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Approved by
Director of RMC "Test center"
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TEST REPORT

№ 015.12CV-20

Testing laboratory TL RMC "Test center" tests were carried out by:
ACBs BA50-47 4000H40 3H M11C11S11 39U00
(Product Type:)

The Applicant of tests:	«Cheboksary Electric Apparatus Plant», AO CHEAZ, AO 428020, Russian Federation, Chuvash Republic, Cheboksary, I. Y.Yakovlev pr., 5
Brand;	CHEAZ
Models:	—
Factory number:	—
Manufacturer:	«Cheboksary Electric Apparatus Plant», AO CHEAZ, AO 428020, Russian Federation, Chuvash Republic, Cheboksary, I. Y.Yakovlev pr., 5

1. CHARACTERISTIC OF TESTS

1.1. **Test work started:** **Test work completed:**	 01.12.2020 14.12.2020
1.2 Actual address of the testing laboratory:	Testing laboratory RESEARCH AND MANUFACTURING COMPLEX "TEST CENTER" (RMC, Address: 69096, c.Zaporizhzhia, str. Borodinska, 108

1.3 Applied standards:
EN 60947-1:2007/A2:2014 «Low-voltage switchgear and controlgear. General rules»;
EN 60947-2:2017/A1:2020 «Low-voltage switchgear and controlgear. Circuit-breakers»;
EN 60947-3:2009/A1:2012 «Low-voltage switchgear and controlgear. Switches, disconnectors, switch-disconnectors and fuse-combination units».

2. Test conditions:

– Temperature, °C:	21
– Relative humidity, %:	48
– Atmospheric pressure, kPa:	102

3. Testing equipment according to laboratory data sheet of Testing and Measuring equipment have actual terms of stamps of calibration seals, licences and certificates.

4. RESULTS OF THE TESTS

Requirement - Test	Clause	Result - Remark	Verdict
1	2	3	4
EN 60947-1:2007/A2:2014, EN 60947-2:2017/A1:2020, EN 60947-3:2009/A1:2012			
Constructional and performance requirements	7		
Constructional requirements	7.1		
Materials	7.1.2		
General materials requirements The manufacturer shall specify which test method, 7.1.2.2 or 7.1.2.3, is to be used. Parts of insulating materials which might be exposed to thermal stresses due to electrical effects within the equipment shall not be adversely affected by abnormal heat and by fire.	7.1.2.1	—	P
Current-carrying parts and their connections Current-carrying parts shall have the necessary mechanical strength and current-carrying capacity for their intended use. For electrical connections, no contact pressure shall be transmitted through insulating material other than ceramic or other material with characteristics not less suitable, unless there is sufficient resiliency in the metallic parts to compensate for any possible shrinkage or yielding of the insulation material. Compliance shall be verified by inspection and by conducting the test sequences according to the relevant product standard.	7.1.3	—	P
Terminals	7.1.8		
Constructional requirements All parts of terminals which maintain contact and carry current shall be of metal having adequate mechanical strength. Terminal connections shall be such that the force to connect the conductors may be applied by screws, screwless-type or other quivalent means so as to ensure that the necessary contact pressure is maintainet. Terminals shall be so constructed that	7.1.8.1	—	P

Requirement - Test	Clause	Result - Remark	Verdict
the conductors can be clamped between suitable surfaces without any significant damage either to conductors or terminals. Terminals shall not allow the conductors to be displaced or be displaced themselves in a manner detrimental to the operation of equipment and the insulation voltage shall not be reduced below the rated values. If required by the application, terminals and conductors may be connected by means of cable lugs for copper conductors only. Screwless-type clamping units, unless otherwise specified by the manufacturer, shall accept rigid and flexible conductors as indicated in Table 1. On screwless-type clamping unit, the connection or disconnection of conductors shall be made as follows: – on universal clamping units by the use of a general purpose tool or a convenient device, integral with the clamping unit to open it for the insertion or withdrawal of the conductors; – on push-wire clamping units by simple insertion. For the disconnection of the conductors an operation other than a pull only on the conductor shall be necessary. The use of a general purpose tool or of a convenient device, integral with the clamping unit is allowed in order to "open" it and to assist the insertion or the withdrawal of the conductor. Examples of terminals are given in Annex D. The requirements of this subclause shall be verified by the tests of 8.2.4.2, 8.2.4.3 and 8.2.4.4, as applicable.			
Connecting capacity The manufacturer shall state the type (rigid – solid or stranded – or flexible), the minimum and the maximum cross-sections of conductors for which the	7.1.8.2	—	P

Requirement - Test	Clause	Result - Remark	Verdict
terminal is suitable and, if applicable, the number of conductors simultaneously connectable to the terminal. However, the maximum cross-section shall not be smaller than that stated in 8.3.3.3 for the temperature-rise test and the terminal shall be suitable for conductors of the same type (rigid – solid or stranded – or flexible) at least two sizes smaller, as given in the appropriate column of Table 1.			
Connection Terminals for connection to external conductors shall be readily accessible during installation. Clamping screws and nuts shall not serve to fix any other component although they may hold the terminals in place or prevent them from turning.	7.1.8.3	—	P
Terminal identification and marking Terminals shall be clearly and permanently identified in accordance with IEC 60445 and Annex L, unless superseded by the requirements of the relevant product standard. Terminal connections shall be such that the force to connect the conductors may be applied by screws, screwless-type or other equivalent means so as to ensure that the necessary contact pressure is maintained. Screwless-type clamping units, unless otherwise specified by the manufacturer, shall accept rigid and flexible conductors as indicated in Table 1. On screwless-type clamping unit, the connection or disconnection of conductors shall be made as follows: – on universal clamping units by the use of a general purpose tool or a convenient device, integral with the clamping unit to open it for the insertion or withdrawal of the conductors; – on push-wire clamping units by simple insertion. For the disconnection of the conductors an operation other than a pull only on	7.1.8.4	—	P

