REPORT No 11495

Date of issue: *December 10, 2025*

Status: FINAL REPORT

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IEC 60898-1

CIRCUIT-BREAKERS FOR OVERCURRENT PROTECTION FOR HOUSEHOLD AND SIMILAR INSTALLATIONS - CIRCUIT-BREAKERS FOR AC OPERATION

Program: SQO-EM9 Round 10

****

Prepared by:	Reviewed by:	Approved by:
cn=VALENTYN E. KRAVCHENKO, o=PT SOUTH QUALITY SAS, ou=SOUTH QUALITY, email=tech@ptsouthquality.com, c=AR 2025.12.10 15:42:10 -03'00'	cn=ESTEBAN DI MARCO, o=PT SOUTH QUALITY SAS, ou=SOUTH QUALITY, email=edimarco@ptsouthquality.com, c=AR 2025.12.12 17:07:25 -03'00'	cn=Emiliano Medina, o=SOUTH QUALITY, ou=PT SOUTH QUALITY SAS, email=quality@ptsouthquality.com, c=ES 2025.12.16 11:36:13 -03'00'
Valentyn Kravchenko Assistant Technician	**Eng. Esteban Di Marco** Electromechanical expert	**Eng. Emiliano Medina** Quality Assurance Lead

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1. FOREWORD

This report summarizes the results of the **SQO-EM9 Round 10** proficiency testing program on the verification of compliance of circuit-breakers with operational characteristics. This program is carried out under a simultaneous participation format, according to the A.3.1 classification of the ISO 17043 standard ("Model 2 - Figure A.1").

South Quality conducted the testing program from September to November 2025. The aim of the program was to assess the ability of laboratories to competently perform the nominated tests.

2. ORGANIZATION

Program Coordinator:	Eng. Esteban Di Marco
Assistant Technician:	Valentyn Kravchenko
Statistic:	Lic. Manuel Tozaki
Supervision:	Eng. Emiliano Medina

3. OBJECTIVE

The objective of this proficiency testing program is to determine of compliance with operational characteristics using the following standard:

Standard	Tests
IEC 60898-1: 2015 + AMD1: 2019	Test sequence according Table C.1

To verify this, batches of circuit-breakers have been selected.

Participants in this program have not been informed in advance about the expected values, ranges, or behavior of the samples provided.

4. PARTICIPANTS

In the present round, 19 companies have participated with the following details:

CODE	Country	ISO 17025 accredited	Results delivered
01	Pakistan	No	No
02	France	Yes	Yes
03	Colombia	No	Yes
04	Malaysia	Yes	Yes
05	Spain	Yes	Yes
06	Italy	Yes	Yes
07	Brazil	Yes	No
08	Portugal	Yes	Yes
09	Argentina	Yes	Yes
10	England	Yes	Yes
11	Germany	Yes	Yes
12	Australia	Yes	Yes
13	Hong Kong	No	Yes
14	Mexico	Yes	No
15	Mexico	Yes	Yes
16	Chile	Yes	No
17	Peru	No	No
18	Canada	Yes	Yes
19	Türkiye	Yes	Yes [1]

[1] The participant enrolled only in the following test sequence: A1 + A2 + B + C

5. HOMOGENEITY

A homogeneity study was conducted to verify the compliance of the samples with the requirements of the IEC 60898-1 standard, utilizing an ISO 17025 accredited laboratory.

Three batches of 70 units of various circuit breakers were prepared and tested to assess the homogeneity of the results.

The control process followed ISO 33405: 2024, clauses 7.4.1.1 / 7.4.1.2. Stratified random sampling was applied, and the samples were selected using random-number-generation software.

The results of these tests are presented below:

Size of each batch: **800 units** Tested samples from each batch: **70 units**

IEC 60898-1		SAME RESULTS IN THE SAMPLES TESTED		
TEST SEQUENCE	CLAUSE / SUBCLAUSE	BATCH NO LEM4157	BATCH NO LEM4158	BATCH NO LEM4159
A1	6	YES	YES	NO
	8.1.1	YES	YES	YES
	8.1.2	YES	YES	YES
	9.3	YES	YES	YES
	8.1.3	YES	YES	YES
	9.4	YES	YES	YES
	9.5	YES	YES	YES
	9.6	YES	YES	YES
	8.1.3	YES	YES	YES
	9.14	YES	YES	YES
	9.16	YES	YES	YES
A2	9.15	YES	YES	YES
B	9.7.5.4	YES	YES	YES
	9.7.1	YES	YES	YES
	9.7.2	YES	YES	YES
	9.7.3	YES	YES	YES
	9.7.5.2	YES	YES	YES
	9.8	YES	YES	YES
	9.9	YES	YES	YES
C1	9.11	YES	YES	NO
	9.12.11.2.1	YES	YES	YES
	9.12.12	YES	YES	YES
C2	9.12.11.2.2	YES	YES	YES
	9.12.12	YES	YES	YES

IEC 60898-1		SAME RESULTS IN THE SAMPLES TESTED		
TEST SEQUENCE	CLAUSE / SUBCLAUSE	BATCH NO LEM4157	BATCH NO LEM4158	BATCH NO LEM4159
D0	9.1	YES	YES	NO
D1	9.13	NO	YES	NO
	9.12.11.3	YES	YES	NO
	9.12.12	YES	YES	YES
E1	9.12.11.4.2	YES	YES	YES
	9.12.12	YES	YES	YES

Samples for this program are taken from the selected batch identified as **LEM4158**.

The analysis of the test data indicated that the selected samples exhibited sufficient homogeneity for the program. Therefore, the results of participants identified as outliers cannot be attributed to sample variability

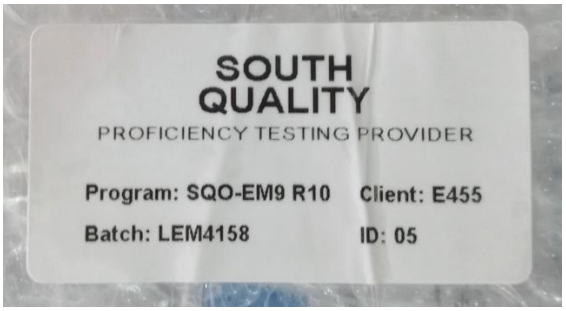
6. SAMPLE INFORMATION

The following samples were sent to be testing (Participant **Code 05**):

Batch:	LEM4158
Sample ID:	05
Characteristics:	Circuit-breaker - 1x25A - 240/415V - 50/60 Hz - 35 units Trademark: SICA Model: 782125

7. IMAGES

SAMPLES



SAMPLES


8. ASSIGNED VALUES

The assigned values are obtained from the results reported by all participants (**Consensus values**).

9. STATISTICS

The results must be treated as qualitative.

For qualitative results, the comparison will be made directly against the assigned values, so any difference will be evaluated as **Unsatisfactory**.

10. PARTICIPANT' RESULTS

Test sequence	Clause / Subclause	LABORATORY CODE														CONSENSUS VALUE
		02	03	04	05	06	08	09	10	11	12	13	15	18	19	
A1	6	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
	8.1.1	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
	8.1.2	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
	9.3	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
	8.1.3	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
	8.1.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	9.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	9.5	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
	9.6	P	P	P	P	P	P	P	P	P	P	F	P	P	P	P
	8.1.3	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
	9.14	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
	9.16	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
A2	9.15	F	P	F	F	F	F	F	F	F	F	F	F	F	F	F
B	9.7.5.4	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
	9.7.1	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
	9.7.2	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
	9.7.3	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
	9.7.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	9.7.5.2	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
	9.8	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
	9.9	P	P	P	N/V	P	P	P	P	P	P	P	P	P	P	P

Test sequence	Clause / Subclause	LABORATORY CODE														CONSENSUS VALUE
		02	03	04	05	06	08	09	10	11	12	13	15	18	19	
C1	9.11	F	F	F	F	F	F	F	F	F	F	F	F	F	P	F
	9.12.11.2.1	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
	9.12.12	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
C2	9.12.11.2.2	F	F	F	F	F	F	F	F	F	F	F	F	F	P	F
	9.12.12	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
D0	9.10	F	F	F	F	F	F	F	F	F	F	F	F	F	-	F
D1	9.13	P	P	P	P	P	F	F	P	P	P	P	P	P	-	P
	9.12.11.3	F	F	F	F	F	F	F	F	F	F	F	F	F	-	F
	9.12.12	F	F	F	F	F	F	F	F	F	F	F	F	F	-	F
E1	9.12.11.4.2	F	F	F	F	F	F	F	F	F	F	F	F	F	-	F
	9.12.12	P	P	P	P	P	P	P	P	P	P	P	P	P	-	P
E2	9.12.11.4.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	N/A
	9.12.12	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	N/A
E3	9.12.11.4.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	N/A
	9.12.12	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	N/A

References:

P: PASS
F: FAIL
N/A: NOT APPLICABLE
N/V: NOT VERIFIED

11. EVALUATION OF PERFORMANCE

Laboratory **Code 01**: The laboratory has not sent the results before the deadline.

Laboratory **Code 02**: The laboratory obtained **SATISFACTORY** results in the verification of all tests.

Laboratory **Code 03**: The laboratory obtained an **UNSATISFACTORY** result in the verification of clause 9.15.

Laboratory **Code 04**: The laboratory obtained **SATISFACTORY** results in the verification of all tests.

Laboratory **Code 05**: The laboratory obtained **SATISFACTORY** results in the verification of the tests performed.

Laboratory **Code 06**: The laboratory obtained **SATISFACTORY** results in the verification of all tests.

Laboratory **Code 07**: The laboratory has not sent the results before the deadline.

Laboratory **Code 08**: The laboratory obtained an **UNSATISFACTORY** result in the verification of clause 9.13.

Laboratory **Code 09**: The laboratory obtained an **UNSATISFACTORY** result in the verification of clause 9.13.

Laboratory **Code 10**: The laboratory obtained **SATISFACTORY** results in the verification of all tests.

Laboratory **Code 11**: The laboratory obtained **SATISFACTORY** results in the verification of all tests.

Laboratory **Code 12**: The laboratory obtained **SATISFACTORY** results in the verification of all tests.

Laboratory **Code 13**: The laboratory obtained an **UNSATISFACTORY** result in the verification of clause 9.6.

Laboratory **Code 14**: The laboratory has not sent the results before the deadline.

Laboratory **Code 15**: The laboratory obtained **SATISFACTORY** results in the verification of all tests.

Laboratory **Code 16**: The laboratory has not sent the results before the deadline.

Laboratory **Code 17**: The laboratory has not sent the results before the deadline.

Laboratory **Code 18**: The laboratory obtained **SATISFACTORY** results in the verification of all tests.

Laboratory **Code 19**: The laboratory has obtained **UNSATISFACTORY** results in the verification of clauses 9.13 and 9.12.11.2.2.

12. CONCLUSIONS

The overall performance in this **SQO-EM9 Round 10** program by the participating laboratories, based on the expected results, is as follows:

- Participants Codes **02, 04, 05, 06, 10, 11, 12, 15** and **18** have obtained a **SUFFICIENT** performance according to the expected results and should not take action;

- Participants Codes **03, 08, 09, 13, and 19** have obtained an **INSUFFICIENT** performance in accordance with the expected results and must take action in the clauses where they have obtained a different result than expected (See **Appendix B**).

The criteria used for evaluating the overall performance are as follows:

- **SUFFICIENT** performance: No unsatisfactory results obtained.

