



**Application No:**

*GQTS/D201608004*

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# Test Report

Company Name: YUEQING FEEO ELECTRIC CO., LTD.

Company Address: Liushi Yueqing Zhejiang China

Product Name: MOULDED CASE CIRCUIT BREAKER

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<b>TEST REPORT</b> <b>EN 60947-1, EN 60947-2</b> <b>Low-voltage switchgear and controlgear –</b> <b>Part 1: General rules</b> <b>Part 2: Circuit- breakers</b>	
Report reference No .....	GQTS/D201608004
Tested by (name and signature).....	Rocky 
Approved by (name and signature) :	Bruce 
Date of issue .....	31/08/2016
Testing Laboratory Name .....	BEIDE (UK) PRODUCT SERVICE LIMITED
Address .....	6F, BLDG E, HOURUI 3 <sup>RD</sup> IND ZONE, XIXIANG, BAO'AN DIST, SHENZHEN, CHINA
Testing location .....	6F, BLDG E, HOURUI 3 <sup>RD</sup> IND ZONE, XIXIANG, BAO'AN DIST, SHENZHEN, CHINA
Applicant's Name .....	YUEQING FEEO ELECTRIC CO., LTD.
Address.....	Liushi Yueqing Zhejiang China
Test specification	
Standard .....	EN 60947-2:2006+A1:2009+A2:2013 EN 60947-1:2007+A1:2011+A2:2014
Test procedure .....	CE
Non-standard test method .....	N/A
Test Report Form	
Test Report Form No.....	EN 60947-1A/16-08
Master TRF .....	Dated 16-08
Test item description.....	MOULDED CASE CIRCUIT BREAKER
Trademark .....	FEEO
Manufacturer :	YUEQING FEEO ELECTRIC CO., LTD.
Model and/or type reference.....	FPVM
Rating(s) .....	Ui: DC1500V,Ue:DC550V,In:125A
Test items particulars:	/
Additional information .....	/
National requirements.....	/
Other requirements.....	/

<p>Test case verdicts</p> <p>Test case does not apply to the test object ... : N/A</p> <p>Test item does meet the requirement..... : P(ass)</p> <p>Test item does not meet the requirement..... : F(ail)</p>
<p>Testing</p> <p>Date of receipt of test item..... : 02/08/2016</p> <p>Date(s) of performance of test..... : 02/08/2016-31/08/2016</p>
<p>General remarks</p> <p>This report shall not be reproduced except in full without the written approval of the testing laboratory.</p> <p>The test results presented in this report relate only to the item(s) tested.</p> <p>"(See remark #)" refers to a remark appended to the report.</p> <p>"(See Annex #)" refers to an annex appended to the report.</p> <p>Throughout this report a comma is used as the decimal separator.</p> <p>"This report is not valid as a CB Test Report unless appended to a CB Test Certificate issued by a NCB, in accordance with IEC 60730-2".</p>

Copy of marking plate:

MOULDED CASE CIRCUIT BREAKER  
Model: FPVM  
Rating:Ui: DC1500V,Ue:DC550V,In:125A

YUEQING FEEO ELECTRIC CO.,LTD  
Liushi, Yueqing, Zhejiang, China  
Made In China






EN 60947-1, EN 60947-2			
Cl.	Requirement – Test	Result	Verdict
3	Classification		P
3.1	According to their utilization category, A or B	A	P
3.2	According to the interrupting medium	Air-break	P
3.3	According to the design		P
3.4	According to the method of controlling the operating mechanism	dependent power operation	P
3.5	According to the suitability for isolation:	suitable for isolation	P
3.6	According to the provision for maintenance:	maintainable	P
3.7	According to the method of installation,	fixed	P
3.8	According to the degree of protection provided by the enclosure (see 7.1.11 of EN 60947-1)	IPX0	P
4	Characteristics of circuit-breakers		—
4.1	Summary of characteristics		P
	The characteristics of a circuit-breaker shall be stated in terms of the following,		P
	– type of circuit-breaker (4.2)		P
	– rated and limiting values of the main circuit (4.3)		P
	– utilization categories (4.4)		P
	– control circuits (4.5)		P
	– auxiliary circuits (4.6)		P
	– releases (4.7)		P
	– integral fuses (integrally fused circuit-breakers) (4.8)		N/A
4.2	Type of circuit-breaker		P
4.2.1	Number of poles		P
4.2.2	Kind of current		P
4.3	Rated and limiting values of the main circuit		P
4.3.1	Rated voltages		P
4.3.1.1	Rated operational voltage ( $U_e$ )		P
4.3.1.2	Rated insulation voltage ( $U_i$ )		P
4.3.1.3	Rated impulse withstand voltage ( $U_{imp}$ )		P
4.3.2	Currents		P
4.3.2.1	Conventional free-air thermal current ( $I_{th}$ )		P

