



ABB s.r.o. EPMV BRNO

Declaration of Conformity to Standards No. 1VLP000955_ver1
according to EN ISO/IEC 17050 -1 Page 1 of 1

Apparatus: Metal-enclosed switchgear UNIGEAR type ZS1 with vacuum circuit-breaker type VD4/P 12.25.32 with PT2 pole, ring-core current transformers type BD 00 and earthing switch type EK6 (P=275)

Identification: Technical catalogue 1VLM000363/2014
Drawing No. 1VL7632220R0101

Ratings:	Rated voltage:	12	kV
	Rated lighting impulse withstand voltage:	75	kV
	Rated power-frequency withstand voltage:	28	kV
	Rated frequency:	50	Hz
	Rated normal current (busbar):	2500	A
	Rated normal current (tee-off):	2500	A
	Rated short-time withstand current:	31,5	kA
	Rated peak withstand current:	80	kA
	Rated duration of short-circuit:	3	s
	IAC AFLR	31,5	kA
	Rated duration of internal arc AFLR classification	1	s

The assigned test reports document the type tests, which were carried out according to the below mentioned standards:

Performances	Test According to	Test reports	
		No.	Issued by
Dielectric test	IEC 62271-200 Subclause 6.2	1VLR018324 15219Ra	ABB PPMV + BVQI Laboratories PEHLA Laboratories
Degree of protection	IEC 62271-200 Subclause 6.7	1VLR017825	ABB PPMV + BVQI Laboratories
Temperature-rise test	IEC 62271-200 Subclause 6.4,6.5	1VLR018370 15177Ra	ABB PPMV + BVQI Laboratories PEHLA Laboratories
Short time and peak withstand current test	IEC 62271-200 Subclause 6.6	14190Ra	PEHLA Laboratories
	IEC 62271-102 Subclause 6.6	08006Ra	PEHLA Laboratories
Mechanical operation test	IEC 62271-200 Subclause 6.102	1VLR017826	ABB PPMV + BVQI Laboratories
Internal arc test	IEC 62271-200 Annex A	11203Ra	PEHLA Laboratories
		11202Ra 14092Ra	
Making and breaking capacity test	IEC 62271-100 Subclause 6.106	14190Ra	PEHLA Laboratories
	IEC 62271-102 Subclause 6.101	08008Ra	PEHLA Laboratories

All tests were carried out by laboratories in compliance with EN ISO/IEC 17025

Date of Issue
09.01.2017

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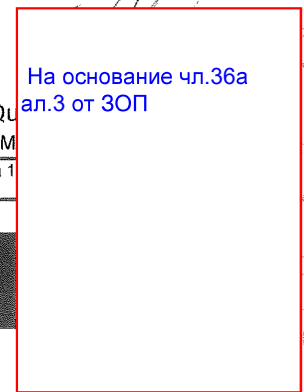
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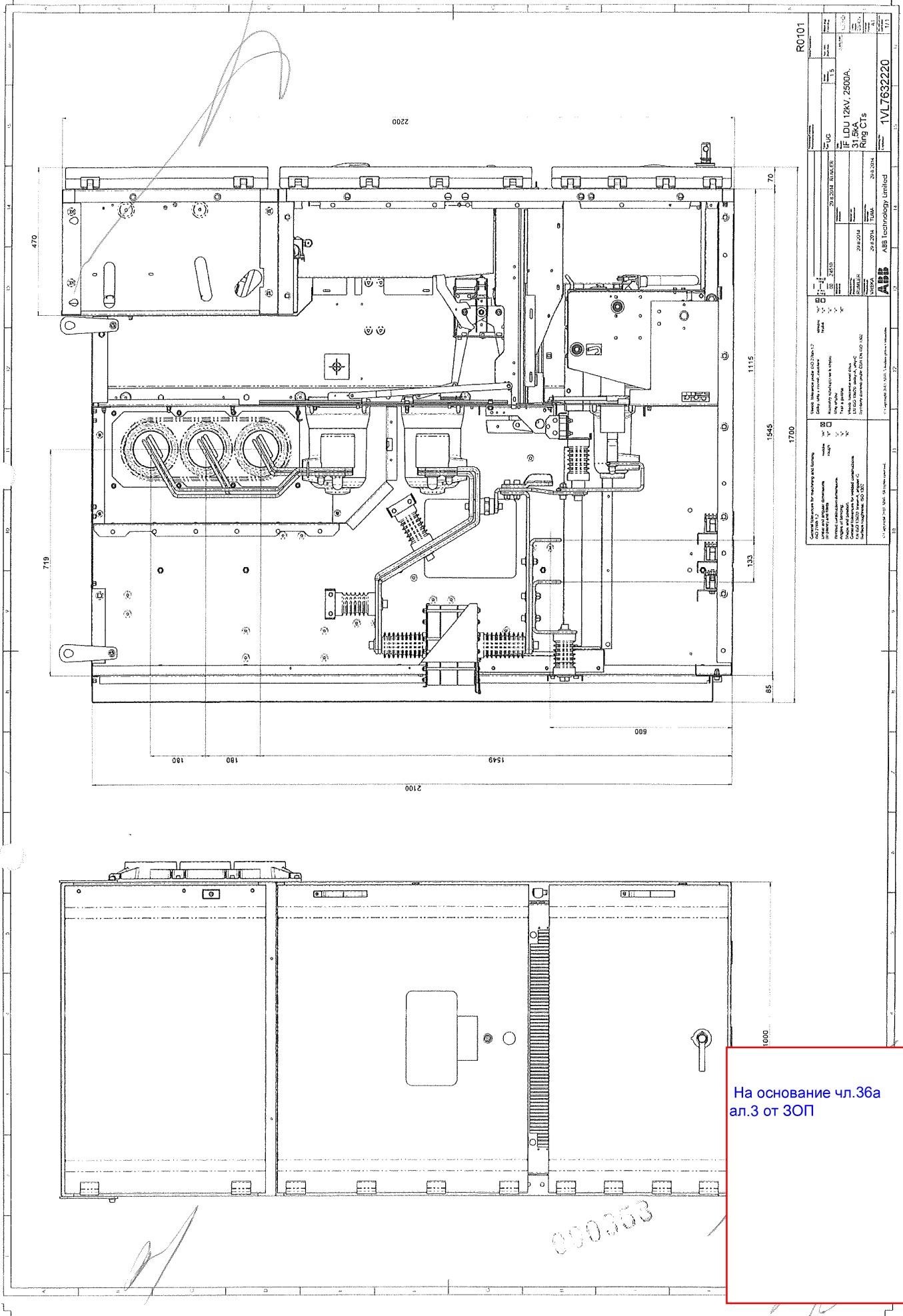
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R0101		LUG	
LDU 12kV, 2500A, 31.5kA Ring CTs		20.02.2014	
ABB		ABB Technology Limited	
1VL7632220		20.02.2014	

На основе чл.36а ал.3 от ЗОП

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Test Object: One couple of metal-enclosed, air-insulated switchgears:
Panel 1: Switchgear type UniGear ZS1 12.25.32 with circuit breaker VD4/P 12.25.32, current transformers TPU 46.33 and earthing switch EK6-1208-275.
Panel 2: Switchgear type UniGear ZS1 12.06.32 with circuit breaker VD4/P 12.06.32, current transformers TPU 43.13 and earthing switch EK6-1208-150.

Type: UniGear ZS1

Ratings:

Rated voltage	12 kV
Rated current of bus-bar	2500 A
Rated current of feeder of panel 1	2500 A
Rated current of feeder of panel 2	630 A
Rated frequency	50 Hz
Rated short time withstand current	31,5 kA / 3s
Rated peak withstand current	80 kA peak
Max. ambient air temperature	40 °C
Internal-arc classification	AFLR
Degree of protection class	IP4x
Temperature class of insulation	E

Client: ABB Technology Ltd., Zürich, Switzerland

Manufacturer: ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

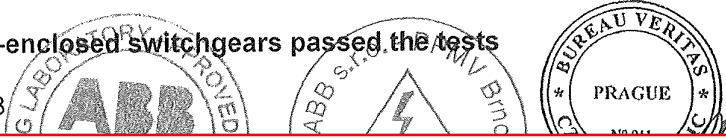
Kind of test: Part of type test – Verification of the IP coding

Test Specification IEC 62271-200, Ed. 2.0, 2011-10, IEC 62271-1, Ed. 1.0, 2007-10
IEC 62271-100, Ed.2.1, 2012-09, IEC 62271-102, Ed.1.1, 2012-02
IEC 60529 , Ed. 2.1 , 2001-02

LSC classification: LSC2B

Test Results: The metal-enclosed switchgears passed the tests

Date of test: 26.07.2013



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12.08.2013

Date of issue

These test results concern exclusively to the object tested. This test report is issued by Technical Laboratory that is member of CTLA (Association of Czech Testing Rooms and Laboratories) with right to use cancellation No. 028. The report shall not be reproduced except in full without the written approval of the Technical Laboratory ABB s.r.o. , PPMV Brno: Technical laboratory Videňská 117 CZ 619 00 Brno Fax : +420 5 4715 2302 Phone: +420 4715 2447

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Referents standards: IEC 62271-200, Ed. 2.0, 2011-10, IEC 62271-1, Ed. 1.0, 2007-10
IEC 62271-100, Ed. 2.1, 2012-09, IEC 62271-102, Ed.1.1, 2012-02
IEC 60529 , Ed. 2.1 , 2001-02

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1. Ratings

1.1 Panel 1

1.1.1 Air insulated switchgear

Referents standards: IEC 62271- 200, Ed. 2.0, 2011 - 10

Type: UniGear ZS1

Manufacturer: Switchgear:
ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Circuit-breaker:
ABB T&D Divisione SACE T.M.S., Dalmine, Italy, under license of ABB Technology Ltd.

Current transformer:
ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Earthing-switch:
ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Serial-No.: 1VLS100029572/4

Year of manufacture: 2013

Drawing-No: GCE8010452R5112

Ratings:	Rated voltage	12 kV
	Rated lightning impulse withstand voltage	
	phase to earth	75 kV
	across the insulating distance	85 kV
	Rated power frequency withstand voltage	
	phase to earth	28 kV
	across the isolating distance	32 kV
	Rated frequency	50 Hz
	Rated normal current of busbar	2500 A
	Rated normal current of feeder	2500 A
	Rated short-circuit peak withstand current	80 kA
	Rated short-time withstand current	31,5 kA
	Rated duration of short circuit	3 s
	Electrical system	
	Earth system	insulated / solid earthed

Permissible values for internal-arc faults:

Peak withstand arc current	80 kA
Short-time arc current	31,5 kA
Rated duration of internal arc	3 s
Installation	indoor
Max. ambient air temperature	+ 40 °C
Min. Ambient air temperature	- 25 °C
Max. altitude	1000 m

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1.1.2 Vacuum circuit-breaker type VD4/P in withdrawable version

Type: VD4/P 12.25.32

Referents standards: IEC 62271-100

Manufacturer: ABB T&D Divisione SACE T.M.S., Italy, under license of ABB Technology Ltd.

Serial No.: 1VC1BD00028338

Drawing No.: TN7417

Year of manufacture: 2013

Ratings:

Rated voltage	12	kV
Rated lightning impulse withstand voltage	75	kV
Rated power frequency withstand voltage	28	kV
Rated frequency	50/60	Hz
Rated normal current	2500	A
Rated short-circuit peak withstand current	80	kA
Rated short-time withstand current	31,5	kA
Rated duration of short circuit	3	s
Rated short-circuit breaking current	31,5	kA
Rated short-circuit making current	80	kA
Rated operating sequence	O-0,3s-CO-15s-CO	
Arc extinguishing medium:	vacuum	
Operating mechanism - spring charged by motor or manually – three-pole gang operation		
Total number of poles	3	
Pole numbers	P2 / VG4-S / BA01541240	Phase L1
	P2 / VG4-S / BA01541216	Phase L2
	P2 / VG4-S / BA01541237	Phase L3
Rated voltage of trip coil	110	V-DC
Rated voltage of closing coil	110	V-DC
Rated supply voltage	110	V-DC
Max. ambient air temperature	40	°C

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1.1.3 Current instrument transformers

Type: TPU 46.33

Referents standards: IEC 60044-1 (2003)

Manufacturer: ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Serial No.: 1VLT5113025679 Phase L1
1VLT5113025683 Phase L2
1VLT5113025678 Phase L3

Year of manufacture: 2013

Ratings:	Rated voltage	12	kV
	Rated ratio	2500 // 5	A
	Rated lightning impulse withstand voltage	75	kV
	Rated power frequency withstand voltage	28	kV
	Rated frequency	50	Hz
	Rated short-circuit peak withstand current	80	kA
	Rated short-time withstand current	31,5	kA
	Rated duration of short circuit	3	s
	Insulation class	E	

1.1.4 Earthing-switch

Type: EK6-1208-275

Referents standards: IEC 62271-102

Manufacturer: ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Serial No.: 1VLA1306632

Drawing No.: GCE7169312R0116 Year of manufacture: 2013

Ratings:	Rated voltage	12	kV
	Rated lightning impulse withstand voltage	75	kV
	Rated power frequency withstand voltage	28	kV
	Rated frequency	50	Hz
	Rated short-time withstand current	31,5	kA
	Rated duration of short circuit	3	s
	Rated short-circuit making current	80	kA
	Electrical system		

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1.2 Panel 2

1.2.1 Air insulated switchgear

Referents

standards: IEC 62271- 200, Ed. 2.0, 2011 - 10

Type: UniGear ZS1

Manufacturer:

Switchgear:
ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Circuit-breaker:
ABB T&D Divisione SACE T.M.S., Dalmine, Italy, under license of ABB Technology Ltd.

Current transformers:
ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Earthing-switch:
ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Serial-No.: 1VLS100029572/3

Year of manufacture: 2013

Drawing-No: GCE8010473R5101

Ratings:	Rated voltage	12 kV
	Rated lightning impulse withstand voltage	
	phase to earth	75 kV
	across the insulating distance	85 kV
	Rated power frequency withstand voltage	
	phase to earth	28 kV
	across the isolating distance	32 kV
	Rated frequency	50 Hz
	Rated normal current of busbar	2500 A
	Rated normal current of feeder	630 A
	Rated short-circuit peak withstand current	80 kA
	Rated short-time withstand current	31,5 kA
	Rated duration of short circuit	3 s
	Electrical system	
	Earth system	insulated / solid earthed
	Permissible values for internal-arc faults:	
	Peak withstand arc current	8
	Short-time arc current	31
	Rated duration of internal arc	
	Installation	indo
	Max. ambient air temperature	+ 4
	Min. Ambient air temperatur	-
	Max. altitude	100

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1.2.2 Vacuum circuit-breaker type VD4/P in withdrawable version

Type: VD4/P 12.06.32

Referents standards: IEC 62271-100

Manufacturer: ABB T&D Divisione SACE T.M.S., Italy, under license of ABB Technology Ltd.

Serial No.: 1VC1BD00028335

Drawing No.: TN7412

Year of manufacture: 2013

Ratings:

Rated voltage	12	kV
Rated lightning impulse withstand voltage	75	kV
Rated power frequency withstand voltage	28	kV
Rated frequency	50/60	Hz
Rated normal current	630	A
Rated short-circuit peak withstand current	80	kA
Rated short-time withstand current	31,5	kA
Rated duration of short circuit	3	s
Rated short-circuit breaking current	31,5	kA
Rated short-circuit making current	80	kA
Rated operating sequence	O-0,3s-CO-15s-CO	
Arc extinguishing medium:	vacuum	
Operating mechanism - spring charged by motor or manually – three-pole gang operation		
Total number of poles	3	
Pole numbers	PT1 / VG4-S / PA01557687	Phase L1
	PT1 / VG4-S / PA01557662	Phase L2
	PT1 / VG4-S / PA01557687	Phase L3
Rated voltage of trip coil	110	V-DC
Rated voltage of closing coil	110	V-DC
Rated supply voltage	110	V-DC
Max. ambient air temperature	40	°C

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1.2.3 Current instrument transformers

Type: TPU 43.13

Referents standards: IEC 60044-1 (2003)

Manufacturer: ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Serial No.: 1VLT5113025677 Phase L1
1VLT5113025672 Phase L2
1VLT5113025673 Phase L3

Year of manufacture: 2013

Ratings:	Rated voltage	12	kV
	Rated ratio	630 // 5	A
	Rated lightning impulse withstand voltage	75	kV
	Rated power frequency withstand voltage	28	kV
	Rated frequency	50	Hz
	Rated short-circuit peak withstand current	80	kA
	Rated short-time withstand current	31,5	kA
	Rated duration of short circuit	3	s
	Insulation class	E	

1.2.4 Earthing-switch

Type: EK6-1208-150

Referents standards: IEC 62271-102

Manufacturer: ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Serial No.: 1VLA1306551

Drawing No.: GCE7169312R0114 Year of manufacture: 2013

Ratings:	Rated voltage	1
	Rated lightning impulse withstand voltage	7
	Rated power frequency withstand voltage	2
	Rated frequency	5
	Rated short-time withstand current	31
	Rated duration of short circuit	
	Rated short-circuit making current	
	Electrical system	

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2. Drawings of Tested Object

2.1 Drawings of Panel 1

The UniGear type ZS1 12.25.32 is a metal-enclosed switchgear system with separated compartments. The compartments are separated each from the other with metallic, earthed partitions. The switchgear is composed of following construction parts:

- apparatus compartment with vacuum circuit-breaker type VD4/P 12.25.32. The breaker is mounted to a withdrawable truck.
- bus-bars compartment.
- cable compartment with earthing switch type EK6-1208-275, current measuring transformers type TPU 46.33 and cable connections.
- LV instruments compartment

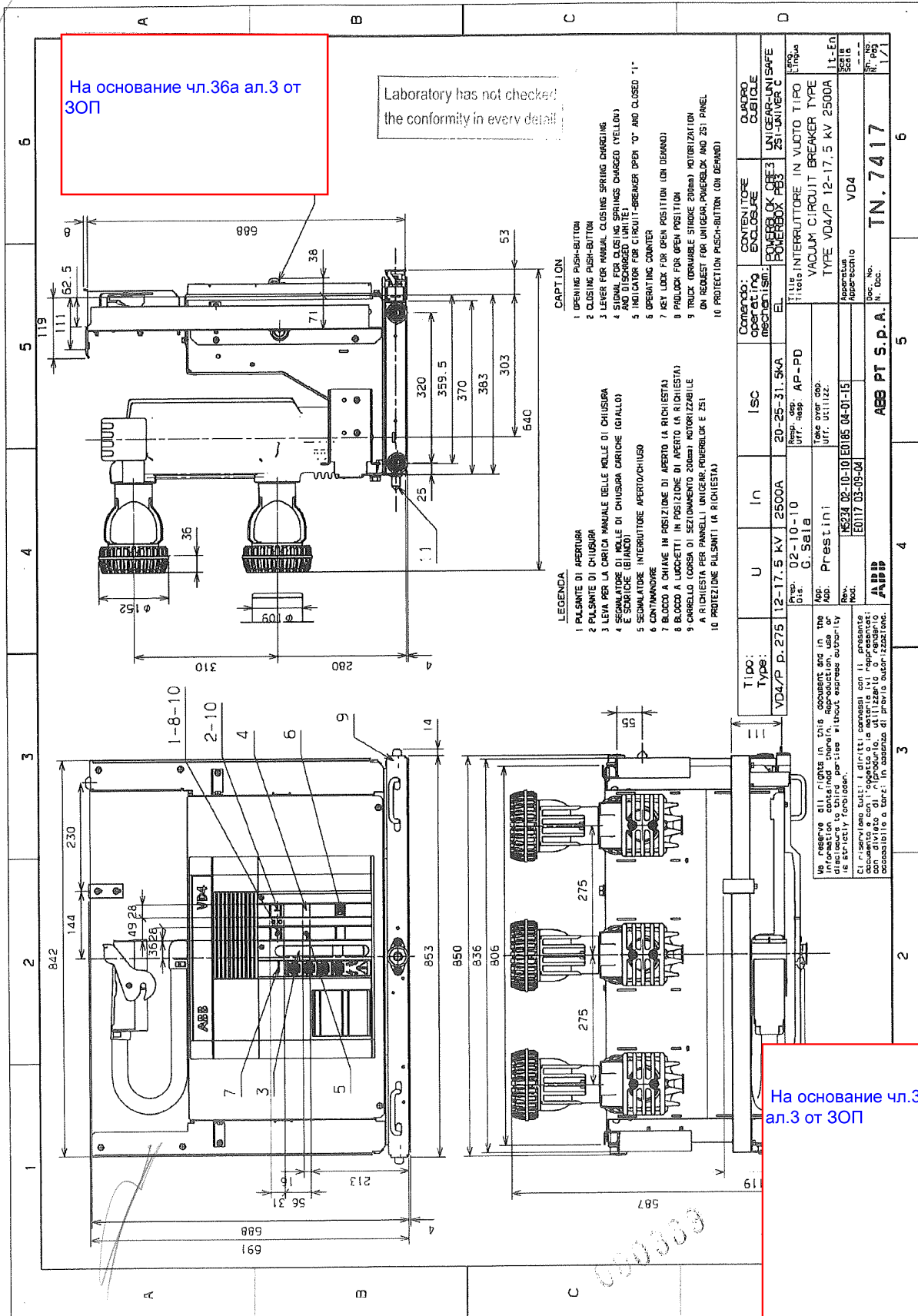
Drawings number	Title of ASSEMBLY or detail
GCE8010452R5112	UG ZS1 12.25.32
TN 7417	CB VD4/P 12.25.32
GCE8010948R0104	SPOUTS-SHUTTERS
GCE8003899R0101	SPOUT
GCE8010105P0102	CONTACT PIN
1VL7625588R0105	CONNECTIONS-COMPLETION
GCE8010604R0111	T-OFF
GCE8010605R0111	TEE-OFF L1
GCE8010605R0112	TEE-OFF L1
GCE8010606R0111	TEE-OFF L2
GCE8010606R0112	TEE-OFF L2
GCE8010607R0111	TEE-OFF L3
GCE8010607R0112	TEE-OFF L3
GCE8010504R0101	CONNECTIONS-BOTTOM
GCE8010540P0101	CONNECTION
GCE8010541P0101	CONNECTION
GCE8010542P0101	CONNECTION
GCE8010543P0101	CONNECTION
1VL7609238R0103	GAS DUCT 1000mm
GCE0931008P0100	INSULATOR
1VL7611710R0101	VENTIL FLAP
1VL7611710R0102	VENTIL FLAP