Requirement - Test	Clause	Result - Remark	Verdict
the conductor shall be necessary. The use of a general purpose tool or of a convenient device, integral with the clamping unit is allowed in order to "open" it and to assist the insertion or the withdrawal of the conductor. Terminals intended exclusively for the neutral conductor shall be identified by the letter "N", in accordance with IEC 60445. The protective earth terminal shall be identified in accordance with 7.1.10			
Provisions for protective earthing	7.1.10		
Constructional requirements The exposed conductive parts (e.g. chassis, framework and fixed parts of metal enclosures) other than those which cannot constitute a danger shall be electrically interconnected and connected to a protective earth terminal for connection to an earth electrode or to an external protective conductor. This requirement can be met by the normal structural parts providing adequate electrical continuity and applies whether the equipment is used on its own or incorporated in an assembly. Exposed conductive parts are considered not to constitute a danger if they cannot be touched on large areas or grasped with the hand or if they are of small size (approximately 50 mm × 50 mm) or are so located as to exclude any contact with live parts. Examples of these are screws, rivets, nameplates, transformer cores, electromagnets of switching devices and certain parts of releases, irrespective of their size.	7.1.10 .1	—	P
Protective earth terminal The protective earth terminal shall be readily accessible and so placed that the connection of the equipment to the earth electrode or to the protective conductor is maintained when the cover or any	7.1.10 .2	—	P

Requirement - Test	Clause	Result - Remark	Verdict
other removable part is removed. The protective earth terminal shall be suitably protected against corrosion. In the case of equipment with conductive structures, enclosures, etc., means shall be provided, if necessary, to ensure electrical continuity between the exposed conductive parts of the equipment and the metal sheathing of connecting conductors. The protective earth terminal shall have no other function, except when it is intended to be connected to a PEN conductor (see 2.1.15 – Note). In this case, it shall also have the function of a neutral terminal in addition to meeting the requirements applicable to the protective earth terminal.			
Protective earth terminal marking and identification The protective earth terminal shall be clearly and permanently identified by its marking. The identification shall be achieved by colour (green-yellow mark) or by the notation PE, or PEN, as applicable, in accordance with IEC 60445, subclause 5.3, or by a graphical symbol for use on equipment. The graphical symbol to be used is the symbol:  2 -IEC-5019 Protective earth (ground) in accordiance with IEC 60417-2.	7.1.10 .3	—	P
General performance characteristics	8.3.3		
Sample number Rated current: In (A) Rated operational voltage: Ue (V) Rated control supply voltage of secondary circuits: Uc (V) Value of tripping current declared by the manufacturer for a single pole, at which value they shall operate: Range of adjustable setting current		#001 4000 AC440 AC230 4kA~80kA 4kA~80kA	
Tripping under short-circuit conditions	8.3.3. 1		

Requirement - Test	Clause	Result - Remark	Verdict
Opening under short-circuit conditions	8.3.3. 1.2		
Test current 85% of the rated, or minimum adjustable setting current (A):		3400	
Operating time >0.2s in case of instantaneous releases (s): L1-L2: L1-L3: L2-L3:		 >0,2 >0,2 >0,2	P
Test current 85% of the rated, or maximum adjustable setting current (A):		68000	
Operating time >0,2s in case of instantaneous releases (s) L1-L2: L1-L3: L2-L3:		 >0,2 >0,2 >0,2	P
Test current 115% of the rated, or minimum adjustable setting current (A):		4600	
Operating time <0.2s in case of instantaneous releases (s): L1-L2: L1-L3: L2-L3:		 0,024 0,022 0,022	P
Test current 115% of the rated, or maximum adjustable setting current (A):		92000	
Operating time <0.2s in case of instantaneous releases (s): L1-L2: L1-L3: L2-L3:		 0,024 0,023 0,021	P
Test current: tripping current declared for single pole operation (A):		4600/92000	
Operating time < 0,2s in case of instantaneous release (s): L1: L2: L3:		4600 A 0,026 0,024 0,023	92000 A 0,027 0,025 0,022	P
Test current: 80% of the rated, or minimum adjustable setting current:		Instantaneous: 3,2 kA Definite time delay: 1280 A	
Operating time: >0,2s in case of instantaneous releases: L1: L2: L3:		 0,442 s 0,455 s 0,431 s	P
Operating time: > twice time delay stated by the manufacturer, in the case of definite time delay releases: L1:		Time delay 0,1 s: 0,288 s	P

Requirement - Test	Clause	Result - Remark	Verdict
L2: L3:		0,332 s 0,321 s	
Test current: 120% of the rated, or minimum adjustable setting current:		Instantaneous: 4,8 kA Definite time delay: 1,92 A	
Operating time: <0,2s in case of instantaneous releases: L1: L2: L3:		 0,033 s 0,026 s 0,036 s	P
Operating time: < twice time delay stated by the manufacturer, in the case of definite time delay releases: L1: L2: L3:		Time delay 0,1 s: 0,021 s 0,022 s 0,022 s	P
Test current: 80% of the maximum adjustable setting current:		Definite time delay: 48 kA	
Operating time: > twice time delay stated by the manufacturer, in the case of definite time delay releases: L1: L2: L3:		Time delay 0,4 s: 0,891 s 0,887 s 0,852 s	P
Test current: 120% of the maximum adjustable setting current:		Definite time delay: 72 kA	
Operating time: < twice time delay stated by the manufacturer, in the case of definite time delay releases: L1: L2: L3:		Time delay 0,4 s: 0,445 s 0,448 s 0,431 s	P
Opening under overload conditions	8.3.3. 1.3		
b) Inverse time delay releases			
Test current: 105% of the rated, or minimum adjustable setting current:		1680 A	
Conventional non-tripping time 2h		t1=15s 3h 16 min / t2=480s 3h 22 min	P
Test current: 130% of the rated, or minimum adjustable setting current:		2080 A	
Conventional tripping time < 2h		t1=15s 1h 2 s / t2=480s 1h 11 s	P
Test current: 105% of the maximum adjustable setting current:		4200 A	
Conventional non-tripping time 2h		t1=15s / t2=480s	P