EN 60947-1, EN 60947-2			
Cl.	Requirement – Test	Result	Verdict
4.3.2.2	Conventional enclosed thermal current (I <sub>the</sub> )		P
4.3.2.3	Rated current (I <sub>n</sub> )		P
4.3.2.4	Current rating for four-pole circuit-breakers		P
4.3.3	Rated frequency		N/A
4.3.4	Rated duty		P
4.3.4.1	Eight-hour duty		N/A
4.3.4.2	Uninterrupted duty		P
4.3.5	Short-circuit characteristics		P
4.3.5.1	Rated short-circuit making capacity (I <sub>cm</sub> )		P
	The rated short-circuit making capacity of a circuit-breaker is the value of short-circuit making capacity assigned to that circuit-breaker by the manufacturer for the rated operational voltage at rated frequency and at a specified power factor for a.c., or time constant for d.c. It is expressed as the maximum prospective peak current.		N/A
	For a.c. the rated short-circuit making capacity of a circuit-breaker shall be not less than its rated ultimate short-circuit breaking capacity, multiplied by the factor n of Table 2 (see 4.3.5.3)		N/A
	For d.c., the rated short-circuit making capacity of a circuit-breaker shall be not less than its rated ultimate short-circuit breaking capacity		P
	A rated short-circuit making capacity implies that the circuit-breaker shall be able to make the current corresponding to that rated capacity at the appropriate applied voltage related to the rated operational voltage		P
4.3.5.2	Rated short-circuit breaking capacities		P
	The rated short-circuit breaking capacities of a circuit-breaker are the values of short-circuit breaking capacity assigned to that circuit-breaker by the manufacturer for the rated operational voltage, under specified conditions		P
	– for a.c., at any power factor not less than that of Table 11 (see 8.3.2.2.4)		N/A
	– for d.c., with any time constant not greater than that of Table 11 (see 8.3.2.2.5)		P
4.3.5.2.1	Rated ultimate short-circuit breaking capacity (I <sub>cu</sub> )		P
4.3.5.2.2	4.3.5.2.2 Rated service short-circuit breaking capacity (I <sub>cs</sub> )		N/A
4.3.5.3	Standard relationship between short-circuit making and breaking capacities and related power factor, for a.c. circuit-breakers		N/A

EN 60947-1, EN 60947-2			
Cl.	Requirement – Test	Result	Verdict
	The standard relationship between short-circuit breaking capacity and short-circuit making capacity is given in Table 2		N/A
4.3.5.4	Rated short-time withstand current ( $I_{cw}$ )		N/A
	The rated short-time withstand current of a circuit-breaker is the value of short-time withstand current assigned to that circuit-breaker by the manufacturer under the test conditions specified in 8.3.6.2		N/A
	For a.c., the value of this current is the r.m.s. value of the a.c. component of the prospective short-circuit current, assumed constant during the short-time delay		N/A
4.4	Utilization categories	A	P
4.5	Control circuits		P
4.5.1	Electrical control circuits		P
4.5.2	Air-supply control circuits (pneumatic or electro-pneumatic)		P
	The characteristics of air-supply control circuits are:		P
	– rated pressure and its limits		P
	– volumes of air, at atmospheric pressure, required for each closing and each opening operation		P
4.6	Auxiliary circuits		P
	The characteristics of auxiliary circuits are the number and kind of contacts (a-contact, b-contact, etc.) in each of these circuits and their ratings according to EN 60947-5 (see note of Clause 1)		P
4.7	Releases		P
4.7.1	Types	Over-current release	P
4.7.2	Characteristics		P
1)	Shunt release and undervoltage release (for opening):		N/A
	– rated control circuit voltage ( $U_c$ )		N/A
	– kind of current		N/A
	– rated frequency, if a.c.		N/A
2)	Over-current release:		P
	– rated current ( $I_n$ )		P
	– kind of current		P
	– rated frequency, if a.c.		N/A
	– current setting (or range of settings)		P



EN 60947-1, EN 60947-2			
Cl.	Requirement – Test	Result	Verdict
	– time setting (or range of settings)		P
4.7.3	Current setting of over-current releases		P
4.7.4	Tripping time setting of over-current releases		P
	The time-delay of such releases is independent of the over-current. The tripping time setting shall be stated as the duration in seconds of the opening time of the circuit-breaker, if the time-delay is not adjustable, or the extreme values of the opening time, if the timedelay is adjustable		P
	Inverse time-delay over-current releases		P
4.8	Integral fuses (integrally fused circuit-breakers)		N/A
	he manufacturer shall state the type or the characteristics of the SCPD to be used with or within the equipment, as the case may be, and the maximum prospective short-circuit current for which the equipment, including the SCPD, is suitable, at the stated operational voltage(s)		N/A