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Laboratory has not checked
the conformity in every detail

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2.2 Drawings of Panel 2

The UniGear type ZS1 12.06.32 is a metal-enclosed switchgear system with separated compartments. The compartments are separated each from the other with metallic, earthed partitions. The switchgear is composed of following construction parts:

- apparatus compartment with vacuum circuit-breaker type VD4/P 12.06.32. The breaker is mounted to a withdrawable truck.
- bus-bars compartment.
- cable compartment with earthing switch type EK6-1208-150, current measuring transformers type TPU 43.13 and cable connections.
- LV instruments compartment

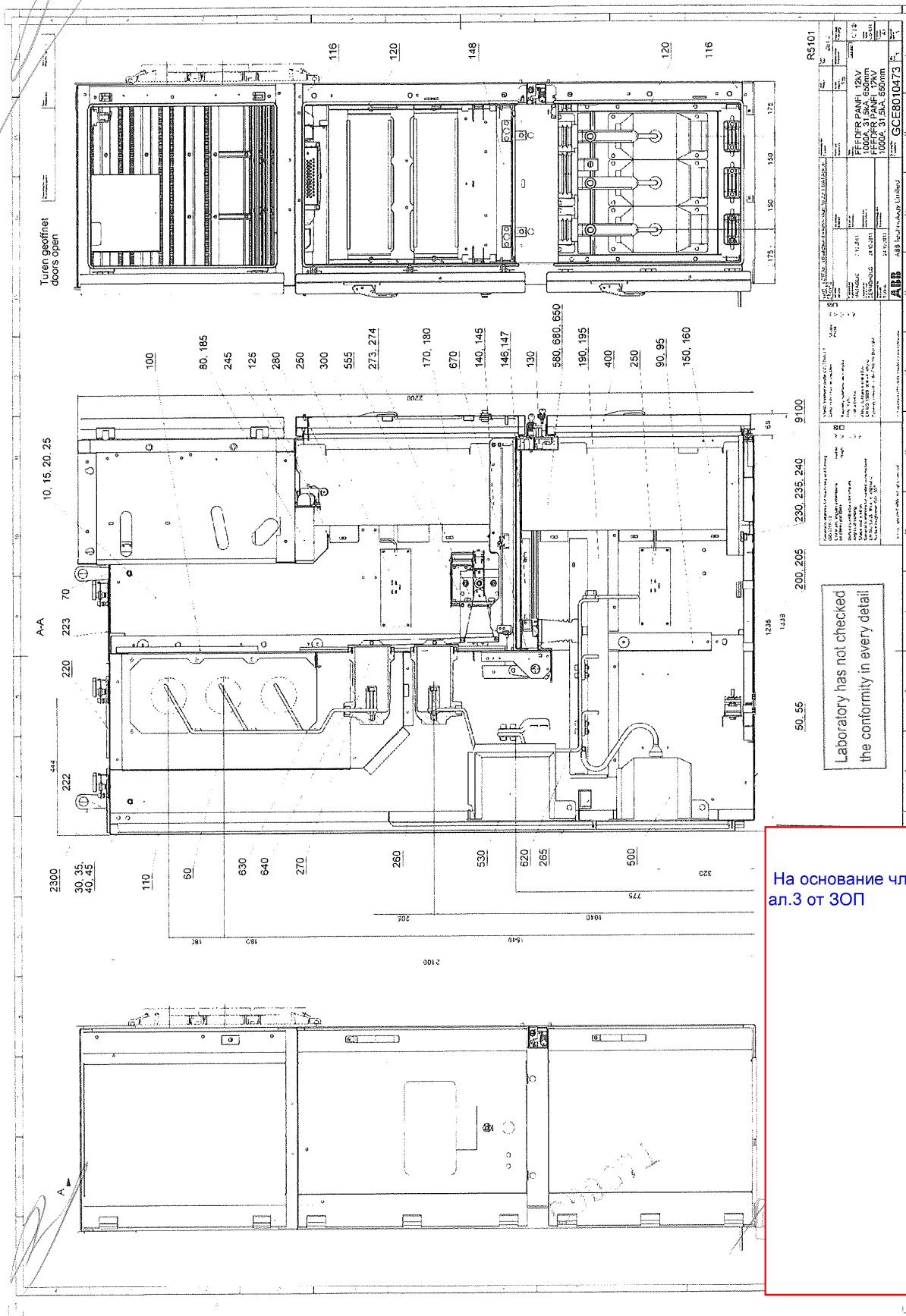
Drawings number	Title of ASSEMBLY or detail
GCE8010473R5101	UG ZS1 12.06.32
TN 7412	CB VD4/P 12.06.32
GCE8011725R0201	SPOUTS-SHUTTERS
GCE8003624R0102	SPOUT
GCE8685778P0121	CONTACT PIN
1VL7625588R0101	CONNECTIONS-COMPLETION
GCE8011729R0101	T-OFF
GCE8011726P0101	TEE-OFF L1
GCE8011727P0101	TEE-OFF L2
GCE8011728P0101	TEE-OFF L3
1VL7606472R0101	CONNECTIONS-BOTTOM
GCE8010054P0101	CONNECTION
1VL7606473P0101	CONNECTION
GCE0931008P0100	INSULATOR
1VL7609238R0101	GAS DUCT 650mm
1VL7608257P0101	VENTIL FLAP
GCE8008730P0101	VENTIL FLAP

Firm:	Dep.:	Name:
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the conformity in every detail

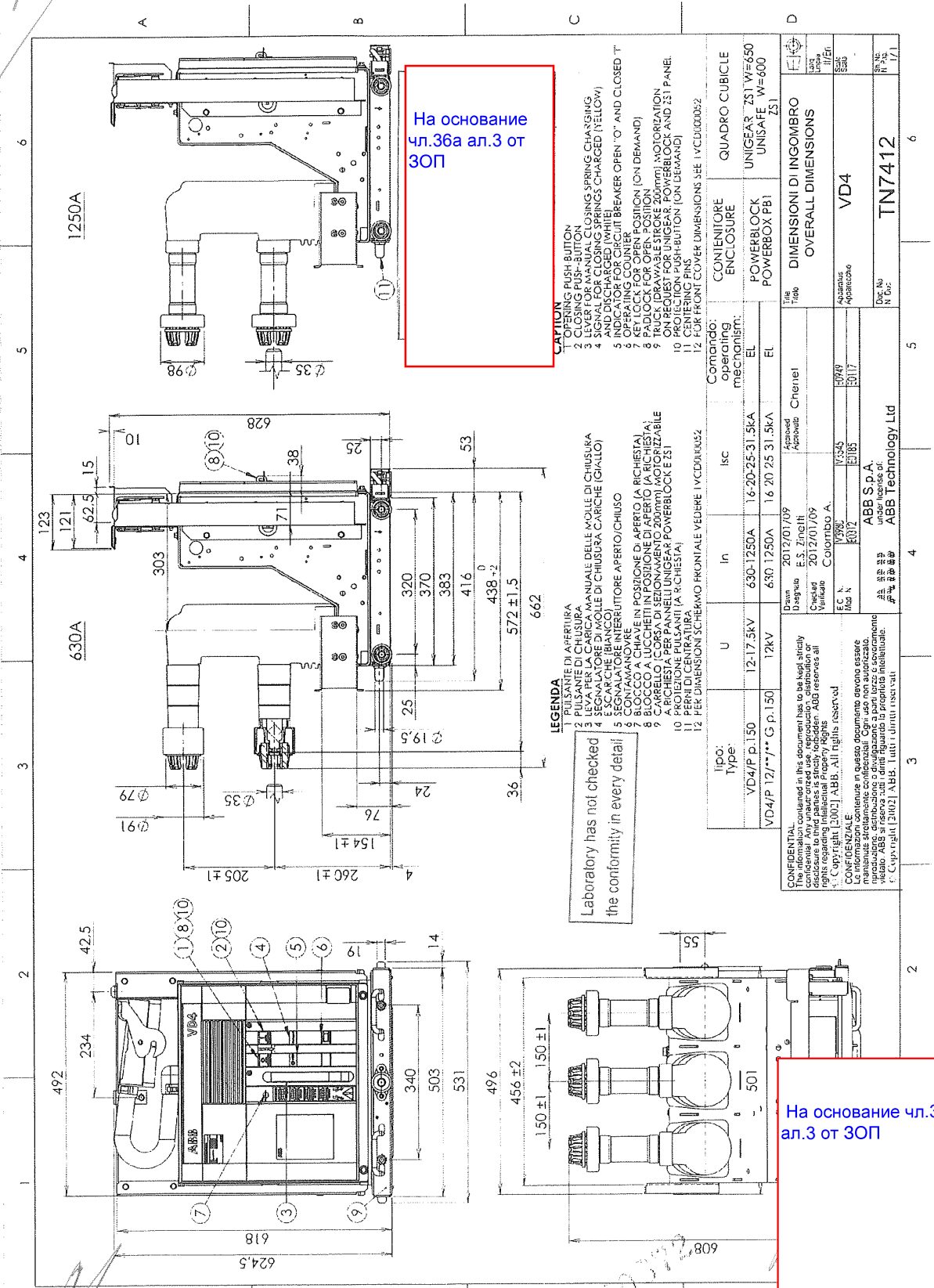
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- CAPTION**
- 1 OPENING PUSH-BUTTON
 - 2 CLOSING PUSH-BUTTON
 - 3 LEVER FOR MANUAL CLOSING SPRING CHARGING
 - 4 SIGNAL FOR CLOSING SPRINGS CHARGED (YELLOW) AND DISCHARGED (WHITE)
 - 5 LOCKING PUSH-BUTTON BREAKER OPEN "O" AND CLOSED "T"
 - 6 OPERATING COUNTER
 - 7 KEY LOCK FOR OPEN POSITION (ON DEMAND)
 - 8 PAD LOCK FOR OPEN POSITION
 - 9 TRUCK DRAWABLE STROKE 200mm (ON DEMAND) LOCK ORIZATION
 - 10 PROTECTIVE PUSH-BUTTON (ON DEMAND)
 - 11 CENTERING PINS
 - 12 FOR FRONT COVER DIMENSIONS SEE 1VCD000022

- LEGENDA**
- 1 PULSANTE DI APERTURA
 - 2 PULSANTE DI CHIUSURA
 - 3 LEVA PER LA CARICA MANUALE DELLE MOLLE DI CHIUSURA
 - 4 SEGNALE DI CARICA MANUALE DELLE MOLLE DI CHIUSURA CARICHE (GIALLO) E SCARICHE (BIANCO)
 - 5 BLOCCO A CHIAVE PER IL RITARDATORE APERTO/CHIUSO
 - 6 BLOCCO A CHIAVE IN POSIZIONE DI APERTO (A RICHIESTA)
 - 7 BLOCCO A LUCCHETTI IN POSIZIONE DI APERTO (A RICHIESTA)
 - 8 CARRELLO A CORSA DI SEGONAMENTO 200mm (MOTORIZZABILE A RICHIESTA)
 - 9 PULSANTE PROTETTIVO (A RICHIESTA)
 - 10 PERNI DI CENTRATURA
 - 12 PER DIMENSIONI SCHERMO FRONTALE VEDERE 1VCD000022

Comando operating mechanism:	CONTENITORE ENCLOSURE	QUADRO CUBICLE
EL	POWERLOCK POWERBOX PBI	UNIGEAR ZS1 WF=650 UNISAFE W=600 ZS1
EL		
The Title		
Drawn	2012/01/09	Approved
Disegnato	E.S. Zinghi	Approvato
Checkato	2012/01/09	Cheruel
Verificato	Colombo A.	
EC N	0398	
Mod N	0307	
ABB S.p.A.		
ABB Technology Ltd		
Doc No		
N°		
Rev		

DIMENSIONI DI INGOMBRO OVERALL DIMENSIONS	
Modello	VD4
Articolo	TN7412

3. Tests carried out

3.1 Verification of the IP coding - clause 6.7.1 IEC 62271-200 , Ed. 1.0 , 2003-11

3.1.1 Degrees of protection against access to hazardous parts and against solid foreign objects indicated by the first characteristic numeral - clause 5 IEC 60529 , Ed. 1.0 , 2003-11

The tests of the protection level of the UNIGEAR type ZS1 switchgears were performed following the IEC 60529 Standard. There were 2 alternatives of switchgear arrangement under test:
The switchgears were connected as a couple.

3.1.1.1 Switchgear enclosure with doors closed

Protection against contact to live parts and the ingress of solid bodies as described by the first characteristic number in the IP designation see IEC 60529 standard, clauses 5.1., 5.2., Table No. I and II.

The test was performed conformably to the clauses 12 and 13 of the IEC 60 529 Standard. The testing steel wire of 1.0 mm diameter and the length of 100 mm was introduced in the inside of the cover by using the force of $1N \pm 10 \%$. The wire was not able to penetrate and the requirements of the degree of protection were satisfied, as defined by the first characteristic number 4, see the Tables No. I. and VI.

Test of degree of protection against the ingress of harmful water, as defined by the second characteristic letter. It is not necessary to fulfill this parameter as the switchgears are designed for indoor use.

3.1.1.2 Between compartments with doors opened

The testing finger with the 12 mm diameter was introduced into the compartment partitions by using the force of $10N \pm 10 \%$. The testing finger did not penetrate into the compartment partitions (or penetrated in some case without having decreased the dielectric strength of the switchgear).

This provides for an evidence that the switchgears complies with the regulations on protection against electric shock as well as the access to live parts as defined by the first characteristic letter 2, and in compliance with the clause 12.3.3 of the above standard.

The testing steel ball without holder, according to the clause 13, Table No. VII of the mentioned standard, was forced into the compartment partitions by using the force of $30 N \pm 10 \%$. The probe did not enter any of the openings. In such a case the switchgear complies with requirements on protection against the ingress of solid bodies into the inside of the switchgears, as stipulated by the first characteristic letter 2.

The complete degree of protection of the switchgears are specified by the symbol II

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4 Ambient Air Conditions during mechanical operation tests:

Ambient air conditions	Temperature (°C)	27,0
	Pressure (hPa)	993
	Air humidity (%)	43

5 List of measuring instruments used:

Testing finger with the 12 mm diameter, serial-No.:001
Testing finger with the 1 mm diameter, serial-No.:003
Measuring device for Temperature, Air humidity
and Pressure, Sensorika HTPN 27/350 reg. No. 100290

The measurement uncertainties of the test results reported in this document are the following:

- dimension : diameter $\pm 0,05$ mm
- atmospheric conditions : temperature: $\pm 2^{\circ}\text{C}$ % , pressure : ± 15 hPa , humidity : ± 10 %

The measurement uncertainties are estimated at the level of twice the standard deviation and have to be considered as maximum values.

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6 Photo of the tested switchgears

Photo 1: Front view of switchgears



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Photo 2: Top view of switchgears

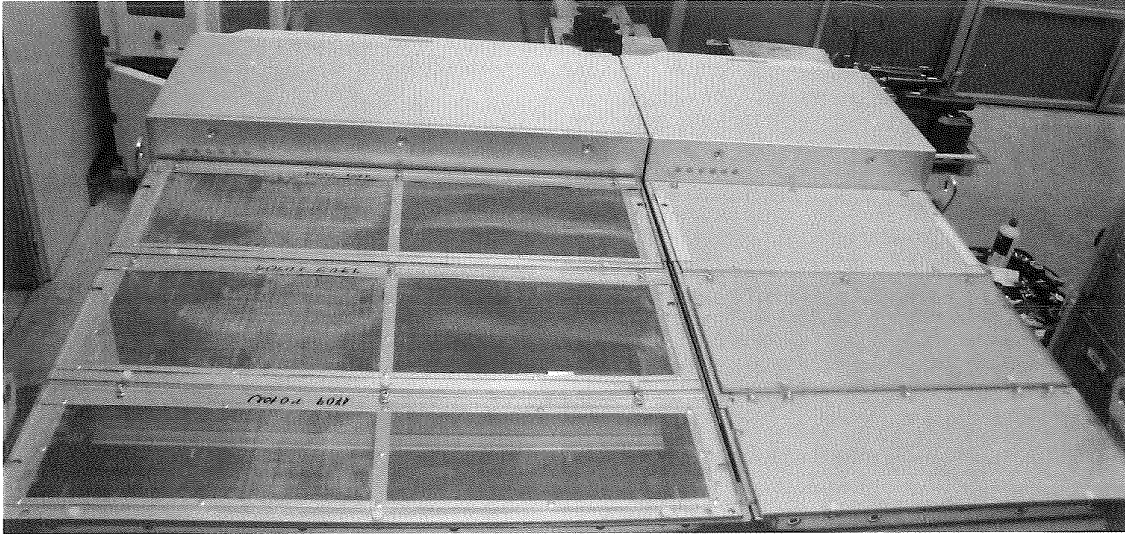
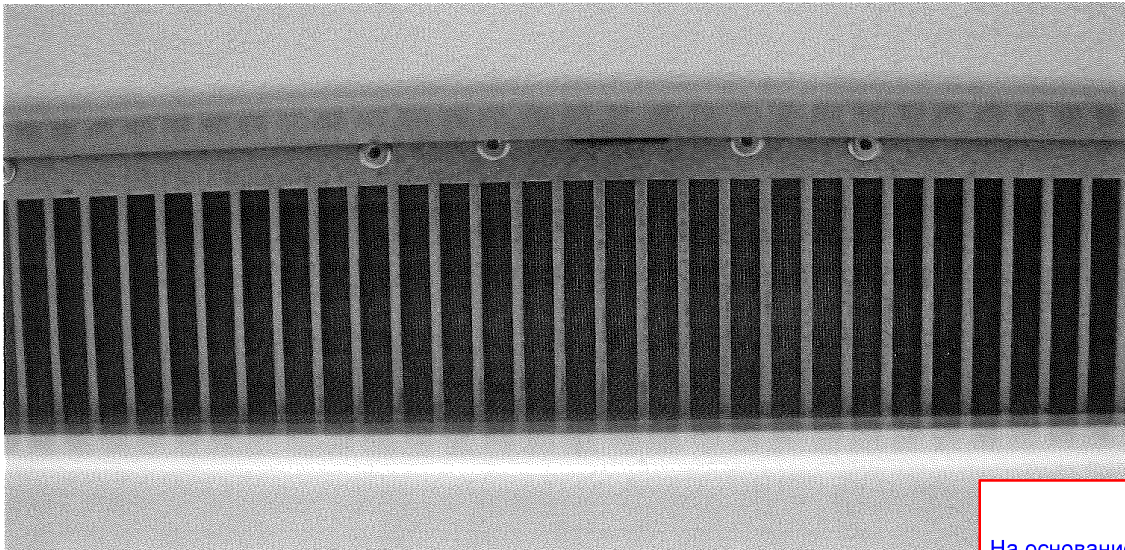


Photo 3: Detail of ventilation drawer UGZS1 12.25.32



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Test Object:

One couple of metal-enclosed, air-insulated switchgears:
Panel 1: Switchgear type UniGear ZS1 12.25.32 with circuit breaker VD4/P 12.25.32, current transformers TPU 46.33 and earthing switch EK6-1208-275.
Panel 2: Switchgear type UniGear ZS1 12.06.32 with circuit breaker VD4/P 12.06.32, current transformers TPU 43.13 and earthing switch EK6-1208-150.

Type:

UniGear ZS1

Ratings:

Rated voltage 12 kV
Rated current of bus-bar 2500 A
Rated current of feeder of panel 1 2500 A
Rated current of feeder of panel 2 630 A
Rated frequency 50 Hz
Rated short time withstand current 31,5 kA / 3s
Rated peak withstand current 80 kA peak
Max. ambient air temperature 40 °C
Internal-arc classification AFLR
Degree of protection class IP4x
Temperature class of insulation E

Client:

ABB Technology Ltd., Zürich, Switzerland

Manufacturer:

ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Kind of test:

Mechanical operation tests

Test Specification

IEC 62271-200, Ed. 2.0, 2011-10, IEC 62271-1, Ed. 1.0, 2007-10
IEC 62271-100, Ed.2.1, 2012-09, IEC 62271-102, Ed.1.1, 2012-02

LSC classification:

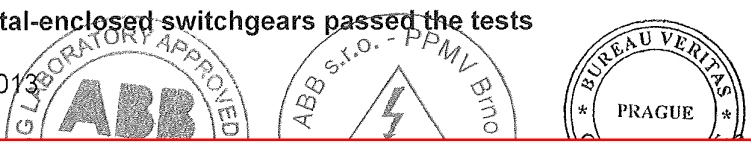
LSC2B

Test Results:

The metal-enclosed switchgears passed the tests

Date of test:

26.07.2013



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12.08.2013
Date of issue

These test results concern exclusively to the object tested. This test report is issued by Technical Laboratory that is member of CTLA (Association of Czech Testing Rooms and Laboratories) with right to use cancellation No. 028. The report shall not be reproduced except in full without the written approval of the Technical Laboratory ABB s.r.o., PPMV Brno: Technical laboratory Videňská 117 CZ 619 00 Brno Fax: +420 5 4715 2302 Phone: +420 4715 2447

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На основании чл.36а ал.3 от ЗОП

Referents standards: IEC 62271-200, Ed. 2.0, 2011-10, IEC 62271-1, Ed. 1.0, 2007-10
IEC 62271-100, Ed. 2.1, 2012-09, IEC 62271-102, Ed.1.1, 2012-02

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1. Ratings

1.1 Panel 1

1.1.1 Air insulated switchgear

Referents

standards: IEC 62271- 200, Ed. 2.0, 2011 - 10

Type: UniGear ZS1

Manufacturer: Switchgear :
ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Circuit-breaker:
ABB T&D Divisione SACE T.M.S., Dalmine, Italy, under license of ABB Technology Ltd.