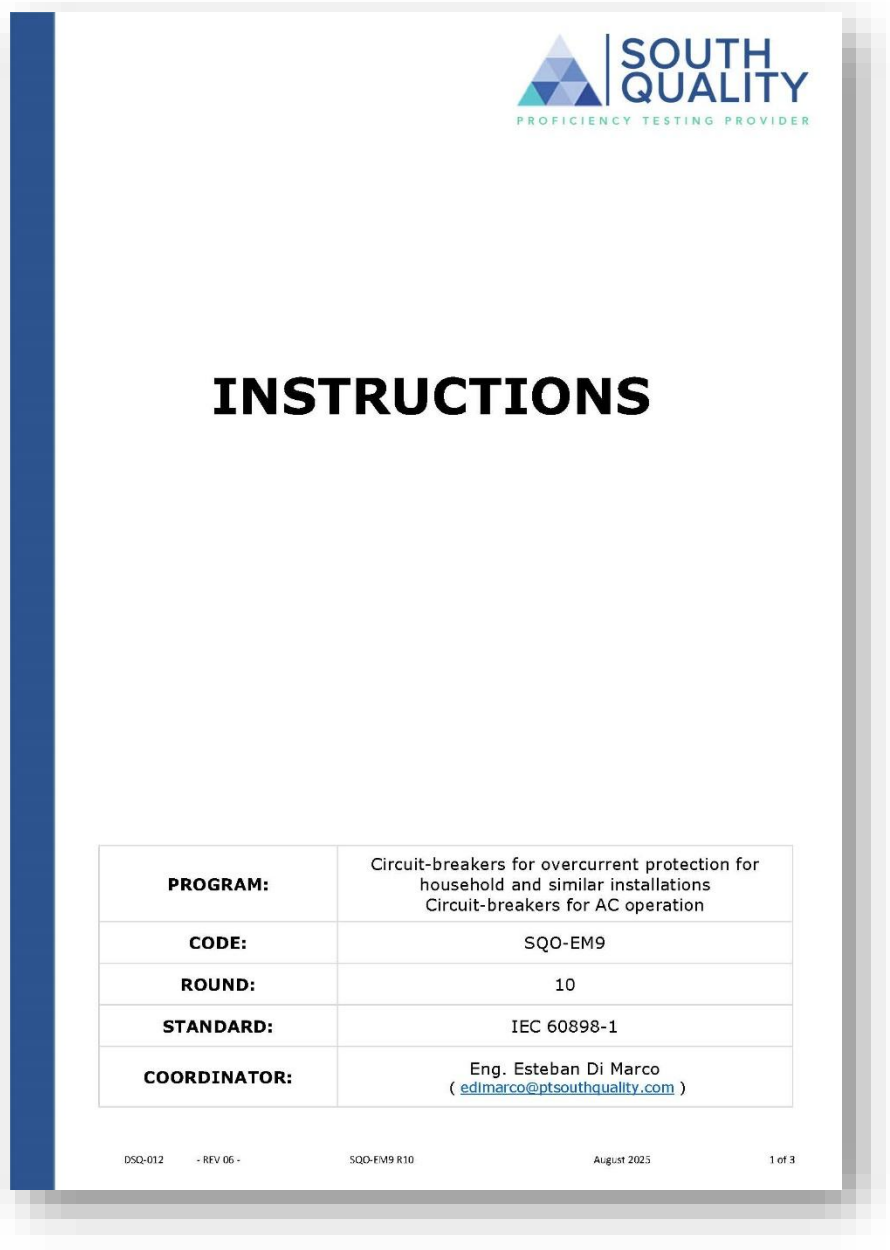
- **INSUFFICIENT** performance: An unsatisfactory result was obtained.

APPENDIX A

A1 - PARTICIPANT DATA

Company:	**Centro de Ensayos, Innovación y Servicios, S.L.**
Laboratory:	**Laboratorio Eléctrico**
Country:	Spain
Client ID:	E455
Contact person:	Rafael Martínez Técnico Dirección de Sistemas de Gestión calidad@ceis.es

A2 - INSTRUCTIONS



INSTRUCTIONS

PROGRAM:	Circuit-breakers for overcurrent protection for household and similar installations Circuit-breakers for AC operation
CODE:	SQO-EM9
ROUND:	10
STANDARD:	IEC 60898-1
COORDINATOR:	Eng. Esteban Di Marco (edimarco@ptsouthquality.com)

DSQ-012 - REV 06 - SQO-EM9 R10 August 2025 1 of 3

1 - General

This document serves as a guide for managing the results of the **SQO-EM9 (Round 10)** program.

2 - Standard

IEC 60898-1: 2015 + AMD 1: 2019

3 - Participant

CENTRO DE ENSAYOS, INNOVACIÓN Y SERVICIOS, S.L. Laboratorio Eléctrico	**CODE 05**

4 - Tests involved

TEST
Complete standard (Test sequences according Table C.1)

5 - Samples

CODE	SAMPLE	QUANTITY
LEM4158-05	Circuit-breaker - 1x25A - 240/415V - 50/60 Hz	35

6 - Notes

a) The deadline for the delivery of results is **November 7, 2025**.
b) The participant must submit the results using the usual report employed by their laboratory.
c) The samples are to be handled as routine lab samples, with all testing, documentation, and reporting adhering to **IEC 60898-1.**
d) Samples must be retained until the end of the program, which concludes with the submission of the final report.
e) To review the results, test images would be appreciated. Images can be attached at the end of this document or sent by email.

PHOTOGRAPHS

A3 - PARTICIPANT RESULTS

Test Report issued under the responsibility of:

CEISLAB

TEST REPORT
IEC 60898-1
Circuit-breakers for over current protection for household and similar installations
Part 1 - Circuit-breakers for a.c. operation

Report Number.....:	CEL_0824_25_1
Date of issue.....:	07/11/2025
Total number of pages	65
Name of Testing Laboratory preparing the Report .....:	CENTRO DE ENSAYOS INNOVACIÓN Y SERVICIOS S.L. (CEISLAB)
Applicant's name .....:	**ONLY VALID FOR INTERCOMPARATION TEST PROPOUSE (PT SOUTH QUALITY SAS)**
Address.....:	sica® Importa y distribuye: INDUSTRIAS SICA S.A.I.C. Av. 25 de Mayo 1200 - (B1824NMY) Lanús Oeste - Prov. de Bs. As. - Argentina Teléfono de Atención al Cliente: 4357-5034 www.sicaelec.com
Test specification:	
Standard .....:	IEC 60898-1:2015, AMD1:2019
Test procedure.....:	CB Scheme
Non-standard test method .....:	N/A
Test Report Form No. .....:	IEC60898_1E
Test Report Form(s) Originator ....:	DEKRA Certification B.V.
Master TRF .....:	Dated 2020-04-17

This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.

General disclaimer:

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing CB Testing Laboratory. The authenticity of this Test Report and its contents can be verified by contacting the NCB, responsible for this Test Report.

Test item description	MCB 1P_C25A_240/415C_3000
Trade Mark(s)	sica Limit
Manufacturer	sica Industrias SICA S.A.I.C.
Model/Type reference	782125
Ratings	1P_25A_240/415C_C_3000A

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):

☒	**CB Testing Laboratory:**	CEISLAB
	Testing location/ address	Cr. Villaviciosa de Odón a Móstoles, km 1,5, 28935 Móstoles (Madrid) - Spain
	Tested by (name, function, signature)	Jose L. Breñosa, Technician
	Check by (name, function, signature)	Luis Sosa, Lab Manager
	Approved by (name, function, signature)	Domingo Urquiza, Project Manager
☐	**Testing procedure: CTF Stage 1:**	
	Testing location/ address	
	Tested by (name, function, signature)	
	Approved by (name, function, signature)	
☐	**Testing procedure: CTF Stage 2:**	
	Testing location/ address	
	Tested by (name + signature)	
	Witnessed by (name, function, signature)	
	Approved by (name, function, signature)	
☐	**Testing procedure: CTF Stage 3:**	
☐	**Testing procedure: CTF Stage 4:**	
	Testing location/ address	
	Tested by (name, function, signature)	
	Witnessed by (name, function, signature)	
	Approved by (name, function, signature)	
	Supervised by (name, function, signature)	

List of Attachments (including a total number of pages in each attachment):

Summary of testing:

Tests performed (name of test and test clause):	**Testing location:**

Summary of compliance with National Differences (List of countries addressed):

☐ **The product fulfils the requirements of _____ (insert standard number and edition and delete the text in parenthesis, leave it blank or delete the whole sentence, if not applicable)**

Statement concerning the uncertainty of the measurement systems used for the tests
(may be required by the product standard or client)

☐ **Internal procedure used for type testing through which traceability of the measuring uncertainty has been established:**
Procedure number, issue date and title:

Calculations leading to the reported values are on file with the NCB and testing laboratory that conducted the testing.

☐ **Statement not required by the standard used for type testing**
(Note: When IEC or ISO standard requires a statement concerning the uncertainty of the measurement systems used for tests, this should be reported above. The informative text in parenthesis should be delete in both cases after selecting the applicable option)

Copy of marking plate:
The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.

Test item particulars	
Classification of installation and use	
Supply Connection	
Possible test case verdicts:	
- test case does not apply to the test object	N/A
- test object does meet the requirement	P (Pass)
- test object does not meet the requirement	F (Fail)
Testing	
Date of receipt of test item	06-08-2025
Date (s) of performance of tests	07-08-2025 to 07-11-2025

General remarks:

"(See Enclosure #)" refers to additional information appended to the report.
"(See appended table)" refers to a table appended to the report.

Throughout this report a ☐ comma / ☐ point is used as the decimal separator.

Manufacturer's Declaration per sub-clause 4.2.5 of IECEE 02:

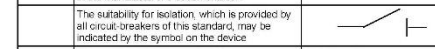
The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided	☐ **Yes** ☐ **Not applicable**

When differences exist; they shall be identified in the General product information section.

Name and address of factory (ies):

General product information and other remarks:

Test item particulars	
Type of circuit-breaker	
Number of poles	☒ 1-P ☐ 1-P+N ☐ 2-P ☐ 3-P ☐ 3-P+N ☐ 4-P
Protection against external influences	☒ enclosed ☐ unenclosed
Method of mounting	☐ surface ☐ flush ☒ panel board
Method of connection	☒ not associated with the mechanical mounting ☐ associated with the mechanical mounting
Type of terminal	☒ screw [2)] [3)] ☐ pillar [2)] [3)] ☐ cage [2)] [3)] ☐ lug ☐ screw less [2)] ☐ flat quick connect [2)] ☐ plug-in ☐ screw-in [2)] copper conductors [3)] aluminium conductors
Instantaneous tripping current	☐ B ☒ C ☐ D
I²t characteristic	
Value of rated operational voltage (Ue)	☐ 120 V ☐ 230 V ☐ 240 V ☐ 120/240 V ☐ 230/400 V ☐ 400 V ☒ 240/415 V ☐ 415 V
Value of rated current (In)	25 A
Value of rated frequency	☒ 50 Hz ☒ 60 Hz
Ambient air temperature (°C)	☒ 30°C ☐ 40°C ☐ Other _____°C
Rated short-circuit capacity (Icn)	☐ 1,5 kA ☒ 3 kA ☐ 4,5 kA ☐ 6 kA ☐ 10 kA ☐ 15 kA ☐ 20 kA ☐ 25 kA
Rated impulse withstand voltage (Uimp)	☐ 2,5 kV ☐ 4 kV ☐ declared ___kV

IEC 60898-1			
Clause	Requirement + Test	Result - Remark	Verdict
	TESTS „A_1" 1 SAMPLE		--
6	**MARKING AND OTHER INFORMATION**		
	Circuit-breaker marked with:		--
	a) Manufacturer's name or trade mark		P
	b) Type designation, catalogue number or other serial number		P
	c) Rated voltage (V)		P
	d) Rated current without symbol "A", preceded by the symbol of instantaneous tripping		P
	e) Rated frequency (Hz)		N/A
	f) Rated short circuit capacity (A)		P
	g) Wiring diagram		N/A
	h) Ambient air temperature, if different from 30°C		N/A
	i) Degree of protection, if different from IP20		N/A
	j) For D-type circuit-breakers: the maximum instantaneous tripping current, if higher than 20 In see table 2)		N/A
	k) Rated impulse withstand voltage Uimp if it is 2,5 kV		N/A
	l) Making and breaking capacity on an individual protected pole of multipole circuit-breakers (Icn1), if different from Icn		P
	Marking d) shall be readily visible when the CB is installed		P
	If, for small devices, the available space is insufficient, markings a), b), c), e), f), h), j) and l) may be put on the side or on the back of the CB		N/A
	Marking g) may be on the inside of any cover which has to be removed in order to connect the supply wires but shall not be on a label loosely attached to the CB		N/A
	Any other information not marked shall be given in the manufacturer's documentation	No information	N/A
	The suitability for isolation, which is provided by all circuit-breakers of this standard, may be indicated by the symbol on the device		N/A
	I²t characteristic (documentation)	No information	N/A
	Symbols on supply and load terminal		N/A
	Terminal for neutral conductor N		N/A