5	Product information		P
5.1	Nature of the information		P
	The following information shall be given by the manufacturer, when required by the relevant product standard:		P
	– manufacturer's name or trademark	YUEQING FEEO ELECTRIC CO., LTD.	P
	– type designation or serial number		P
	– number of the relevant product standard, if the manufacturer claims compliance		P
	– rated operational voltages (see 4.3.1.1 and note to 5.2)		P
	– utilization category and rated operational currents		P
	– the value of the rated frequency/frequencies, e.g.: 50 Hz, 50 Hz/60 Hz, and/or the indication "d.c." or the symbol 		P
	– rated duty, with the indication of the class of intermittent duty, if any (see 4.3.4)		P
	– rated making and/or breaking capacities. These indications may be replaced, where applicable, by the indication of the utilization category		P
5.2	Marking		P
a)	rated current (In)		P
	suitability for isolation		P
b)	manufacturer's name or trade mark		P
	type designation or serial number	FPVM	P

EN 60947-1, EN 60947-2			
Cl.	Requirement – Test	Result	Verdict
	utilization category		P
	rated operational voltage(s) $U_e$		P
	rated impulse withstand voltage ( $U_{imp}$ )		P
	value (or range) of the rated frequency		N/A
	rated service short-circuit breaking capacity ( $I_{cs}$ )		P
	rated ultimate short-circuit breaking capacity ( $I_{cu}$ )		P
	rated short-time withstand current ( $I_{cw}$ ), and associated short-time delay, for utilization category B		N/A
	line and load terminals, unless their connection is immaterial		P
	neutral pole terminals, if applicable, by the letter N		P
	protective earth terminal		N/A
c)	rated short-circuit making capacity ( $I_{cm}$ )		P
	rated insulation voltage ( $U_i$ )		P
	IP Code, where applicable		N/A
	conventional enclosed thermal current ( $I_{the}$ ) if different from the rated current		P
	details of minimum distance between circuit-breaker and earthed metal parts for circuit breakers intended for use without enclosures		P
	suitability for environment A or environment B, as applicable		P
	r.m.s. sensing, if applicable		N/A
d)	rated control circuit voltage of the closing device (see 7.2.1.2 of EN 60947-1) and rated frequency for a.c.		N/A
	rated control circuit voltage of the shunt release (see 7.2.1.4 of EN 60947-1) and/or of the under-voltage release (or of the no-voltage release) (see 7.2.1.3 of EN 60947-1), and rated frequency for a.c.		N/A
	rated current of indirect over-current releases		N/A
	number and type of auxiliary contacts and kind of current, rated frequency (if a.c.) and rated voltages of the auxiliary switches, if different from those of the main circuit		N/A
e)	Terminal marking		P
5.3	Instructions for installation, operation and maintenance		P
	The manufacturer shall specify in his documents or catalogues the conditions for installation, operation and maintenance, if any, of the equipment during operation and after a fault		P

EN 60947-1, EN 60947-2			
Cl.	Requirement – Test	Result	Verdict
	If necessary, the instructions for the transport, installation and operation of the equipment shall indicate the measures that are of particular importance for the proper and correct installation, commissioning and operation of the equipment		P

6	Normal service, mounting and transport conditions		P
6.1.1	Ambient air temperature		P
	The ambient air temperature does not exceed +40 °C and its average over a period of 24 h does not exceed +35 °C		P
	The lower limit of the ambient air temperature is –5 °C		P
6.1.2	Altitude	<2000m	P
6.1.3	Atmospheric conditions		P
6.1.3.1	Humidity	<90%	P
6.1.3.2	Pollution degree	Pollution degree 3	P
6.1.4	Shock and vibration		P
6.2	Conditions during transport and storage	See instructions	P
6.3	Mounting	See instructions	P

7	Constructional and performance requirements		P
7.1	Constructional requirements		P
	Parts of insulating materials which might be exposed to thermal stresses due to electrical effects and the deterioration of which might impair the safety of the equipment shall not be adversely affected by abnormal heat and fire		P
	Tests on equipment shall be made by the glow-wire tests of IEC 60695-2-10, IEC 60695-2-11, IEC 60695-2-12 and IEC 60695-2-13		P
	Parts of insulating materials necessary to retain in position current-carrying parts of the main circuit in service shall conform to the glow-wire test of 8.2.1.1.1 of EN 60947-1, at a temperature of 960 °C		N/A
	Parts of insulating materials other than those specified in the previous paragraph shall conform to the requirements of the glow-wire tests of 8.2.1.1.1 of EN 60947-1 at a temperature of 650 °C	Plastic enclosure	P
7.1.1	Withdrawable circuit-breakers		N/A

