zkratovna

HIGH
POWER
LABORATORY

08 - 110

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INDEPENDENT TESTING LABORATORY, ACCREDITED ACCORDING TO ČSN EN ISO/IEC 17025
BY THE ČESKÝ INSTITUT PRO AKREDITACI, O.P.S., UNDER THE NUMBER 1035

CERTIFICATE
OF TYPE TEST No. 08 - 110

Test object	:	Low-voltage switchgear and controlgear assembly
Type	:	ELMO-R
Serial No.	:	3010.211.1
Ratings		
Rated voltage	:	3 x 230 V / 400 V
Rated current	:	2500 A
Rated frequency	:	50 Hz
Manufacturer	:	ELMO spol. s r.o. Příluky 386, 760 01 Zlín, Czech Republic
Customer	:	ELMO spol. s r.o. Příluky 386, 760 01 Zlín, Czech Republic
Date of test	:	22.10. 2008

The test object produced in accordance with the description, drawings and photographs incorporated in this Certificate, has been subjected to the type tests in accordance with the mentioned Standard :

ČSN EN 60439-1/2000, čl. 8.2.1

The results are shown in the tables and the record of proving tests attached hereto.

♦ Interpretation of results :

The values obtained and the general performance are considered to comply with the above standard and to justify the ratings assigned by the manufacturer as listed on sheet 3 and 4.

The test results apply only to the specific piece of apparatus tested from the particular place of manufacture. The responsibility for conformity of any product having the same designation with that tested rests with the manufacturer.

This document can not substitute the product Certificate according to ČSN EN 45 011.

Copy No.: E

Praha 9, Běchovice
23. 1. 2009
Tested by:

p.p.
Richard Abrahamčík

ACCREDITED HIGH POWER LABORATORY zkratovna BĚCHOVICE PRAHA 9 No. 1035

Vladimír Mastný
Head of the Laboratory

ilac-MRA

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Description of the test object

A three-phase cubicle-type metal-enclosed low-voltage switchgear and controlgear assembly fitted with main busbars and PEN conductor busbar.

The assembly consists of two sections, the first of them has one incoming unit with a main circuit breaker and the second section contains an outgoing unit with a circuit breaker.

Ratings assigned by the manufacturer

Low-voltage switchgear and controlgear assembly

Type	:	ELMO-R
Serial No.	:	3010.211. 1
Year of manufacture	:	2008
Rated voltage	:	3 x 230 V / 400 V
Rated insulation voltage	:	2500 V
Rated frequency	:	50 Hz
Rated current of main busbars	:	2500 A
Rated current of outlets	:	1 x 2500 A
Rated peak withstand current	:	143 kA
Rated short-time withstand current	:	65 kA/1s
Degree of protection	:	IP 40/00
Rated diversity factor	:	1
Protection of persons	:	Automatic disconnection from the power supply
Service conditions	:	For indoor use
Distribution system	:	3PEN 230/400 V AC 50 Hz TN-C
Dimensions (height × width x depth)	:	2100 mm x 1600 mm x 600 mm
Main busbars	:	Cu flat conductor 2 x 100 / 10 mm
PEN conductor busbar	:	Cu flat conductor 100 / 10 mm
Busbars holders		
Type	:	Support insulators PD-QK-PW40M8/100
Manufacturer	:	OEZ s.r.o., Letohrad, Czech Republic
Max. working temperature	:	130 °C
Type	:	Busbars holders PD-QK-DELTA210
Manufacturer	:	OEZ s.r.o., Letohrad, Czech Republic
Max. working temperature	:	130 °C

Incoming unit

Circuit-breaker

Type	:	E3N25 PR121/P withdrawable design1SDA056129R0001
Manufacturer	:	ABB SACE S.p.A., L.V.Breakers, Via Baioni 35 I-24123 Bergamo, Italy
Rated ultimate short-circuit breaking capacity	:	I_{cu}/I_{cw}(1s) = 65 kA / 415 – 690 V
Rated current	:	2500 A
Max. working temperature of terminals	:	120 °C

Power–factor capacitor

Type	:	FORTIS
Manufacturer	:	KBH Energy s.r.o., Na Spravedlnosti 1533 530 02 Pardubice, Czech Republic
Rated voltage	:	440V / 50 Hz
Reactive power	:	12,5 kVAr
Total power losses	:	12 W
Max. working temperature	:	50 °C