IEC 60898-1			
Clause	Requirement + Test	Result - Remark	Verdict
	Earthing terminal if any (IEC 60417-5019)		N/A
	On - off position shall be clearly indicated - O I -		P
	For push-button CB the off push-button shall either be red or be marked with the symbol "0"		N/A
	Red not used for other push-button		N/A
	For CB with multiple current ratings, the maximum value is marked, the adjusted value indicated without ambiguity		N/A
	For rail-mounted circuit-breakers, appropriate rail(s) shall be indicated in the manufacturer's documentation	No information	N/A
	Marking shall be indelible and easily legible (not on removable parts), 15 s with water, 15 s with hexane (see cl. 9.3)		P
8.	**REQUIREMENTS FOR CONSTRUCTION AND OPERATION**		
8.1.1	**General**		
	Circuit-breakers shall be so designed and constructed that, in normal use, their performance is reliable and without danger to the user or surroundings		
8.1.2	**Mechanism**		
	The moving contact shall be mechanically coupled so that all poles make and break together, whether operated manually or automatically, even if an overload occurs on one pole only		N/A
	The switched neutral shall close before and open after the protected pole (s)		N/A
	Neutral pole having adequate making and breaking capacity and CB with independent manual operation: all poles operate together including neutral pole		N/A
	CB shall have a trip free mechanism		P
	It shall be possible to switch the CB on and off by hand		P
	No intermediate position of the contacts		P
	Position of contacts shall be indicated		P
	Indication visible from the outside		P

IEC 60898-1			
Clause	Requirement + Test	Result - Remark	Verdict
	If the indication is on the actuating means, it shall, when released, automatically take up or stay in the position corresponding to that of the moving contacts; operating means shall have two different rest positions, except that, for automatic operation, a third distinct rest position may be provided		P
	If a separate mechanical indicator is used to indicate the position of the main contacts, colour red shall be used for the on position and green for the off position.		N/A
	The action of the mechanism shall not be influenced by the position of enclosures		P
	If the cover is used as a guiding means for push-button, it shall not be possible to remove this button from the outside		N/A
	Operating means securely fixed, not possible to remove them without a tool		P
	For the up-down operating means the contacts shall be closed by the up movement.		P
8.1.3	**Clearances and creepage distances and operation**		
	The minimum required clearances and creepage distances are based on the CB being designed for operating in an environment with pollution degree 2		P
	Parts of PCBs connected to live parts and protected against pollution by the use of a type 2 protection according to IEC 60664-3 are exempted from this verification		N/A
	The insulating materials are classified into material groups on the basis of their comparative tracking index (CTI) according to IEC 60664-1		N/A
	For clearances on printed wiring material, footnote 3 in Table F.2 of IEC 60664-1:2007 applies. For creepage distances on printed wiring material, the distances from Table F.4 of IEC 60664-1:2007 for pollution degree 1 can be applied only if protected with a coating meeting IEC 60664-3 requirements and tests		N/A
8.1.3.1	Clearances		
	Compliance for item 1 in Table 4 is checked by measurement and by the test of 9.7.5.4. The test is carried out with samples not submitted to the humidity treatment described in 9.7.1		P

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Clause	Requirement + Test	Result - Remark	Verdict
	Compliance as regards items 2 and 4 in Table 4 is checked by measurement and, if the clearances are reduced, by the tests of 9.7.5.2		P
	The clearances of items 2 and 4 (except accessible surface after installation) may be reduced provided that the measured clearances are not shorter than the minimum allowed in IEC 60664-1 for homogenous field conditions.		P
	In this case, compliance as regards items 2 and 4 is always checked by the test of 9.7.5.2		P
	Compliance as regards item 3 in Table 4 is checked by measurement		P
	Minimum clearances (see table 4)		
	Clearances [mm] Uimp		--
	4 kV (see table 4) 2,5 kV (see table 4)	☒ ☐	--
		minimum clearances [mm]	--
	1.between live parts (of the main circuits) which are separated when the CB is in off position ..... :	4,2	P
	2.between live parts of different polarity..... :		N/A
	3.between circuits supplied from different sources, one of which being PELV or SELV..... :		N/A
	4.between live parts and		
	- accessible surfaces of operating means..... :	30 (External)	P
	- screws or other means for fixing covers ..... :		N/A
	- surface on which the base is mounted..... :	42,2 (External)	P
	- screws or other means for fixing the circuit breaker ..... :		N/A
	- metal covers or boxes..... :		N/A
	- other accessible metal parts ..... :		N/A
	- metal frames supporting the base (flush-type) ..		N/A
8.1.3.2	Creepage distances		
	Compliance as regards items 1, 2, 3 and 4 of Table 4 is checked by measurement		P
	Minimum creepage distances (see table 4)		
	Material group	☐ IIIa ☐ IIIb ☐ II ☐ I	--
		minimum creepage distances [mm]	--

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Clause	Requirement + Test	Result - Remark	Verdict
	1.between live parts (of the main circuits) which are separated when the CB is in off position ..... :	4,9	P
	2.between live parts of different polarity..... :		N/A
	3.between circuits supplied from different sources, one of which being PELV or SELV..... :		N/A
	4.between live parts and		
	- accessible surfaces of operating means..... :	43,6 (external)	P
	- screws or other means for fixing covers ..... :		N/A
	- surface on which the base is mounted..... :	43 (external)	P
	- screws or other means for fixing the circuit breaker ..... :		N/A
	- metal covers or boxes..... :		N/A
	- other accessible metal parts ..... :		N/A
	- metal frames supporting the base (flush-type) .. :		N/A
8.1.3.3	Solid insulation		
	Compliance is checked by the tests according to 9.7.2, 9.7.3, 9.7.4 and 9.7.5, as applicable		P
8.1.4	**Screws, current-carrying parts and connections**		
8.1.4.1	Connections withstand mechanical stresses occurring in normal use		P
	Screws for mounting of the CB not of the thread-cutting type		P
	Test according to cl. 9.4:		
	- 10 times (screw Ø / torque Nm)	Ø___mm___Nm (see table 11) Ø___mm___Nm	N/A
	- 5 times (screw Ø / torque Nm)	Ø4,85mm 2Nm (see table 11) Ø4,85mm 2Nm	P
	After test connections have not become loose nor electrical function impaired		P
8.1.4.2	Screws with a thread of insulating material ensured correct introduction		N/A
8.1.4.3	Electrical connection: contact pressure not transmitted through insulating material, unless there is sufficient resilience in the metallic parts		P

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Clause	Requirement + Test	Result - Remark	Verdict
8.1.4.4	Current-carrying parts including parts intended for protective conductors, if any, shall be made of a metal having, under the conditions occurring in the equipment, mechanical strength, electrical conductivity and resistance to corrosion adequate for their intended use. Examples below.	Without manufacturer's declaration	
	- copper	Without manufacturer's declaration	
	- alloy 58% copper for worked cold parts	Without manufacturer's declaration	
	- alloy 50% copper for other parts	Without manufacturer's declaration	
	- other metal	Without manufacturer's declaration	
	In case of using ferrous alloys or suitably coated ferrous alloys, compliance to resistance to corrosion is checked by a test of resistance to rusting (see 9.16).		P
	The requirements of this subclause do not apply to contacts, magnetic circuits, heater elements, bimetals, shunts, electronic components, including printed circuit board or to screws, nuts, washers, clamping plates, similar parts of terminals and parts of the test circuit		P
	Compliance is checked by inspection in accordance with the manufacturer's declaration	Without manufacturer's declaration	
8.1.5	**Terminals for external conductors**		--
	Compliance is checked by inspection and by the tests as relevant for the type of connection:		--
	by tests of clause 9.5 for screw-type terminals		P
	by specific tests for plug-in or bolt-on CBs included in this document		N/A
	by the tests of Annexes J, K		N/A
8.1.5.1	Terminals ensure the necessary contact pressure		P
9.5	Torque test:		
	- torque (Nm); diameter (mm)..... :	2Nm, 4.85Ø mm	--
	- torque (Nm); diameter (mm)..... :		--
	- torque (Nm); diameter (mm)..... :		--
	- max. cross-sectional area (mm²)..... :	6	--
9.5.2	Pull test:		

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Clause	Requirement + Test	Result - Remark	Verdict
	Terminals shall be suitable for all types of conductors: rigid (solid or stranded) and flexible, unless otherwise specified by the manufacturer.		--
	Min. cross-section solid / stranded / flexible (mm²)..... :	1,5mm²	--
	Max. cross-section solid / stranded / flexible (mm²)..... :	6mm²	--
	Torque ²/₃ (Nm) ..... :	1,33Nm	--
	Pull for 1 min solid / stranded / flexible (N)..... :	50/60N	
	During the test no noticeable move of conductor		P
9.5.3	Torque test:		
	- torque ²/₃ (Nm)..... :	1,33Nm	--
	- min. cross-sectional area (mm²)..... :	1,5mm²	--
	- max. cross-sectional area (mm²)..... :	6mm²	--
	The conductor shows no undue damage nor severed strands		P
	Terminals have not worked loose and no damage		P
9.5.4	Terminals fitted with the largest cross-section area specified in Table 5, for stranded copper conductor.		P
	Max. cross-section stranded (mm²)..... :	6mm²	--
	Torque ²/₃ (Nm) ..... :	1,33Nm	--
	After the test no strand of conductor escaped outside		P
8.1.5.2	Terminals allow the connection of conductors of the following cross-sectional areas: (table 5)		P

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Clause	Requirement + Test	Result - Remark	Verdict
	Rated current (A) / Range of nominal cross sections to be clamped* (mm²): Rigid (solid or stranded) conductors / Flexible conductors ≤ 13: 1 to 2,5 / 1 to 2,5 > 13 ≤ 16: 1 to 4 / 1 to 4 > 16 ≤ 25: 1,5 to 6 / 1,5 to 6 > 25 ≤ 32: 2,5 to 10 / 2,5 to 6 > 32 ≤ 50: 4 to 16 / 4 to 10 > 50 ≤ 80: 10 to 25 / 10 to 16 > 80 ≤ 100: 16 to 35 / 16 to 25 > 100 ≤ 125: 24 to 50 / 25 to 35	1,5 to 6 mm²	P
	*It is required that, for current ratings up to and including 50 A, terminals be designed to clamp solid conductors as well as rigid stranded conductors. Nevertheless, it is permitted that terminals for conductors having cross-sections from 1 mm² up to 6 mm² be designed to clamp solid conductors only.		P
	- or terminals for external untreated aluminium conductors and with aluminium screw-type terminals for use with copper or with aluminium conductors according to Annex L.		N/A
8.1.5.3	Means for clamping the conductors in the terminals not serve to fix any other component (See test sub-clause 9.5)		P
8.1.5.4	Terminals for $I_N \leq 32$ A allow the connection of conductors without special preparation		P
8.1.5.5	Terminals shall have adequate mechanical strength; ISO thread or equivalent (See tests of sub-clause 9.4 and 9.5.2)		P
8.1.5.6	Clamping of conductor without damage to the conductor (See test of sub-clause 9.5.3)		P
8.1.5.7	Clamping of conductor between metal surfaces (See tests of sub-clause 9.4 and 9.5.2)		P
8.1.5.8	Conductor shall not slip-out when the clamping screw or nuts are tightened (See test of sub-clause 9.5.4)		P
8.1.5.9	Terminals shall be properly fixed. No work loose when the clamping screws or nuts are tightened or loosened (See test of sub-clause 9.4)		P
8.1.5.10	Clamping screws or nuts of terminals for protective conductors adequately secured against accidental loosening		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
8.1.5.11	Pillar terminals shall allow full insertion and reliable clamping of the conductor		N/A
8.1.5.12	Screws and nuts of terminals for external conductors shall be in engagement with a metal thread, and the screws shall not be the thread cutting type		P
8.1.6	**Non-interchangeability**		
	For circuit-breakers intended to be mounted on bases forming a unit therewith (plug-in or screw-in type) it shall not be possible, without the aid of a tool, to replace a circuit-breaker when mounted as for normal use by another of the same make having a higher rated current, compliance is checked by inspection		
8.1.7	**Mechanical mounting of plug-in circuit-breakers**		
8.1.7.1	The mechanical mounting of plug-in circuit-breakers, the retention of which does not depend solely on their plug-in connection(s), shall be reliable and have adequate stability		N/A
8.1.7.2	Plug-in type circuit-breakers, the retention of which does not depend solely on their plug-in connection(s) Compliance of the mechanical mounting is checked by the relevant test 9.13		N/A
8.1.7.3	Plug-in type circuit-breakers, the retention of which does depend solely on their plug-in connection(s) Compliance of the mechanical mounting is checked by the relevant test 9.13		N/A
8.14	**Electromagentic Immunity**		
	Circuit-breakers for overcurrent protection for household and similar installations are not sesetive to normal electromagetic disturbance and the therefore no immunity tests are required		
8.15	**Electromagnetic emission**		
	Electromagnetic disturbance can only be generated by circuit-breakers for overcurrent protection for household and similar installations during occasional switching or automatic breaking operations. The duration of the distrubances is of the order of millisections		