Current transformers:
ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Earthing-switch:
ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Serial-No.: 1VLS100029572/4

Year of manufacture: 2013

Drawing-No: GCE8010452R5112

Ratings:	Rated voltage	12 kV
	Rated lightning impulse withstand voltage	
	phase to earth	75 kV
	across the insulating distance	85 kV
	Rated power frequency withstand voltage	
	phase to earth	28 kV
	across the isolating distance	32 kV
	Rated frequency	50 Hz
	Rated normal current of busbar	2500 A
	Rated normal current of feeder	2500 A
	Rated short-circuit peak withstand current	80 kA
	Rated short-time withstand current	31,5 kA
	Rated duration of short circuit	3 s
	Electrical system	
	Earth system	insulated / solid earthed

Permissible values for internal-arc faults:

Peak withstand arc current	31
Short-time arc current	indd
Rated duration of internal arc	+
Installation	10
Max. ambient air temperature	
Min. Ambient air temperatur	
Max. altitude	

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1.1.2 Vacuum circuit-breaker type VD4/P in withdrawable version

Type: VD4/P 12.25.32

Referents standards: IEC 62271-100

Manufacturer: ABB T&D Divisione SACE T.M.S., Italy, under license of ABB Technology Ltd.

Serial No.: 1VC1BD00028338

Drawing No.: TN7417

Year of manufacture: 2013

Ratings:

Rated voltage	12	kV
Rated lightning impulse withstand voltage	75	kV
Rated power frequency withstand voltage	28	kV
Rated frequency	50/60	Hz
Rated normal current	2500	A
Rated short-circuit peak withstand current	80	kA
Rated short-time withstand current	31,5	kA
Rated duration of short circuit	3	s
Rated short-circuit breaking current	31,5	kA
Rated short-circuit making current	80	kA
Rated operating sequence	O-0,3s-CO-15s-CO	
Arc extinguishing medium:	vacuum	
Operating mechanism - spring charged by motor or manually – three-pole gang operation		
Total number of poles	3	
Pole numbers	P2 / VG4-S / BA01541240	Phase L1
	P2 / VG4-S / BA01541216	Phase L2
	P2 / VG4-S / BA01541237	Phase L3
Rated voltage of trip coil	110	V-DC
Rated voltage of closing coil	110	V-DC
Rated supply voltage	110	V-DC
Max. ambient air temperature	40	°C

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1.1.3 Current instrument transformers

Type: TPU 46.33

Referents standards: IEC 60044-1 (2003)

Manufacturer: ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Serial No.: 1VLT5113025679 Phase L1
1VLT5113025683 Phase L2
1VLT5113025678 Phase L3

Year of manufacture: 2013

Ratings: Rated voltage 12 kV
Rated ratio 2500 // 5 A
Rated lightning impulse withstand voltage 75 kV
Rated power frequency withstand voltage 28 kV
Rated frequency 50 Hz
Rated short-circuit peak withstand current 80 kA
Rated short-time withstand current 31,5 kA
Rated duration of short circuit 3 s
Insulation class E

1.1.4 Earthing-switch

Type: EK6-1208-275

Referents standards: IEC 62271-102

Manufacturer: ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Serial No.: 1VLA1306632

Drawing No.: GCE7169312R0116 Year of manufacture: 2013

Ratings: Rated voltage
Rated lightning impulse withstand voltage
Rated power frequency withstand voltage
Rated frequency
Rated short-time withstand current
Rated duration of short circuit
Rated short-circuit making current
Electrical system

На основании чл.36а
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1.2 Panel 2

1.2.1 Air insulated switchgear

Referents

standards: IEC 62271- 200, Ed. 2.0, 2011 - 10

Type: UniGear ZS1

Manufacturer: Switchgear: ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Circuit-breaker: ABB T&D Division SACE T.M.S., Dalmine, Italy, under license of ABB Technology Ltd.

Current transformers: ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Earthing-switch: ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Serial-No.: 1VLS100029572/3

Year of manufacture: 2013

Drawing-No: GCE8010473R5101

Ratings:	Rated voltage	12	kV
	Rated lightning impulse withstand voltage		
	phase to earth	75	kV
	across the insulating distance	85	kV
	Rated power frequency withstand voltage		
	phase to earth	28	kV
	across the isolating distance	32	kV
	Rated frequency	50	Hz
	Rated normal current of busbar	2500	A
	Rated normal current of feeder	630	A
	Rated short-circuit peak withstand current	80	kA
	Rated short-time withstand current	31,5	kA
	Rated duration of short circuit	3	s
	Electrical system		
	Earth system	insulated / solid earthed	
	Permissible values for internal-arc faults:		
	Peak withstand arc current	8	kA
	Short-time arc current	31	kA
	Rated duration of internal arc		
	Installation		
	Max. ambient air temperature		
	Min. Ambient air temperatur		
	Max. altitude		

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1.2.2 Vacuum circuit-breaker type VD4/P in withdrawable version

Type: VD4/P 12.06.32

Referents standards: IEC 62271-100

Manufacturer: ABB T&D Divisione SACE T.M.S., Italy, under license of ABB Technology Ltd.

Serial No.: 1VC1BD00028335

Drawing No.: TN7412

Year of manufacture: 2013

Ratings:	Rated voltage	12	kV
	Rated lightning impulse withstand voltage	75	kV
	Rated power frequency withstand voltage	28	kV
	Rated frequency	50/60	Hz
	Rated normal current	630	A
	Rated short-circuit peak withstand current	80	kA
	Rated short-time withstand current	31,5	kA
	Rated duration of short circuit	3	s
	Rated short-circuit breaking current	31,5	kA
	Rated short-circuit making current	80	kA
	Rated operating sequence	O-0,3s-CO-15s-CO	
	Arc extinguishing medium:	vacuum	
	Operating mechanism - spring charged by motor or manually – three-pole gang operation		
	Total number of poles	3	
	Pole numbers	PT1 / VG4-S / PA01557687	Phase L1
		PT1 / VG4-S / PA01557662	Phase L2
		PT1 / VG4-S / PA01557687	Phase L3
	Rated voltage of trip coil	110	V-DC
	Rated voltage of closing coil	110	V-DC
	Rated supply voltage	110	V-DC
	Max. ambient air temperature	40	°C

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1.2.3 Current instrument transformers

Type: TPU 43.13

Referents standards: IEC 60044-1 (2003)

Manufacturer: ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Serial No.: 1VLT5113025677 Phase L1
1VLT5113025672 Phase L2
1VLT5113025673 Phase L3

Year of manufacture: 2013

Ratings: Rated voltage 12 kV
Rated ratio 630 // 5 A
Rated lightning impulse withstand voltage 75 kV
Rated power frequency withstand voltage 28 kV
Rated frequency 50 Hz
Rated short-circuit peak withstand current 80 kA
Rated short-time withstand current 31,5 kA
Rated duration of short circuit 3 s
Insulation class E

1.2.4 Earthing-switch

Type: EK6-1208-150

Referents standards: IEC 62271-102

Manufacturer: ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Serial No.: 1VLA1306551

Drawing No.: GCE7169312R0114

Year of manufacture: 2013

Ratings: Rated voltage
Rated lightning impulse withstand voltage
Rated power frequency withstand voltage
Rated frequency
Rated short-time withstand current
Rated duration of short circuit
Rated short-circuit making current
Electrical system

На основании чл.36а
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2. Drawings of Tested Object

2.1 Drawings of Panel 1

The UniGear type ZS1 12.25.32 is a metal-enclosed switchgear system with separated compartments. The compartments are separated each from the other with metallic, earthed partitions. The switchgear is composed of following construction parts:

- apparatus compartment with vacuum circuit-breaker type VD4/P 12.25.32. The breaker is mounted to a withdrawable truck.
- bus-bars compartment.
- cable compartment with earthing switch type EK6-1208-275, current measuring transformers type TPU 46.33 and cable connections.
- LV instruments compartment

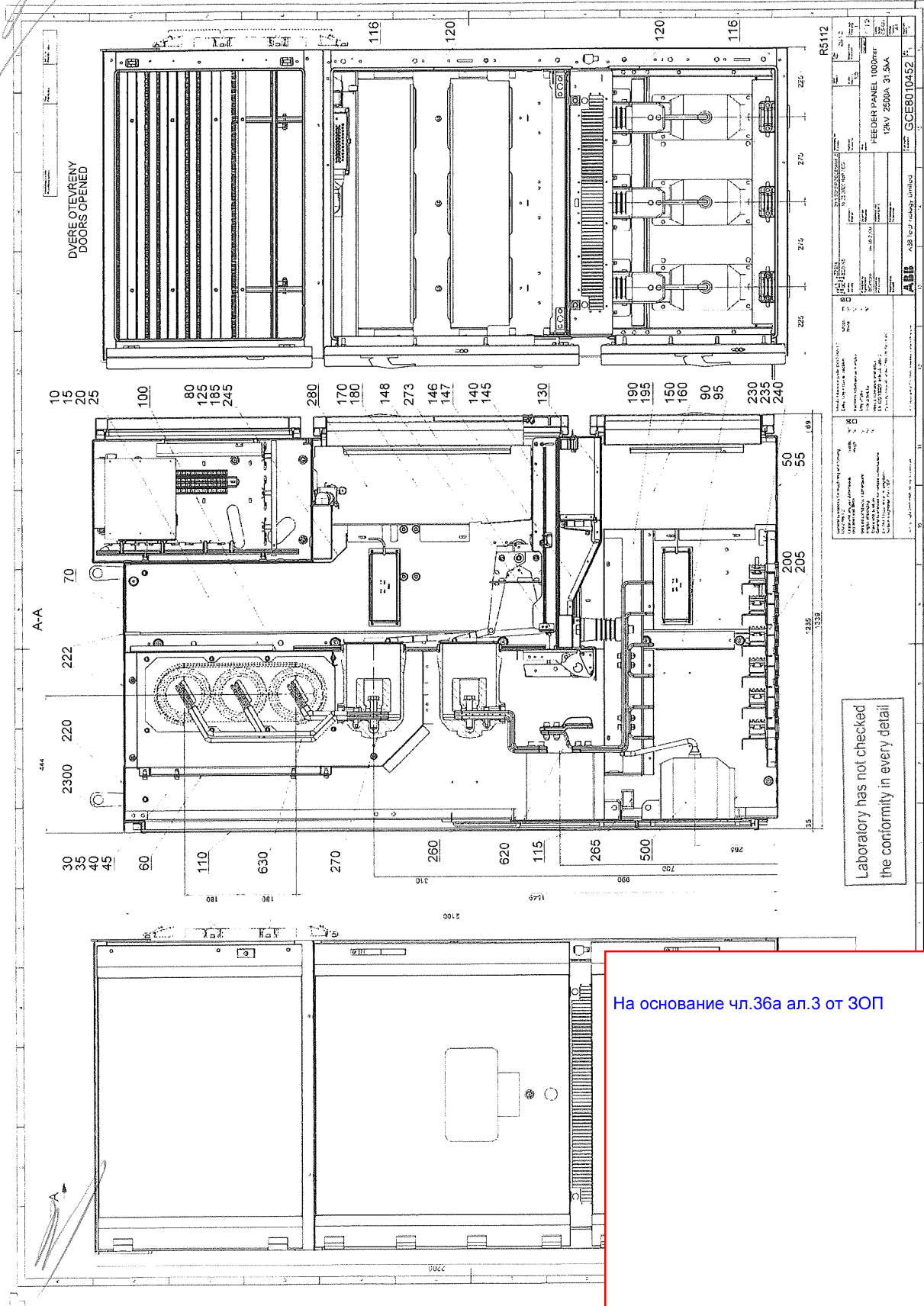
Drawings number	Title of ASSEMBLY or detail
GCE8010452R5112	UG ZS1 12.25.32
TN 7417	CB VD4/P 12.25.32
GCE7169312	Earthing-switch
GCE8010948R0104	SPOUTS-SHUTTERS
GCE8003899R0101	SPOUT
GCE8010105P0102	CONTACT PIN
1VL7625588R0105	CONNECTIONS-COMPLETION
GCE8010604R0111	T-OFF
GCE8010605R0111	TEE-OFF L1
GCE8010605R0112	TEE-OFF L1
GCE8010606R0111	TEE-OFF L2
GCE8010606R0112	TEE-OFF L2
GCE8010607R0111	TEE-OFF L3
GCE8010607R0112	TEE-OFF L3
GCE8010504R0101	CONNECTIONS-BOTTOM
GCE8010540P0101	CONNECTION
GCE8010541P0101	CONNECTION
GCE8010542P0101	CONNECTION
GCE8010543P0101	CONNECTION
1VL7609238R0103	GAS DUCT 1000mm
GCE0931008P0100	INSULATOR
1VL7611710R0101	VENTIL FLAP
1VL7611710R0102	VENTIL FLAP

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Laboratory has not checked
the conformity in every detail

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Laboratory has not checked the conformity in every detail

2.2 Drawings of Panel 2

The UniGear type ZS1 12.06.32 is a metal-enclosed switchgear system with separated compartments. The compartments are separated each from the other with metallic, earthed partitions. The switchgear is composed of following construction parts:

- apparatus compartment with vacuum circuit-breaker type VD4/P 12.06.32. The breaker is mounted to a withdrawable truck.
- bus-bars compartment.
- cable compartment with earthing switch type EK6-1208-150, current measuring transformers type TPU 43.13 and cable connections.
- LV instruments compartment

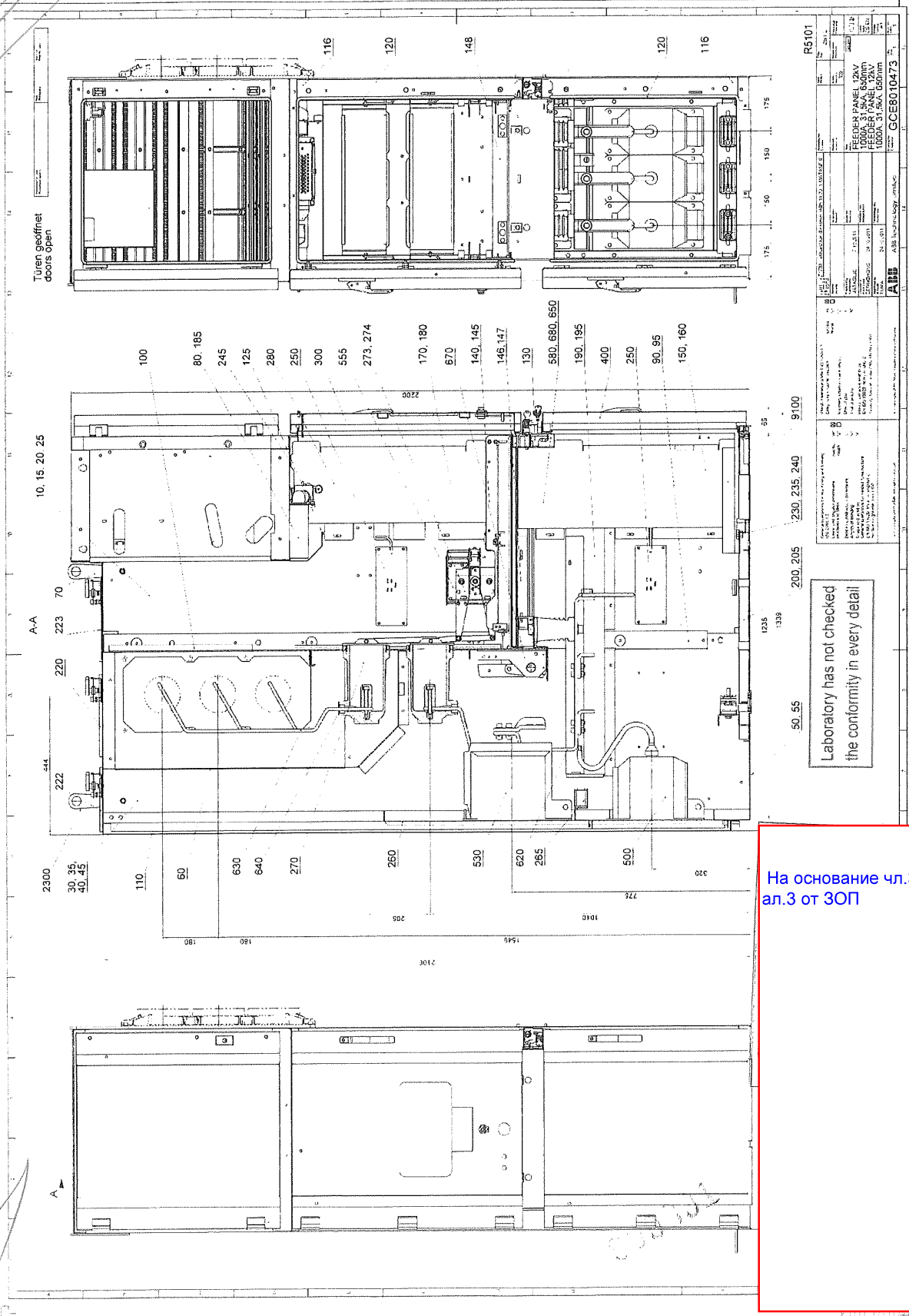
Drawings number	Title of ASSEMBLY or detail
GCE8010473R5101	UG ZS1 12.06.32
TN 7412	CB VD4/P 12.06.32
GCE7169312	Earthing-switch
GCE8011725R0201	SPOUTS-SHUTTERS
GCE8003624R0102	SPOUT
GCE8685778P0121	CONTACT PIN
1VL7625588R0101	CONNECTIONS-COMPLETION
GCE8011729R0101	T-OFF
GCE8011726P0101	TEE-OFF L1
GCE8011727P0101	TEE-OFF L2
GCE8011728P0101	TEE-OFF L3
1VL7606472R0101	CONNECTIONS-BOTTOM
GCE8010054P0101	CONNECTION
1VL7606473P0101	CONNECTION
GCE0931008P0100	INSULATOR
1VL7609238R0101	GAS DUCT 650mm
1VL7608257P0101	VENTIL FLAP
GCE8008730P0101	VENTIL FLAP

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Laboratory has not checked
the conformity in every detail

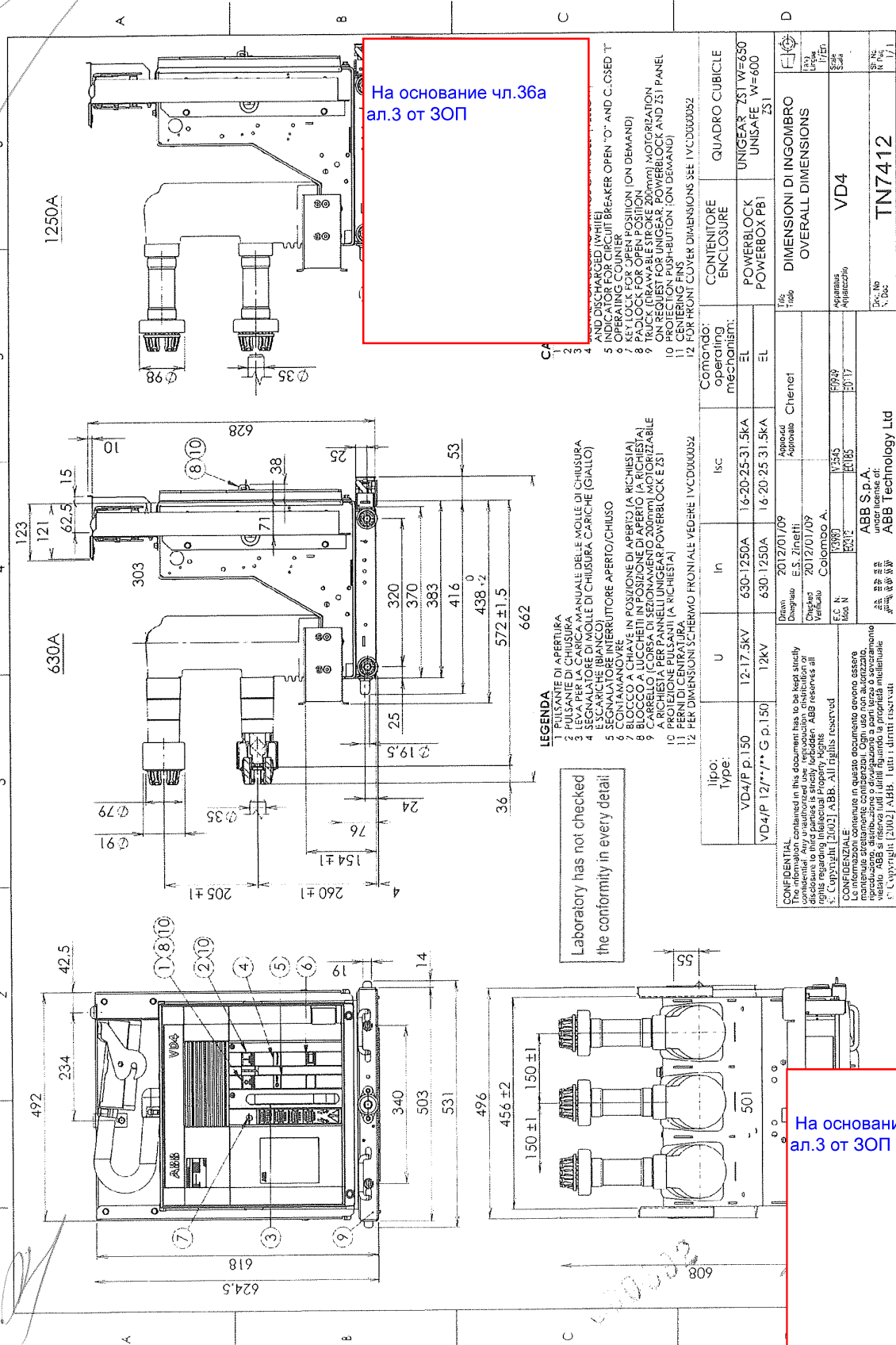
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the conformity in every detail

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3. Tests carried out

3.1 Mechanical operation tests - clause 6.102 IEC 62271-200 , Ed. 2.0 , 2011-10 - Panel 1

3.1.1 Switching devices and removable parts - clause 6.102.1 IEC 62271-200 , Ed.2.0 , 2011-10

The circuit breaker and earthing-switch were operated 50 times "C" and 50 times "O" to verify satisfactory operation of the equipments.