Requirement - Test	Clause	Result - Remark		Verdict
		2h 48 min	3h 32 min	
Test current: 130% of the maximum adjustable setting current:		5200 A		
Conventional tripping time < 2h		t1=15s 1h 12 s	t2=480s 1h 1 min	P
An additional test, at a current specified by the manufacturer to verify the time/current characteristic of the releases conform to the curves provided by the manufacturer				
Test current specified by the manufacturer at maximum adjustable setting current:		3200 A		
Tripping time according time/current characteristic of the releases conform to the curves provided by the manufacturer (within the stated tolerances) L1-L2-L3:		t1=15s 8 s	t2=480s 241 s	P
Additional test for definite time-delay releases	8.3.3. 1.4			
a) Time delay				
Overload release (all phases loaded) Test current: 1,5 times of the rated or minimum adjustable setting current:		2400 A		
Operating time between the limits stated by the manufacturer: L1-L2-L3:		t1=480 s 365 s		P
Short-circuit release (two poles in series carrying the test current, using successively all possible combinations of poles having a short-circuit release) Test current: 1,5 times of the maximum adjustable setting current:		21600 A		
Operating time between the limits stated by the manufacturer: L1-L2: L2-L3: L1-L3:		t1=0,1s 0,102 s 0,100 s 0,101 s	t1=15s 0,417 s 0,411 s 0,420 s	P
b) Non-tripping duration				
Overload release (all phases loaded) Test current: 1,5 times of the rated or minimum adjustable setting current: Time interval of non-tripping duration stated by the manufacturer:		2400 A 56 s at t1=60		

Requirement - Test	Clause	Result - Remark	Verdict
CB shall not trip after time interval of non-tripping duration stated by the manufacturer and after current is reduced to the rated current and maintained at this value for twice the time-delay stated by the manufacturer: L1-L2-L3:		No trip	P
Short-circuit release (two poles in series carrying the test current, using successively all possible combinations of poles having a short-circuit release) Test current: 1,5 times of the maximum adjustable setting current: Time interval of non-tripping duration stated by the manufacturer:		21600 A >=0,06 at t1=0,1; >=0,35 at t2=0,4	
CB shall not trip after time interval of non-tripping duration stated by the manufacturer and after current is reduced to the rated current and maintained at this value for twice the time-delay stated by the manufacturer: L1-L2: L2-L3: L1-L3:		 No trip No trip No trip	P
Test of dielectric properties, impulse withstand voltage	8.3.3.2		
The 1,2/50μs impulse voltage shall be applied 5 times fr each polarity at intervals of 1s minimum	8.3.3.4 part 1		
- rated impulse withstand voltage (kV): - sea level of the laboratory: - test Uimp main circuits (kV): - test Uimp on open main contacts (equipment suitable for isolating) (kV):		12 Sea level 14,8 18,5	
a) Application of test voltage			
i) Between all terminals of the main circuit connected together (incl. control and auxiliary circuits connected to the main circuit) and the enclosure or mounting plate, with the contacts in al normal positions of operation.			P
ii) Between all terminals of the main circuit and the other poles connected together and to the enclosure or mounting plate, with the contacts in all			P

Requirement - Test	Clause	Result - Remark	Verdict
normal positions of operation			
iii) Between each control and auxiliary circuit not normally connected to the main circuit and: - the main circuit - other circuits - exposed conductive parts - enclosure of mounting plate			P
iv) equipment suitable for isolation - no unintentional disruptive discharge during tests			P
Application of test voltage	8.3.3. 2.2		
a) 1) With circuit-breaker in the closed position - between all live parts of all poles connected together and the frame of the circuit-breaker - between each pole and all the other poles connected to the frame f the circuit-breaker			P
a) 2) With circuit-breaker in the open position and, additionally, in the tripped position, if any: - between all live parts of all poles connected together and the frame of the circuit-breaker - between the terminals of one side connected together and the terminals of the other side connected together			P
b) 1) Between all the control and auxiliary circuits which are not normally connected to the main circuit, connected together, and the frame of the circuit-breaker			P
b) 2) Where appropriate, between each part of the control and auxiliary circuits which may be isolated from the other parts during normal operation and all the other parts connected together			P
For circuit-breaker suitable for isolation, the leakage current shall be measured through each pole with the contacts in the open position, at a test voltage of 1,1 Ue and shall not exceed	8.3.3. 2	< 0,03 mA	P

Requirement - Test	Clause	Result - Remark	Verdict
0,5 mA			
Mechanical operation and operational performance capability	8.3.3.3		
Construction and mechanical operation	8.3.3.3.2		
a) Construction			
A withdrawable circuit-breaker shall be checked for the requirements stated in 7.1.1			P
A circuit-breaker with stored energy operation shall be checked for compliance with 7 2.1.1.5. regarding the charge indicator and the direction of operation of manual energy storing			P
b) Mechanical operation			
A circuit-breaker with stored energy operation shall comply with the requirements stated in 7.2.1.5 with the auxiliary supply voltage at 85% and 110% of the rated control supply voltage			P
It shall also be verified that the moving contacts cannot be moved from the open position when the operating mechanism is charged to slightly below the full charge as evidenced by the indicating device			P
For a trip-free circuit-breaker it shall not be possible to maintain the contacts in the touching or closed position when the tripping release is in the position to trip the circuit-breaker			P
c) Undervoltage releases			
Undervoltage releases shall comply with the requirements of 7.2.1.3 of Part 1. For this purpose the release shall be fitted to a circuit-breaker having the maximum current rating for which the release is suitable			P
i) Drop out voltage			
It shall be verified that the release operates to open the circuit-breaker between the voltage limits specified			P
The voltage shall be reduced from rated voltage at a rate to reach 0 V in			P