EN 60947-1, EN 60947-2			
Cl.	Requirement – Test	Result	Verdict
	In the disconnected position, the isolating contacts of the main circuit and, where applicable, auxiliary circuits of withdrawable circuit-breakers shall have isolating distances which comply with the requirements specified for the isolating function, taking account of manufacturing tolerances and changes in dimensions due to wear		N/A
	The withdrawable mechanism shall be fitted with a reliable indicating device which indicates unambiguously the positions of the isolating contacts		N/A
	The withdrawable mechanism shall be fitted with interlocks which only permit the isolating contacts to be separated or re-closed when the main contacts of the circuit-breaker are open		N/A
	In addition, the withdrawable mechanism shall be fitted with interlocks which only permit the main contacts to be closed – when the isolating contacts are fully closed, or – when the specified isolating distance is achieved between the fixed and moving parts of the isolating contacts (disconnected position)		N/A
7.1.2	Additional requirements for circuit-breakers suitable for isolation		N/A
	Indication of the contact position		N/A
	Indicating means		N/A
	When an equipment is provided with means for indicating the closed and open positions, these positions shall be unambiguous and clearly indicated. This is done by means of a position indicating device (see 2.3.18).		N/A
	Indication by the actuator		N/A
7.1.3	Clearances and creepage distances		P
7.1.4	Requirements for the safety of the operator		P
	There shall be no path or opening which allows incandescent particles to be discharged from the area of the manual operating means		P
7.1.5	List of construction breaks		P
	Circuit-breakers of a given frame size are considered to have a construction break (see 2.1.2), if any one of the following features are not the same:		P
	– material, finish and dimensions of internal current-carrying parts, admitting, however, the variations listed in a), b) and c) below		P
	– size, material, configuration and method of attachment of the main contacts		P
	– any integral manual operating mechanism, its materials and physical characteristics		P
	– moulding and insulating materials		P
	– the principle of operation, materials and construction of the arc extinction device		P

EN 60947-1, EN 60947-2			
Cl.	Requirement – Test	Result	Verdict
	– the basic design of the over-current tripping devices, admitting, however, the variations detailed in a), b) and c) below		P
	Variations in the following do not constitute a construction break:		P
	a) dimensions of terminals, provided that creepage and clearance distances are not reduced		P
	b) in the case of thermal and magnetic releases those dimensions and materials of the release components, including flexible connections, which determine the current rating		P
	c) secondary windings of current transformer operated releases		P
	d) external operating means, additional to the integral operating means		P
	e) type designation and/or purely aesthetic features (e.g. labels)		P
7.1.6	Additional requirements for circuit-breakers provided with a neutral pole		P
	If a pole with an appropriate making and breaking capacity is used as a neutral pole, then all poles, including the neutral pole, may operate substantially together		P
7.2	Performance requirements		P
7.2.1	Operating conditions		P
7.2.1.1	Closing		P
	For a circuit-breaker to be closed safely on to the making current corresponding to its rated short-circuit making capacity, it is essential that it should be operated with the same speed and the same firmness as during the type test for proving the short-circuit making capacity		P
7.2.1.1.1	Dependent manual closing		P
	For a circuit-breaker having a dependent manual closing mechanism, it is not possible to assign a short-circuit making capacity rating irrespective of the conditions of mechanical operation		P
7.2.1.1.2	Independent manual closing		N/A
	A circuit-breaker having an independent manual closing mechanism can be assigned a shortcircuit making capacity rating irrespective of the conditions of mechanical operation		N/A
7.2.1.1.3	Dependent power closing		N/A
7.2.1.1.4	Independent power closing		N/A
7.2.1.1.5	Stored energy closing		P
7.2.1.2	Opening		P
7.2.1.2.1	Opening		P

EN 60947-1, EN 60947-2			
Cl.	Requirement – Test	Result	Verdict
7.2.1.2.2	Opening by undervoltage releases		P
7.2.1.2.3	Opening by shunt releases		P
7.2.1.2.4	Opening by over-current releases		P
	a) Opening under short-circuit conditions		P
	b) Opening under overload conditions		N/A
7.2.2	Temperature-rise		P
7.2.2.1	Temperature-rise limits		P
7.2.2.2	Ambient air temperature		P
7.2.2.3	Main circuit		P
7.2.2.4	Control circuits		P
7.2.2.5	Auxiliary circuits		P
7.2.3	Dielectric properties		P
	Type tests shall be made in accordance with 8.3.3.2.		P
7.2.3.1	Impulse withstand voltage		P
7.2.3.2	Power-frequency withstand voltage of the main, auxiliary and control circuits		N/A
	Power-frequency tests are used in the following cases:		N/A
	– dielectric tests as type tests for the verification of solid insulation		N/A
	– dielectric withstand verification, as a criterion of failure, after switching or short-circuit type tests		N/A
	– routine tests		N/A
7.2.3.3	Clearances		P
7.2.3.4	Creepage distances		P
7.2.3.5	Solid insulation		P
7.2.3.6	Spacing between separate circuits		N/A
7.2.4	Ability to make and break under no load, normal load and overload conditions		P
7.2.4.1	Overload performance		P
7.2.4.2	Operational performance capability		P
	The circuit-breaker shall be capable of meeting the requirements of Table 8:		P
	– for the test of operational performance without current in the main circuit under the test conditions specified in 8.3.3.3.3		P
	– for the test of operational performance with current in the main circuit under the test conditions specified in 8.3.3.3.4.		P
7.2.5	Ability to make and break under short-circuit conditions		P

