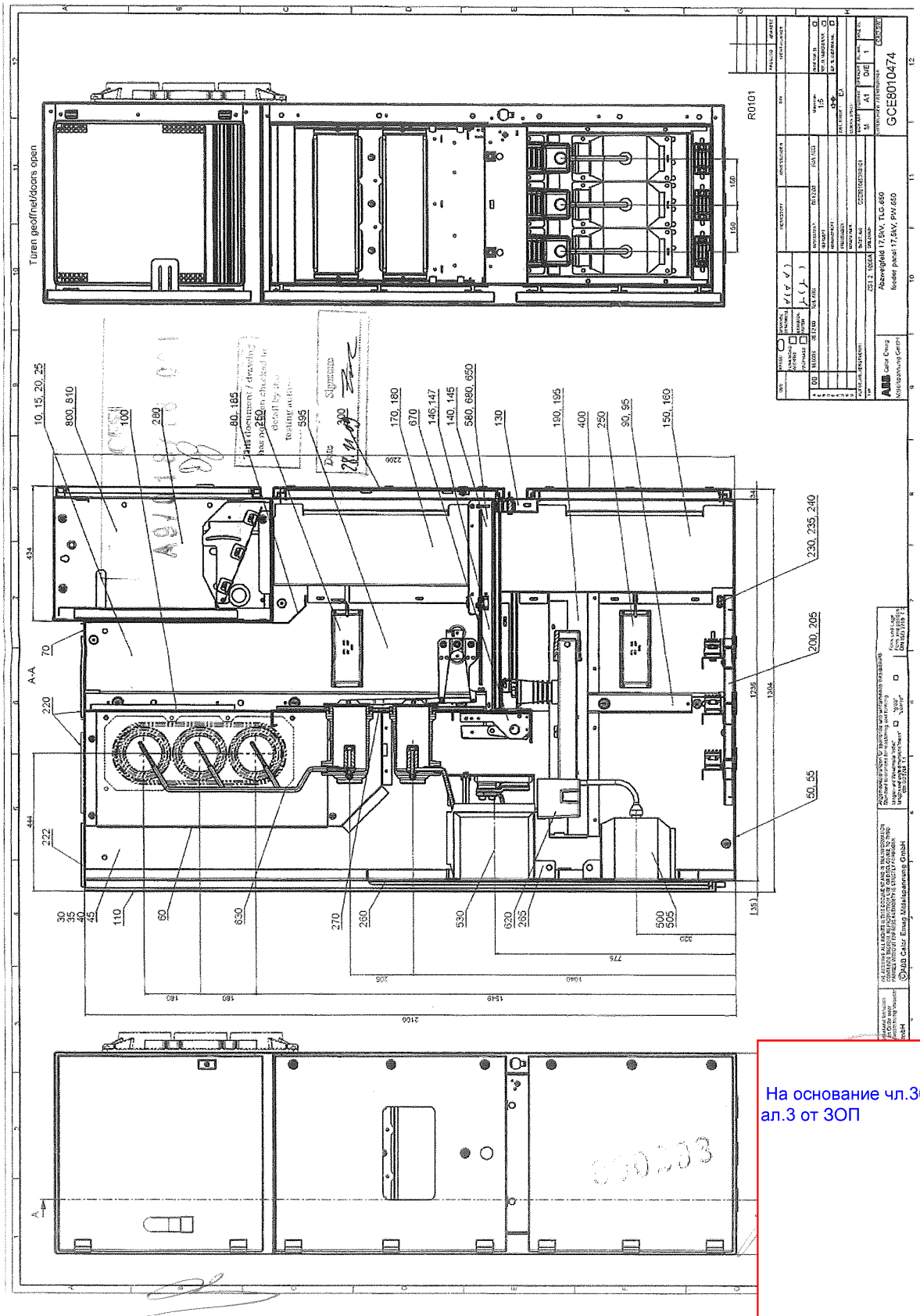
На основание чл.36а ал.3 от ЗОП

Drawing No. GCE8010474R0102 / Feeder Panel 17.5kV, PW. 650



На основание чл.36а ал.3 от ЗОП

Drawing No. GCE8010474R0101 / Feeder Panel 17.5kV, PW. 650

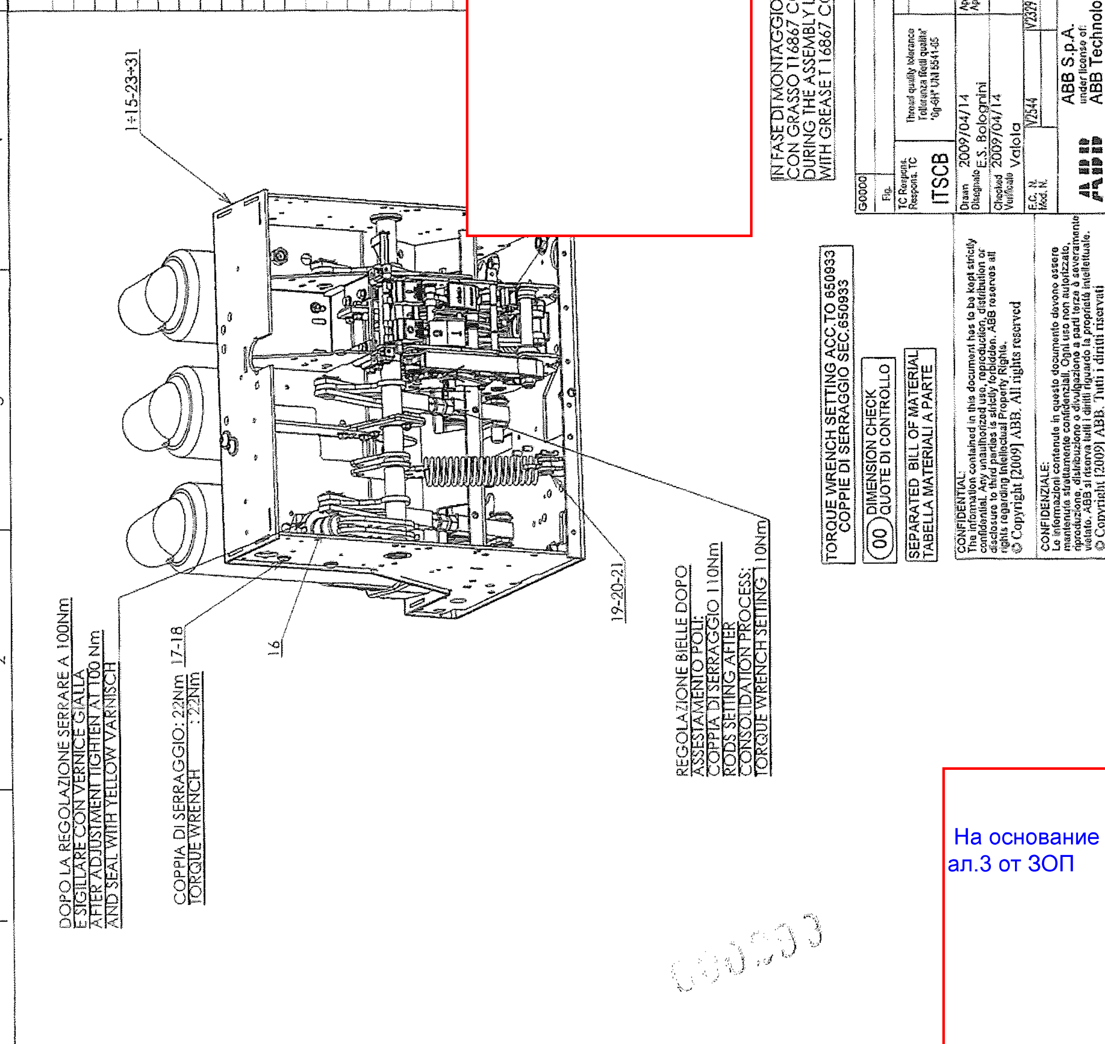


На основание чл.36а ал.3 от ЗОП

Drawing No. 1VCR016097G0019 / Base C.B. Poles P1