Requirement - Test	Clause	Result - Remark	Verdict
approximately 30 s			
The test for the lower limit is made without current in the main circuit and without previous heating of the release coil			P
In the case of a release with a range of rated voltages, this test applies to the maximum voltage of the range			P
The test for the upper limit is made starting from a constant temperature corresponding to the application of rated control supply voltage to the release and rated current m the main poles of the circuit-breaker			P
In the case of a release with a range of rated voltages, this test is made at both the minimum and maximum rated control supply voltages			P
ii) Test for limits of operation			
Starting with the circuit breaker open at the temperature of the test room, and with the supply voltage at 30% rated maximum control supply voltage, it shall be verified that the circuit-breaker cannot be closed by the operation of the actuator			P
When the supply voltage is raised to 85% of the minimum control supply voltage it shall be verified that the circuit-breaker can be closed by the operation of the actuator			P
iii) Performance under overvoltage conditions			
With the circuit-breaker closed and without current in the main circuit. It shall be verified that the undervoltage release will withstand the application of 110% rated control supply voltage for 4 h without impairing its functions			P
d) Shunt releases			
Shunt releases shall comply with the requirements of 7.2.1.4 of Part 1. For this purpose, the release shall be fitted to a circuit-breaker having the maximum rated current for which the			P

Requirement - Test	Clause	Result - Remark	Verdict
release is suitable			
It shall be verified that the release will operate to open the circuit-breaker at 70% rated control supply voltage when tested at an ambient temperature of 55 °C ± 2 °C without current in the main poles of the circuit-breaker			P
In the case of a release having a range of rated control supply voltages, the test voltage shall be 70% of the minimum rated control supply voltage			P
Operational performance capability without current	8.3.3. 3.3		
Rated control supply voltage of shunt releases Uc (V)		AC230	
Number of operating cycles per hour		10	
10% of total cycles for circuit-breaker with fitted shunt release energized at the rated Uc (50% at the beginning/50% at the end of the test):		200/200	P
Number of cycles without current, not including cycles made by shunt release		3600	P
Operational performance capability with current	8.3.3. 3.4		
Rated current (A)		4000	
Maximum rated operational voltage Ue (V)		690	
Number of operating cycles per hour		10	
Conditions, make/break operations: - test voltage U/Ue=1,0 (V) L1: L2: L3: - test current I/Ie=1,0 (A) L1: L2: L3: - power factor/time constant - frequency (Hz) - on-time (ms) - off-time (s)		 692 692 692 4000 4000 4010 0,82 50 153 360	
Number of cycles with current (total)		1000	P
Additional test of operational performance capability without current for withdrawable circuit-breaker	8.3.3. 3.5		
Number of operations cycle		100	P
After test, the isolating contacts, withdrawable mechanism and interlocks			P

Requirement - Test	Clause	Result - Remark	Verdict
shall be suitable for further service			
Verification of dielectric withstand	8.3.3.5		
- equal to twice the rated operational voltage with a minimum of 1000 V		1380 V Leakage current <0,01 mA	P
- no breakdown or flashover			
Verification of temperature-rise	8.3.3.6		
Test current Ie (A)		4000	
Temperature rise of main circuit terminals <=80 K (K)		See table: temperature rise measurement	P
Verification of overload releases	8.3.3.7		
Test current 1,45 times the value of their current setting at the reference temperature (A)		5800	
Conventional trippmg time <2h when In > 63 A (s)		1h 1 min	P
Verification of undervoltage and shunt releases	8.3.3.8		
Test made at room temperature. Shunt release shall operate at 70% of the minimum rated control supply voltage (V):		154	P
Test sequence II/III (Ics=Icu)	8.3.4		
Sample no Rated current: In (A) Rated operational voltage: Ue (V) Rated ultimate short-circuit breaking capacity (kA):		#002 4000 400 100	
The circuit-breaker is mounted complete on its own support Test made in free air The characteristics of the metallic screen: - perforated metal - ratio hole area/total area - size of hole (mm^2) Finish: conductive plating Fusr "F": copper wire diameter/long Circuit is earthed at supply-star Conductor cross-sectional area (mm^2): Line connected at underside Tightering torques (Nm):		 0,5 29 120 14,0	
Test sequence of operation: O – t – CO – t – CO			

Requirement - Test		Clause	Result - Remark	Verdict
Test voltage U/Ue = 1,05 (V)				
	L1:		428,1	
	L2:		428,2	
	L3:		428,6	
R.m.s. test current AC/DC: (kA)				
	L1:		101,0	
	L2:		102,5	
	L3:		102,3	
Power factor/time constant :			0,170	
Factor "n"			2,2	
Peak test current (kA):			227,0	
Test sequence "O"				
Max. let-through current (kApeak):				
	L1:		35,454	
	L2:		33,670	P
	L3:		12,614	
Joule integral I^2dt (kA^2s):				
	L1:		1529	
	L2:		1516	P
	L3:		132	
Pause, t (min):			3	
Test sequence "CO"				
Max. let-through current (kApeak):				
	L1:		33,220	
	L2:		16,360	P
	L3:		33,469	
Joule integral I^2dt (kA^2s):				
	L1:		1898	
	L2:		603	P
	L3:		1420	
Pause, t (min):			3	
Test sequence "CO"				
Max. let-through current (kApeak):				
	L1:		31,532	
	L2:		34,186	P
	L3:		14,223	
Joule integral I^2dt (kA^2s):				
	L1:		1174	
	L2:		1871	P
	L3:		492	
Melting of the fusible element				P
Damage to insulation on conductors				P
Holes in the PE-sheet for test sequence				