Outgoing unit
Circuit-breaker

Type	:	E3N25 PR121/P withdrawable design 1SDA056129R0001
Manufacturer	:	ABB SACE S.p.A., L.V.Breakers, Via Baioni 35 I-24123 Bergamo, Italy
Rated ultimate short-circuit breaking capacity	:	$I_{cu}/I_{cw}(1s)$ = 65 kA / 415 – 690 V
Rated current	:	2500 A
Max. working temperature of terminals	:	120 °C

Parameters proved by tests

Temperature-rise limits

Devices built-in the assembly		
terminals of the circuit breaker E3N25 PR121/P	:	80 K
ambient air of power – factor capacitor	:	15 K
Terminals for external insulated conductors	:	70 K
Busbars fixed onto holders	:	90 K
Manual operating components of non-metallic material	:	25 K
Accessible external cover with metal surface	:	30 K

Documents presented by the manufacturer

The manufacturer has guaranteed that the object submitted for tests has been manufactured in accordance with the presented drawings.
The Testing Laboratory Zkratovna has verified that these drawings adequately represent the test object.

-	ROZVÁDĚČ ELMO – R	- technical terms for temperature test
EL–R01 LIST Č. 2,3	ROZVÁDĚČ RH2.1	- single-pole electrical chart
EL–R02 LIST Č. 4	ROZVÁDĚČ RH2.1	- front view – devices
EL–R03 LIST Č. 5	ROZVÁDĚČ RH2.1	- front view – doors
EL–R04 LIST Č. 6,7,8,9	ROZVÁDĚČ RH2.1	- control circuits chart
EL–R05 LIST Č. 10	ROZVÁDĚČ RH2.1	- dimensioning of busbars system
EL–R06 LIST Č. 11	ROZVÁDĚČ RH2.1	- dimensioning of bars holders
EL–R07 LIST Č. 12	ROZVÁDĚČ RH2.1	- types of bars holders
-	DRŽÁKY A IZOLÁTORY OEZ	- catalogue sheet of holders and insulators
-	Přehled výrobků SACE Emax	- catalogue sheet of circuit breakers
-	Kompenzační kondenzátory FORTIS	- catalogue sheet of power-factor capacitors

Summary of tests

Test	Test standard	Test results
Verification of temperature-rise limits	ČSN EN 60439 -1 /2000, čl. 8.2.1	Tab. 1, Sheet 7

The tests were witnessed by

Libor Kolařík, ELMO spol. s r.o., Zlín, Czech Republic

Test conditions

Working frequency f = 50 Hz

The verification of temperature-rise limits of the three-phase LV switchgear and controlgear assembly was carried out with the rated current 2500 A in a three-phase test circuit with the supply voltage of ca 5 V.

The busbars of the assembly incoming unit were connected to the test circuit by means of six parallel Cu-cables with a cross-section of 240 mm^2 and ca 3 m in length on each phase. The cables of the same cross-section and length were connected onto the terminals of the outgoing unit and the cables were short-circuited outside the assembly.

The power losses of 12 W of the built-in devices were substituted by heating resistors supplied by appropriate current and placed in appropriate places of the assembly.

The test was carried out in a closed room, the ambient temperature was measured by means of three mercury thermometers placed in small bottles containing about 1 l of oil.

The connection of the test object to the test circuit is documented by the photograph in Fig. 1.

List of symbols

a) Used in the table of test results

θ_1, θ_2, θ_3	-	temperature of the bolted connection of input, phases L1, L2, L3
θ_4, θ_5, θ_6	-	temperature of the incoming circuit breaker terminals, phases L1, L2, L3
θ_7, θ_8, θ_9	-	temperature of main busbars, near the holders, phases L1, L2, L3
θ_{10}, θ_{11}, θ_{12}	-	temperature of the outgoing circuit breaker terminals, phases L1, L2, L3
θ_{13}, θ_{14}, θ_{15}	-	temperature of the bolted connection of outlet, phases L1, L2, L3
θ_{18}	-	temperature of the air under ceiling in the incoming unit
θ_{19}	-	temperature of the air under ceiling in the outgoing unit
θ_{20}	-	temperature of the air near the power-factor capacitor
θ_a	-	ambient temperature
I	-	average value of the current, phases L1, L2, L3
t	-	time

b) Used in the graph

θ_2	-	temperature of the bolted connection of input, phase L2
θ_5	-	temperature of the incoming circuit breaker terminals, phase L2
θ_8	-	temperature of main busbars near the holders, phase L2
θ_{11}	-	temperature of the outgoing circuit breaker terminals, phase L2
θ_{13}, θ_{14}, θ_{15}	-	temperature of the bolted connection of outlet, phases L1, L2, L3
θ_{18}	-	temperature of the air under ceiling in the incoming unit
θ_{19}	-	temperature of the air under ceiling in the outgoing unit
θ_{20}	-	temperature of the air near the power-factor capacitor
θ_a	-	ambient temperature
t	-	time