EN 60947-1, EN 60947-2			
Cl.	Requirement – Test	Result	Verdict
	The equipment shall be so constructed as to be capable of withstanding, under conditions specified in the relevant product standard, the thermal, dynamic and electrical stresses resulting from short-circuit currents. In particular the equipment shall behave in such a manner that it complies with the requirements of 8.3.4.1.8.		P
	The rated short-circuit making capacity shall be in accordance with 4.3.5.1 and 4.3.5.3		P
	The rated short-circuit breaking capacity shall be in accordance with 4.3.5.2		P
	The rated short-time withstand current shall be in accordance with 4.3.5.4		P
7.2.6	Vacant		—
7.2.7	Additional requirements for circuit-breakers suitable for isolation		P
7.2.8	Specific requirements for integrally fused circuit-breakers		N/A
7.2.9	Co-ordination between a circuit-breaker and another short-circuit protective device		N/A
7.3	Electromagnetic compatibility (EMC)		P

8	Tests		P
8.1	Kind of tests		P
8.1.1	The tests to verify the characteristics of circuit-breakers are:		P
	– type tests (see 8.3)		P
	– routine tests (see 8.4)		N/A
8.2	Compliance with constructional requirements		P
8.3	Type tests		P
8.3.1	Test sequences		P
8.3.2	General test conditions		P
8.3.2.1	General test conditions		P
8.3.2.2	Test quantities		P
8.3.2.2.1	Values of test quantities		P
	All the tests shall be made with the values of test quantities corresponding to the ratings assigned by the manufacturer, in accordance with the relevant tables and data of the relevant product standard		P
8.3.2.2.2	Tolerances on test quantities		P
	The test recorded in the test report shall be within the tolerances given in Table 8, unless otherwise specified in the relevant subclauses. However, with the agreement of the manufacturer, the tests may be made under more severe conditions than those specified		P

EN 60947-1, EN 60947-2			
Cl.	Requirement – Test	Result	Verdict
8.3.2.2.3	Frequency of the test circuit for a.c.		N/A
	All tests shall be made at the rated frequency of the circuit-breaker. For all short-circuit tests, if the rated breaking capacity is essentially dependent on the value of the frequency, the tolerance shall not exceed $\pm 5\%$		N/A
8.3.2.2.4	Power factor of the test circuit		P
8.3.2.2.5	Time constant of the test circuit		P
8.3.2.2.6	Power-frequency recovery voltage		N/A
8.3.2.3	Evaluation of test results		P
	The case shall not be broken but hairline cracks are acceptable		P
8.3.2.4	Test reports		P
	Test values and parameters shall form part of the test report		P
8.3.2.5	Test conditions for temperature-rise test		P
	Ambient air temperature		P
	The ambient air temperature shall be recorded during the last quarter of the test period by at least two temperature sensing means, e.g. thermometers or thermocouples, equally distributed around the equipment at about half its height and at a distance of about 1 m from the equipment. The temperature sensing means shall be protected against air currents, heat radiation and indicating errors due to rapid temperature changes		P
	During the tests, the ambient air temperature shall be between $+10\text{ }^{\circ}\text{C}$ and $+40\text{ }^{\circ}\text{C}$ and shall not vary by more than 10 K		P
	Measurement of the temperature of parts		P
	For parts other than coils, the temperature of the different parts shall be measured by suitable temperature sensing means at those points most likely to attain the maximum temperature; these points shall be stated in the test report		P
	The oil temperature of oil-immersed equipment shall be measured at the upper part of the oil; this measurement may be made by means of a thermometer		P
	The temperature sensing means shall not significantly affect the temperature-rise		P
	Good thermal conductivity between the temperature sensing means and the surface of the part under test shall be ensured		P
	For electromagnet coils, the method of measuring the temperature by variation of resistance shall generally be used. Other methods are permitted only if it is impracticable to use the resistance method		P



EN 60947-1, EN 60947-2			
Cl.	Requirement – Test	Result	Verdict
	The temperature of the coils before beginning the test shall not differ from that of the surrounding medium by more than 3 K		P
	Temperature-rise of a part	Terminal:63.1K Switch:9.2K Enclosure:25.4K	P
	The temperature-rise of a part is the difference between the temperature of the part measured in accordance with 8.3.3.3.2, and the ambient air temperature measured in accordance with 8.3.3.3.1		P
	Temperature-rise of the main circuit		P
	The equipment shall be mounted as specified in 8.3.2.1 and shall be protected against abnormal external heating or cooling		P
	For the conventional thermal current test (free air or enclosed), equipment having an integral enclosure and equipment only intended for use with a specified type of enclosure shall be tested in its enclosure		P
	Temperature-rise of control circuits		N/A
	The temperature-rise tests of control circuits shall be made with the specified current and, in the case of a.c., at the rated frequency. Control circuits shall be tested at their rated voltage		N/A
	Circuits intended for continuous operation shall be tested for a sufficient time for the temperature-rise to reach a steady-state value		N/A
	Temperature-rise of coils of electromagnets		N/A
	Coils and electromagnets shall be tested according to the conditions given in 7.2.2.6		N/A
	Temperature-rise of auxiliary circuits		N/A
	The temperature-rise tests of auxiliary circuits shall be made under the same conditions as those specified in 8.3.3.3.5, but may be carried out at any convenient voltage.		N/A
8.3.2.6	Test conditions for short-circuit tests		P
8.3.2.6.1	General requirements		P
8.3.2.6.2	Test circuit		P
8.3.6.2.3	Calibration of the test circuit		P
8.3.6.4	Test procedure		P
	Tests for the performance under short-circuit conditions shall be made according to the sequences in Table 9		P
8.3.2.6.5	Behaviour of the circuit-breaker during short-circuit making and breaking tests		P
8.3.2.6.6	Interpretation of records		P