Requirement - Test	Clause	Result - Remark	Verdict
"O"			P
Cracks observed			P
Oscillograms		See table: "Oscillograms"	
Additional requirements for circuit-breakers with electronic over-current protection	An. F		
Immunity tests	F.4		
Sample number Rated current: In (A) Rated operational voltage: Ue (V) Rated control supply voltage of secondary circuits: Uc (V)		#003 4000 AC690 AC230	
Harmonic currents	F.4.1		
Non tripping time (10x tripping time at 2Ir) t1 (s): Conventional time t2 (s): Tripping time t3=0,9x tmin at 2Ir (s): Tripping time t4=1,1x tmax at 2Ir (s): Rated frequency (Hz) Test of option		84 (t1=15s) 7200 6,43 10,6 50 B	P
Test current 0,95x1,05xIr (true r.m.s) (A): Amplitude of third harmonic >60% Amplitude of fifth harmonic >14% Amplitude of seventh harmonic >7% Peak factor lp/lrms >=2,1 No tripping t>=t1 (s)		1600 (Ir1=0,4In) 68% 17% 7,5% 2,1 84	P
Test current 1,05x1,3xIr (true r.m.s) (A): Amplitude of third harmonic >60% Amplitude of fifth harmonic >14% Amplitude of seventh harmonic >7% Peak factor lp/lrms >=2,1 No tripping t<=t2 (s)		2180 68% 17% 7,5% 2,1 17	P
Test current 2xIr (true r.m.s) (A): Amplitude of third harmonic >60% Amplitude of fifth harmonic >14% Amplitude of seventh harmonic >7% Peak factor lp/lrms >=2,1 No tripping t3<=t<=t4 (s)		3200 68% 17% 7,5% 2,1 9	P
Current dips	F4.2		
Maximum tripping time at 2xIr (s) Test duration (s)		9,66 (t1=15s) 35	
Test no 1 with Io=0 and Δt=0,5T No tripping		No	P

Requirement - Test	Clause	Result - Remark	Verdict
Test no 2 with Io=0 and Δt=1T No tripping		No	P
Test no 3 with Io=0 and Δt=5T No tripping		No	P
Test no 4 with Io=0 and Δt=25T No tripping		No	P
Test no 5 with Io=0 and Δt=50T No tripping		No	P
Test no 6 with Io=0,4xIr and Δt=10T No tripping		No	P
Test no 7 with Io=0,4xIr and Δt=25T No tripping		No	P
Test no 8 with Io=0,4xIr and Δt=50T No tripping		No	P
Test no 9 with Io=0,7xIr and Δt=10T No tripping		No	P
Test no 10 with Io=0,7xIr and Δt=25T No tripping		No	P
Test no 11 with Io=0,7xIr and Δt=50T No tripping		No	P
Electrostatic discharges	F4.3		
Discharge test voltage		8 kV	P
Polarity of discharges		Positive/negative	P
Electrical fast transients/bursts (EFT/B)	F4.5		
Test level of power port		4kV/2,5 kHz	
Surge	F4.6		
Test level of power port Ue>=100 Va.c		6 kV line to earth 3 kV line to line	P
Conducted disturbances induced by radio-frequency fields (common mode)	F4.7		
Test level of power port		10 V/m (0,15 to 80 MHz with 80% AM at 1 kHz)	P
Emission tests	F.5		
Radiated RF disturbances (30 MHz – 1 GHz)	F5.4		
CISPR 11/CISPR 22			P
Dry heat test	F.7		
Test chamber temperature Test duration		40°C 168h	
No tripping of the circuit-breaker shall occur	F7.2		P
No operation of the electronic controls			

Requirement - Test	Clause	Result - Remark	Verdict
which could cause the circuit-breaker to trip occur			P
Verification of overload releases	F7.3		
Ambient air temperature Minimum current setting (A): Minimum time setting at 1,5xIr (s):		30°C 1600 15	
Conventional non tripping current 1,05xIr (A): No tripping time (s):		1680 >2h	P
Conventional tripping current 1,3xIr (A): Tripping time (s):		2080 15	P
Maximum current setting (A): Minimum time setting at 1,5xIr (s):		4000 15	
Conventional non tripping current 1,05xIr (A): No tripping time:		4200 >2h	P
Conventional tripping current 1,3xIr (A): Tripping time (s):		5200 17	P
Damp heat test	F.8		
Upper temperature		55°C	P
Number of cycles		6	P
Verification of overload releases	F8.2		
Ambient air temperature Minimum current setting (A): Minimum time setting at 1,5xIr (s):		28°C 1600 15	
Conventional non tripping current 1,05xIr (A): No tripping time:		1680 >2h	P
Conventional tripping current 1,3xIr (A): Tripping time (s):		2080 17	P
Maximum current setting (A): Minimum time setting at 1,5xIr (s):		4000 15	
Conventional non tripping current 1,05xIr (A): No tripping time (s):		4200 >2h	P
Conventional tripping current 1,3xIr (A): Tripping time (s):		5200 15	P
Temperature variation cycles at a specified rate of change	F.9		
Maximum test chamber temperature: Rate of change of temperature:		80°C 1K/min±0,2K/min	