Then it was made 25 times insertion and 25 times withdrawal of withdrawable part.

Deviation of force (torque) needed to insert and remove the withdrawable parts was less than limit mentioned in IEC standard

3.1.2 Mechanical interlocks - clause 6.102.2 IEC 62271-200 , Ed. 2.0 , 201-10

There were 25 attempts to insert and 25 attempts to withdraw the withdrawable part made successfully together with satisfactory function of interlock.

During these tests the function of movable shutters was inspected and no failures were observed. The insertion and disengagement of movable contacts was found to be defect-free.

3.1.2.1 Interlocks of doors

There were 25 attempts to open any interlocks doors.

There was not able to open interlocked doors.

3.1.2.2 Interlocks of circuit breaker / withdrawable part

service position - the withdrawable part was not able to be withdrawn into disconnected position with the circuit - breaker switched ON.

disconnected position - the withdrawable part can not be inserted into working position with the circuit - breaker switched ON.

These tests were done with force 750N applied halfway along the length of the gripping part of the standard operating handle of withdrawable part..

The blocking of both positions was 50-times rechecked.

During these tests was made 10 attempts to operate switching device (circuit breaker) manually in the wrong direction. It was not able.

3.1.2.3 Interlocks of circuit breaker / earthing switch

In case of withdrawable part inserted in "service position" it was not able to switch ON earthing switch.

The withdrawable part was not able to inserted into "service position" with earthing switch switched ON.

These tests were done with force 750N applied halfway along the length of the gripping part of the standard operating handle of withdrawable part and earthing switch.

The blocking of both positions was 50-times rechecked.

In case of withdrawable part inserted in "service position " it was not able to insert earthing switch.

The switchgear passed the tests successfully

На основании чл.36а
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3.2 Mechanical operation tests - clause 6.102 IEC 62271-200 , Ed. 2.0 , 2011-10 - Panel 2

3.2.1 Switching devices and removable parts - clause 6.102.1 IEC 62271-200 , Ed.2.0 , 2011-10

The circuit breaker and earthing-switch were operated 50 times "C" and 50 times "O" to verify satisfactory operation of the equipments.
Then it was made 25 times insertion and 25 times withdrawal of withdrawable part.
Deviation of force (torque) needed to insert and remove the withdrawable parts was less than limit mentioned in IEC standard. See table No.1

3.2.2 Mechanical interlocks - clause 6.102.2 IEC 62271-200 , Ed. 2.0 , 201-10

There were 25 attempts to insert and 25 attempts to withdraw the withdrawable part made successfully together with satisfactory function of interlock.
During these tests the function of movable shutters was inspected and no failures were observed.
The insertion and disengagement of movable contacts was found to be defect-free.

3.2.2.1 Interlocks of doors

There were 25 attempts to open any interlocks doors.
There was not able to open interlocked doors.

3.2.2.2 Interlocks of circuit breaker / withdrawable part

service position - the withdrawable part was not able to be withdrawn into disconnected position with the circuit - breaker switched ON.

disconnected position - the withdrawable part can not be inserted into working position with the circuit - breaker switched ON.

These tests were done with force 750N applied halfway along the length of the gripping part of the standard operating handle of withdrawable part..

The blocking of both positions was 50-times rechecked.

During these tests was made 10 attempts to operate switching device (circuit breaker) manually in the wrong direction. It was not able.

3.2.2.3 Interlocks of circuit breaker / earthing switch

In case of withdrawable part inserted in "service position" it was not able to switch ON earthing switch.

The withdrawable part was not able to inserted into "service position" with earthing switch switched ON.

These tests were done with force 750N applied halfway along the length of the gripping part of the standard operating handle of withdrawable part and earthing switch.

The blocking of both positions was 50-times rechecked.

In case of withdrawable part inserted in "service position " it was not able to insert of earthing switch.

На основании чл.36а
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The switchgear passed the tests successfully

4. Ambient air conditions during mechanical operation tests:

Temperature (°C)	27,0
Pressure (hPa)	993
Air humidity (%)	41,0

5. List of measuring instruments used:

1. Digital torque key No. 009220102
2. Digital torque measuring adapter RJ – 7521 No. CK02490
3. Measuring device for Temperature, Air humidity and Pressure, Sensorika HTPN 27/350 reg. No. 100290

The measurement uncertainties of the test results reported in this document are the following:

torque : $\pm 1 \%$

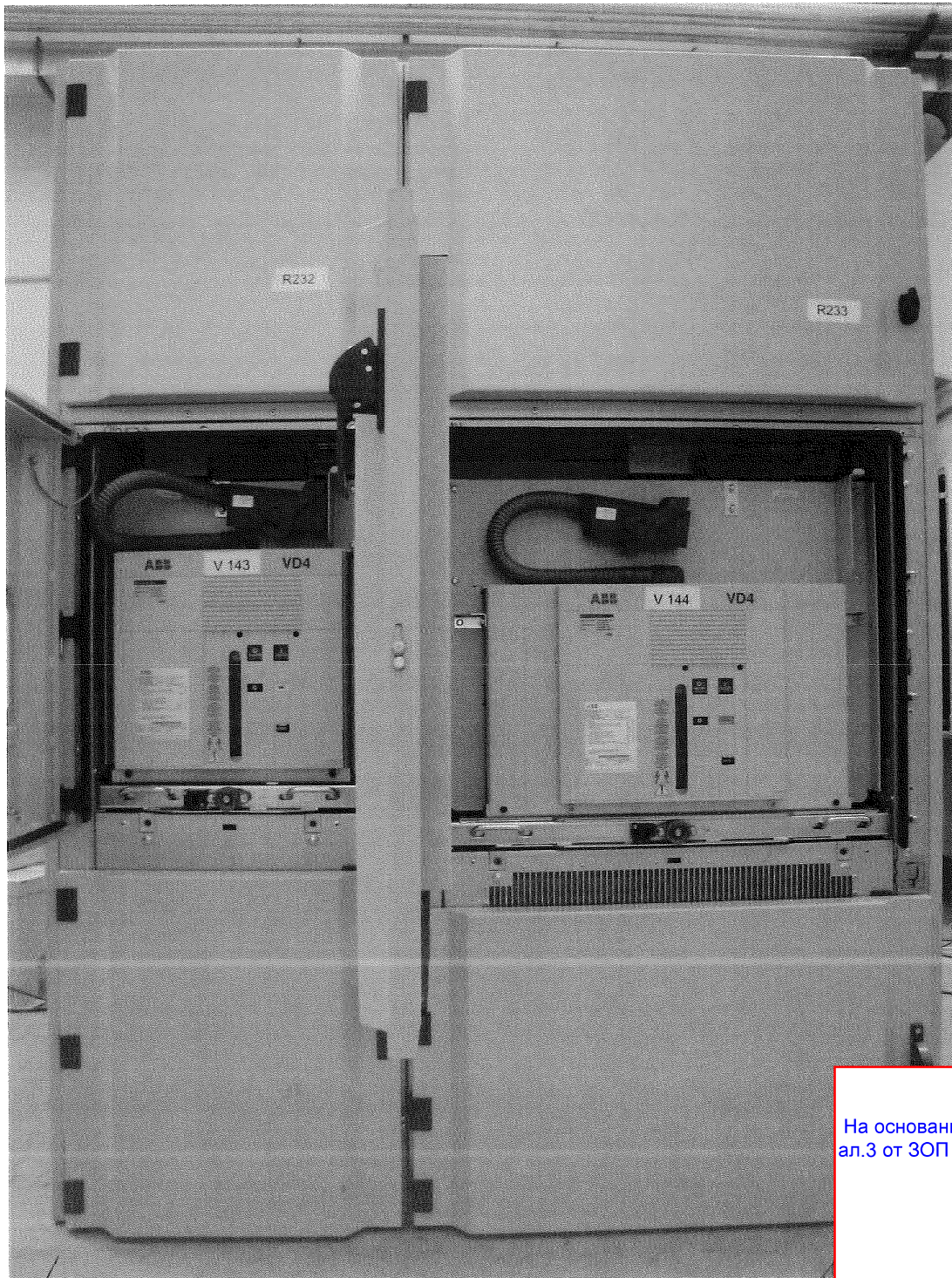
atmospheric conditions : temperature: $\pm 2^{\circ}\text{C}$, pressure : $\pm 15 \text{ hPa}$, humidity : $\pm 10 \%$

The measurement uncertainties are estimated at the level of twice the standard deviation and have to be considered as maximum values.

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6. Photos of the tested switchgear

Photo 1: Front view of switchgears UniGear ZS1 12.06.32 and 12.25.32



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Photo No.2 Circuit-breaker on truck under test with torque measuring device – Panel 1

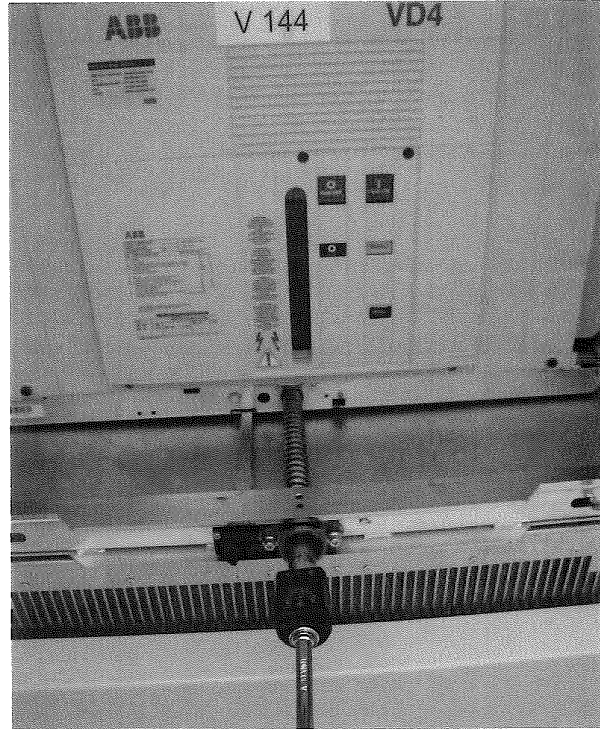
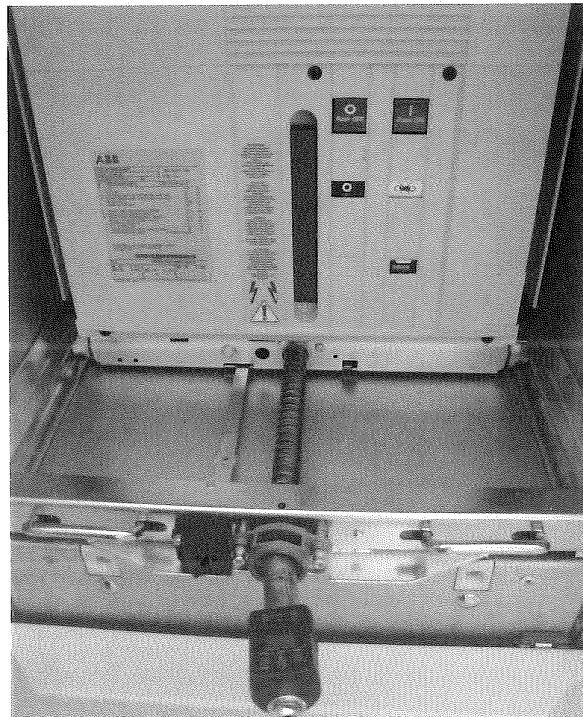


Photo No.3 Circuit-breaker on truck under test with torque measuring device – Panel 2



На основании чл.36а
ал.3 от ЗОП

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Test Object: Metal-enclosed, air-insulated switchgear type UniGear ZS1 with vacuum circuit-breaker type VD4/P 12.25.32, earthing-switch type EK6 1208-275 and ring-core current transformers type BD 00.

Type: UniGear type ZS1

Ratings:	Rated voltage	12 kV
	Rated current of bus-bar	2500 A
	Rated max. current of feeder	2500 A
	Rated frequency	50 Hz
	Rated short time withstand current	31,5 kA / 3s
	Rated peak withstand current	80/82 kA peak
	Max. ambient air temperature	40 °C
	Internal-arc classification	AFLR
	Degree of protection class	IP4x
	Temperature class of insulation	E

Client: ABB Technology Ltd., Zürich, Switzerland

Manufacturer: ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Kind of test: Part of type test - Power-frequency voltage tests (dry)
- Lightning impulse voltage tests (dry)
- Partial discharge tests

Test Specification: IEC 62271-200, Ed. 2.0, 2011-10, IEC 62271-1, Ed. 1.0, 2007-10
IEC 62271-100 Ed.2, 2008-04, IEC 62271-102, Ed.1.1, 2012-02

Tests were carried-out under observation of BVQI inspector Mr.Ing.Ladislav Krátký

LSC classification: LSC2B

Test Results: The metal-enclosed switchgear passed the tests.

Date of test: 17.10.2014

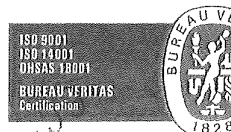


На основании чл.36а ал.3 от ЗОП

20.10.2014
Date of issue

These test results concern exclusively to the object tested. This test report is issued by Technical Laboratory that is member of CTLA (Association of Czech Testing Rooms and Laboratories) with right to use cancellation No. 028. The report shall not be reproduced except in full without the written approval of the Technical Laboratory ABB s.r.o. PPMV Brno : Technical laboratory Vídeňská 117 CZ 619 00 Brno Fax: +420 5 4715 2302 Phone: +420 4715 2447.

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Czech Republic	Czech Republic	



На основании чл.36а ал.3 от ЗОП

Referents standards: IEC 62271-200, Ed. 2.0, 2011-10, IEC 62271-1, Ed. 1.0, 2007-10
IEC 62271-100, Ed. 2.0, 2008-04, IEC 62271-102, Ed.1.1, 2012-02,
IEC 60044-1 (2003)

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1. Ratings

1.1 Air insulated switchgear

Referents

standards: IEC 62271- 200, Ed. 2.0, 2011 - 10

Type: UniGear ZS1

Manufacturer:

Switchgear:
ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Circuit-breaker:
ABB S.p.A. , Dalmine , Italy, under license of ABB Technology Ltd.

Ring-core current transformers:
ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Earthing switch:
ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Serial-No.: 1VLS1000033913/002, R310

Year of manufacture: 2014

Drawing-No.: 1VL7632220R0101

Ratings:	Rated voltage	12 kV
	Rated lightning impulse withstand voltage	
	phase to earth	75 kV
	across the insulating distance	85 kV
	Rated power frequency withstand voltage	
	phase to earth	28 kV
	across the isolating distance	32 kV
	Rated frequency	50 Hz
	Rated normal current of busbar	2500 A
	Rated normal max. current of feeder	2500 A
	Rated short-circuit peak withstand current	80/82 kA
	Rated short-time withstand current	31,5 kA
	Rated duration of short circuit	3 s
	Electrical system	3 Phases
	Earth system	insulated / solid earthed

Permissible values for internal-arc faults:

Peak arc withstand current	80/82 kA	На основании чл.36а ал.3 от ЗОП
Short-time arc current	31,5 kA	
Rated duration of internal arc	3 s	
Installation	indoor	
Max. ambient air temperature	+ 40 °C	
Min. Ambient air temperatur	- 25 °C	
Max. altitude	1000 m	

000 101



1.2 Vacuum circuit-breaker type VD4/P in withdrawable version

Type: VD4/P 12.25.32

Referents standards: IEC 62271-100 Ed.2, 2008-04

Manufacturer: ABB S.p.A. , Dalmine , Italy, under license of ABB Technology Ltd.

Serial No.: 1VC1BB00045925, V91

Drawing No.: TN 7417

Year of manufacture: 2012

Ratings:	Rated voltage	12	kV
	Rated lightning impulse withstand voltage	75	kV
	Rated power frequency withstand voltage	28	kV
	Rated frequency	50/60	Hz
	Rated normal current	2500	A
	Rated short-circuit 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
	Rated short-circuit making current	80/82	kA
	Rated operating sequence	O-0,3s-CO-3min-CO	
	Arc extinguishing medium:	vacuum	
	Operating mechanism - spring charged by motor or manually – three-pole gang operation		
	Total number of poles	3	
	Pole numbers	P2 / VG4-S / BA01161665	Phase L1
	P2 / VG4-S / BA01161664	Phase L2	
	P2 / VG4-S / BA01161656	Phase L3	
Rated voltage of trip coil	230	V-50Hz	
Rated voltage of closing coil	230	V-50Hz	
Rated supply voltage	230	V-50Hz	
Max. ambient air temperature	40	°C	

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1.3 Ring-core current transformers

Type: BD 00

Referents standards: IEC 60044-1 (2003)

Manufacturer: ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Serial No.:	Phase L1	Phase L2	Phase L3
	1VLT5114044936	1VLT5114044937	1VLT5114044944
	1VLT5114044938	1VLT5114044940	1VLT5114044939
	1VLT5114044942	1VLT5114044943	1VLT5114044941

Year of manufacture: 2014

Ratings:	Rated voltage	12 kV
	Rated ratio	2500 // 1 A
	Rated lightning impulse withstand voltage	75 kV
	Rated power frequency withstand voltage	28 kV
	Rated frequency	50 Hz
	Rated short-circuit peak withstand current	80 kA
	Rated short-time withstand current	31,5 kA
	Rated duration of short circuit	3 s
	Insulation class	E

1.4 Earthing-switch

Type: EK6 - 1208-275

Referents standards: IEC 62271-102, Ed.1.1, 2012-02

Manufacturer: ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Serial No.: 1VLA1403880 Year of manufacture : 2014

Drawing No: GCE 7169312R0116

Rated voltage
Rated short-time withstand current
Rated duration of short circuit
Rated short-circuit making current

12 kV
31,5 kA
3 s
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2. List of drawings of tested object

The switchgear type UniGear ZS1 is a metal-enclosed switchgear system with separated compartments. The compartments are separated each from the other with metallic, earthed partitions. The switchgear is composed of following construction parts:

- apparatus compartment with vacuum circuit-breaker type VD4/P 12.25.32. The breaker is mounted to a withdrawable truck.
- busbars compartment
- cable compartment with earthing switch type EK6 -1208-275, ring-core current measuring transformers type BD 00 and cable connections
- LV instruments compartment

List of drawings handed to the laboratory:

Drawings number	Title of ASSEMBLY or detail
1VL7632220R0101	IF LDU 12kV, 2500A, 31,5kA
TN 7417	VACUUM CIRCUIT BREAKER
1VCR011648G0001	T-OFF ASS.12/17,5kV 2500A
GCE8010604R0111	TEE-OFF BAR SYSTEM
GCE8010605P0101	T-OFF BAR L1
GCE8010605P0102	T-OFF BAR L1
GCE8010606P0101	T-OFF BAR L2
GCE8010606P0102	T-OFF BAR L2
GCE8010607P0101	T-OFF BAR L3
GCE8010607P0102	T-OFF BAR L3
GCE8010105P0102	CONTACT PIN 12/17,5kV 109mm 2500A
GCE8010104P0103	INSERT OF CONTACT PIN 109MM
1VL7632214R0101	BD ASSEMBLY
1VL7632219R0101	CONNECTION ASSEM.
1VL7632221R0101	CONNECTING BAR
1VL7632222R0101	CONNECTING BAR
1VL7632223P0101	CONNECTING BAR
1VL7632224P0101	CONNECTING BAR
1VL7632225P0101	CONNECTING BAR
1VL7632207P0101	CONNECTING BAR
GCE0931008P0100	SUPPORT INSULATOR 12kV TYPE B
1VL7606539R0101	CT ROD 17,5 kV, 2500 A 50kA/3s
1000065848	POST TYPE INSULATOR 50

Included in the test report:

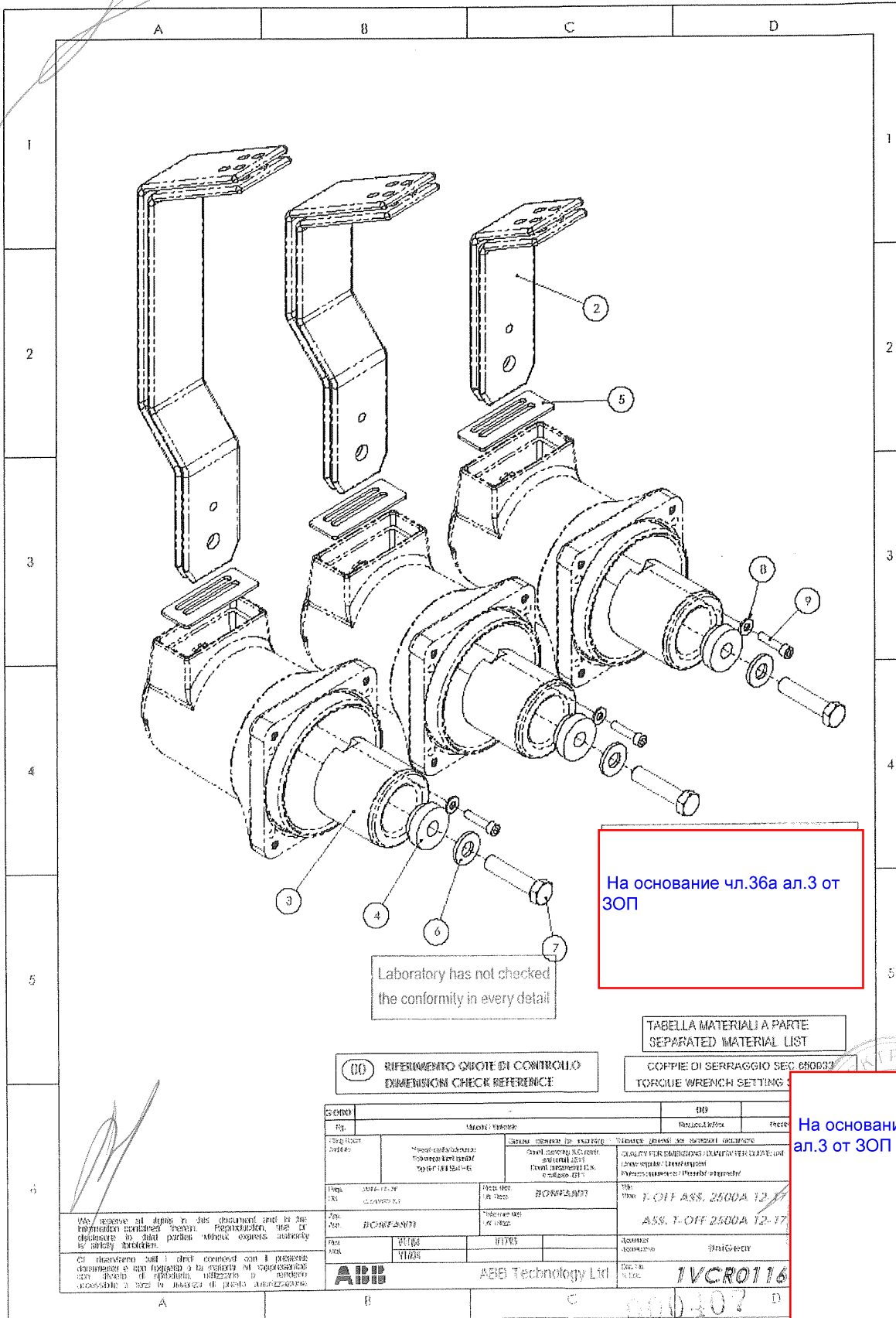
Drawing number:	Title of ASSEMBLY or detail:
1VL7632220R0101	IF LDU 12kV, 2500A, 31,5kA
TN 7417	VACUUM CIRCUIT BREAKER
1VCR011648G0001	T-OFF ASS.12/17,5kV 2500A
1VL7632214R0101	BD ASSEMBLY
1VL7632219R0101	CONNECTION ASSEM.

ABB guarantees that tested objects are manufactured according to submitted drawings. Bureau Veritas checked that these drawings adequately represent in shape and dimensions details and parts of tested objects.

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Укр. Веритас



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Laboratory has not checked the conformity in every detail

TABELLA MATERIALI A PARTE
SEPARATED MATERIAL LIST
COPPIE DI SERRAGGIO SEC. 680331
TORQUE WRENCH SETTING

00 RIFERIMENTO QUOTE DI CONTROLLO
DIMENSIONI CHECK REFERENCE

COND.	Materiale		DB
Fig.	Descrizione	Quantità	Prezzo
1	1	1	
2	2	1	
3	3	1	
4	4	1	
5	5	1	
6	6	1	
7	7	1	
8	8	1	
9	9	1	

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Ho ricevuto al dipinto in suo incarico e in nome
della ditta di cui sono amministratore, l'incarico
di verificare la conformità delle parti in oggetto
alle specifiche tecniche fornite e di redigere
il presente rapporto di prova.

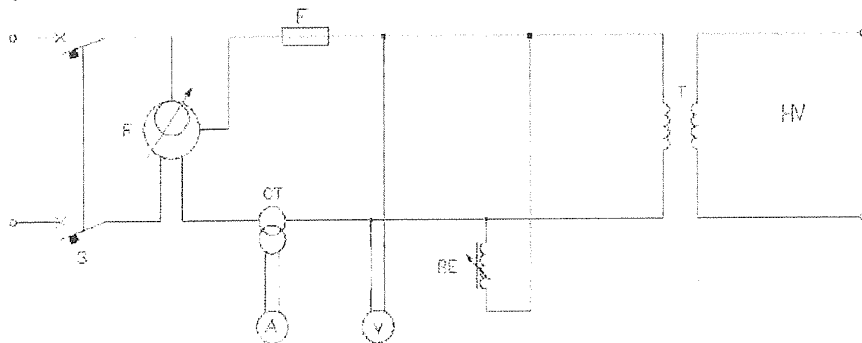
3. Tests carried out

3.1 Power-frequency voltage tests - clause 6.2.6.1 IEC 62271-200 , Ed. 2.0 , 2011-10

Application of the test voltage and test conditions:

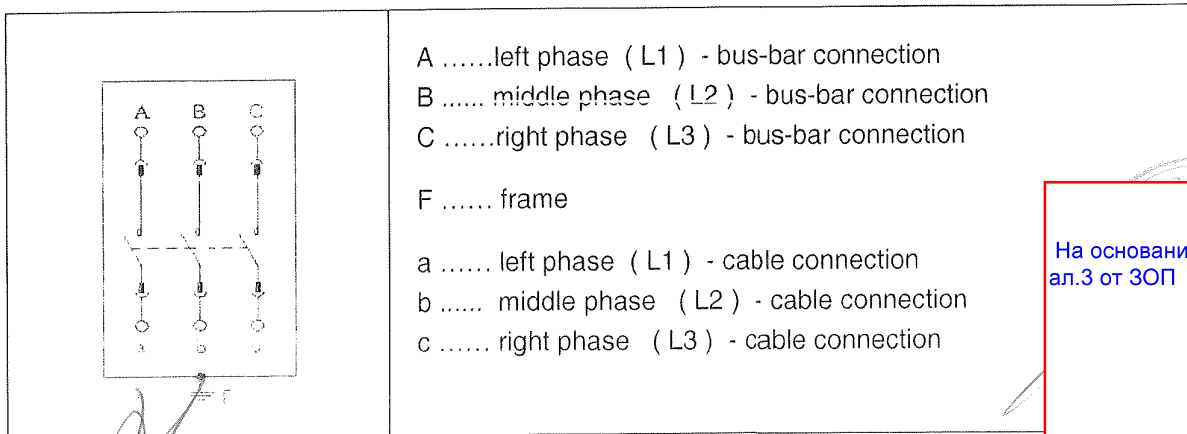
The switchgear type UniGear ZS1 with vacuum circuit-breaker type VD4/P 12.25.32, earthing-switch type EK6 1208-275 and ring-core current transformers type BD 00 was subjected to short-duration power-frequency voltage withstand test in accordance with IEC 60060-1.
The test voltage was raised for each test condition to the test value and maintained for 1 min.
Frequency of test voltage during of power frequency voltage test was 50Hz.
Condition of the test object before test : new

Power frequency test circuit:



- R Booster transformer
- F Protection fuse
- T High voltage transformer
- RE Variable reactor
- V Digital control transformer
- CT Current transformer
- A Digital control ammeter
- S Switch

Test configuration:



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With reference to connection of a three-pole switching device, the test voltage was applied according to Table 1 and Table 2.

Table 1: Test connection - phase to earth

Test condition	Switching device	Voltage applied to	Connected to earth	Voltage applied [kV]	Result: Test duration / flashovers	Note:
1	Closed	Aa	BbCcF	28	1 minute / 0	passed
2	Closed	Bb	AaCcF	28	1 minute / 0	passed
3	Closed	Cc	AaBbF	28	1 minute / 0	passed
4	Open	A	BCabcF	28	1 minute / 0	passed
5	Open	B	ACabcF	28	1 minute / 0	passed
6	Open	C	ABabcF	28	1 minute / 0	passed
7	Open	a	ABCbcF	28	1 minute / 0	passed
8	Open	b	ABCacF	28	1 minute / 0	passed
9	Open	c	ABCabF	28	1 minute / 0	passed
10	Withdraw	A	BCabcF	28	1 minute / 0	passed
11	Withdraw	B	ACabcF	28	1 minute / 0	passed
12	Withdraw	C	ABabcF	28	1 minute / 0	passed
13	Withdraw	a	ABCbcF	28	1 minute / 0	passed
14	Withdraw	b	ABCacF	28	1 minute / 0	passed
15	Withdraw	c	ABCabF	28	1 minute / 0	passed

Table 2: Test connection - across the insulating distance

Test condition	Switching device	Voltage applied to	Connected to earth	Voltage applied [kV]	Result: Test duration / flashovers	Note:
1	Open	a	A	32	1 minute / 0	passed
2	Open	b	B	32	1 minute / 0	passed
3	Open	c	C	32	1 minute / 0	
4	Open	A	a	32	1 minute / 0	
5	Open	B	b	32	1 minute / 0	
6	Open	C	c	32	1 minute / 0	

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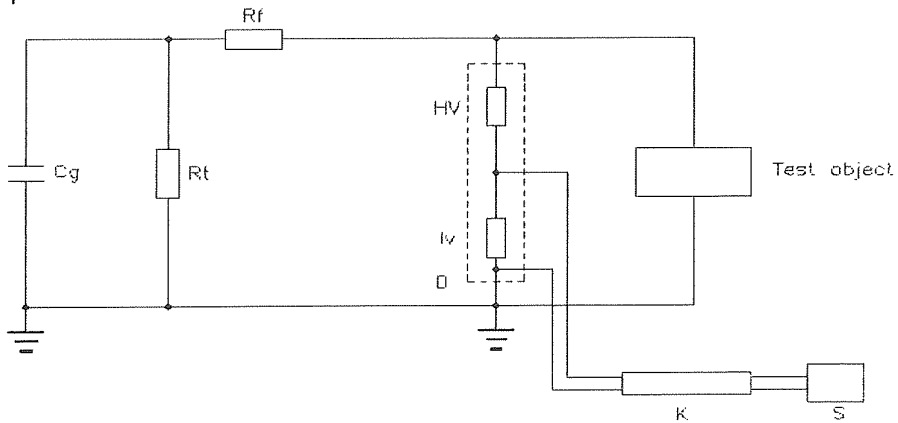
During this type of test the remaining phases and frame were insulated again the earth. Power frequency voltage tests were performed without using of correction factors.

3.2 Lightning impulse voltage tests - clause 6.2.6.2 IEC 62271-200, Ed. 2.0, 2011-10

Application of the test voltage and test conditions:

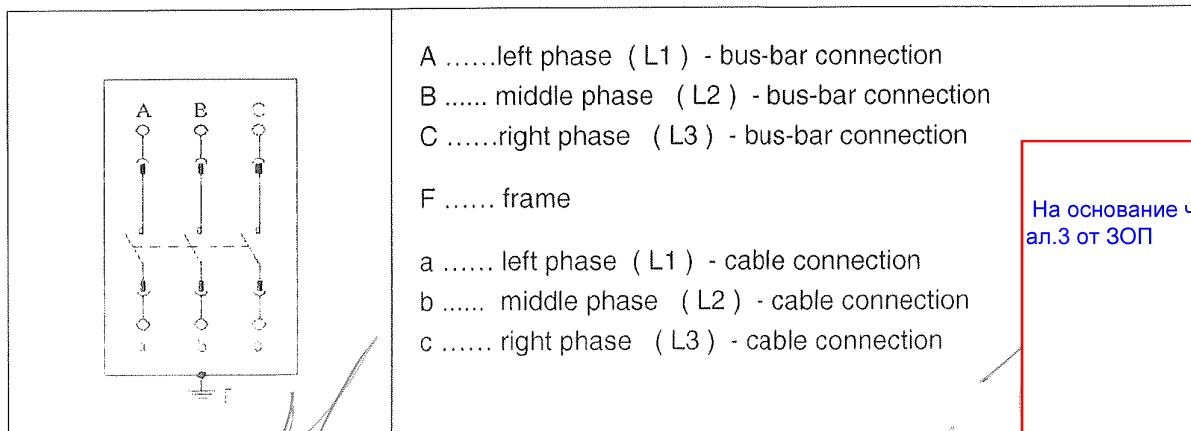
The switchgear type UniGear ZS1 with vacuum circuit-breaker type VD4/P 12.25.32, earthing-switch type EK6 1208-275 and ring-core current transformers type BD 00 was subjected to the lightning impulse voltage test with fifteen positive and fifteen negative impulses of wave-shape 1,2/50 μ s. Voltage was measured by means of digital impulse voltage measuring system. The standard lightning impulse was in accordance with IEC 60060-1.

Lightning impulse test circuit:



No. of stages	4
Cg	250 nF
Rt	256 Ω
Rf	43 Ω
D	Divider HIGHVOLT, Type SMC 2000/400
HV	High-voltage capacitance
Lv	Low-voltage capacitance
K	Coaxial cable
S	Evaluating system Dr. STRAUSS, Type MIRA 25-8

Test configuration:



- Aleft phase (L1) - bus-bar connection
- B middle phase (L2) - bus-bar connection
- Cright phase (L3) - bus-bar connection

- F frame
- a left phase (L1) - cable connection
- b middle phase (L2) - cable connection
- c right phase (L3) - cable connection

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With reference to connection of a three-pole switching device, the test voltage was applied according to Table 3 and Table 4.

Table 3: Test connection - phase to earth

Test condition	Switching device	Voltage applied to	Connected to earth	Voltage applied [kV]	Result: Number of impulses / flashovers	Note:
1	Closed	Aa	BbCcF	+ 72,2 - 72,8	15 / 0 15 / 0	passed
2	Closed	Bb	AaCcF	+ 72,2 - 72,8	15 / 0 15 / 0	passed
3	Closed	Cc	AaBbF	+ 72,2 - 72,8	15 / 0 15 / 0	passed
4	Open	A	BCabcF	+ 72,2 - 72,8	15 / 0 15 / 0	passed
5	Open	B	ACabcF	+ 72,2 - 72,8	15 / 0 15 / 0	passed
6	Open	C	ABabcF	+ 72,2 - 72,8	15 / 0 15 / 0	passed
7	Open	a	ABCbcF	+ 72,2 - 72,8	15 / 0 15 / 0	passed
8	Open	b	ABCacF	+ 72,2 - 72,8	15 / 0 15 / 0	passed
9	Open	c	ABCabF	+ 72,2 - 72,8	15 / 0 15 / 0	passed
10	Withdraw	A	BCabcF	+ 72,2 - 72,8	15 / 0 15 / 0	passed
11	Withdraw	B	ACabcF	+ 72,2 - 72,8	15 / 0 15 / 0	passed
12	Withdraw	C	ABabcF	+ 72,2 - 72,8	15 / 0 15 / 0	passed
13	Withdraw	a	ABCbcF	+ 72,2 - 72,8	15 / 0 15 / 0	passed
14	Withdraw	b	ABCacF	+ 72,2 - 72,8	15 / 0 15 / 0	passed
15	Withdraw	c	ABCabF	+ 72,2 - 72,8	15 / 0 15 / 0	passed

Lightning impulse voltage tests were performed with using of correction factors.

No more than two disruptive discharges (flashovers) on self-restoring insulation occurred on each test conditions. This was verified, when it happened, by 5 consecutive impulses withstood follow the last disruptive discharge.

No disruptive discharges on non-self-restoring insulation occurred.

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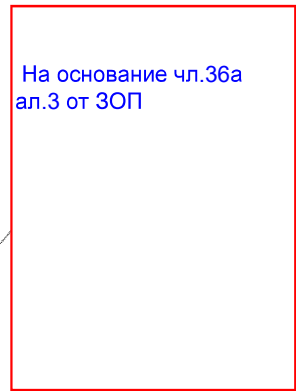
Table 4: Test connection - across the insulating distance

Test condition	Switching device	Voltage applied to	Connected to earth	Voltage applied [kV]	Result: Number of impulses / flashovers	Note:
1	Open	A	a	+ 85,2 - 85,4	15 / 0 15 / 0	passed
2	Open	B	b	+ 85,2 - 85,4	15 / 0 15 / 0	passed
3	Open	C	c	+ 85,2 - 85,4	15 / 0 15 / 0	passed
4	Open	a	A	+ 85,2 - 85,4	15 / 0 15 / 0	passed
5	Open	b	B	+ 85,2 - 85,4	15 / 0 15 / 0	passed
6	Open	c	C	+ 85,2 - 85,4	15 / 0 15 / 0	passed

During this type of test the remaining phases and frame were insulated again the earth.
Lightning impulse voltage tests were performed without using of correction factors.

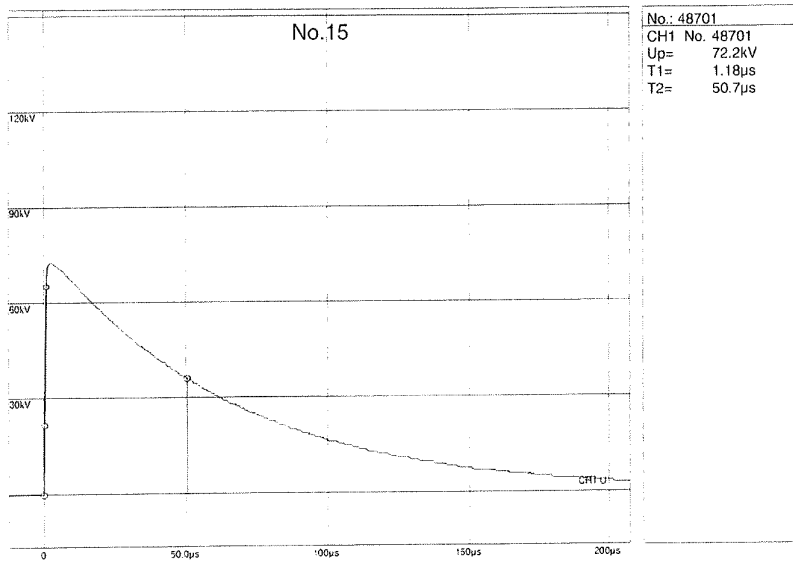
На основании чл.36а
ап.3 от ЗОП

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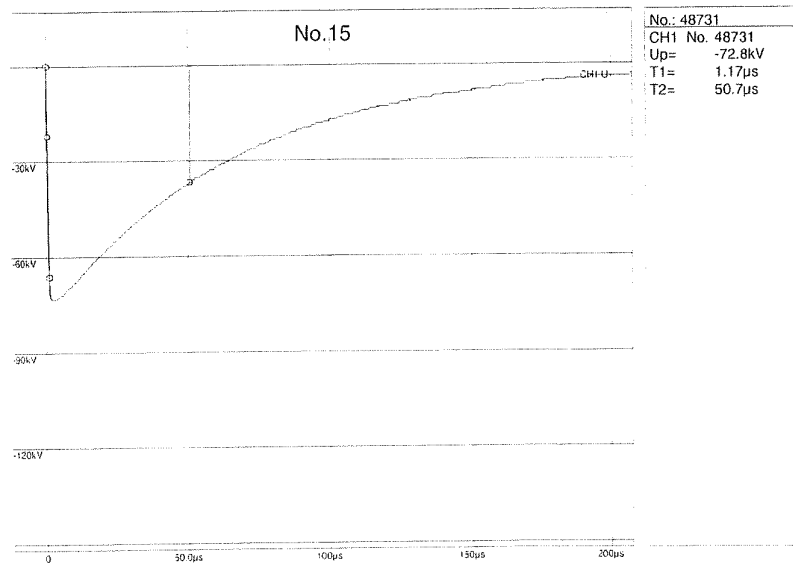