The Certificate contains: 11 sheets i.e.:

1	introductory sheet
1	title sheet
4	text sheets
3	table sheets
1	photograph
1	graph

1. Table of test results : Verification of temperature-rise limits

t (hh:mm)	I (A)	θ_1 (°C)	θ_2 (°C)	θ_3 (°C)	θ_4 (°C)	θ_5 (°C)	θ_6 (°C)	θ_7 (°C)	θ_8 (°C)	θ_9 (°C)	θ_{10} (°C)	θ_{11} (°C)	θ_{12} (°C)	θ_{13} (°C)	θ_{14} (°C)	θ_{15} (°C)	θ_{18} (°C)	θ_{19} (°C)	θ_{20} (°C)	θ_a (°C)
8:18	2485	19,9	20,7	19,3	25,1	27,6	25,0	21,0	25,3	21,4	24,9	28,0	24,9	19,1	20,3	21,0	18,5	18,4	17,7	15,7
8:33	2501	26,4	28,5	25,4	36,6	41,1	36,2	27,8	33,8	28,2	35,9	41,4	35,2	24,5	27,1	27,8	23,5	22,7	20,7	15,8
8:48	2494	26,7	28,7	26,4	43,6	49,4	42,5	32,0	38,4	31,0	41,8	49,3	40,2	24,0	27,4	29,0	18,8	19,7	17,4	15,8
9:03	2490	25,7	27,9	26,2	48,3	55,0	46,5	34,3	41,3	32,6	45,7	54,5	43,5	23,3	27,3	29,4	18,7	19,6	17,3	15,8
9:18	2500	25,6	27,7	26,5	51,8	59,1	49,5	36,2	43,5	33,9	48,5	58,3	45,9	23,2	27,3	29,7	18,9	19,9	17,2	15,9
9:33	2499	25,7	28,0	26,8	54,3	62,2	51,6	37,6	45,3	35,0	50,5	61,1	47,7	23,4	27,5	30,1	18,9	20,0	17,5	16,0
9:48	2489	25,8	28,2	26,9	56,1	64,4	53,3	38,7	46,6	35,8	52,0	63,1	49,0	23,6	27,6	30,4	19,2	20,2	17,7	16,0
10:03	2494	26,2	28,7	27,3	57,6	66,2	54,5	39,6	47,7	36,5	53,0	64,6	49,8	23,6	27,6	30,5	19,4	20,4	18,0	16,1
10:18	2489	26,7	29,2	27,8	58,9	67,6	55,6	40,3	48,6	37,1	53,9	65,9	50,5	23,7	27,7	30,7	19,9	20,5	18,6	16,2
10:33	2518	27,1	29,5	28,1	60,0	68,8	56,6	40,9	49,5	37,6	54,6	66,9	51,2	23,9	28,0	30,9	20,1	20,7	18,5	16,4
10:48	2522	27,3	29,8	28,4	60,8	70,0	57,3	41,5	50,1	38,0	55,3	67,8	51,8	23,9	28,1	31,1	20,1	20,8	18,5	16,4
11:03	2519	27,4	29,8	28,6	61,6	70,7	57,9	41,9	50,7	38,3	55,8	68,5	52,3	24,0	28,2	31,2	20,2	20,8	18,6	16,5
11:18	2519	27,2	29,6	28,3	61,9	71,2	58,3	42,3	50,8	38,4	56,1	69,0	52,6	24,1	28,4	31,4	20,0	20,9	18,3	16,5
11:33	2492	27,4	30,0	28,6	62,5	71,9	58,7	42,5	51,2	38,7	56,5	69,5	52,8	24,1	28,3	31,4	20,3	21,0	18,7	16,5
11:48	2499	27,5	30,0	28,7	62,6	72,0	58,8	42,6	51,3	38,8	56,5	69,5	52,8	24,1	28,3	31,4	20,4	21,0	18,7	16,5
12:03	2484	27,6	30,2	28,8	62,7	72,2	58,8	42,7	51,4	38,9	56,6	69,6	52,9	24,1	28,2	31,4	20,4	21,0	18,7	16,4
12:18	2503	27,5	30,2	28,8	62,8	72,1	58,8	42,7	51,4	38,7	56,6	69,6	52,8	23,9	28,1	31,3	20,5	20,9	18,6	16,4
12:33	2508	27,5	30,0	28,7	62,8	72,2	58,9	42,8	51,4	38,8	56,6	69,6	52,8	24,0	28,1	31,3	20,3	21,0	18,6	16,4