EN 60947-1, EN 60947-2			
Cl.	Requirement – Test	Result	Verdict
8.3.2.6.7	Verification after short-circuit tests		P
	a) After the opening operations of the short-circuit making and breaking capacity tests of 8.3.4.1, 8.3.5.2, 8.3.6.4, 8.3.7.1, 8.3.7.6, 8.3.8.3, as applicable, the polyethylene sheet shall show no holes visible with normal or corrected vision without additional magnification.		P
	b) After the short-circuit tests, the circuit-breaker shall comply with the verifications specified for each test sequence, as applicable.		P
8.3.3	Test sequence I: General performance characteristics		P
8.3.3.1	Test of tripping limits and characteristics		P
	Power operated equipment		P
	It shall be verified that the equipment opens and closes correctly within the limiting values of the control quantities, such as voltage, current, air pressure and temperatures, specified in the relevant product standard. Tests are made with no current flowing through the main circuit, unless otherwise specified.		P
	Relays and releases		P
	The operating limits of relays and releases shall comply with the requirements of 7.2.1.3, 7.2.1.4 and 7.2.1.5 and shall be verified according to the test procedure defined in the relevant product standard.		P
	For undervoltage relays and releases, see 7.2.1.3.		P
	For shunt releases, see 7.2.1.4		P
	For current operated relays and releases, see 7.2.1.5		P
8.3.3.1.1	General		P
8.3.3.1.2	Opening under short-circuit conditions		P
	The operation of short-circuit releases (see 4.7.1) shall be verified at 80 % and 120 % of the short-circuit current setting of the release. The test current shall have no asymmetry.		P
	For circuit-breakers with electromagnetic overcurrent releases,		P
	- within 0,2 s in the case of instantaneous releases (see 2.20) - within an interval of time equal to twice the time-delay stated by the manufacturer, in the case of definite time-delay releases		P
8.3.3.1.3	Opening under overload conditions		P
	a) Instantaneous or definite time-delay releases		P
	b) Inverse time-delay releases		P
8.3.3.1.4	Additional test for definite time-delay releases		P

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Cl.	Requirement – Test	Result	Verdict
	a) Time-delay		P
	b) Non-tripping duration		N/A
8.3.3.2	Test of dielectric properties		P
	(i) with reference to 8.3.3.4.1, item 2) c) i) and ii), of EN 60947-1: the normal positions of operation include the tripped position, if any		P
	ii) with reference to 8.3.3.4.1, item 3 c), of EN60947-1: for the purposes of this standard circuits incorporating solid-state devices connected to the main circuit shall be disconnected for the test		P
	iii) circuit-breakers not declared as suitable for isolation shall be tested with the test voltage applied across the poles of the main circuit, the line terminals being connected together and the load terminals being connected together. The test voltage shall be in accordance with Table 12 of EN 60947-1		N/A
	(iv) for circuit-breakers suitable for isolation (see 3.5) and having an operational voltage greater than 50 V, the leakage current, measured through each pole with the contacts in the open position, at a test voltage of 1,1 Ue, shall not exceed 0,5 mA		P
8.3.3.3	Tests of mechanical operation and of operational performance capability		P
8.3.3.3.1	General test conditions		P
8.3.3.3.2	Construction and mechanical operation		P
	a) Construction		P
	b) Mechanical operation		P
	c) Undervoltage releases		P
	d) Shunt releases		P
8.3.3.3.3	Operational performance capability without current		P
	These tests shall be made under the conditions specified in 8.3.2.1. The number of operating cycles to be carried out on the circuit-breaker is given in column 3 of Table 8; the number of operating cycles per hour is given in column 2 of this table		P
8.3.3.3.4	Operational performance capability with current		P
	The circuit-breaker shall be operated so as to make and break its rated current at its maximum rated operational voltage, assigned by the manufacturer, at a power factor or time constant as applicable in accordance with Table 11, the tolerance being in accordance with 8.3.2.2.2		P
8.3.3.3.5	Additional test of operational performance capability without current for withdrawable circuit-breakers		N/A