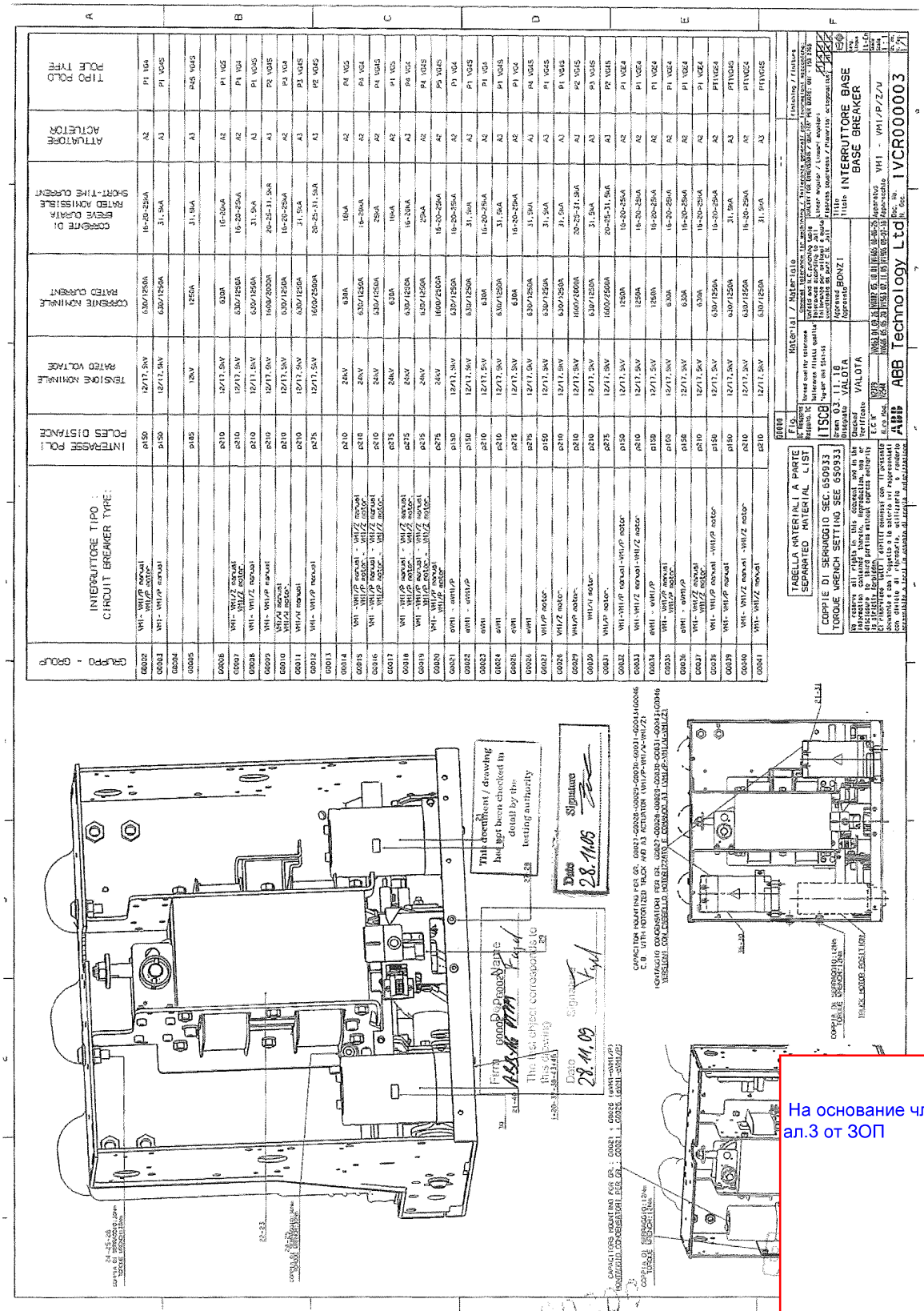
TIPO TYPE	INTERASSE POLI POLES DISTANCE	TIPO POLO POLES TYPE
G0001	P.150	P1VG5
G0002	P.150	P1VG4S
G0003	P.210	P1VG5
G0004	P.210	P1VG4S
G0005	P.275	P1VG5
G0006	P.275	P1VG4S
G0007	P.150	P1VG5
G0008	P.150	P1VGE4
G0009	P.275	P1VGE4
G0010	P.210	P1VGE4
G0011	P.150	P1VGE4
G0012	P.150	P1VGE4
G0013	P.275	P1VGE4
G0014	P.210	P1VGE4
G0015	P.150	P1VGE4
G0016	P.150	P1VG4
G0017	P.210	P1VG5
G0018	P.210	P1VG4
G0019	P.150	PT1VGE4
G0020	P.150	PT1VG4S
	P.210	PT1VGE4
	P.210	PT1VG4S
	P.275	PT1VGE4
	P.275	PT1VG4S

На основание чл.36а ал.3 от ЗОП



На основание чл.36а ал.3 от ЗОП

Drawing No. 1VCR000003G0038 / VM1 – VM1/P/Z/W Base Breaker



На основание чл.36а ал.3 от ЗОП