3.2.1 Oscillograms of tests lightning impulse voltage tests

Records of lightning impulse test, wave-shape 1,2/50 μ s, + U = 72,2 kV



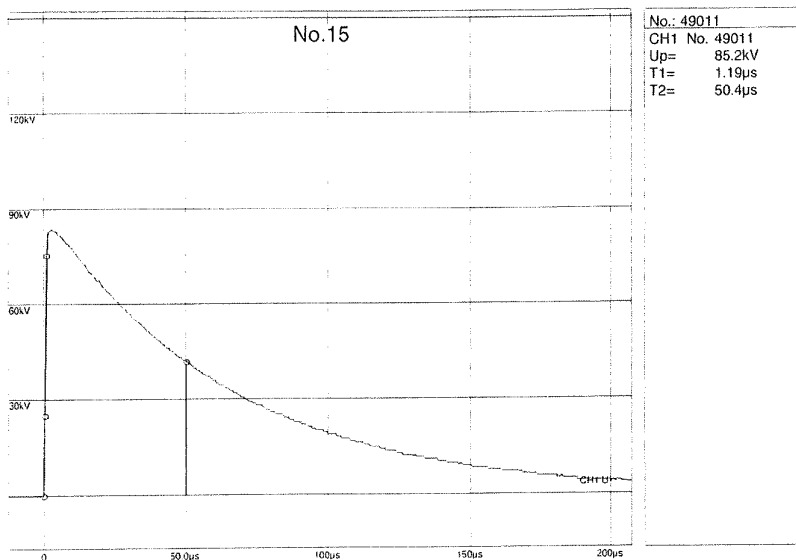
Records of lightning impulse test, wave-shape 1,2/50 μ s, - U = 72,8 kV



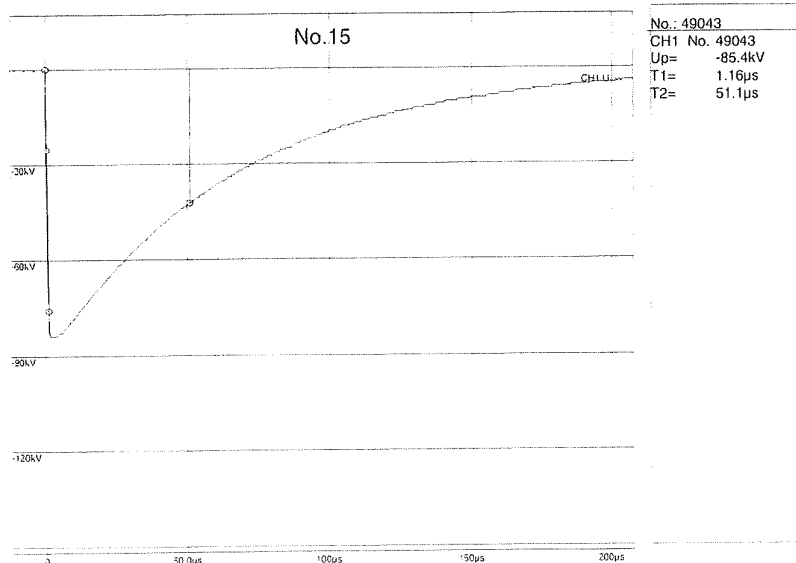
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Records of lightning impulse test, wave-shape 1,2/50 μ s, + U = 85,2 kV



Records of lightning impulse test, wave-shape 1,2/50 μ s, - U = 85,4 kV



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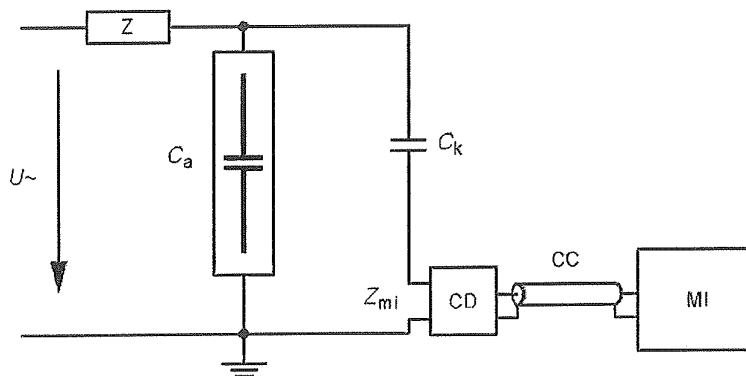
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3.3 Partial discharge tests - clause 6.2.9 IEC 62271-200, Ed. 2.0, 2011-10

PD test procedure:

- Single-phase testing, procedure A according to IEC 62271-200, cl.6.2.9, Annex BB and IEC 60270.
The applied power-frequency voltage was raised up to $1,3xU_r$ and maintained at this value for at least 10 sec.
- The voltage was then decreased without interruption to $1,1xU_r$ and the partial discharge quantity was measured at these voltages if any.
- Frequency of test voltage was 50Hz.

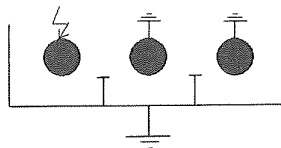
Partial discharge test circuit:



- U~ High-voltage supply
- Z Filter
- Z_{mi} Input impedance of measuring system
- CC Connecting coaxial cable
- C_a Test object
- C_k Coupling capacitor
- CD Coupling device
- MI Measuring instrument

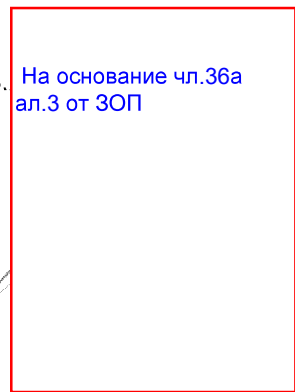
Basic diagram: Single-phase testing, procedure A according to IEC 62271-200, cl.6.

На основании чл.36а
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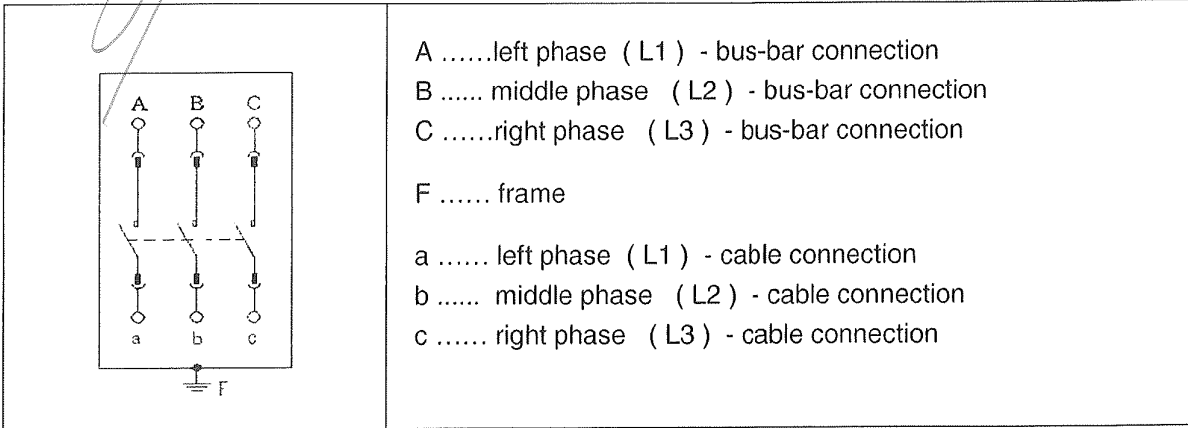


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Test configuration:



With reference to connection of a three-pole switching device, the test voltage was applied according to Table 5.

Table 5: Test connection and test results of partial discharge tests

Voltage source connected to	Connected to earth	Prestress voltage 1,3 U _r =15,6 kV	Value of partial discharges measured at test voltage 1,1 U _r =13,2 kV
Aa	BbCcF	15,6kV – 10s	0,3 pC
Bb	AaCcF	15,6kV – 10s	0,3 pC
Cc	AaBbF	15,6kV – 10s	0,3 pC

The background noise value was less than 0,3 pC during all tests.

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4. Ambient air conditions during dielectric tests

Test	Power frequency Partial discharge tests	Impulse 1,2 / 50 μ s
Date of test	17.10.2014	17.10.2014
Ambient air conditions	Temperature ($^{\circ}$ C)	24,0
	Pressure (hPa)	985
	Air humidity (g/m^3)	10,19
Correction factors	k_1 : 0,9593	k_1 : 0,9593
	k_2 : 0,9955	k_2 : 0,9963
	K_t : 0,9550	K_t : 0,9557
Rated test voltage: Phase to phase	28 kV	75 kV
Calculated reduced test voltage: Phase to phase	26,74 kV	71,67 kV
Applied test voltage during tests: Phase to phase	28 kV	+72,2 kV -72,8 kV

5. List of measuring instruments used

Impulse voltage generator HIGHTVOLT IPF 20/400 L	reg. No. 885217
Digital Impulse Voltage Measuring System TR-AS 25-8, Strauss	reg. No. 269/1999
High Voltage Test System WGBS, HIGHVOLT	reg. No. 885169
Digital partial discharge measuring system LDS-6	reg. No. 30536181
Calibrator of partial discharges Type 9216	reg. No. 146373
Measuring device for Temperature, Air humidity and Pressure, Sensorika HTPN 27/350	reg. No. 100290

The measurement uncertainties of the test results reported in this document are the following:

- dielectric tests with impulse voltage : peak value : $\pm 3\%$ time parameters : $\pm 10\%$
- dielectric tests with alternating voltage : voltage (rms): $\pm 3\%$ time parameters : $\pm 3,5\%$
- partial discharge measurement : up to 10 pC : $\pm 1\text{ pC}$ above 10 pC : $\pm 10\%$
- atmospheric conditions : temperature: $\pm 2^{\circ}\text{C}\%$, pressure : $\pm 15\text{ hPa}$, humidity : $\pm 10\%$

The measurement uncertainties are estimated at the level of twice the standard deviation and have to be considered as maximum values.

На основании чл.36а
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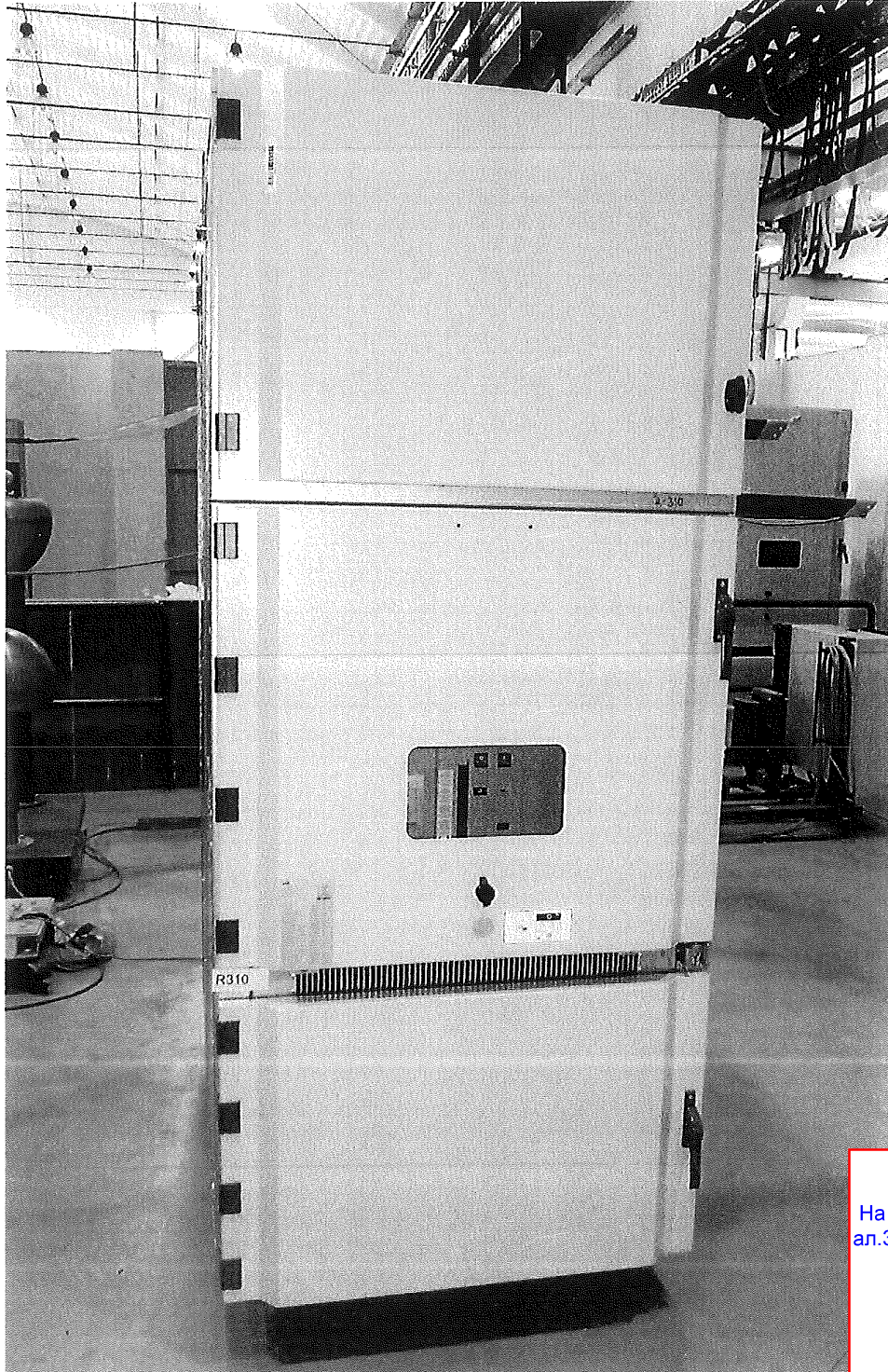


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6. Photos of the tested object

Photo 1: Tested object during impulse voltage test - front view



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Photo 2: Apparatus compartment with vacuum circuit-breaker type VD4/P 12.25.32

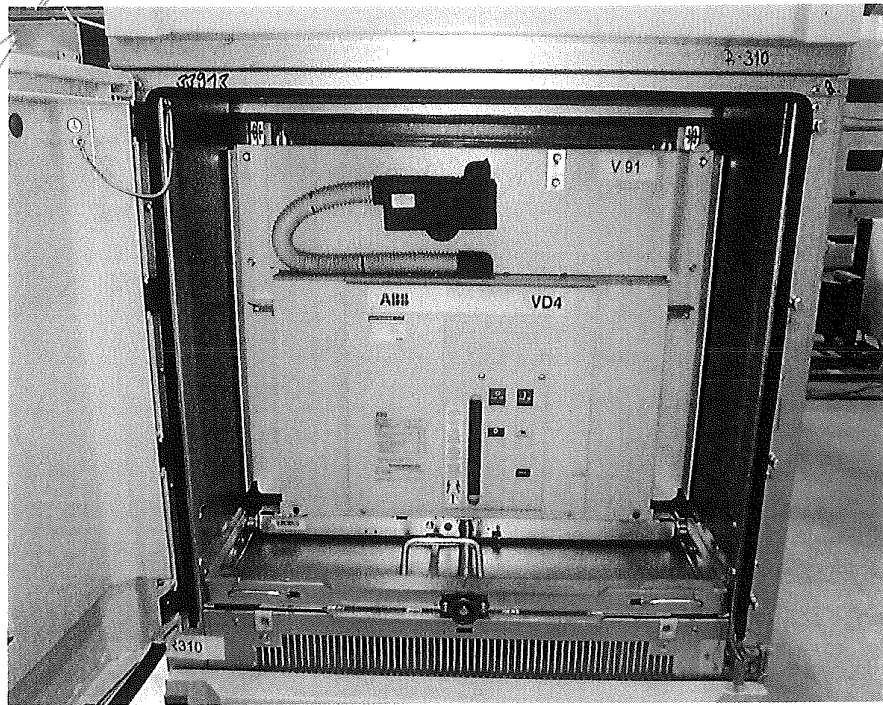
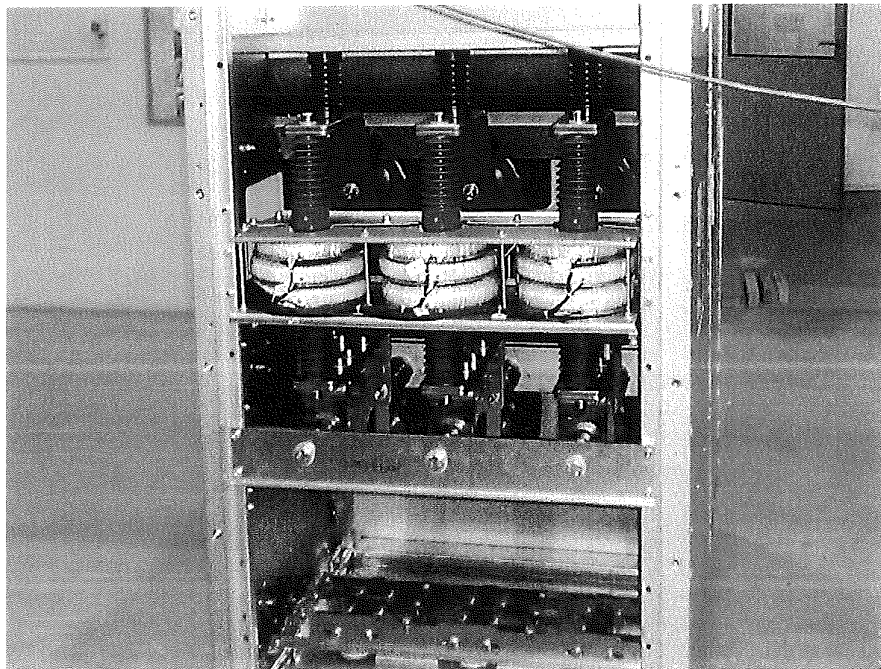


Photo 3: Cable compartment with ring-core current measuring transformers type BD 00.



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350420



Technical Laboratory

TEST REPORT No. 1VLR018370

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issued by a Technical laboratory in accordance with IEC 17025

Test Object: Metal-enclosed, air-insulated switchgears UniGear type ZS1 with vacuum circuit-breaker type VD4/P 12.25.32, earthing-switch type EK6 1208-275 and ring-core current transformers BD 00 (P=275mm).

Type: UniGear type ZS1

Ratings:	Rated voltage	12 kV
	Rated current of bus-bar	2500 A
	Rated current of feeder	2500 A
	Rated frequency	50 Hz
	Rated short time withstand current	31,5 kA / 3s
	Rated peak withstand current	80/82 kA peak
	Max. ambient air temperature	40 °C
	Internal-arc classification	AFLR
	Degree of protection class	IP4x
	Temperature class of insulation	E

Client: ABB Technology Ltd., Zürich, Switzerland

Manufacturer: ABB s.r.o., PPMV Brno, Czech Republic, under license of ABB Technology Ltd.

Kind of test: Part of type test - Measurement of the resistance of the main circuit
Part of type test - Temperature rise test of the main circuit

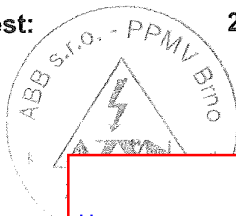
Test Specification IEC 62271-200, Ed. 2.0, 2011-10, IEC 62271-1, Ed. 1.0, 2007-10
IEC 62271-100, Ed.2.1, 2012-09, IEC 62271-102, Ed.1.1, 2012-02

Tests were carried-out under observation of BVQI inspector
Mr. Ing. Milan Klecker.

LSC classification: LSC2B

Test Results: The metal-enclosed switchgear passed the tests

Date of test: 29.10.2014



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30.10.2014

Date of issue

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На основании чл.36а ал.3 от ЗОП

Referents standards: IEC 62271-200, Ed. 2.0, 2011-10, IEC 62271-1, Ed. 1.0, 2007-10
IEC 62271-100, Ed. 2.1, 2012-09, IEC 62271-102, Ed. 1.1, 2012-02

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1. Ratings

1.1 Air insulated switchgear

Referents

standards: IEC 62271- 200, Ed. 2.0, 2011 - 10

Type: UniGear ZS1

Manufacturer: **Switchgear:**
ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Circuit breaker:
ABB T& D Divisione SACE T.M.S., Italy, under license of ABB Technology Ltd.

Current transformers:
ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Earthing switch:
ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Serial-No.: 1VLS1000033913/002 **Year of manufacture:** 2014

Drawing-No: 1VL7632220R0101

Ratings:	Rated voltage	12 kV
	Rated lightning impulse withstand voltage phase to earth	75 kV
	across the insulating distance	85 kV
	Rated power frequency withstand voltage phase to earth	28 kV
	across the isolating distance	32 kV
	Rated frequency	50 Hz
	Rated normal current of busbar	2500 A
	Rated normal current of feeder	2500 A
	Rated short-circuit peak withstand current	80/82 kA
	Rated short-time withstand current	31,5 kA
	Rated duration of short circuit	3 s
	Electrical system	3 phases
	Earth system	insulated / solid earthed

Permissible values for internal-arc faults:

Peak withstand arc current

Short-time arc current

Rated duration of internal arc

Installation

Max. ambient air temperature

Min. Ambient air temperatur

Max. altitude

80,3
3

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1.2. Vacuum circuit-breaker type VD4/P in withdrawable version

Type: VD4/P 12.25.32

Referents standards: IEC 62271-100, Ed .2.1, 2012-09

Manufacturer: ABB T&D Divisione SACE T.M.S., Dalmine, Italy, under license of ABB Technology Ltd.