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Cl.	Requirement – Test	Result	Verdict
	A test of operational performance capability without current shall be carried out on the withdrawal mechanism and associated interlocks of withdrawable circuit-breakers		N/A
	After this test, the isolating contacts, withdrawal mechanism and interlocks shall be suitable for further service. This shall be verified by inspection		N/A
8.3.3.4	Overload performance		P
8.3.3.5	Verification of dielectric withstand		P
	For circuit-breakers suitable for isolation the leakage current shall be measured in accordance with 8.3.3.2, item (iv), except that the leakage current shall not exceed 2 mA		P
8.3.3.6	Verification of temperature-rise		P
8.3.3.7	Verification of overload releases		P
	The operating time shall not exceed the conventional tripping time		P
8.3.3.8	Verification of undervoltage and shunt releases		P
8.3.3.9	Verification of the main contact position		P
8.3.4	Test sequence II: Rated service short-circuit breaking capacity		
	Except when the test sequence VI (combined) applies (see 8.3.8), this test sequence applies to all circuit-breakers and comprises the following tests:		P
8.3.4.1	Test of rated service short-circuit breaking capacity		P
8.3.4.2	Verification of operational capability		P
8.3.4.3	Verification of dielectric withstand		P
8.3.4.4	Verification of temperature-rise		P
8.3.4.5	Verification of overload releases		P
8.3.5	Test sequence III: Rated ultimate short-circuit breaking capacity		P
	Except where the test sequence VI (combined) applies (see 8.3.8), this test sequence applies to circuit-breakers of utilization category A and to circuit-breakers of utilization category B having a rated ultimate short-circuit breaking capacity higher than the rated short-time withstand current		P
	For circuit-breakers of utilization category B having a rated short-time withstand current equal to their rated ultimate short-circuit breaking capacity, this test sequence need not be made, since, in this case, the ultimate short-circuit breaking capacity is verified when carrying out test sequence IV.		N/A
8.3.5.1	Verification of overload releases		P

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Cl.	Requirement – Test	Result	Verdict
	The operation of overload releases shall be verified at twice the value of their current setting on each pole separately. This test may be made at any convenient voltage		P
8.3.5.2	Test of rated ultimate short-circuit breaking capacity		P
8.3.5.3	Verification of dielectric withstand		P
	Following the test according to 8.3.5.2 the dielectric withstand shall be verified according to 8.3.3.5. For circuit breakers suitable for isolation, the leakage current shall not exceed 6 mA		P
8.3.5.4	Verification of overload releases		P
	The operating time shall not exceed the maximum value stated by the manufacturer for twice the value of the current setting, at the reference temperature, on a pole singly		P
8.3.6	Test sequence IV: Rated short-time withstand current		N/A
	Except where the test sequence VI (combined) applies (see 8.3.8), this test sequence applies to circuit-breakers of utilization category B and to those circuit-breakers of category A covered by note 3 of Table 4; it comprises the following tests.		N/A
8.3.6.1	Verification of overload releases		N/A
8.3.6.2	Test of rated short-time withstand current		N/A
8.3.6.3	Verification of temperature-rise		N/A
8.3.6.4	Test of short-circuit breaking capacity at the maximum short-time withstand current		N/A
8.3.6.5	Verification of dielectric withstand		N/A
8.3.6.6	Verification of overload releases		N/A
8.3.7	Test sequence V: Performance of integrally fused circuit-breakers		N/A
	This test sequence applies to integrally fused circuit-breakers. It replaces test sequence III and comprises the following tests:		N/A
8.3.7.1	Short-circuit at the selectivity limit current		N/A
8.3.7.2	Verification of temperature-rise		N/A
8.3.7.3	Verification of dielectric withstand		N/A
8.3.7.4	Verification of overload releases		N/A
8.3.7.5	Short-circuit at 1,1 times the take-over current		N/A
8.3.7.6	Short-circuit at ultimate short-circuit breaking capacity		N/A
8.3.7.7	Verification of dielectric withstand		N/A
8.3.7.8	Verification of overload releases		N/A
8.3.8	Test sequence VI: combined test sequence		N/A

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Cl.	Requirement – Test	Result	Verdict
	At the discretion of, or in agreement with the manufacturer, this test sequence may be applied to circuit-breakers of utilization category B:		N/A
8.3.8.1	Verification of overload releases		N/A
8.3.8.2	Test of rated short-time withstand current		N/A
8.3.8.3	Test of rated service short-circuit breaking capacity		N/A
8.3.8.4	Verification of operational capability		N/A
8.3.8.5	Verification of dielectric withstand		N/A
8.3.8.6	Verification of temperature-rise		N/A
8.3.8.7	Verification of overload releases		N/A
8.4	Routine tests		N/A
8.4.1	Mechanical operation tests		N/A
8.4.1.1	The following tests shall be made on manually-operated circuit-breakers		N/A
	– two close-open operations		N/A
	– two trip-free operations		N/A
8.4.1.2	The following tests shall be made on power-operated circuit-breakers at 110 % of the maximum rated control supply voltage and/or of the rated supply pressure, and at 85 % of the minimum rated control supply voltage and/or of the rated supply pressure:		N/A
	– two close-open operations		N/A
	– two trip-free operations		N/A
	– for automatic reclosing circuit-breakers, two automatic reclosing operations		N/A
8.4.2	Verification of the calibration of overcurrent releases		N/A
8.4.2.1	Inverse time-delay releases		N/A
8.4.2.2	Instantaneous and definite time-delay releases		N/A
8.4.3	Verification of the operation of undervoltage and shunt releases		N/A
8.4.3.1	Undervoltage releases		N/A
	a) Hold-in voltage		N/A
	b) Drop-out voltage		N/A
8.4.3.2	Shunt releases (for opening)		N/A
8.4.4	Additional tests for CBRs		N/A
	a) Operation of the test device		N/A
	b) Verification of the calibration of the residual current tripping device of the CBR		N/A
8.4.5	Dielectric tests		N/A