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Clause	Requirement + Test	Result - Remark	Verdict
	The frequency, the level and the consequences of the these emissions are considered as part of the normal eletromagnetic enviroment of low-voltage installations. Therefore the requirements for electromagnetic emissions are deemed to be satisfied and no verifications is necessary		
8.2	**Protection against electric shock**		
	Live parts not accessible in normal use		P
	For CB, other than plug-in type, external parts, other than screws and other means for fixing covers, which are accessible shall be of insulating material		P
	Unless the live parts are within an internal enclosure of insulating material: Lining - reliable fixed, - adequate thickness and - mechanical strength		P
	Inlet openings for cables shall be in insulating material or be provided with bushings or similar devices in insulating material Such device - shall be reliable fixed - shall have adequate mechanical strength		N/A
	For plug-in CB, external parts, other than screws and other means for fixing covers, which are accessible shall be in insulating material		N/A
	Metallic operating means insulated from live parts		N/A
	Metal parts of the mechanism not accessible and insulated from accessible metal parts, metal frames (for flush-type), screws or other means for fixing the base		P
	Replacement of plug-in CB possible without touching live parts		N/A
	Lacquer or enamel not considered		
8.1.3	**Creepage distances [mm] (see table 4)**		
	Internal parts only	See above	P
9.6	**Test of protection against electric shock**		
	This verification is applicable to those parts of circuit breakers which are exposed to the operator when mounted as for normal use		P

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Clause	Requirement + Test	Result - Remark	Verdict
	Use of test finger so designed that each jointed can be turned through an angle of 90° with respect to the finger		P
	Circuit-breaker with enclosures of thermoplastic material are additional tested at 35 °C for 1 min with a force of 75 N		P
8.10	**Resistance to heat**		
	CB sufficiently resistant to heat		P
9.14	**Test of resistance to heat**		
9.14.1	Test:		
	- without removable covers ..... 1 h (100 ± 2) °C		P
	- removable covers ..... 1 h (70 ± 2) °C		N/A
	After the test no access to live parts, marking still legible		P
9.14.2	Ball pressure test for external parts of insulating material (parts retaining current-carrying parts and parts of the protective circuit in position) T = 125°C Ø of impression ≤ 2 mm	Impression: 0,8 mm	P
9.14.3	Ball pressure test for external parts of insulating material (parts not retaining current-carrying parts and parts of the protective circuit in position T = (70 + 2)°C or T = 71 °C + (40 ± 2)°C + max. temperature rise of sub-clause 9.8 Ø of impression < 2 mm	Impression: 0,45 mm	P
8.12	**Resistance to rusting**		
	Ferrous parts adequately protected against rusting		P
9.16	**Test of resistance to rusting:**		
	- 10 min immersed in a cold chemical degreaser such as methyl-chloroform or refined petrol		P
	- 10 min immersed in a 10% solution of chloride in water at 20°C		P
	- 10 min at 95% humidity at 20°C		P
	- 10 min at 100°C		P
	No sign of rust		P

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Clause	Requirement + Test	Result - Remark	Verdict

	TESTS „A_2" 3 samples	$A_{2.4}$ $A_{2.2}$ $A_{2.3}$	--
8.11	**Resistance to abnormal heat and to fire**		
	External parts of insulating material shall not ignite or spread fire under fault or overload conditions		P
9.15	**Resistance to abnormal heat and to fire**		
	Test performed on a complete CB		P
	If it is not possible to perform the test on the complete end product, it is acceptable, according to IEC 60695-2-11:2014, 4.3, to remove the part under its entirety and test tis separately		N/A
	external parts retaining current-carrying parts and parts of the protective circuit in position ..... (960 + 15)°C		F
	all other external parts ..... (650 + 10)°C		P
	No visible flames, no sustained glowing, or		P
	flames and glowing extinguish within 30 s after removal		P
	No ignition of tissue paper or scorching of the pinewood board		F

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Clause	Requirement + Test	Result - Remark	Verdict

	TESTS „B" 3 samples	B_1 B_2 B_3	--
8.3	**Dielectric properties and isolating capability**		
8.3.1	CB shall have adequate dielectric properties and shall ensure isolation:		P
8.3.2	Dielectric strength at power frequency		
	Compliance is checked by the tests 9.7.1, 9.7.2 and 9.7.3 on circuit-breaker in new condition		P
8.3.3	Isolating capability		
	Circuit-breakers shall be suitable for isolation. Compliance is checked by the verification of compliance with the minimum clearances and creepage distances of item 1 of table 4 and by tests of 9.7.5.1 and 9.7.5.3.		P
8.3.4	Dielectric strength at rated impulse withstand voltage (Uimp)		
	Circuit-breakers shall adequately withstand impulse voltages. Compliance is checked by the tests of 9.7.5.2.		P
9.7	**Test of dielectric properties**		
9.7.5.4	Verification of resistance of the insulation of open contact and basic insulation against an impulse voltage (suitability for isolation)		P
	These tests are not preceded by the humidity treatment described in 9.7.1.		P
	The test is carried out on an CB fixed on a metal support		P
	The impulses are given by a generator producing positive and negative impulses having a front time of 1,2µs, and a time to half-value of 50µs		P
	The shape of the impulses is adjusted with the CB under test connected to the impulse generator.		P
	rated impulse withstand voltage [kV]:	4kV	--
	sea level of test laboratory [m]:	500m	--
	test voltage (acc. Table 15) [kV]:	5,8kV	--
	CB in open position (contacts in open position)		P
	The impulses are applied between:		--
	the line terminals connected together and the load terminals connected together		P

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Clause	Requirement + Test	Result - Remark	Verdict

	Five positive impulses and five negative impulses are applied, the interval between consecutive impulses being at least 1 s for impulses of the same polarity and being at least 10 s for impulses of the opposite polarity.		P
	No disruptive discharges during the test		P
9.7.1	**Resistance to humidity**		
9.7.1.1	Preparation of the circuit-breaker for test		
	Inlet openings, if any, are left open; if knock-outs are provided, one of them is opened.		P
9.7.1.2	Test conditions		
	The humidity treatment is carried out in humidity cabinet 91% to 95% and the temperature of the air between 20 °C and 30 °C	Rf = 93 % T = 25 °C	P
	Before being placed in the humidity cabinet, the sample is brought to a temperature between T °C and T °C +4 °C		P
9.7.1.3	Test procedure.		
	The sample is kept in the cabinet for 48 h.		P
	In order to achieve the specified conditions within the cabinet, it is necessary to ensure constant circulation of the air within and , in general, to use a cabinet which is thermally insulated		P
9.7.1.4	Conditions of the circuit breaker after the tests.		
	The sample show no damage within the meaning of this standard and shall withstand the tests of 9.7.2 and 9.7.3, 9.7.4 and 9.7.5.2		P
9.7.2	**Insulation resistance of the main circuit**		
	After an interval between 30 min and 60 min flowing this treatment, the insulation resistance is measured 5 s after application of a d.c. voltage of approximately 500 V (0, +100 V), consecutively as follows:	[MΩ] [MΩ] [MΩ]	P
	a) In open position, between the terminals which are electrically connected together when the circuit-breaker is in the closed position, in turn on each pole ≥ 2 MΩ	9000 14000 13000	P
	b) in closed position, between each pole in turn and the others connected together, electronic components connected between current paths being disconnected ≥ 2 MΩ		N/A
	c) in closed position, between all poles connected together and the frame > 5 MΩ	20000 19000 23000	P

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Clause	Requirement + Test	Result - Remark	Verdict

	d) for circuit-breakers with metal enclosure having an internal lining of insulating material, between the frame and a metal foil in contact with the inner surface of the lining of the insulating material including bushings and similar devices > 5 MΩ		N/A
9.7.3	**Dielectric strength of the main circuit**		
	After the circuit-breakers have passed the tests of 9.7.2 the test voltage specified is applied for 1 min between the parts indicated in 9.7.2		P
	with electronic components, if any, being disconnected for the test		N/A
	a) 2000 V		P
	b) 2000 V		N/A
	c) 2000 V		P
	d) 2500 V		N/A
	No flashover or breakdown		P
9.7.4	**Insulation resistance and dielectric strength of the auxiliary circuits**		N/A
	Insulation resistance of auxiliary circuits measured with 500^{+100} V DC after 1 min:		--
	Where electronic components connected to the main circuit in normal service are used, the temporary connections for test shall be made so that no voltage between the incoming and outgoing sides of the components		N/A
	1) between all auxiliary circuits and the frame (MΩ) > 2 MΩ		N/A
	2) between each part of the auxiliary circuits which might be isolated from the other parts and the whole of the other parts connected together (MΩ) > 2 MΩ		N/A
	Dielectric strength of auxiliary circuits measured with an AC voltage at rated frequency for 1 min:		--
	Rated voltage of auxiliary circuits (a.c. or d.c.) / Test voltage (V) ≤ 30 — 600 > 30 ≤ 50 — 1000 > 50 ≤ 110 — 1500 > 110 < 250 — 2000 > 250 ≤ 500 — 2500	V	--

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Clause	Requirement + Test	Result - Remark	Verdict
	1) between all auxiliary circuits and the frame		N/A
	2) between each part of the auxiliary circuits which might be isolated from the other parts and the whole of the other parts connected together		N/A
	No flashover or perforation		N/A
9.7.5.1	General testing procedure for the impulse withstand voltage tests		p
	The impulses are given by a generator producing positive and negative impulses having a front time of 1,2µs, and a time to half-value of 50µs		P
	Five positive impulses and five negative impulses are applied, the interval between consecutive impulses being at least 1 s for impulses of the same polarity and being at least 10 s for impulses of the opposite polarity.		P
	The surge impedance of the test apparatus 500Ω and surge protective devices disconnected before testing or		P
	When carrying out tests on a circuit-breaker incorporating components across the parts under test (e.g. surge protective components), an impulse generator with a virtual impedance of 2Ω shall be used		N/A
	The shape of the impulses is adjusted with the circuit-breaker under test connected to the impulse generator. For this purpose, appropriate voltage dividers and voltage sensors shall be used		P
	For a circuit-breaker incorporating components across the parts under test (e.g. surge protective components), the shape of the impulses is adjusted without connection of the CB to the impulse generator		N/A
9.7.5.2	Verification of clearances with the impulse withstand voltage		P
	If the measurement of clearances of items 2 and 4 in Table 4 shows a reduction of the required length, this test applies.		P
	The test is carried out on an CB fixed on a metal support and being in the closed position		P
	rated impulse withstand voltage (kV):	4kV	--
	see level of test laboratory (m):	500m	--

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Clause	Requirement + Test	Result - Remark	Verdict
	test voltage (acc. Table 14) (kV):	4,7kV	--
	a) in turn between each pole and the other poles connected together, electronic components connected between current paths being disconnected		P
	b) between all poles connected together and the frame including a metal foil or part in contact with the outer surface of the housing of insulating material but with the terminal areas kept completely free to avoid flashover between terminals and the metal foil		N/A
	c) for circuit-breakers with a metal enclosure having an internal lining of insulating material, between the frame and a metal foil in contact with the inner surface of the lining of insulating material, including bushings and similar devices		P
	No disruptive discharges during the test		P
	If, however, only one such disruptive discharge occurs, ten additional impulses having the same polarity as that which caused the disruptive discharge are applied, the connections being the same as those with which the failure occurred		N/A
	No further disruptive discharge shall occur		N/A
8.4	**Temperature rise**		
	Temperature rise does not exceed the limiting values stated in table 6:	sect. 4 mm²	P
9.8.2	Test current: I_N= (reach the steady-state value) Four-pole CB's: ☐ 1) Three poles loaded 2) One pole and neutral pole loaded ☐ 1) Four-poles loaded	I_N = 25A	P
	Ambient air temperature.....	Tamb= 21,3C	
	Parts..... Temperature rise [K]	[K] [K] [K]	
	L1	32,1 33,3 27,2	P
	L2		
	L3		
	L4(N)		
	L3		
	N		