Serial No.: 1VC1BB00045925

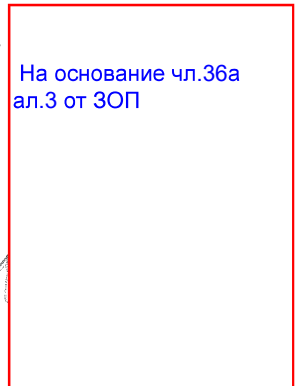
Drawing No.: TN.7417

Year of manufacture: 2012

Ratings:	Rated voltage	12 kV
	Rated lightning impulse withstand voltage	75 kV
	Rated power frequency withstand voltage	28 kV
	Rated frequency	50/60 Hz
	Rated normal current	2500 A
	Rated short-circuit 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
	Rated short-circuit making current	80/82 kA
	Rated operating sequence	O-0,3s-CO-15s-CO
	Arc extinguishing medium:	vacuum
	Operating mechanism - spring charged by motor or manually – three-pole gang operation	3
	Total number of poles	3
	Pole numbers	
	-Phase L1: P2 / VG4-S / BA01161656	
	-Phase L2: P2 / VG4-S / BA01161664	
	-Phase L3: P2 / VG4-S / BA01161665	
	Rated voltage of trip coil	220 V
	Rated voltage of closing coil	220 V
	Rated supply voltage	220 V
	Max. ambient air temperature	40 °C

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1.3 Ring-core current transformers

Type: BD 00

Referents standards: IEC 60044-1 (2003)

Manufacturer: ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Serial No.:

Phase L1	Phase L2	Phase L3
1VLT5114044936	1VLT5114044937	1VLT5114044944
1VLT5114044938	1VLT5114044940	1VLT5114044939
1VLT5114044942	1VLT5114044943	1VLT5114044941

Year of manufacture: 2014

Ratings:

Rated voltage	12 kV
Rated ratio	2500 // 1 A
Rated lightning impulse withstand voltage	75 kV
Rated power frequency withstand voltage	28 kV
Rated frequency	50 Hz
Rated short-circuit peak withstand current	80 kA
Rated short-time withstand current	31,5 kA
Rated duration of short circuit	3 s
Insulation class	E

1.4 Earthing-switch

Type: EK6 - 1208-275

Referents standards: IEC 62271-102, Ed. 1.1, 2012-02

Manufacturer: ABB s.r.o., PPMV Brno, Czech republic, under license of ABB Technology Ltd.

Serial No.: 1VLA1403880 **Year of manufacture :** 2014

Drawing No: GCE 7169312R0116

Rated voltage
Rated short-time withstand current
Rated duration of short circuit
Rated short-circuit making current

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2. Drawings of Tested Object

The UniGear type ZS1 is a metal-enclosed switchgear system with separated compartments. The compartments are separated each from the other with metallic, earthed partitions. The switchgear is composed of following construction parts:

- apparatus compartment with vacuum circuit-breaker type VD4/P 12.25.32. The breaker is mounted to a withdrawable truck.
- cable compartment with earthing switch type EK6 1208-275, ring-core current measuring transformers type BD 00 and cable connections.
- LV instruments compartment

List of drawings handed to the laboratory:

Drawings number	Title of ASSEMBLY or detail
1VL7632220R0101	IF LDU 12kV, 2500A, 31,5kA
TN.7417	CB VD4/P 12.25.32
1VCR011648G0001	T-OFF ASS.12/17,5kV 2500A
GCE8010604R0111	TEE-OFF BAR SYSTEM
GCE8010605P0101	T-OFF BAR L1
GCE8010605P0102	T-OFF BAR L1
GCE8010606P0101	T-OFF BAR L2
GCE8010606P0102	T-OFF BAR L2
GCE8010607P0101	T-OFF BAR L3
GCE8010607P0102	T-OFF BAR L3
GCE8010105P0102	CONTACT PIN 12/17,5kV 109mm 2500A
GCE8010104P0103	INSERT OF CONTACT PIN 109MM
1VL7632214R0101	BD ASSEMBLY
1VL7632219R0101	CONNECTION ASSEM.
1VL7632221R0101	CONNECTING BAR
1VL7632222R0101	CONNECTING BAR
1VL7632223P0101	CONNECTING BAR
1VL7632224P0101	CONNECTING BAR
1VL7632225P0101	CONNECTING BAR
1VL7632207P0101	CONNECTING BAR
GCE0931008P0100	SUPPORT INSULATOR 12kV TYPE B
1VL7606539R0101	CT ROD 17,5 kV, 2500 A 50kA/3s
1000065848	POST TYPE INSULATOR 50

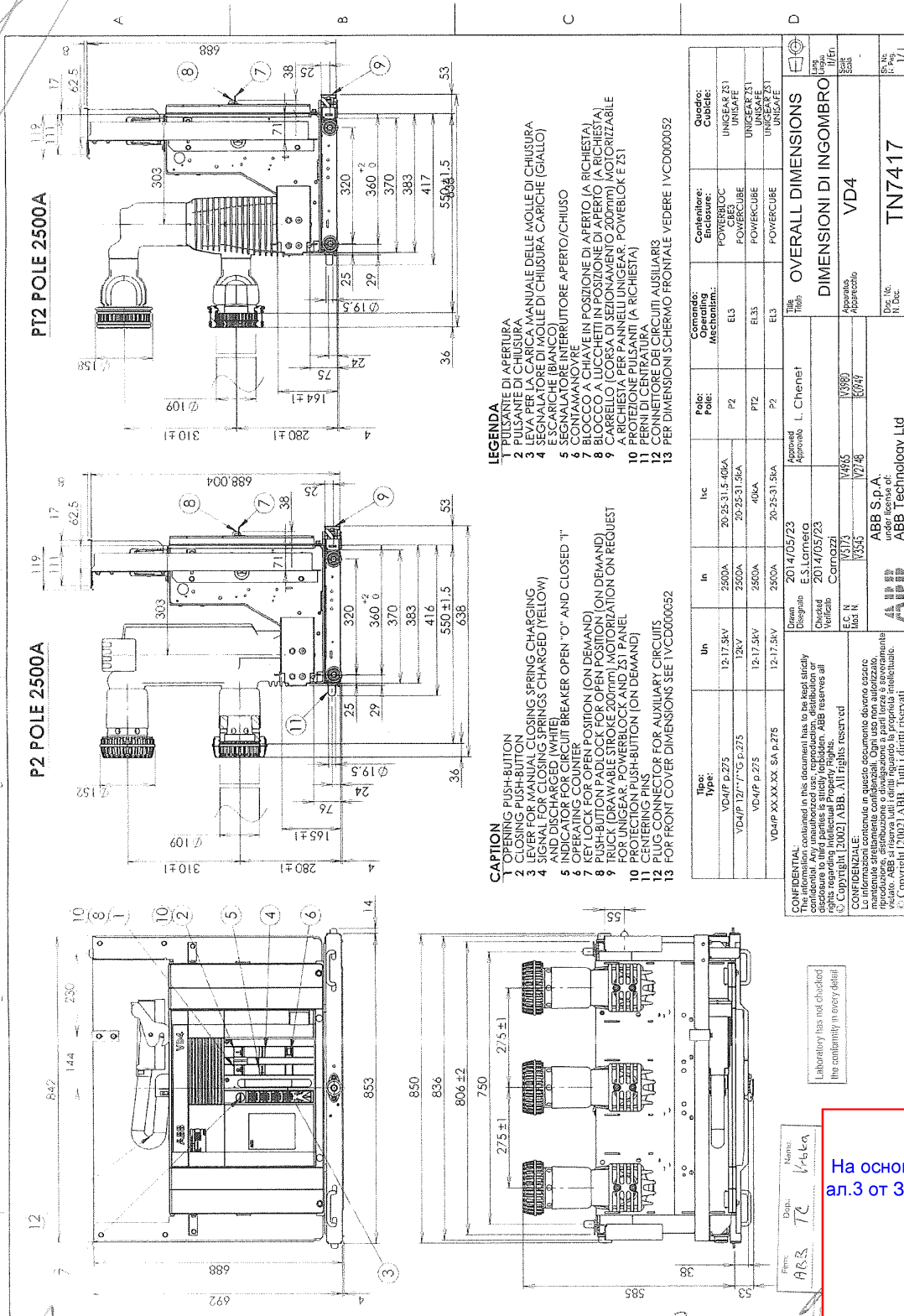
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Laboratory has not checked
the conformity in every detail

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ABB guarantess that tested objects are manufactured according to submitted drawing Bureau Veritas checked that these drawings adequately represent in shape and dime details and parts of tested objects.

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LEGENDA
 1 PULSANTE DI APERTURA
 2 PULSANTE DI CHIUSURA
 3 LEVA PER LA CARICA MANUALE DELLE MOLLE DI CHIUSURA
 4 SEGNALE DI CHIUSURA CARICHE (GIALLO)
 5 SEGNALE DI CHIUSURA CARICHE (BIANCO)
 6 SEGNALE DI CHIUSURA CARICHE (VERDE)
 7 PULSANTE PER IL CARICAMENTO MANUALE
 8 PULSANTE PER IL CARICAMENTO MANUALE
 9 PULSANTE PER IL CARICAMENTO MANUALE
 10 PULSANTE PER IL CARICAMENTO MANUALE
 11 PULSANTE PER IL CARICAMENTO MANUALE
 12 PULSANTE PER IL CARICAMENTO MANUALE
 13 PULSANTE PER IL CARICAMENTO MANUALE

CAPTION
 1 PUSH-BUTTON
 2 PUSH-BUTTON
 3 LEVER FOR MANUAL CLOSING SPRING CHARGING
 4 SIGNAL FOR CLOSING SPRINGS CHARGED (YELLOW)
 5 AND DISCHARGED (WHITE)
 6 INDICATOR FOR CIRCUIT BREAKER OPEN "O" AND CLOSED "I"
 7 OPERATING COUNTER
 8 OPERATING COUNTER
 9 OPERATING COUNTER
 10 OPERATING COUNTER
 11 OPERATING COUNTER
 12 OPERATING COUNTER
 13 OPERATING COUNTER

Type:		Un	In	Icc	Pole:	Comando:	Contenitore:	Quadro:
VD4/P 0.275	12-17.5kV	2500A	2500A	20-25-31.5kA	P2	EL3	POWERLOC	UNIGEAR Z51
VD4/P 12-17.5 I.275	12kV	2500A	2500A	20-25-31.5kA	PT2	EL3	POWERCLUBE	UNIGEAR Z51
VD4/P 0.275	12-17.5kV	2500A	2500A	40kA	P2	EL3	POWERCLUBE	UNIGEAR Z51
VD4/P 25-31.5kV SA p.275	12-17.5kV	2500A	2500A	20-25-31.5kA	P2	EL3	POWERCLUBE	UNIGEAR Z51

Overall Dimensions		Dimensions of Ingombro	
Drawn	2014/05/23	Approved	L. Chenet
Checked	E.S.Lorner	Approved	
Released	2014/05/23	Apparatus	VD4
EC N	13773	Dis. No.	TN7417
Rev. N	13773	Rev. No.	1/1
Rev. N	13773	Rev. No.	1/1

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3. Tests carried out

3.1 Measurement of the resistance clause 6.4.1, IEC 62271-200, Ed. 2.0, 2011-10

The tests were performed before and after the temperature - rise test on the main circuit.

The voltage drops method was used out with a current of 200 A DC.

The values of the resistance of the main circuit were calculated from values of the voltage drops.

Calculated values of the resistance of the main circuit for temperature 20°C.

Thermo-couple No:	(μΩ)		Thermo-couple No:	(μΩ)		Thermo-couple No:	(μΩ)		Note:
	before	after		before	after		before	after	
4 - 7	2,34	2,47	5 - 8	2,09	1,98	6 - 9	2,34	2,47	
7 - 13	7,27	7,42	8 - 14	9,07	9,40	9 - 15	10,81	10,88	
13 - 16	8,82	8,90	14 - 17	9,32	9,40	15 - 18	9,22	9,40	
16 - 19	1,35	1,48	17 - 20	2,04	1,98	18 - 21	1,64	1,48	
19 - 22	3,29	3,22	20 - 23	2,69	2,97	21 - 24	2,39	2,47	
22 - 25	12,60	12,37	23 - 26	12,60	12,37	24 - 27	12,95	13,36	
25 - 28	3,84	3,71	26 - 29	3,59	3,46	27 - 30	3,39	3,46	
28 - 31	1,84	1,73	29 - 32	2,14	1,98	30 - 33	1,39	1,48	
31 - 34	5,48	5,44	32 - 35	4,28	4,45	33 - 36	2,59	2,72	
34 - 37	11,41	11,38	35 - 38	11,51	11,33	36 - 39	10,86	10,88	
37 - 40	11,76	11,87	38 - 41	6,08	5,94	39 - 42	13,25	13,36	
4 - 40	70,55	70,24	5 - 41	65,86	65,74	6 - 42	71,04	71,23	

The deviation of resistance before and after of temperature-rise test didn't exceed value of ± 20%.

The measuring points are described on pages 10, 11 and 12.

Atmospheric conditions during the measurement of the voltage drops:

Before temperature-rise test

Temperature: 20,9 °C
 Pressure: 1001 hPa
 Air humidity: 41,2 %

After temperature-rise test

Temperature: 22,7 °C
 Pressure: 1002 hPa
 Air humidity: 42,3 %

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3.2 Temperature - rise test on the main circuit - clause 6.5 IEC 62271-200, Ed. 2.0, 2011-10

Condition of the test object before the test: new.

The test was done in three phase connection with frequency of 50 Hz.

The side walls of the panel were covered with a layer of polystyrene with 30mm thickness and the outer bus-bars and short were covered in expanded 2 layers of cardboard sheets with each 6mm thickness.

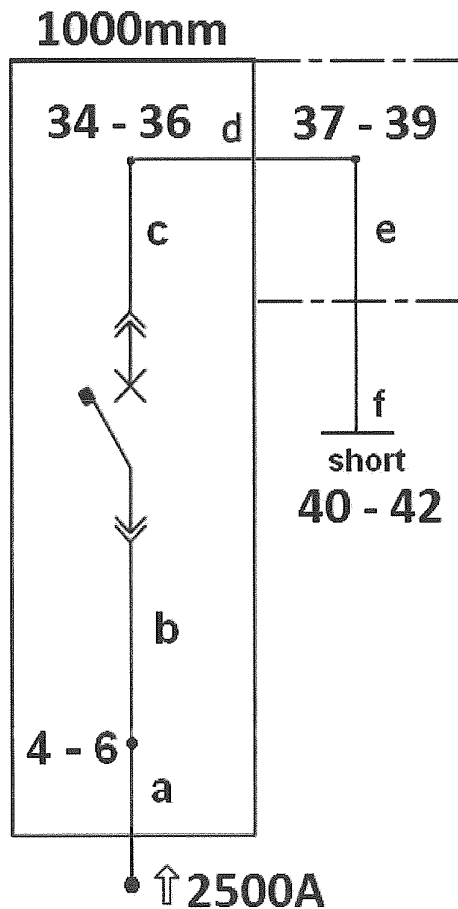
The power loss of heat in the low voltage compartments was simulated by heating resistor of 100W which represented power loss of equipment installed in low-voltage compartments.

The flaps were mounted on the top of all compartments.

The temperature-rise test was stopped when the temperature reached the steady state condition for all installed thermocouples.

The switchgear was not equipped with cooling fan – natural cooling.

Test arrangement and installation of thermocouples are shown below:

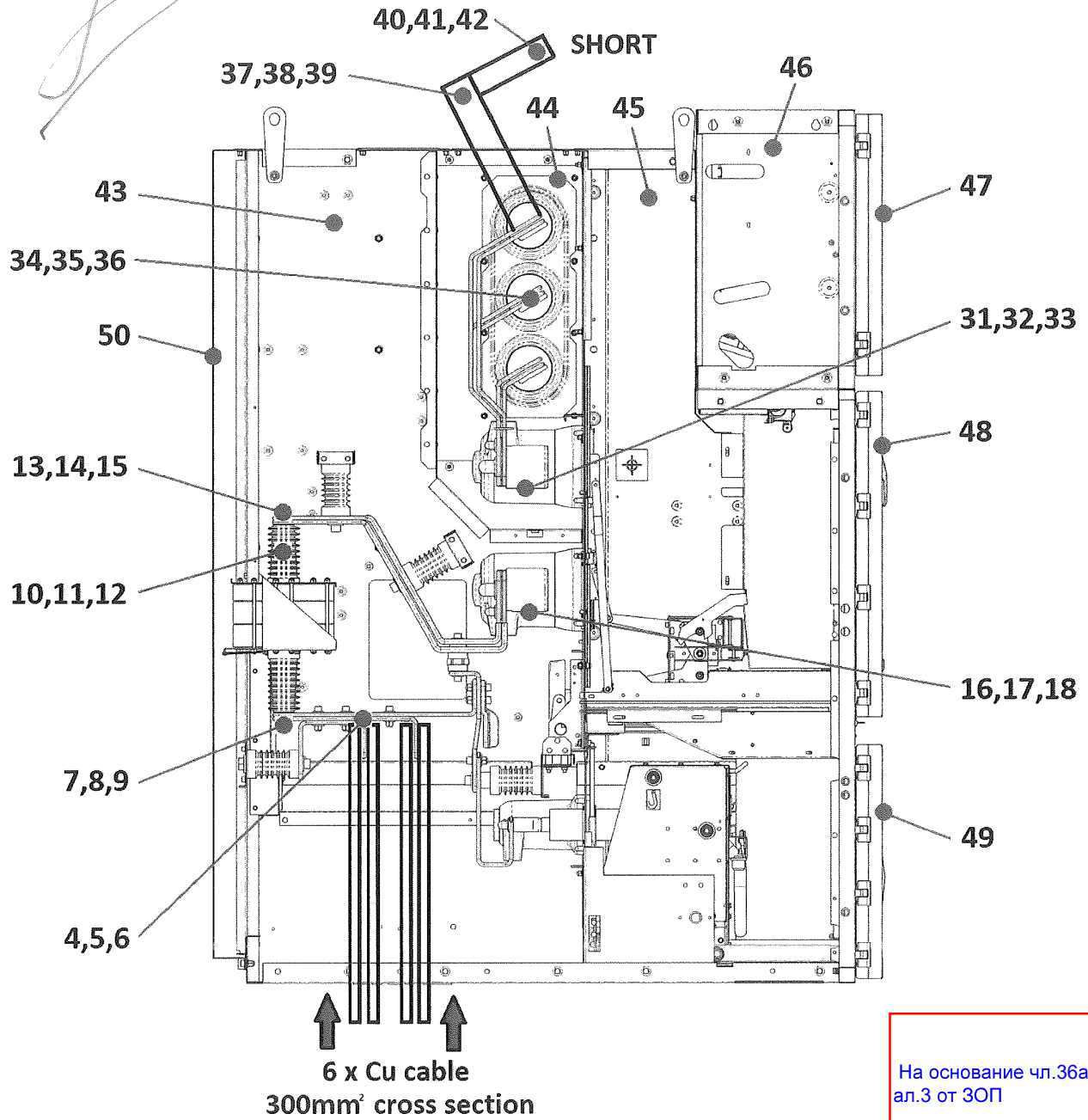


Connections:

- | | | |
|---|----------------------------|---|
| a | supply | 6xCu cable 300mm ² cross section |
| b | cable connection | 2xCu 100/10 |
| c | tee off bars inside panel | 2xCu 100/10 |
| d | bus-bars | 2xCu 80/10 mm - silver coated contact surface |
| e | tee off bars outside panel | 2xCu 120/10 |
| f | short | 2xCu 120/10mm |

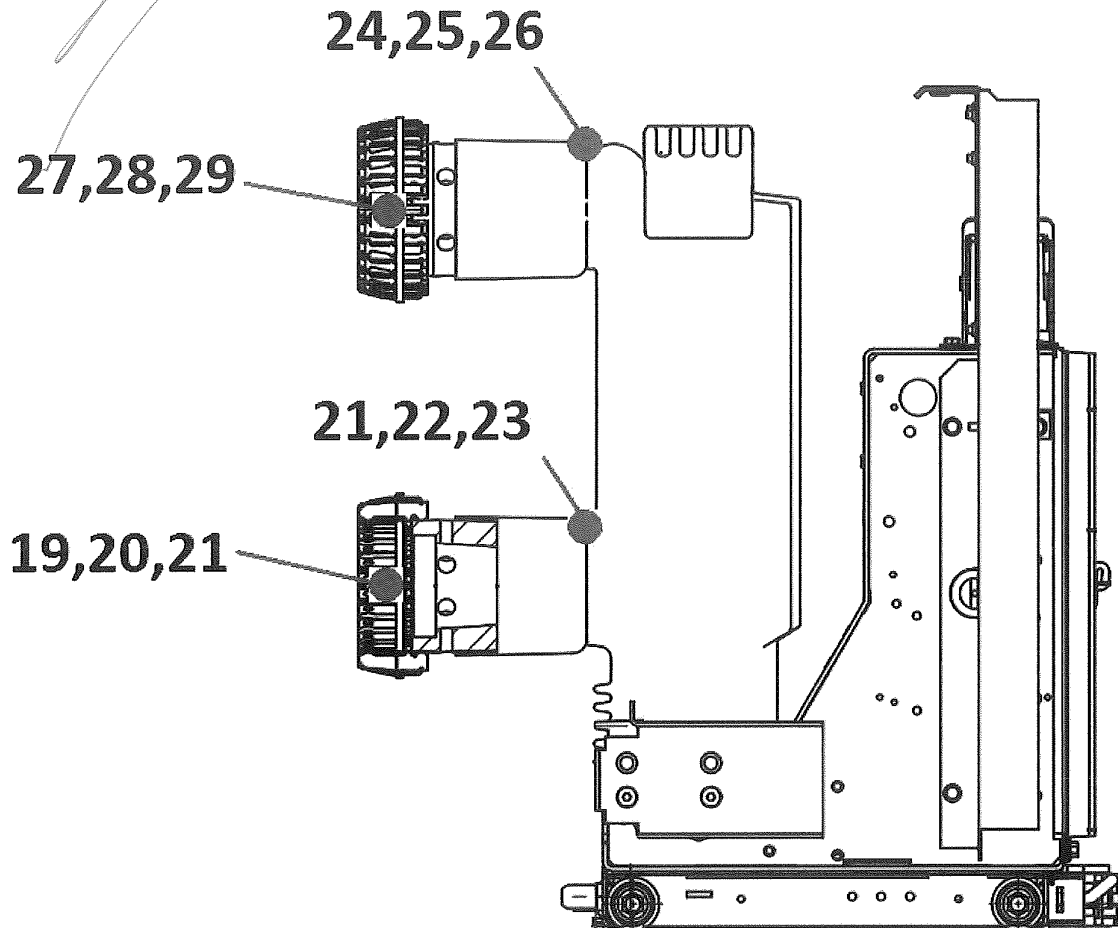
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Layout drawing of the thermocouples in tested panel:



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Layout drawing of the circuit breaker VD4/P 12.25.32



Installation of thermo-couples number inside panel:

- 1,2,3 – Supply transformer
- 47,48,49 - Doors of switchgear
- 43 – Upper space of compartment with cable connection and ring core transformers
- 44 – Upper space of bus-bars compartment
- 45 - Upper space of compartment with withdrawing part
- 46 - Space of LV instruments compartment
- 50 - Rear covers of panel
- 51,52,53 - Ambient temperature

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3.2.1 Results of the temperature rise test

In table below you can see final values of temperature rise test

No. of thermocouple	Position of thermocouples	Value of Temperature-rise (K)	Max. values of temperature-rise 50Hz (K)
1	Supply transformer L1	35,2	---
2	Supply transformer L2	38,0	---
3	Supply transformer L3	37,8	---
4	Cable connection in cable compartment L1	37,9	50,0
5	Cable connection in cable compartment L2	42,3	50,0
6	Cable connection in cable compartment L3	41,3	50,0
7	Connection of CT rod in L1	47,5	75,0
8	Connection of CT rod in L2	49,8	75,0
9	Connection of CT rod in L3	47,5	75,0
10	Surface of CT rod in L1	54,2	---
11	Surface of CT rod in L2	56,2	---
12	Surface of CT rod in L3	58,0	---
13	Connection of CT rod in L1	62,9	75,0
14	Connection of CT rod in L2	68,5	75,0
15	Connection of CT rod in L3	66,6	75,0
16	Down pin contact in L1	60,7	65,0
17	Down pin contact in L2	60,5	65,0
18	Down pin contact in L3	59,2	65,0
19	Down tulip contact in L1	58,0	65,0
20	Down tulip contact in L2	62,5	65,0
21	Down tulip contact in L3	55,1	65,0
22	Down contact arm of CB in L1	62,1	75,0
23	Down contact arm of CB in L2	62,9	75,0
24	Down contact arm of CB in L3	59,0	75,0
25	Up contact arm of CB in L1	58,7	75,0
26	Up contact arm of CB in L2	60,9	75,0
27	Up contact arm of CB in L3	55,9	75,0
28	Up tulip contact in L1	58,2	65,0
29	Up tulip contact in L2	60,5	65,0
30	Up tulip contact in L3	53,7	65,0
31	Up pin contact in L1	59,9	65,0
32	Up pin contact in L2	63,4	65,0
33	Up pin contact in L3	54,9	65,0
34	Connection of tee-off and bus-bars inside panel in L1	63,1	75,0
35	Connection of tee-off and bus-bars inside panel in L2	64,9	75,0
36	Connection of tee-off and bus-bars inside panel in L3	55,6	75,0
37	Connection of bus-bars and tee-off outside in L1	61,4	---
38	Connection of bus-bars and tee-off outside in L2	60,6	---
39	Connection of bus-bars and tee-off outside in L3	55,4	---
40	Short L1		
41	Short L2		
42	Short L3		
43	Upper space of compartment with cable connection and transformers		
44	Upper space of bus-bars compartment		
45	Upper space of circuit breaker compartment		
46	Space of LV instruments compartment		

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Continue of table from previous side:

No. of thermocouple	Position of thermocouples	Value of Temperature-rise (K)	Max. values of temperature-rise 50Hz (K)
47	Door of the LV compartment	3,3	30,0
48	Door of the circuit-breaker compartment	4,4	30,0
49	Door of the cable compartment	1,0	30,0
50	Rear cover of panel	16,1	40,0
51	Surface of Ring core current transformer in L1	45,4	---
52	Surface of Ring core current transformer in L2	47,1	---
53	Surface of Ring core current transformer in L3	44,7	---

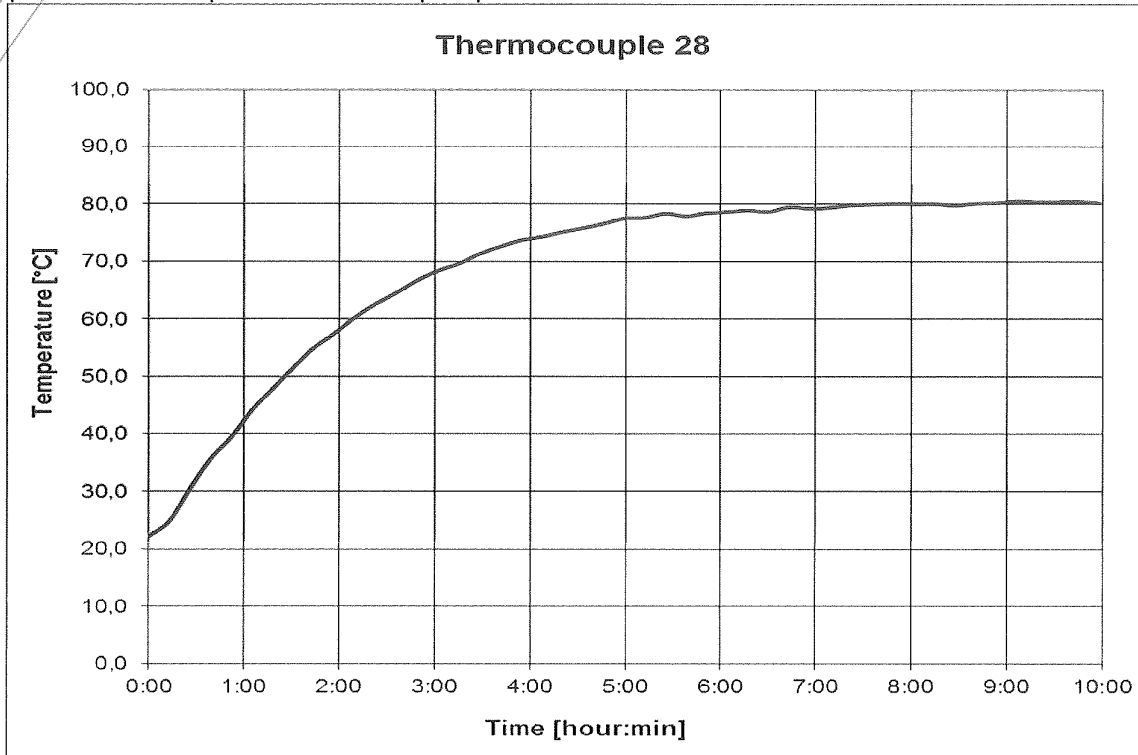
Average of ambient air temperature at the end of the test: 22.0°C.
Duration of the test: 10 hours.

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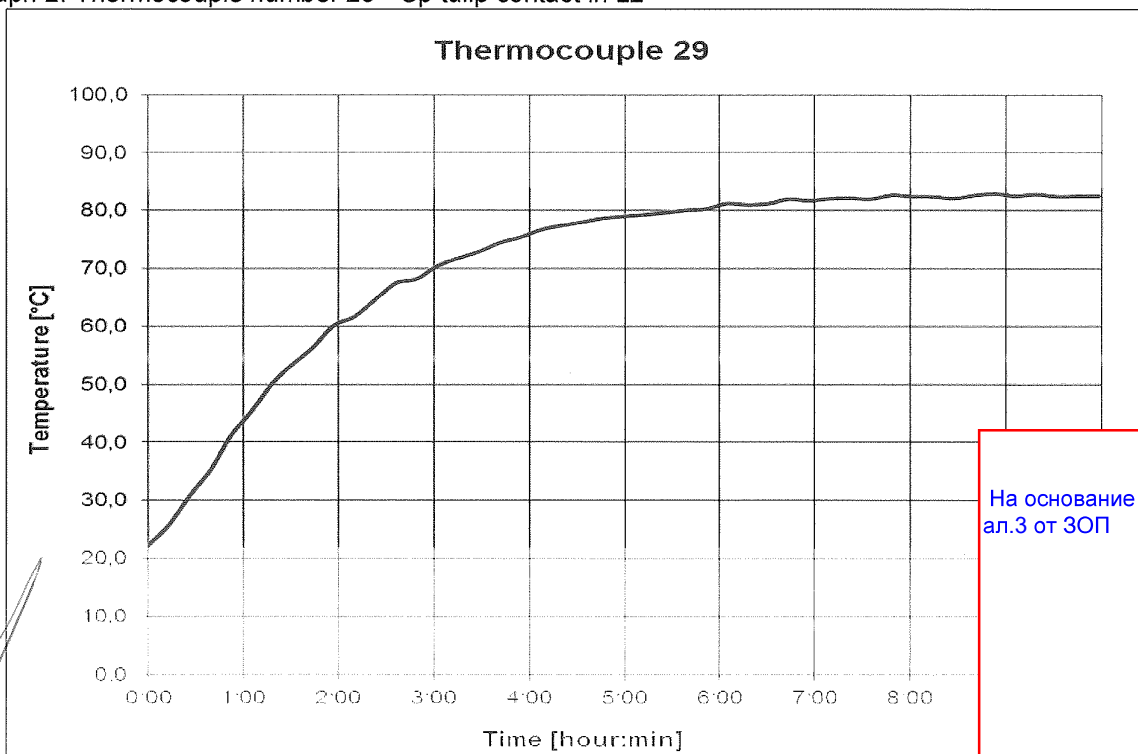
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3.2.2 Oscillograms of temperature-rise tests

Graph 1: Thermocouple number 28 - Up tulip contact in L1



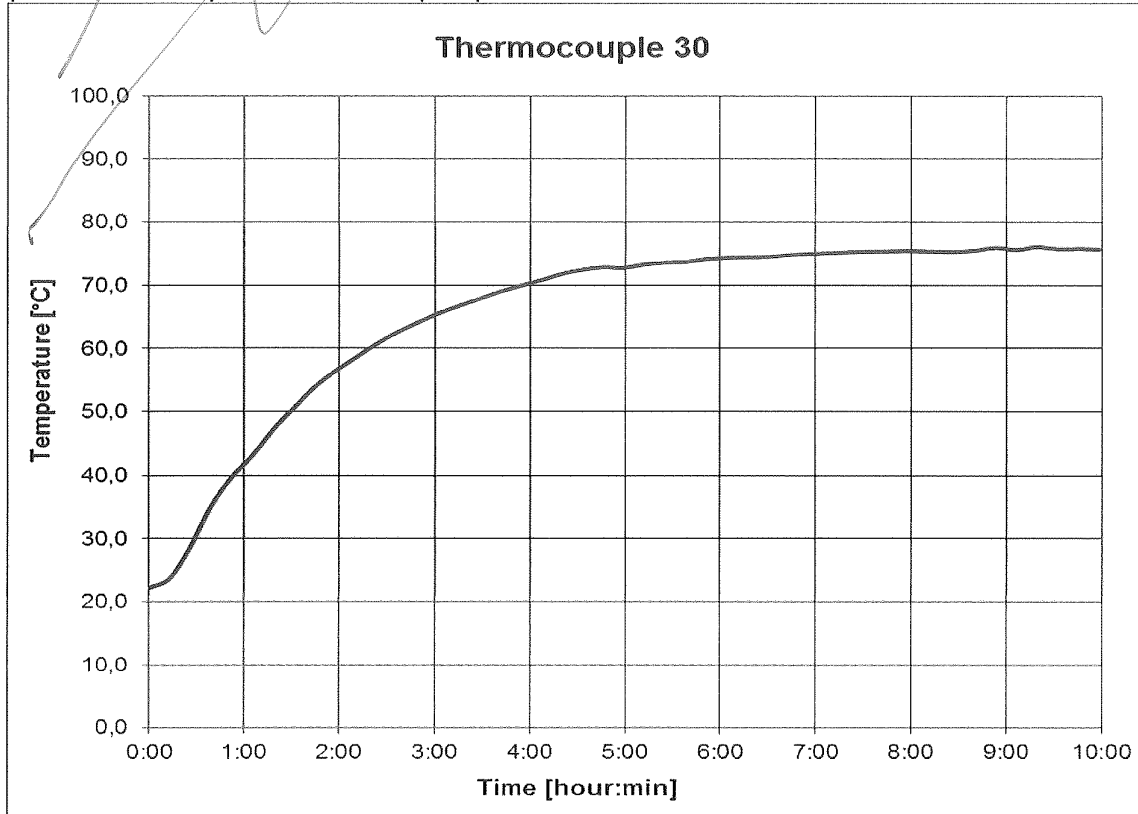
Graph 2: Thermocouple number 29 - Up tulip contact in L2



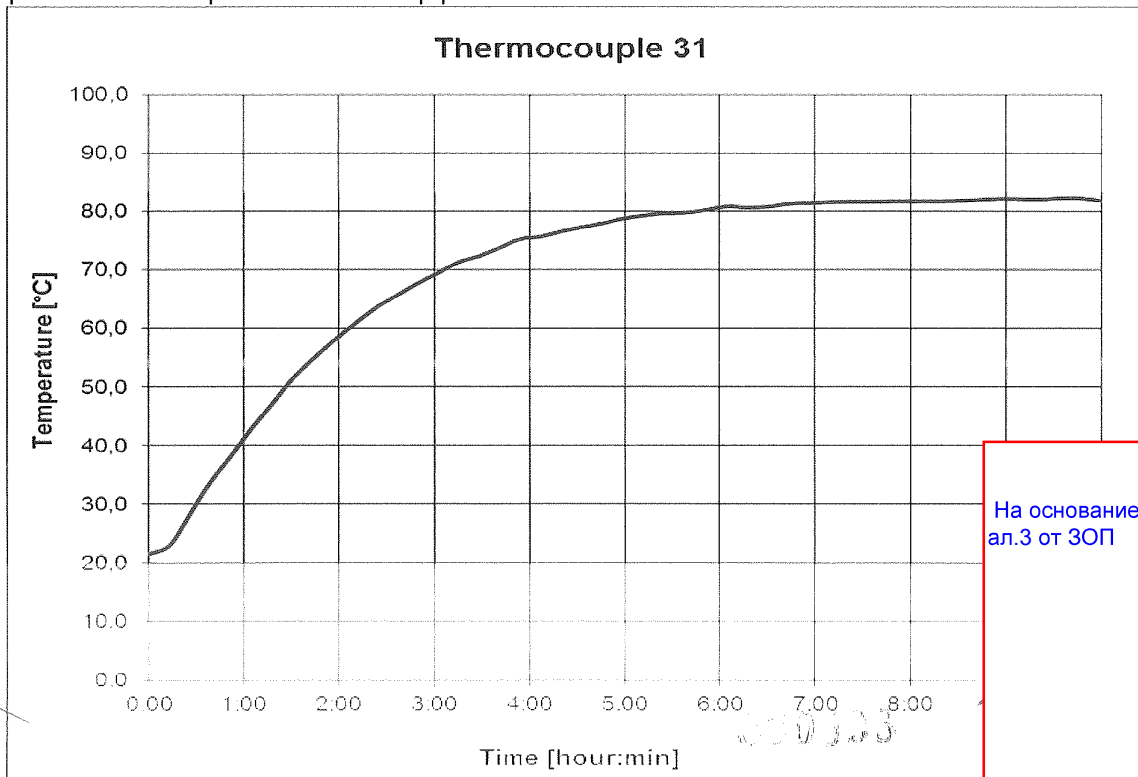
На основании чл.36а
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Graph 3: Thermocouple number 30 - Up tulip contact in L3

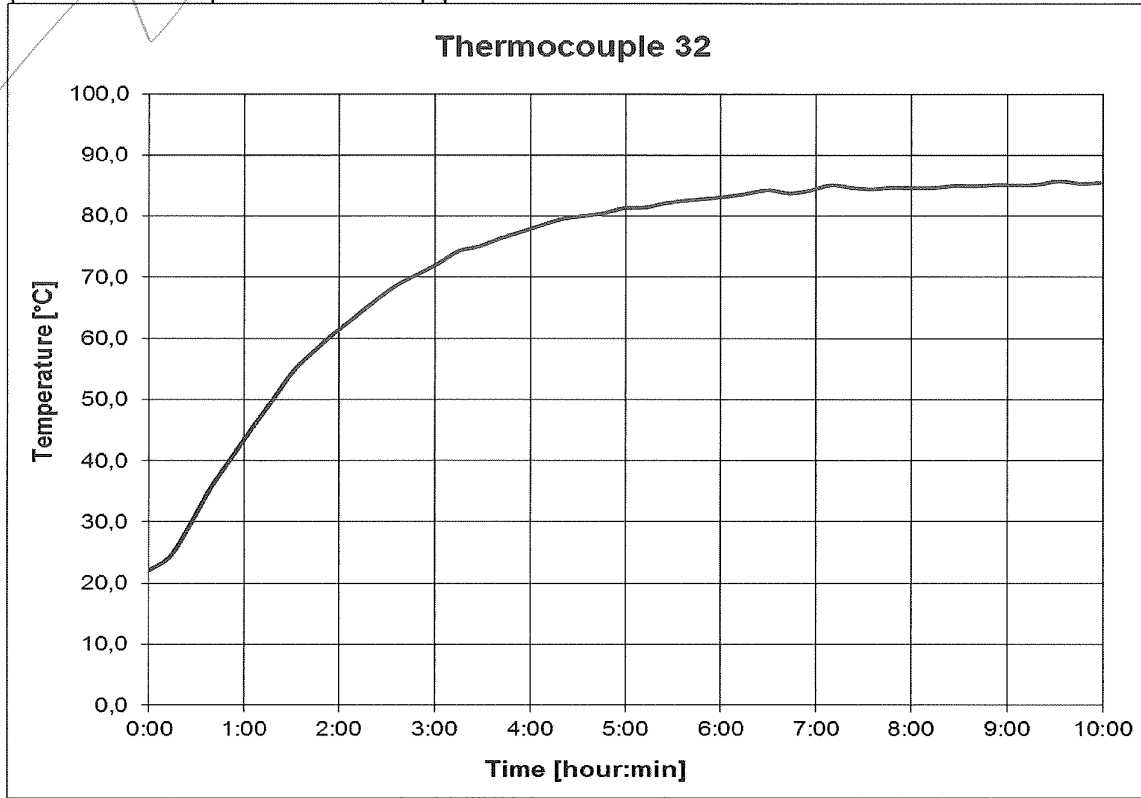


Graph 4: Thermocouple number 31 - Up pin contact in L1

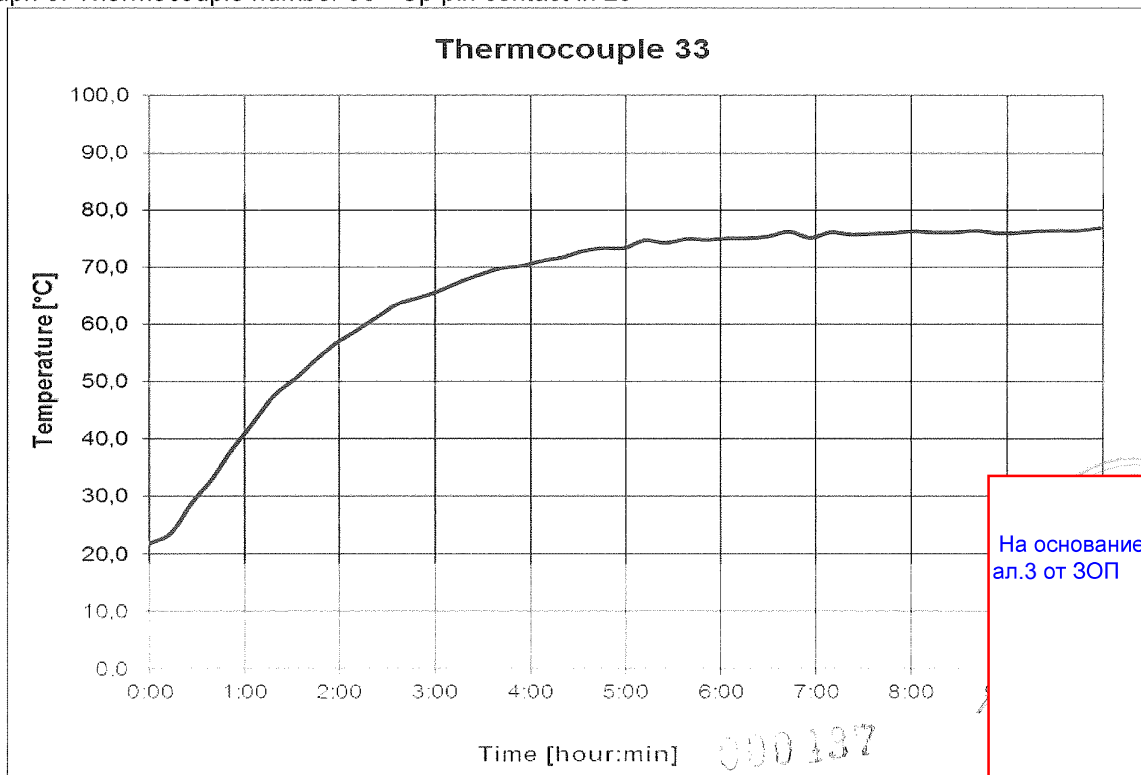


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Graph 5: Thermocouple number 32 - Up pin contact in L2



Graph 6: Thermocouple number 33 - Up pin contact in L3



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