2. Table of test results: Final temperature rises

Parts of tested assembly	Final temperature rise (K)	Temperature rise limits (K)	Note
Built-in components			
Terminals of circuit breaker E3N25 PR121/P			
- incoming unit, phase L1	46	80	$\Delta\Theta_4 = \theta_4 - \theta_a$
- incoming unit, phase L2	56	80	$\Delta\Theta_5 = \theta_5 - \theta_a$
- incoming unit, phase L3	43	80	$\Delta\Theta_6 = \theta_6 - \theta_a$
- outgoing unit, phase L1	40	80	$\Delta\Theta_{10} = \theta_{10} - \theta_a$
- outgoing unit, phase L2	53	80	$\Delta\Theta_{11} = \theta_{11} - \theta_a$
- outgoing unit, phase L3	36	80	$\Delta\Theta_{12} = \theta_{12} - \theta_a$
Terminals for external insulated conductors			
- input, phase L1	11	70	$\Delta\Theta_1 = \theta_1 - \theta_a$
- input, phase L2	14	70	$\Delta\Theta_2 = \theta_2 - \theta_a$
- input, phase L3	12	70	$\Delta\Theta_3 = \theta_3 - \theta_a$
- output, phase L1	8	70	$\Delta\Theta_{13} = \theta_{13} - \theta_a$
- output, phase L2	12	70	$\Delta\Theta_{14} = \theta_{14} - \theta_a$
- output, phase L3	15	70	$\Delta\Theta_{15} = \theta_{15} - \theta_a$
Busbars			
- phase L1	26	90	$\Delta\Theta_7 = \theta_7 - \theta_a$
- phase L2	35	90	$\Delta\Theta_8 = \theta_8 - \theta_a$
- phase L3	22	90	$\Delta\Theta_9 = \theta_9 - \theta_a$
Accessible external cover with metal surface			
Doors	3	30	Measured by contact thermometer at the end of the test
Manual operating components of insulating material			
Circuit breakers E3N25 PR121/P	4	25	Measured by contact thermometer at the end of the test
Ambient air for built-in components			
Power-factor capacitor	2	15	$\Delta\Theta_{20} = \theta_{20} - \theta_a$

Meteorological conditions

Time (hh:mm)	Relative humidity (%)	Atmospheric pressure (hPa)
8:00	82	984
9:00	68	984
10:00	65	985
11:00	64	985
12:00	63	985
13:00	63	985