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Clause	Requirement + Test	Result - Remark			Verdict
	Terminals for external connections.....60 K				P
	External parts liable to be touched during manual operation of the circuit-breaker, including operating means of insulating material and metallic means for coupling of insulating operating means of several poles.....40 K	7	6,8	7,2	P
	External metallic parts of operating means...25 K				N/A
	Other external parts, including that face of the circuit-breaker is in direct contact with the mounting surface.....60 K	20,9	18,5	16,6	P
9.8.5	Measurement of power losses	B_1	B_2	B_3	P
	Power loss do not exceed the values stated in table 8				
	Test current: I_N = 25 A (reach the steady state value)		25A		P
	Loaded one pole after the other				P
	Max. power loss : 4,5 W	W	W	W	
	L1	2,5	2,8	2,63	P
	L2				
	L3				
	L4(N)				
	L3				
	N				
8.5	**Uninterrupted duty**				
	Circuit-breakers operate reliable even after long service				
9.9	**28 day test**				N/A
	28 cycles - 21 h with current - 3 h without current Cross-sectional area: ____ mm²	I_N = _____A			
	During the first period of current flow the temperature of the terminals shall be measured				
	Ambient air temperature	°C			
	Parts.....Temperature rise [K]	[K]	[K]	[K]	
	Terminals for external connections.....				

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Clause	Requirement + Test	Result - Remark	Verdict
	During the last period of current flow the temperature of the terminals shall be measured		
	Ambient air temperature.....	°C	
	Parts.....Temperature rise [K]	[K] [K] [K]	
	Terminals for external connections.....		
	The temperature rise does not exceed the value measured during the first period by more than 15 K		
	Test current 1,45 I_N=_____A		
	- Tripping within	[s] [s] [s]	
	- 1h (< 63 A)		
	- 2h (> 63 A)		

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Clause	Requirement + Test	Result - Remark			Verdict
	TESTS „C“ 3 +3 samples				--
8.7	**Test „C_1“ Mechanical and electrical endurance**	**C_{1-1}**	**C_{1-2}**	**C_{1-3}**	
	Circuit-breaker shall be capable to perform an adequate number of cycles with rated current				
9.11.1	General test conditions				
	Test: Test Voltage 222/219/222V (rated voltage) Test Current 25,2/25,2/25,1A (rated current) Power factor 0,87/0,87/0,88 (0,85-0,9) Cross sect. area 4 mm²				P
9.11.2	Test procedure				
	The circuit-breaker is submitted to 4000 operating cycles with rated current.				
	- $I_N \leq$ 32 A: 2 s on - 13 s off				P
	- $I_N >$ 32 A: 2 s on - 28 s off				N/A
	During the test the circuit-breaker shall be operated as in normal use.				P
9.11.3	Conditions of the circuit breaker after the tests.				
	Following the test 9.11.2 the sample shall not show:				
	- undue wear				P
	- discrepancy between the position of the moving contacts and corresponding position of the indicating device				P
	- damage to the enclosure permitting access to live parts by test finger (see 9.6)				P
	- loosening of electrical or mechanical connections	After current verification at 2,55In the sample 9 is not able to operate.			F
	- seepage of sealing compound				
	Moreover test current..... 2,55 I_N 63,8A	63,8A			
	Opening time not less 1 s or more than	[s]	[s]	[s]	
	- 60 s (< 32 A)	21	110	47	F
	- 120 s (> 32 A)				
	Dielectric strength reduced to 1500 V				P

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Clause	Requirement + Test	Result - Remark			Verdict
9.12.11.2	**Test at reduced short-circuit currents**				
9.12.11.2.1	**Test on all circuit-breakers**				
	Test at reduced short-circuit currents: Fig. 3				
	Test current:	Obtained			--
	- 500 A or 10 In	I test = 502A			--
	Test voltage 1,05 Un	Un = 251V			--
	Power factor 0,93-0,98	0,98			--
9.12.9.2	Test in free air copper wire F': ☐ 0,12 mm / ☒ 0,16 mm resistor R' : ☐ 0,75 Ohm / ☒ 1,5 Ohm	'a' = 35 mm			P
9.12.9.3	Test in enclosures copper wire F': ☐ 0,12 mm / ☐ 0,16 mm resistor R' : ☐ 0,75 Ohm / ☐ 1,5 Ohm	dimension of enclosure: _____x_____x_____mm			N/A
	I_{Peak} (A) max. value	635/-----/643A			--
	Sequence: 6 x "O" and 3 x "CO"	[kA²s]	[kA²s]	[kA²s]	--
	Max. $I^2t \leq$ _____kA²s	1,58		1,49	
	- No permanent arcing				P
	- No flash-over between poles or between poles and frame				P
	- No blowing of the fuses F and F'				P
	- Polyethylene foil shows no holes				P
	After the test:				--
9.12.12	Verification of the circuit-breaker after short-circuit tests				
9.12.12.1	The circuit-breakers shall show no damage impairing their further use and shall maintenance, withstand the following tests				
	a) leakage current across open contacts, according to 9.7.5.3, each pole is supplied at a voltage 1,1 times Un = 264 V. The circuit – breaker is in the open position	C_{1-1} [mA]	C_{1-2} [mA]	C_{1-3} [mA]	
	The leakage current shall not exceed 2 mA L1	<0,01	<0,01	<0,01	P
	L2				
	L3				
	L4(N)				
	Electric strength test:				

IEC 60898-1			
Clause	Requirement + Test	Result - Remark	Verdict
	Test voltage 1500 V (see 9.7.3)		P
	a) 1500		P
	b)		N/A
	c) 1500		P
	d) 2000 V		N/A

IEC 60898-1					
Clause	Requirement + Test	Result - Remark			Verdict
9.12.11.2.2	**Test „C_2“ Short-circuit test on circuit-breakers for use in IT systems**				--
	Test current:				--
	- 500 A or 1,2 times the upper limit of the standard range of instantaneous tripping (see table 2) whichever is the higher, but < 2500 A. When tripping exceed 20 In the current adjusted at 1,2 times the upper limit even when higher 2500 A	I test= 521A			--
	Test voltage 1,05 Un	Un = 433V			--
	Power factor 0,93-0,98	0,97			--
9.12.9.2	Test in free air copper wire F': ☐ 0,12 mm / ☒ 0,16 mm resistor R' : ☐ 0,75 Ohm / ☒ 1,5 Ohm	'a' = 35 mm			--
9.12.9.3	Test in enclosures copper wire F': ☐ 0,12 mm / ☐ 0,16 mm resistor R' : ☐ 0,75 Ohm / ☐ 1,5 Ohm	dimension of enclosure: _____x_____x_____mm			--
	I_{Peak} (A) max. value	758A			--
	Sequence: "O" + "CO" on each protected pole	[kA²s]	[kA²s]	[kA²s]	--
	Shifted point 30 ° on the other protected pole	**C_{2-1}**	**C_{2-2}**	**C_{2-3}**	--
	Max. $I^2t \leq$ 20kA²s L1	123,9	1,84	70,9	F
	L2	___	___	___	
	L3	___	___	___	
	L4 (N)	___	___	___	
		Samples 11 and 13 do not disconnect before 0,1s during the CO maneuver. The energy is above the standard limit (Annex ZA UNE EN 60898-1:2020)			
	- No permanent arcing				P
	- No flash-over between poles or between poles and frame				P
	- No blowing of the fuses F and F'				P
	- Polyethylene foil shows no holes				P
	After the test:				--
9.12.12.1	The circuit-breakers shall show no damage impairing their further use and shall maintenance, withstand the following tests.				

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Clause	Requirement + Test	Result - Remark			Verdict
	a) leakage current across open contacts, according to 9.7.5.3, each pole is supplied at a voltage 1,1 times Un = 456 V. The circuit – breaker is in the open position	C_{2-1} [mA]	C_{2-2} [mA]	C_{2-3} [mA]	--
	The leakage current shall not exceed 2 mA L1	<0,01	<0,01	<0,01	P
	L2				
	L3				
	L4(N)				
	Electric strength test:				
	Test voltage 1500 V (see 9.7.3)				
	a)				P
	b)				N/A
	c)				P
	d) 2000 V				N/A

IEC 60898-1					
Clause	Requirement + Test	Result - Remark			Verdict
	TESTS „D" 3 samples				--
8.6	**Automatic operation**				
8.6.1	Standard time-current zone				
	Tripping characteristic of CB ensures adequate protection of the circuit, without premature operation.				
9.10	**Tests „D_0"**	D_{0-1}	D_{0-2}	D_{0-3}	
	I_N (A)		25A		--
	Sect. (mm²)		4mm²		--
	Instantaneous tripping current:	☐ B	☒ C	☐ D	--
9.10.1	General				
	If the test is made in a test chamber, it shall be made in still air; the volume of the test chamber shall be such as not to affect the test results				
9.10.2	Test of time-current characteristic				
9.10.2.1	Test current 1,13 I_N (A) starting from cold for:		28,25A		
	- 1 h ($I_N \leq$ 63 A)				
	- 2 h ($I_N >$ 63 A)				
	No tripping				P
	Then steadily increased within 5 s to 1,45 I_N (A)		36,35A		
	- Tripping within	[s]	[s]	[s]	--
	- 1h (≤ 63 A)	490	26	18	P
	- 2h (> 63 A)				
9.10.2.2	Test current 2,55 I_N (A) starting from cold for:		63,8A		
	opening time not less than 1 s or more than	[s]	[s]	[s]	--
	- 60 s (≤ 32 A)	18,8	14,1	14,1	P
	- 120 s (> 32 A)				N/A
9.10.3	Test of instantaneous tripping and of correct opening of the contacts				
9.10.3.1	General test conditions				
	For the lower values of the test current the test is made once, at any convenient voltage.				P
	For the upper values of the test current the test is made at rated voltage Un(phase to neutral) with a power factor between 0,95 and 1.				P
	The sequence of operation is : O-CO-CO-CO Interval time: > 3 min				P

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Clause	Requirement + Test	Result - Remark			Verdict
	The tripping time of the O operation is measured				P
	After each operation the indicating means shall show the open position of the contacts				F
9.10.3.2	☐ For circuit-breakers of the B – Type				N/A
	Test current 3I_N (A), starting from cold	_____A			--
	Opening time:	[s]	[s]	[s]	--
	≥ 0,1 s				N/A
	Test current 5 I_N (A), starting from cold	_____A			N/A
	Tripping less than 0,1 s				N/A
9.10.3.3	☒ For circuit-breakers of the C – Type				N/A
	Test current 5I_N (A), starting from cold	125A			N/A
	Opening time:	[s]	[s]	[s]	--
	≥ 0,1 s	2,78	2,36	2,41	P
	Test current 10 I_N (A), starting from cold	256A			
	Tripping less than 0,1 s	0,009	0,009	0,01	
9.10.3.4	☐ For circuit-breakers of the D – Type				N/A
	Test current 10I_N (A), starting from cold	N/A			N/A
	Opening time:	[s]	[s]	[s]	--
	≥ 0,1 s				N/A
	Test current 20 I_N (A) or to the maximum instantaneous tripping current(see cl. 6, item j), starting from cold	_____A			N/A
	Tripping less than 0,1 s				N/A
9.10.4	Test of effect of single pole loading on the tripping characteristic of multi-pole circuit-breakers:				N/A
	Test current 1,1 It (A), (two pole) starting from cold	_____A			N/A
	Tripping within	[min]	[min]	[min]	--
	- 1h (≤ 63 A)				N/A
	- 2h (> 63 A)				N/A
	Test current 1,2 It (A), (three pole or four pole) starting from cold	_____A			N/A
	Tripping within	[min]	[min]	[min]	--
	- 1h (≤ 63 A)				N/A
	- 2h (> 63 A)				N/A