Requirement - Test	Clause	Result - Remark	Verdict
Duration of exposure at maximum temperature: Minimum test chamber temperature: Rate of change of temperature: Duration of exposure at minimum temperature: Number of cycles:		2h -25°C 1K/min±0,2K/min 2h 28	
No operation of the electronic controls which could cause the circuit-breaker to trip occur	F9.3		P
Verification of overload releases	F9.4		
Ambient air temperature Minimum current setting (A): Minimum time setting at 1,5xIr (s):		28°C 1600 15	
Conventional non tripping current 1,05xIr (A): No tripping time:		1680 >2h	P
Conventional tripping current 1,3xIr (A): Tripping time (s):		2080 16	P
Maximum current setting (A): Maximum time setting at 1,5xIr (s):		4000 15	
Conventional non tripping current 1,05xIr (A): No tripping time (s):		4200 >2h	P
Conventional tripping current 1,3xIr (A): Tripping time (s):		5200 17	P
Individual pole short-circuit test sequence	An. H		
Test of individual pole short-circuit breaking capacity	H.2		
Sample no Rated current: In (A) Rated operational voltage: Ue (V) Rated ultimate short-circuit breaking capacity (kA):		#004 4000 AC400 100	
The circuit-breaker is mounted complete on its own support Test made in free air The characteristics f the metallic screen: - perforated metal - ratio hole area/total area - size of hole		 0,45-0,65 <30 mm^2	

Requirement - Test	Clause	Result - Remark	Verdict
Finish: conductive plating Fusr "F": copper wire diameter/long Circuit is earthed at load-star Conductor cross-sectional area (mm^2): Line connected at underside Tightering torques (Nm): Test circuit according figure 9		0,8mm/50mm 4x100x10 14,0	
Test voltage U/Ue=1,05 (V) L1: L2: L3: R.m.s. test current (kA): Power factor/time constant Peak test current (kAmax):		 436 436 436 50,2 0,24 107	
Test sequence "O' L1			
- max. let-through current (kApeak) - Joule integral I^2dt (MA^2s)		101 71,6	P
Pause t (min):		3	
Test sequence "CO' L1			
- max. let-through current (kApeak) - Joule integral I^2dt (MA^2s)		77,5 43,8	P
Test sequence "O' L2			
- max. let-through current (kApeak) - Joule integral I^2dt (MA^2s)		96,8 65,1	P
Pause t (min):		3	
Test sequence "CO' L2			
- max. let-through current (kApeak) - Joule integral I^2dt (MA^2s)		72,7 42,6	P
Test sequence "O' L3			
- max. let-through current (kApeak) - Joule integral I^2dt (MA^2s)		75,0 64,8	P
Pause t (min):		3	
Test sequence "CO' L3			
- max. let-through current (kApeak) - Joule integral I^2dt (MA^2s)		73,5 46,9	P
Melting of the fusible element Holes in the PE-shield for test sequence "O": Cracks observed		No No No	P P P
Verification of dielectric withstand	H.3		
- equal to twice of the rated operational voltage with a minimum of 1000 V (V):		1000	P
- no breakdown or flashover		<0,02 mA	P
Verification of overload releases	H.4		

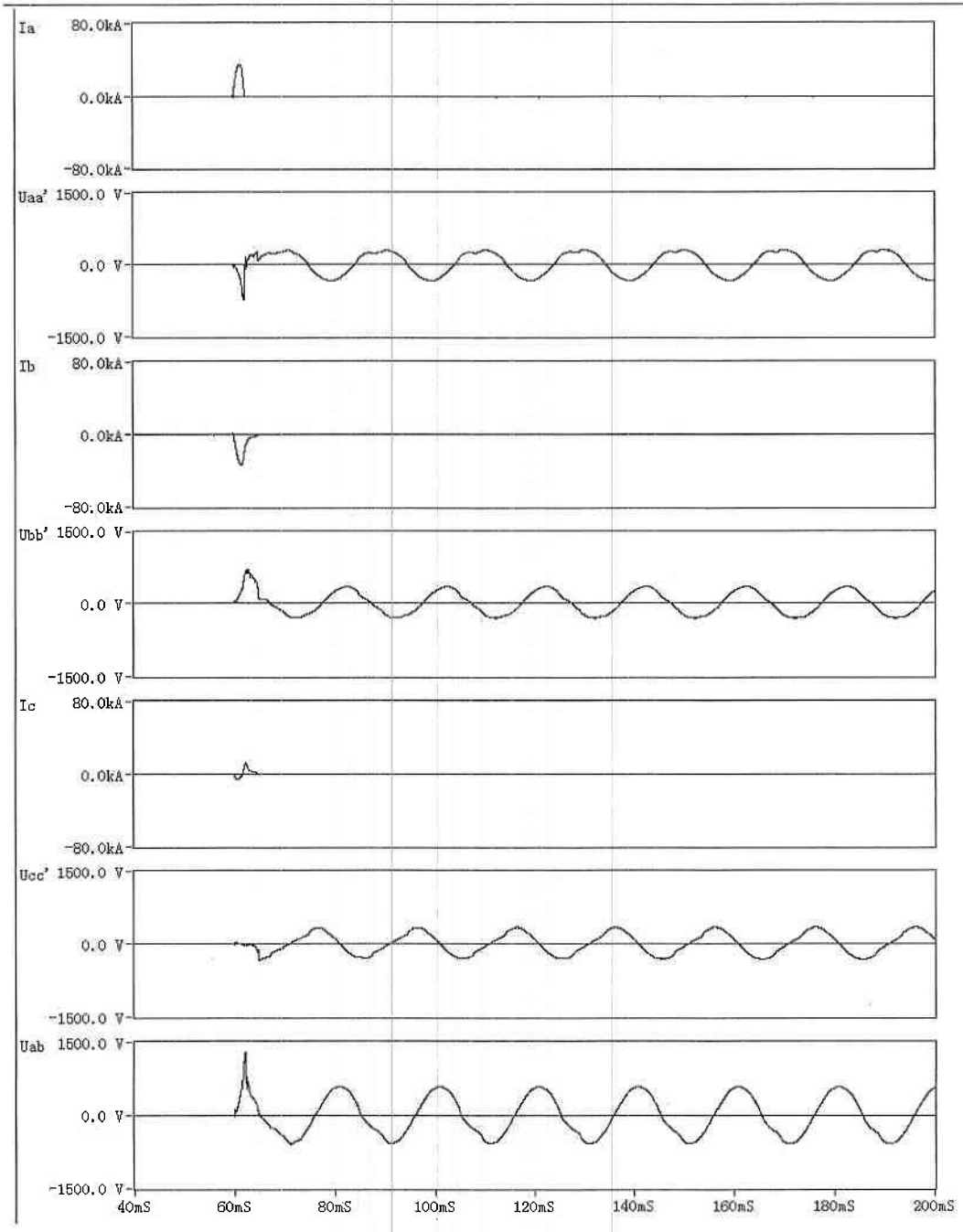
Requirement - Test	Clause	Result - Remark	Verdict
The operation of overload releases shall be verified at 2,5 times the value of their current setting on each pole separately (A):		4000 (Ir1=0,4In)	
Time specified by manufacturer at 2 times the value of current setting (s):		<=9,66 (t1=15s)	
Operation time (s): L1: L2: L3:		 5 5 4	 P