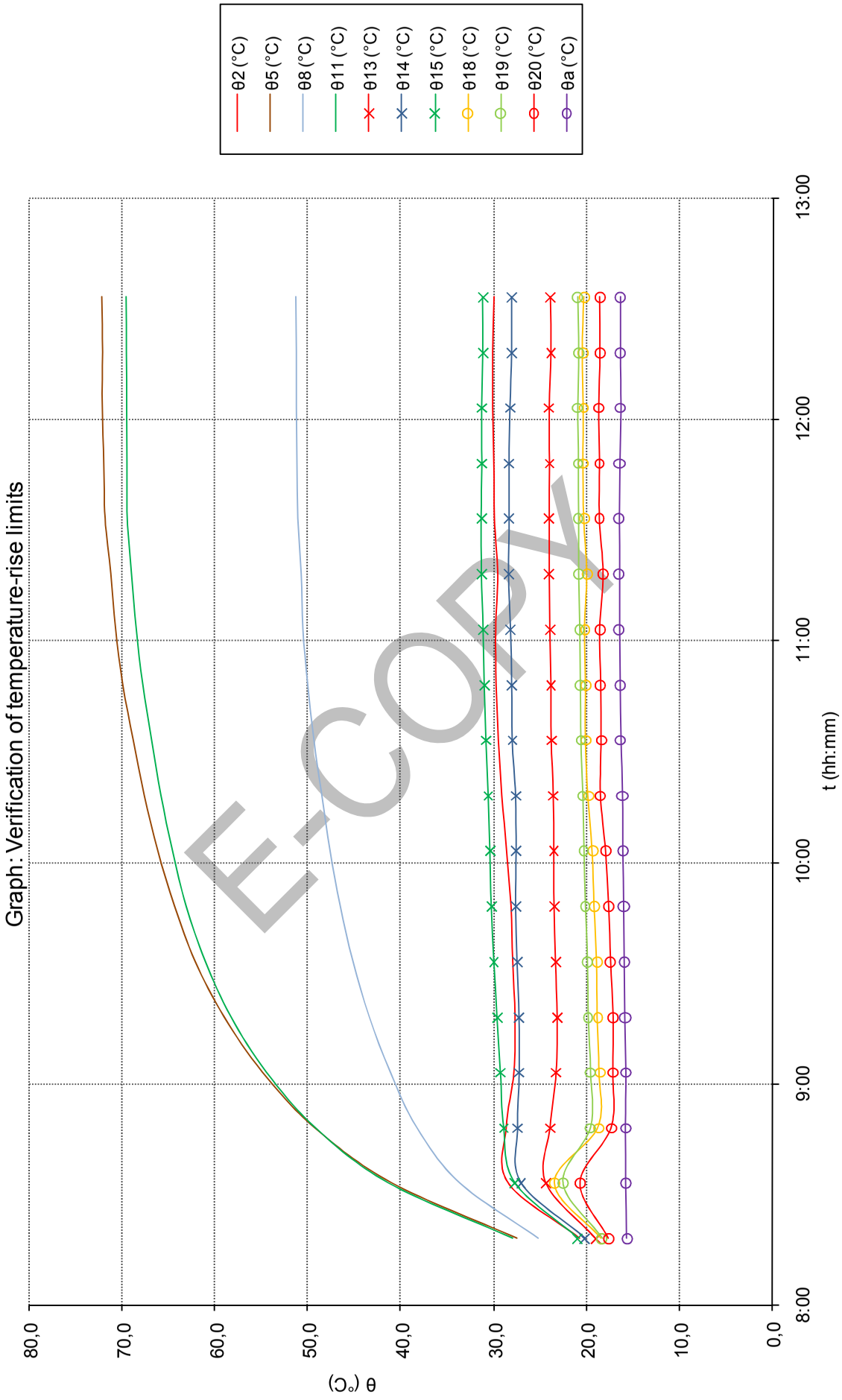
Measuring devices used

Measuring devices	Type	Range of measuring	Serial No.	Producer
Contact thermometer	Pt 100	---	66322	AMR
Ammeter	EL20	1-2,5-5-10-25 A	5130226	Metra
Ammeter	EL20	1-2,5-5-10-25 A	8053075	Metra
Ammeter	EL20	1-2,5-5-10-25 A	9720520	Metra
Current measuring transformer	JVP 10	10 kA / 5A	140738	Křižík
Current measuring transformer	JVP 10	10 kA / 5A	140737	Křižík
Current measuring transformer	JVP 10	10 kA / 5A	740741	Křižík
Digital multichannel thermometer	Agilent	---	MY 44022962	Agilent
Thermocouple	T	---	---	---
Mercury thermometer	glass	50 °C	T01/04	Exatherm
Mercury thermometer	glass	50 °C	T02/04	Exatherm
Mercury thermometer	glass	50 °C	T03/04	Exatherm

Meteorological conditions measurement

Meteorological station, type Vantage Pro 2, serial No. 3788-6312

Fig. 1
Connection of the test object to the test circuit


θ2 (°C)
θ5 (°C)
θ8 (°C)
θ11 (°C)
θ13 (°C)
θ14 (°C)
θ15 (°C)
θ18 (°C)
θ19 (°C)
θ20 (°C)
θa (°C)
Graph: Verification of temperature-rise limits
θ (°C)
80,0
70,0
60,0
50,0
40,0
30,0
20,0
10,0
0,0
8:00
9:00
10:00
11:00
12:00
13:00
t (hh:mm)