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Clause	Requirement + Test	Result - Remark			Verdict
9.10.5	Test of effect of ambient temperature on the tripping characteristics				P
	a) Ambient temperature of (35 + 2) K below the ambient air reference temperature	T =-5ºC			P
	Test current 1,13 I_N (A)	28,25A			P
	- Passed for 1h				P
	- Passed for 2h				N/A
	Current is then steadily increased to 1,9 I_N (A) within 5s	47,5A			P
	Tripping within	[s]	[s]	[s]	--
	- 1h (≤ 63 A)	189	55	29	P
	- 2h (> 63 A)				N/A
	b) Ambient temperature of (10 ± 2) K above the ambient air reference temperature	40			P
	Test current I_N (A)	25A			P
	No tripping within				--
	- 1h (≤ 63 A)				P
	- 2h (> 63 A)				N/A

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Clause	Requirement + Test	Result - Remark	Verdict

	Tests „D_1“	D_{1-1}	D_{1-2}	D_{1-3}	--
8.9	**Resistance to mechanical shock and impact**				
	CB shall have adequate mechanical behaviour so as to withstand the stresses imposed during installation and use				P
9.13.1	**Mechanical shock**				
	- 50 falls on two sides of vertical board C				P
	- Vertical board turned 90°				P
	- 50 falls on two sides of vertical board C				P
	During the test the circuit-breakers shall not open				P
9.13.2	**Mechanical impact**				
9.13.2.2	All types:				
	- Impact test: 10 blows-height 10 cm, no damage				P
9.13.2.3	Screw-in types:				
	- Torque 2,5 Nm for 1 min, no damage				N/A
9.13.2.4	CB intended to be mounted on a rail				
	- downward vertical 50 N for 1 min				P
	- upward vertical 50 N for 1 min, no damage				P
9.13.2.5	Plug-in types				
	The circuit-breaker are mounted in their normal position, complete with plug-in base but without cables and any cover plate				N/A
	A force of 20 N applied for 1 min to the circuit-breaker (see fig 16).				N/A
	During this test the circuit-breaker part shall not become loose from the base and shall not show damage impairing further use.				N/A
9.12.11.3	**Test at 1500 A:**				
	Prospective current of 1500 A - power factor 0,93 to 0,98				
	If the neutral of a four-pole circuit-breaker is not marked by the manufacturer, four samples are tested using successively a different pole as the neutral				N/A
	Prospective current obtained (A)		1507A		--
	Power factor		0,95		--
	Test voltage 1,05 Un		250V		--

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Clause	Requirement + Test	Result - Remark	Verdict

	Test circuit: figure		3		--
	T (min)		3min		--
9.12.9.2	Test in free air copper wire F': ☐ 0,12 mm / ☒ 0,16 mm resistor R' : ☐ 0,75 Ohm / ☒ 1,5 Ohm		"a" = 35 mm		--
9.12.9.3	Test in enclosures copper wire F': ☐ 0,12 mm / ☐ 0,16 mm resistor R' : ☐ 0,75 Ohm / ☐ 1,5 Ohm		dimension of enclosure: _____x_____x_____mm		--
	Sequence		_____		--
	I_{Peak} (A) max. value		2077A		--
	I²t < 20 kA²s		[kA²s]	[kA²s]	[kA²s]	--
	Max. I²t < 20kA²s L1 L2 L3 L4(N)		7,13 ___ ___ ___	200,3 ___ ___ ___	8,11 ___ ___ ___	F
			Sample 18 does not disconnect during the CO1 maneuver and afterward is unable to connect. The energy is above the standard limit (Annex ZA UNE EN 60898-1:2020)			
	- No permanent arcing					P
	- No flash-over between poles or between poles and frame					P
	- No blowing of the fuses F and F'					P
	- Polyethylene foil shows no holes					P
	After the test:					--
9.12.12.1	The circuit-breakers shall show no damage impairing their further use and shall maintenance, withstand the following tests.					F
	a) leakage current across open contacts, according to 9.7.5.3, each pole is supplied at a voltage 1,1 times Un.= 264 V. The circuit – breaker is in the open position		D_{1-1} [mA]	D_{1-2} [mA]	D_{1-3} [mA]	--
	The leakage current shall not exceed 2 mA L1		<0,01		<0,01	P
	L2					
	L3					
	L4(N)					
	Electric strength test:					

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Clause	Requirement + Test	Result - Remark	Verdict

	Test voltage 1500 V (see 9.7.3)				
	a)				P
	b)				N/A
	c)				P
	d) 2000 V				N/A
	Test current 0,85x non-tripping current (1,13 I_N)		24A		
	- Passed for 1h				P
	- Passed for 2h				N/A
	Current is then steadily increased to 1,1 x tripping current (1,45 I_N) within 5s		39,9A		P
		D_{1-1} [s]	D_{1-2} [min]	D_{1-3} [s]	--
	Tripping within ☒ 1 hour / ☐ 2 hour	87	_____	29	P

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Clause	Requirement + Test	Result - Remark	Verdict

	TESTS „E_1“ 3 + 4 samples				--
9.12.11.4.2	**Test E_1: Test at service short-circuit capacity**	E_{1-1}	E_{1-2}	E_{1-3}	
	Service short-circuit capacity (Ics)		3000A		--
	Test circuit: figure		3		--
	Test voltage 1,05 Un		255V		--
	Prospective current		3000A		--
	Prospective current obtained		3060A		--
	Power factor		0,85 to 0,9		--
	Power factor obtained		0,9		--
	Sequence		O-t-O-t-CO		--
	T (min)		3min		--
9.12.9.2	Test in free air copper wire F': ☐ 0,12 mm / ☒ 0,16 mm resistor R' : ☐ 0,75 Ohm / ☒ 1,5 Ohm		"a" = 35 mm		--
9.12.9.3	Test in enclosures copper wire F': ☐ 0,12 mm / ☐ 0,16 mm resistor R' : ☐ 0,75 Ohm / ☐ 1,5 Ohm		dimensions of enclosure: _____x_____x_____mm		--
	I_{Peak} (A) max. value		2816A		--
	I²t ≤ _____ kA²s		[kA²s]	[kA²s]	[kA²s]	--
	Max. I²t ≤ 20kA²s L1 L2 L3 L4(N)		31,5 ___ ___ ___	23,6 ___ ___ ___	22,8 ___ ___ ___	F
			The energy is above the standard limit			
	- No permanent arcing					P
	- No flash-over between poles or between poles and frame					P
	- No blowing of the fuses F and F'					P
	- Polyethylene foil shows no holes					P
	After the test:					--
9.12.12.1	The circuit-breakers shall show no damage impairing their further use and shall maintenance, withstand the following tests.					P

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Clause	Requirement + Test	Result - Remark			Verdict
	a) leakage current across open contacts, according to 9.7.5.3, each pole is supplied at a voltage 1,1 times Un = 264 V. The circuit – breaker is in the open position	E_{t-1} [mA]	E_{t-2} [mA]	E_{t-3} [mA]	--
	The leakage current shall not exceed 2 mA L1	<0,01	<0,01	<0,01	P
	L2				
	L3				
	L4(N)				
	Electric strength test:				
	Test voltage 1500 V (see 9.7.3)				
	a)				P
	b)				
	c)				P
	d) 2000 V				
	Test current 0,85x non-tripping current (1,13 I_N)	24A			P
	- Passed for 1h				P
	- Passed for 2h				N/A
	Current is then steadily increased to 1,1 x tripping current (1,45 I_N) within 5s	39,9A			P
		E_{t-1} [s]	E_{t-2} [s]	E_{t-3} [s]	--
	Tripping within ☒ 1 hour / ☐ 2 hour	220	171	64	P

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Clause	Requirement + Test	Result - Remark			Verdict
9.12.11.4.2	**Test „E_1"(Test at service short-circuit capacity) three phase tests for single circuit-breakers**	E_{1-4}	E_{1-5}	E_{1-6}	--
	Service short-circuit capacity (Ics)	3000A			--
	Test circuit: figure	3			--
	Test voltage 1,05 Un	438V			--
	Prospective current	3000A			--
	Prospective current obtained	3133A			--
	Power factor	0,85 to 0,9			--
	Power factor obtained	0,96			--
	Sequence	(O-C-O)-t'-(t'-CO-O)-t-(O-t'-CO)-t-(CO-O-t')			--
	t (min)	3min			--
9.12.9.2	Test in free air copper wire F': ☐ 0,12 mm / ☒ 0,16 mm resistor R' : ☐ 0,75 Ohm / ☒ 1,5 Ohm	"a" = 35 mm			--
9.12.9.3	Test in enclosures copper wire F': ☐ 0,12 mm / ☐ 0,16 mm resistor R' : ☐ 0,75 Ohm / ☐ 1,5 Ohm	dimensions of enclosure: _____x_____x_____mm			N/A
	$I_{max.}$ (A) max. value	2959A			--
	- No permanent arcing				P
	- No flash-over between poles or between poles and frame				P
	- No blowing of the fuses F and F'				P
	- Polyethylene foil shows no holes				P
	After the test:				--
9.12.12.1	The circuit-breakers shall show no damage impairing their further use and shall maintenance, withstand the following tests.				P
	a) leakage current across open contacts, according to 9.7.5.3, each pole is supplied at a voltage 1,1 times Un = _____ V. The circuit – breaker is in the open position	E_{1-4} [mA]	E_{1-5} [mA]	E_{1-6} [mA]	--
	The leakage current shall not exceed 2 mA L1	0,0	0,0	0,0	P
	L2				
	L3				
	L4(N)				
	Electric strength test:				

IEC 60898-1					
Clause	Requirement + Test	Result - Remark			Verdict
	Test voltage 1500 V (see 9.7.3)				
	a)				P
	b)				N/A
	c)				P
	d) 2000 V				N/A
	Test current 0,85x non-tripping current (1,13 I_N)	24A			P
	- Passed for 1h				P
	- Passed for 2h				N/A
	Current is then steadily increased to 1,1 x tripping current (1,45 I_N) within 5s	39,9A			P
		E_{1-4} [s]	E_{1-5} [s]	E_{1-6} [s]	--
	Tripping within ☒ 1 hour / ☐ 2 hour	164	381	114	P

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Clause	Requirement + Test	Result - Remark			Verdict
	TESTS „E_2" 3 + 4 samples				--
9.12.11.4.3	**Test: E2 (Test at rated short-circuit capacity)**	E_{2-1}	E_{2-2}	E_{2-3}	N/A(k=1)
	Rated short-circuit capacity (Icn)	_____A			--
	Test circuit: figure	_____			--
	Test voltage 1,05 Un	_____V			--
	Prospective current	_____A			--
	Prospective current obtained	_____A			--
	Power factor	_____			--
	Power factor obtained	_____			--
	Sequence	_____			--
	T (min)	_____min			--
9.12.9.2	Test in free air copper wire F': ☐ 0,12 mm / ☐ 0,16 mm resistor R' : ☐ 0,75 Ohm / ☐ 1,5 Ohm	"a" = _____ mm			--
9.12.9.3	Test in enclosures copper wire F': ☐ 0,12 mm / ☐ 0,16 mm resistor R' : ☐ 0,75 Ohm / ☐ 1,5 Ohm	dimensions of enclosure: _____x_____x_____mm			--
	$I_{max.}$ (A) max. value	_____A			--
	I²t ≤ _____ kA²s	[kA²s]	[kA²s]	[kA²s]	--
	Max. I²t ≤ _____kA²s L1 L2 L3 L4(N)	___ ___ ___ ___	___ ___ ___ ___	___ ___ ___ ___	
	- No permanent arcing				
	- No flash-over between poles or between poles and frame				
	- No blowing of the fuses F and F'				
	- Polyethylene foil shows no holes				
	After the test:				--
9.12.12.2	The circuit-breakers shall show no damage impairing their further use and shall maintenance, withstand the following tests.				
	a) leakage current across open contacts, according to 9.7.5.3, each pole is supplied at a voltage 1,1 times Un = _____ V. The circuit – breaker is in the open position	E_{2-1} [mA]	E_{2-2} [mA]	E_{2-3} [mA]	--
	The leakage current shall not exceed 2 mA L1				