TABLE: temperature rise masurements

Thermocouple locations	Max. temperature measured (°C)			Max. temperature limit (°C)
#01	L1	L2	L3	
Upper terminal	62	79	66	80
Lower terminal	62	75	64	80
Handle	3			25
Enclosure	4			40
Back	7			50

TABLE: Oscillograms

Oscillogram: SFA190418-#1-1



Product: ACB
Type: 3P/4000A
Sequence: O
I/I_p:
101.9/227.0kA
cos φ: 0.170

U_t: 428.3V

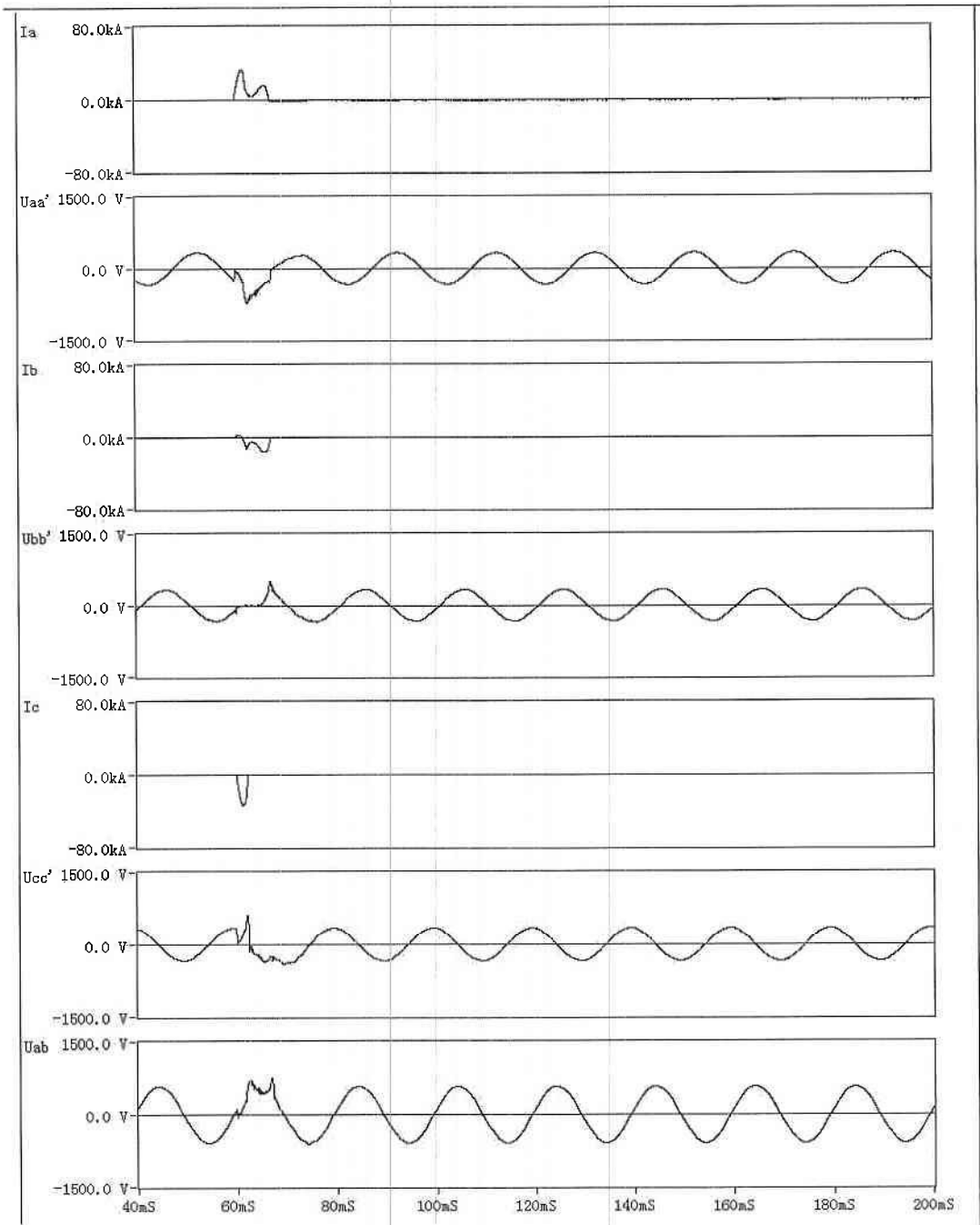
I_p A=35.454kA
I_p B=33.670kA
I_p C=12.614kA