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Cl.	Requirement – Test	Result	Verdict
8.4.6	Test for the verification of clearances less than those corresponding to case A of Table 13 of EN 60947-1		N/A

<b>Annex A</b>	Co-ordination under short-circuit conditions between a circuit-breaker and another short-circuit protective device associated in the same circuit		N/A
A.1	Introduction		N/A
A.2	Scope and object		N/A
A.3	General requirements for the co-ordination of a circuit-breaker with another SCPD		N/A
A.3.1	General considerations		N/A
A.3.2	Take-over current		N/A
A.3.3	Behaviour of C1 in association with another SCPD		N/A
A.4	Type and characteristics of the associated SCPD		N/A
A.5	Verification of discrimination		N/A
A.6	Verification of back-up protection		N/A
A.6.1	Determination of the take-over current		N/A
A.6.2	Verification of back-up protection		N/A
A.6.3	Tests for verification of back-up protection		N/A
A.6.4	Results to be obtained		N/A

<b>Annex B</b>	Circuit-breakers incorporating residual current protection		N/A
B.1	Scope and object		N/A
B.2	Definitions		N/A
B.3	Classification		N/A
B.3.1	Classification according to the method of operation of the residual current function		N/A
B.3.2	Classification according to the possibility of adjusting the residual operating current		N/A
B.3.3	Classification according to time-delay of the residual current function		N/A
B.3.4	Classification according to behaviour in presence of a d.c. component		P
B.4	Characteristics of CBRs concerning their residual current function		N/A
B.4.1	Rated values		N/A
B.4.2	Preferred and limiting values		N/A
B.4.3	Value of the rated residual short-circuit making and breaking capacity ( $I_{\Delta m}$ )		N/A

EN 60947-1, EN 60947-2			
Cl.	Requirement – Test	Result	Verdict
B.4.4	Operating characteristics in case of an earth fault current in the presence or absence of a d.c. component		P
B.5	Marking		N/A
B.6	Normal service, mounting and transport conditions		N/A
B.7	Design and operating requirements		N/A
B.7.1	Design requirements		N/A
B.7.2	Operating requirements		N/A
B.8	Electromagnetic compatibility		N/A
B.8.1.1	General		N/A
B.8.1.2	Additional test sequences		N/A
B.8.2	Verification of the operating characteristic		N/A
B.8.3	Verification of dielectric properties		N/A
B.8.4	Verification of the operation of the test device at the limits of rated voltage		N/A
B.8.5	Verification of the limiting value of the non-operating current under over-current conditions		N/A
B.8.6	Verification of the resistance against unwanted tripping due to surge currents resulting from impulse voltages		N/A
B.8.7	Verification of the behaviour of CBRs of type A in the case of an earth fault current comprising a d.c. component		P
B.8.8	Verification of the behaviour of CBRs functionally dependent on line voltage classified under B.3.1.2.1		N/A
B.8.9	Verification of the behaviour of CBRs functionally dependent on line voltage as classified under B.3.1.2.2 in the case of failure of line voltage		N/A
B.8.10	Verification of the residual short-circuit making and breaking capacity		N/A
B.8.11	Verification of the effects of environmental conditions		N/A
B.8.12	Verification of electromagnetic compatibility		N/A
B.8.13	Test for variations or interruptions of voltage and for voltage dips		N/A



TABLE A	Dielectric strength measurement			P
test voltage applied across:		test voltage (V)	breakdown	
Each pair of the terminal		1890	No	
Each pole and the others connected together		1890	No	
Poles connected together and the plastic enclosure		1890	No	

TABLE B	Minimum clearances in air and minimum creepage distances				P
Parts / Pollution degree 3	Measured value		Required limit (mm)		
	cl	cr	cl	cr	
Live part of different polarity	6	8	3	6.3	
Live part and accessible surface of operating means	8	8	3	6.3	

TABLE C	TABLE: list of critical components				P
Object/part No.	Manufacturer/ trademark	Type/ model	Technical data	Standard	Mark(s) of conformity
Enclosure	SABIC INNOVATIVE PLASTICS CHINA CO LTD	923 (f1)	V-0, 125 degree	UL 94 UL748C	UL