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Clause	Requirement + Test	Result - Remark			Verdict
	L2				
	L3				
	L4(N)				
	Electric strength test:				
	Test voltage 900 V (see 9.7.3)				
	a)				
	b)				
	c)				
	d)				
	Test current 2,8 I_N	_____A			
	Tripping within > 0,1 s up to	[s]	[s]	[s]	--
	- 60 s				
	- 120 s				

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Clause	Requirement + Test	Result - Remark				Verdict
9.12.11.4.3	**Test „E_2"(Test at rated short-circuit capacity) three phase tests for single circuit-breakers**	**$E_{2.4}$**	**$E_{2.5}$**	**$E_{2.6}$**	**$E_{2.7}$**	NA (K=1)
	Rated short-circuit capacity (Icn).....	_____A				--
	Test circuit: figure.....	_____				--
	Test voltage 1,05 Un	_____V				--
	Prospective current	_____A				--
	Prospective current obtained	_____A				--
	Power factor	_____				--
	Power factor obtained	_____				--
	Sequence	_____				--
	T (min)	_____min				--
9.12.9.2	Test in free air copper wire F': ☐ 0,12 mm / ☐ 0,16 mm resistor R' : ☐ 0,75 Ohm / ☐ 1,5 Ohm	"a" = _____ mm				--
9.12.9.3	Test in enclosures copper wire F': ☐ 0,12 mm / ☐ 0,16 mm resistor R' : ☐ 0,75 Ohm / ☐ 1,5 Ohm	dimensions of enclosure: _____x_____x_____mm				--
	I_{max} (A) max. value.....	_____A				--
	- No permanent arcing					
	- No flash-over between poles or between poles and frame					
	- No blowing of the fuses F and F'					
	- Polyethylene foil shows no holes					
	After the test:					--
9.12.12.2	The circuit-breakers shall show no damage impairing their further use and shall maintenance, withstand the following tests.					
	a) leakage current across open contacts, according to 9.7.5.3, each pole is supplied at a voltage 1,1 times Un.= _____ V. The circuit – breaker is in the open position	**$E_{2.4}$** [mA]	**$E_{2.5}$** [mA]	**$E_{2.6}$** [mA]	**$E_{2.7}$** [mA]	--
	The leakage current shall not exceed 2 mA L1					
	L2					
	L3					
	L4(N)					
	Electric strength test:					
	Test voltage 900 V (see 9.7.3)					

IEC 60898-1						
Clause	Requirement + Test	Result - Remark				Verdict
	a)					
	b)					
	c)					
	d)					
	Test current 2,8 I_N	_____A				
	Tripping within > 0,1 s up to	[s]	[s]	[s]	[s]	--
	- 60 s					
	- 120 s					

IEC 60898-1					
Clause	Requirement + Test	Result - Remark			Verdict
	TESTS „E_3" 3 samples				--
9.12.11.4.4	**Test: E_3 (Test at making and breaking capacity on an individual pole (Icn1)**	**$E_{3.1}$**	**$E_{3.2}$**	**$E_{3.3}$**	NA
	Icn1.....	_____A			--
	Test circuit: figure.....	_____			--
	Test voltage 1,05 Un	_____V			--
	Prospective current	_____A			--
	Prospective current obtained	_____A			--
	Power factor	_____			--
	Power factor obtained	_____			--
	Sequence	_____			--
	T (min)	_____min			--
9.12.9.2	Test in free air copper wire F': ☒ 0,12 mm / ☐ 0,16 mm resistor R' : ☐ 0,75 Ohm / ☒ 1,5 Ohm	"a" = _____ mm			--
9.12.9.3	Test in enclosures copper wire F': ☐ 0,12 mm / ☐ 0,16 mm resistor R' : ☐ 0,75 Ohm / ☐ 1,5 Ohm	dimensions of enclosure: _____x_____x_____mm			--
	I_{max} (A) max. value.....	_____A			--
	I²t ≤ _____ kA²s	[kA²s]	[kA²s]	[kA²s]	--
	Max. I²t ≤ _____kA²s L1 L2 L3 L4	___ ___ ___ ___	___ ___ ___ ___	___ ___ ___ ___	
	- No permanent arcing				
	- No flash-over between poles or between poles and frame				
	- No blowing of the fuses F and F'				
	- Polyethylene foil shows no holes				
	After the test:				--
9.12.12.2	The circuit-breakers shall show no damage impairing their further use and shall maintenance, withstand the following tests.				
	a) leakage current across open contacts, according to 9.7.5.3, each pole is supplied at a voltage 1,1 times Un.= _____ V. The circuit – breaker is in the open position	**$E_{3.1}$** [mA]	**$E_{3.2}$** [mA]	**$E_{3.3}$** [mA]	--
	The leakage current shall not exceed 2 mA L1				

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Clause	Requirement + Test	Result - Remark			Verdict
	L2				
	L3				
	L4				
	Electric strength test:				
	Test voltage 900 V (see 9.7.3)				
	a)				
	b)				
	c)				
	d)				
	Test current 2,8 I_N	____A			
	Tripping within > 0,1 s up to	[s]	[s]	[s]	--
	- 60 s				
	- 120 s				

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Clause	Requirement + Test	Result - Remark	Verdict
	Annex E		N/A
	Special requirements for auxiliary circuits for safety extra-low voltage		
8.1.3	**Clearances and creepage distances**		
	Additional note to table 4 NOTE 4 live parts in auxiliary circuits intended to be connected to safety extra low voltages shall be separated from circuits with higher voltages in accordance with the requirements of 411.1.3.3 of IEC 60364-4-41		--
	Compliance is checked by inspection		
9.7.4	**Dielectric strength of the auxiliary circuits**		
	Note: A test for circuits intended for connection to safety extra-low voltage is under consideration		

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Clause	Requirement + Test	Result - Remark	Verdict
	Annex J		
	Particular requirements for circuit-breakers with screwless- type terminals for external copper conductors (in not exceeding 40 A, cross-sectional area up to 10 mm²)		
J.6	**Marking**		
	Universal terminals		--
	- no marking		P
	Non-universal		--
	- declared for rigid-solid conductors	marked with "sol"	N/A
	- declared for rigid(solid and stranded)	marked with "r"	N/A
	- declared for flexible conductors	Marked with "f"	N/A
	The markings should appear on the circuit-breaker or, if available space is not sufficient, on smallest package unit or in technical information		N/A
	Indication of length of insulation to be removed on the circuit-breaker.....	____mm	N/A
J.7	**Standard conditions for operation in service**		
	Clause 7 applies		
J.8	**Constructional requirements**		
J.8.1	**GENERAL**		
	In clause 8.1.5 only 8.1.5.1, 8.1.5.2, 8.1.5.3, 8.1.5.6 and 8.1.5.7 apply		
	Compliance is checked by inspection and by the tests of J.9.1 and J.9.2		
J.8.2	**Connection or disconnection of conductors**		
	The connection or disconnection shall be made by:		
	A general purpose tool or by a convenient device integral with the terminal or		
	for rigid conductors by simple insertion		
	For disconnection an operation other than a pull shall be necessary (push-wire terminals)		
	Universal terminals shall accept rigid (solid or stranded and flexible unprepared conductors		
	They may also accept prepared conductors according to the manufacture's declaration		
	Non-universal terminals shall accept conductors declared by the manufacturer		

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Clause	Requirement + Test	Result - Remark	Verdict
	Compliance is checked by inspection and by the tests of J.9.1 and J.9.2		
J.8.3	**Dimensions of connectable conductors**		
	The dimensions of connectable conductors are given in table J.1		
	The ability to connect these conductors shall be checked by inspection and by the tests of J.9.1 and J.9.2		
J.8.4	**Connectable cross-sectional areas**		
	The nominal cross-sections to be clamped are given in table J.2		
	Compliance is checked by inspection and by the tests of J.9.1 and J.9.2		
J.8.5	**Insertion and connection of conductors**		
	The insertion and disconnection of the conductors shall be made in accordance with the manufacturer's instructions		
J.8.6	**Design and construction of terminals**		
	Terminals shall be designed and constructed that:		
	- each conductor is clamped individually		
	- connection or disconnection connectors connected or disconnected separate or same		
	- inadequate insertion of the conductor is avoided		
	Compliance is checked by inspection and by the tests of J.9.1 and J.9.2		
J.8.7	**The terminals shall be resistant to ageing**		
	Compliance is checked by the tests of J.9.3		
J.9	**Tests**		--
	Clause 9 applies, by replacing 9.4 and 9.5 by the follow		
J.9.1	**Test of reliability of screw less terminals**		
J.9.1.1	**Reliability of screw less system**		
	5 times connection and disconnection		
	3 rigid conductors min. cross-section max. cross-section	____mm² ____mm²	
	3 flexible conductors min. cross-section max. cross-section	____mm² ____mm²	

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Clause	Requirement + Test	Result - Remark	Verdict
	After tests, the terminal shall not be damage in such a way as to impair its further use		
J.9.1.2	**Test of reliability of connection**		
	3 terminals of poles of new sample are fitted with new copper conductors according table J.2		
	rigid conductors min. cross-section max. cross-section	____mm² ____mm²	
	flexible conductors min. cross-section max. cross-section	____mm² ____mm²	
	Each conductor is either pushed as far as possible into the terminal or shall be inserted so that adequate connection is obvious		
	After tests, no wire of the conductor shall have escaped outside the terminals		
J.9.2	**Tests of reliability of terminals for external conductors: Mechanical strength**		
	Three terminals of new samples are fitted with new conductors of the type and of the minimum and maximum cross sectional area according table J.2		
	Each conductor is subjected to a pull force of value shown in table J.3 for 1 min		
	Terminal screw torque : 2/3 of table 11	_____ Nm	
	rigid conductors min. cross-section max. cross-section	_____ mm² / _____N _____ mm² / _____N	
	flexible conductors min. cross-section max. cross-section	_____ mm² / _____N _____ mm² / _____N	
	During the test the conductor shall not slip out of the terminal		
J.9.3	**Cycling test**		
	The test is carried out with new copper conductors having a cross sectional area according table 10	_____ mm ²	
	The test is carried out on new samples(a sample is one pole, the number of which is defined below, according the type of terminal		
	- universal terminals for rigid (solid and stranded) and flexible conductors	3 + 3 samples	
	- non-universal terminals for solid conductors only	3 samples	
	-- non- universal terminals for rigid (solid and stranded) conductors	3 + 3 samples	

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Clause	Requirement + Test	Result - Remark	Verdict
	- non-universal terminals for flexible conductors only	3 samples	
	The conductors are connected in series as in normal use to each of the three samples as defined on fig. J.1.		
	The sample is provided with a hole or equivalent in order to measure the voltage drop on the terminal		
	The test arrangement is placed in a heating cabinet which is initially on 20°C		
	Except the cooling period the test current (rated current) is applied to the circuit	I test: _____ A	
	The samples shall be subjected to 192 temperature cycles, each cycle having a duration of +/- 1 hour		
	Description of the temperature cycle: In 20 min raised to 40°C, maintained for 10 min, then cool down in 20 min to 30 °C, maintained for 10 min. For measurement of the voltage drop it is allowed to cool down to 20 °C		
	The maximum voltage drop, measured on each terminal, at the end of the 192nd cycle, with Inom shall not exceed the smaller of the two following values - either 22,5 mV - or 1,5 times the value measured after the 24 cycle	Uv max: _____mV	
	Sample after 24 cycles: rigid conductors (mV) flexible conductors (mV)	J1 J2 J3 _____ _____ _____ _____ _____ _____	
	Sample after 192 cycles: rigid conductors (mV) flexible conductors (mV)	J1 J2 J3 _____ _____ _____ _____ _____ _____	
	After this test the samples shall show no changes evidently impairing further use, such as cracks, deformations or like		

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Clause	Requirement + Test	Result - Remark	Verdict