I^2t A=1.529MAAS
I^2t B=1.516MAAS
I^2t C=132.0kAAS

T_{mb} A=2.320mS
T_{mb} B=4.800mS
T_{mb} C=4.840mS

T_{rac} A=1.892mS
T_{rac} B=4.352mS
T_{rac} C=1.096mS

Oscillogram: SFA190418-#1-2



Product: ACB
Type: 3P/4000A
Sequence: CO
I/I_p:
101.9/227.0kA
cos ϕ : 0.170

U_t: 428.3V

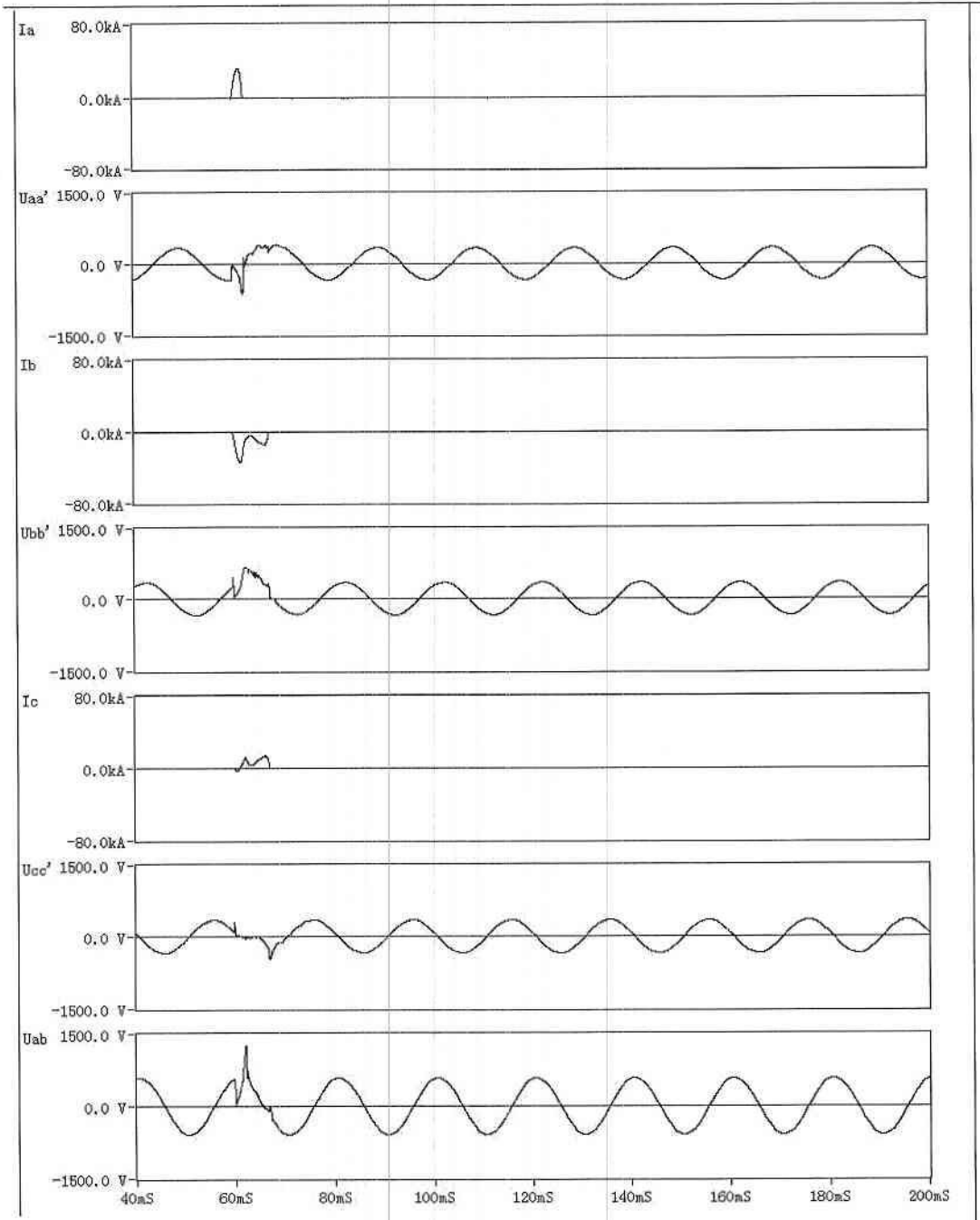
I_p A=33.220kA
I_p B=16.360kA
I_p C=33.469kA

I^2t A=1.898MAAS
I^2t B=603.0kAAS
I^2t C=1.420MAAS

T_{mb} A=7.160mS
T_{mb} B=7.120mS
T_{mb} C=2.380mS

T_{rac} A=6.732mS
T_{rac} B=2.146mS
T_{rac} C=2.095mS

Oscillogram: SFA190418-#1-3



Product: ACB
Type: 3P/4000A
Sequence: CO
I/I_p:
101.9/227.0kA
cos ϕ: 0.170

U_t: 428.3V

I_p A=31.532kA
I_p B=34.186kA
I_p C=14.223kA

I^2t A=1.174MAAS
I^2t B=1.871MAAS
I^2t C=492.0kAAS

T_{mb} A=2.260mS
T_{mb} B=7.200mS
T_{mb} C=7.180mS

T_{rac} A=2.168mS
T_{rac} B=6.973mS
T_{rac} C=2.142mS

-test case does apply to the test object : **N/A**
-test object does meet the requirement : **P**
-test object does not meet the requirement : **F**

5. RESULT:

BA50-47 4000H40 3H M11C11S11 39U00, conform the requirements of EN 60947-1:2007/A2:2014, EN 60947-2:2017/A1:2020, EN 60947-3:2009/A1:2012. Requirements of Normative documents, which are reflected in test report, are not expended to the test sample.

Testing engineer: Huz Yevhen.