	Annex K	NA
	Particular requirements for circuit-breakers with flat quick-connect terminations	--
K.6	**Marking**	
	The whole of clause 6 applies	
	Addition after the lettered item k	--
	The following information regarding the female connector according to IEC 61210 and the type of conductor to be used shall be given in the manufacturer's instructions	
	a) manufacturers name or trade mark	--
	b) type reference	
	c) information on cross-sections of conductors and colour code of insulating female connectors (see table K.1)	
	d) the use of only silver or tin-plated copper alloys	
K.7	**Standard conditions for operation in service**	
	Clause 7 applies	
K.8	**Constructional requirements**	
	Clause 8 applies with the follow modifications:	
	replacement of 8.1.3 by:	
K.8.1	**Clearances and creepage distances (see annex B)**	
	Subclause 8.1.3 applies, the female connectors being fitted to the male tabs of the circuit-breaker	
	Replacement of 8.1.5 by:	
K.8.2	**Terminals for external conductors**	
K.8.2.1	Male tabs and female connectors shall be of a metal having mechanical strength, electrical conductivity and resistance to corrosion adequate for their intended use	
K.8.2.2	The nominal width of male tab is 6,3 mm and the thickness 0,8 mm, applicable to rated currents up to and including 16 A NOTE 1: The use for rated currents up to and including 20 A is accepted in BE, FR, IT, PT, ES and US	
	The dimensions of the male tab shall comply with those specified in table K.3 and in figures K.2, K3, K4, K5, where the dimensions A, B, C, D, E, F, J, M, N and Q are mandatory	

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Clause	Requirement + Test	Result - Remark	Verdict
	The dimensions of the female connector which may be fitted-on are given in figure K.6 and in table K.4		
	Compliance is checked by inspection and by measurement	See table on page _____	
K.8.2.3	**Male tabs shall be securely retained**		
	Compliance is checked by the mechanical overload test of K.9.1		
K.9	**Tests**		
	Clause 9 applies, with follow modifications:		
	Replacement of 9.5 by:		
K.9.1	**Mechanical overload-force**		
	10 terminals of circuit-breakers, mounted as normal use are subjected to a axial push force and successively the axial pull force specified in table K2 applied to male tab once	push force 96 N pull force 88 N	
	No damage which could impair further use shall occur to the tab or to the circuit-breaker in which the tab is integrated		
	Addition to 9.8.3:		
	Fine –wire thermocouples shall be placed in such a way as not to influence the contact or the connection area. An example of placement is shown in fig K.1		

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Clause	Requirement + Test	Result - Remark	Verdict

		Dimensions of tabs according Table K.3		Measured in mm	Verdict
		Minimum	Maximum		
A	Dimple	0,7	1,0	_____	
	Hole	0,5	1,0	_____	
B	Dimple	7,8 min		_____	
	Hole	7,8 min		_____	
C	Dimple	0,77	0,84	_____	
	Hole	0,77	0,84	_____	
D	Dimple	6,20	6,40	_____	
	Hole	6,20	6,40	_____	
E	Dimple	3,6	4,1	_____	
	Hole	4,3	4,7	_____	
F	Dimple	1,6	2,0	_____	
	Hole	1,6	2,0	_____	
J	Dimple	8°	12°	_____	
	Hole	8°	12°	_____	
M	Dimple	2,2	2,5	_____	
	Hole	---	---	---	---
N	Dimple	1,8	2,0	_____	
	Hole	---	---	---	---
P	Dimple	0,7	1,8	_____	
	Hole	0,7	1,8	_____	
Q	Dimple	8,9 min	---	_____	
	Hole	8,9 min	---	_____	
B3			7,8 max	_____	
L2			3,5 max	_____	

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Clause	Requirement + Test	Result - Remark	Verdict

	Annex L		NA
	Specific requirements for circuit-breakers with screw-type terminals for external untreated aluminium conductors and with aluminium screw-type terminals for use with copper or with aluminium conductors		
L.6	**Marking**		
	In addition to clause 6 the following apply:		
	Terminal marking according table L.1, on the circuit breaker, near the terminals		--
	Conductor types accepted:		
	Copper only	☐ None	
	Aluminium only	☐ "Al"	
	Aluminium and copper	☐ "Al/Cu"	
	Other information concerning the number of conductors, screw torque (if different from table 11) and cross-section shall be indicated on the circuit-breaker	_____ Nm _____ mm²	
L.7	**Standard conditions for operation in service**		
	Clause 7 applies		
L.8	**Constructional requirements**		
	Clause 8 applies with the following exceptions:		
8.1.5.2	is completed by:		
	For connection of aluminium conductors, circuit-breakers shall be provided with screw-type terminals allowing the connection of conductors having nominal cross-sections as shown in table L.2		
	Terminals for the connection of aluminium conductors and terminals of aluminium for the connection of copper or aluminium conductors shall have mechanical strength adequate to withstand the tests of 9.4, with the test conductors tightened with the torque indicated in table 11, or with the torque specified by the manufacturer, which shall never be lower than that specified in table 11.		
	Compliance is checked by inspection, by measurement and by fitting in turn one conductor of the smallest and one of the largest cross-section areas as specified		
8.1.5.4	Terminals shall allow the conductors to be connected without special preparation		

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Clause	Requirement + Test	Result - Remark	Verdict

	Compliance is checked by inspection and by the tests of L.9		
L.9	**Tests**		
	Clause 9 applies with the following modifications/additions:		
	For the tests which are influenced by the material of the terminal and the type of conductor that can be connected, the test conditions of table L.3 are applied		
	Additionally the test of L.9.2 is carried out on terminals separated from the circuit-breaker		
L.9.2	**Current cycling test**		
	This test is carried out on separate terminals		
	The general arrangement of the samples shall be as shown in figure L.1		
	90 % of torque stated by the manufacturer or selected in table 11 used for the specimens	torque:_____Nm	
	The test is carried out with conductors according to table L.5. For aluminium conductors or according to Table 10 for copper conductors used with aluminium terminals. The length of the test conductor from the point of entry to the screw-type terminal specimens to the equalizer shall be as in table L.6	cross-section:_____mm² minimum conductor length:_____mm	
	Cross section of equalizer not greater than that given in table L.7	max. crosssection_____mm²	
L.9.2.5	Test method and acceptance criteria		
	Test loop subjected to 500 cycles of 1h current-on and 1h current-off, starting at an a.c. current value of 1.12 times the test current value determined in table L.6	test current:_____A	
	Near the end of each current-on period of the first 24 cycles, the current shall subsequently be adjusted to raise the temperature of the reference conductor to 75°C		
	At the end of the 25th cycle the test current shall be adjusted the last time and the stable temperature shall be recorded as the first measurement. No further adjustment of test current for the remainder of the test		
	Temperatures recorded for at least one cycle of each working day, and after approximately 25, 50, 75, 100, 125, 175, 225, 350, 425 and 500 cycles		

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Clause	Requirement + Test	Result - Remark	Verdict

	For each screw-type terminal			
	- the temperature rise shall not exceed 110 K			
	- the stability factor Sf shall not exceed ± 10 %			
	ambient air temperature: _____°C	max. temperature rise [K]	max. stability factor Sf [°C]	

TABLE: Heating Test		
Test voltage (V) ..... :	30V	—
Ambient (°C) ..... :	21,3°C	—

Thermocouple Locations	max. temperature measured, (K)	max. temperature limit, (K)
Terminal 1 Sample 5	31,7	60
Terminal 2 Sample 5	32,1	60
Lateral part Sample 5	20,9	60
Front part Sample 5	7,1	40
Terminal 1 Sample 6	26,5	60
Terminal 2 Sample 6	33,3	60
Lateral part Sample 6	18,5	60
Front part Sample 6	6,6	40
Terminal 1 Sample 7	27,2	60
Terminal 2 Sample 7	26	60
Lateral part Sample 7	16,6	60
Front part Sample 7	7,2	40
Supplementary information:		

TABLE: Dielectric Strength		
Test voltage applied between:	Test potential applied (V)	Breakdown / flashover (Yes/No)
Supplementary information:		

TABLE: Insulation resistance measurements		
Insulation resistance R between:	R (MΩ)	Required R (MΩ)
Between mains poles (primary fuse disconnected)		
Between parts separated by basic or supplementary insulation		

Between parts separated by double or reinforced insulation		
Supplementary information:		

TABLE: Impact Resistance			
Impacts per surface	Surface tested	Impact energy (Nm)	Comments
Supplementary information:			

TABLE: Clearance And Creepage Distance Measurements						
clearance cl and creepage distance dcr at/of:	Up (V)	U r.m.s. (V)	Required cl (mm)	cl (mm)	required dcr (mm)	dcr (mm)
Supplementary information:						

TABLE: Ball Pressure Test of Thermoplastics			
Allowed impression diameter (mm) ..... :			—
Object/ Part No./ Material	Manufacturer/ trademark	Test temperature (°C)	Impression diameter (mm)
External material		125	0,8
Rail clip		71	0,45
Supplementary information:			

TABLE: Needle- flame test (NFT)					
Object/ Part No./ Material	Manufacturer/ trademark	Duration of application of test flame (ta); (s)	Ignition of specified layer Yes/No	Duration of burning (tb) (s)	Verdict
Supplementary information: NFT not relevant (or applicable) for Parts of material classified as V-0 or V-1 NFT not relevant (or applicable) for Base material of PCBs classified as V-0 or if relevant VTM-0					

TABLE: Glow-wire test			F
part under test	material designation	test temperature (°C)	remarks
Rocker (sample 2)	Thermoplastic	651	P
Rocker (sample 3)	Thermoplastic	650	P
Rocker (sample 4)	Thermoplastic	650	P
Enclosure (sample 2)	Thermoplastic	959	F
Enclosure (sample 3)	Thermoplastic	959	F
Enclosure (sample 4)	Thermoplastic	960	F
Supplementary information:			

TABLE: Resistance to heat and fire - Glow wire tests								
Object/ Part No./ Material	Manufacturer / trademark	Glow wire test (GWT); (°C)						Verdict
		550	650		750		850	
			te	ti	te	ti		

Object/ Part No./ Material	Manufacturer / trademark	Glow-wire flammability index (GWFI), °C				GW ignition temp. (GWIT), °C		Verdict
		550	650	750	850	675	775	

The test specimen passed the glow wire test (GWT) with no ignition [(te – ti) ≤ 2s] (Yes/No):								
If no, then surrounding parts passed the needle-flame test of annex E (Yes/No)								
The test specimen passed the test by virtue of most of the flaming material being withdrawn with the glow-wire (Yes/No)?								
Ignition of the specified layer placed underneath the test specimen (Yes/No)								
Supplementary information: 550 °C GWT not relevant (or applicable) to parts of material classified at least HB40 or if relevant HBF The GWIT pre-selection option, the 850 °C GWFI pre-selection option, and the 850 °C GWT are not relevant (or applicable) for attended appliances.								

TABLE: Threaded Part Torque Test			
Threaded part identification	**Diameter of thread (mm)**	**Column number (I, II, or III)**	**Applied torque (Nm)**
Supplementary information:			

List of test equipment used:

A completed list of used test equipment shall be provided in the Test Reports when a Manufacturer Testing Laboratory according to CTF stage 1 or CTF stage 2 procedure has been used.
Note: This page may be removed when CTF stage 1 CTF stage 2 are not used. See also clause 4.8 in OD 2020 for more details.

Clause	Measurement / testing	Testing / measuring equipment / material used, (Equipment ID)	Range used	Last Calibration date	Calibration due date
		ELE-282			
		ELE-234			
		LME-P-2808			
		LEL-024			
		ELE-289			
		ELE-233			
		ELE-149			
		ELE-270			
		LEL-009			
		CBL-C-0801			
		LME-P-1405			
		LME-P-1406			
		LME-P-1404			
		LME-P-0702			
		LME-K-09			
		LME-K-0611			
		LME-K-0604			
		LME-P-2613			
		LEL-015			
		LME-P-0304			
		ELE-265			
		LME-U-03			

Statement of Measurement Uncertainty

The Test Report shall include a statement concerning the uncertainty of the measurement systems used for the tests conducted when it is required by the standard, client or other authorities.
In such cases, the table below is to be used for reporting U of M.

This page may be removed from the final Test Report when not required. See also clause 4.8 in OD 2020 for more details.

Clause #	Parameter/ Measurement / test method	Requirement % or k	Calculated U of M*

*Note: Calculations leading to the reported value are on file with the NCB

End of the report

APPENDIX B

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----- END OF REPORT -----