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# 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.** ..... : | 180801235SHA-002 |
| **Date of issue** ..... : | 2018-08-27 |
| **Total number of pages** ..... | 36 |
| **Applicant's name** ..... : | Wenzhou Huajia Electrical Equipment Co., Ltd. |
| **Address** ..... : | No. 311, LATITUDE FIFTEEN ROAD, YUEQING ECONOMIC DEVELOPMENT ZONE, ZHEJIANG, CHINA. |
| **Test specification:** | |
| **Standard** ..... : | IEC 60898-1: 2015 |
| **Test procedure** ..... : | CB scheme |
| **Non-standard test method** ..... : | N/A |
| **Test Report Form No.** ..... : | IEC60898_1D |
| **Test Report Form(s) Originator** .... : | DEKRA Certification B.V. |
| **Master TRF** ..... : | Dated 2015-09 |



If this Test Report Form is used by non-IECEE members, the IECEE/IEC logo and the reference to the CB Scheme procedure shall be removed.

**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** ..... : | Circuit-breakers with overcurrent protection |
| **Trade Mark** ..... : | TEXENERGO |
| **Manufacturer** ..... : | Wenzhou Huajia Electrical Equipment Co., Ltd.<br>No. 311, LATITUDE FIFTEEN ROAD, YUEQING ECONOMIC DEVELOPMENT ZONE, ZHEJIANG, CHINA. |
| **Model/Type reference** ..... : | SGP |
| **Ratings** ..... : | $U_e$= 400V~(230V~) (2P)<br>$I_n$= 6, 10, 16, 20, 25, 32, 40, 50, 63A |

| | | | |
|---|---|---|---|
| **Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):** | | | |
| ☒ | **CB Testing Laboratory:** | Intertek Testing Services Shanghai | |
| **Testing location/ address ..... :** | | Building No.86, 1198 Qinzhou Road (North), Shanghai 200233, China | |
| ☒ | **Associated CB Testing Laboratory:** | Inspection Center of Products' Quality of Low Voltage Electric Apparatus in Zhejiang Province | |
| **Testing location/ address ..... :** | | No. 400 Guangqiong Rd., Jiaxing, Zhejiang, China | |
| **Tested by (name, function, signature) ..... :** | | Mark He | Mark He |
| **Approved by (name, function, signature) .. :** | | Quiet Lin | |
| | | | |
| ☐ | **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) :** | | | |

**Summary of testing:**
**The products mentioned in this test report comply with IEC 60 898-1:2015.**

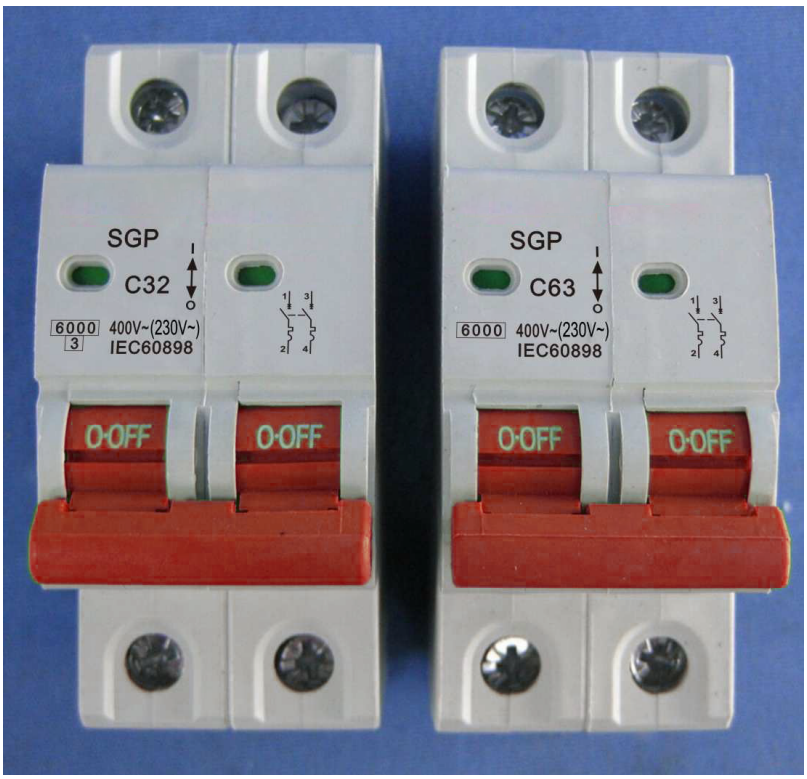
| Clause | Testing items | Testing location |
|---|---|---|
| 6 | Marking and other product information | CBTL |
| 8.1.1 | General | CBTL |
| 8.1.2 | Mechanism | CBTL |
| 8.1.3 | Clearances and creepage distances | CBTL |
| 8.1.6 | Non-interchangeability | CBTL |
| 9.3 | Test of Indelibility of marking | CBTL |
| 9.4 | Test of reliability of screws, current-carrying parts and connections. | CBTL |
| 9.5 | Reliability of terminals for external conductors | CBTL |
| 9.6 | Test of protection against electric shock | CBTL |
| 9.7 | Test of dielectric properties | |
| 9.7.1 | Resistance to humidity | CBTL |
| 9.7.2 | Insulation resistance of the main circuit | CBTL |
| 9.7.3~9.7.6 | Dielectric strength | CBTL |
| 9.8 | Test of temperature-rise | CBTL |
| 9.9 | 28-days test | ACTL |
| 9.10 | Tripping characteristic | ACTL |
| 9.11 | Mechanical and electrical endurance | ACTL |
| 9.12 | short circuit | ACTL |
| 9.13 | Resistance to mechanical shock and impact | CBTL |
| 9.14 | Resistance to heat | CBTL |
| 9.15 | Resistance to abnormal heat and to fire | CBTL |
| 9.16 | Resistance to rust | CBTL |

**Summary of compliance with National Differences:**

☒ **The product fulfils the requirements of EN 60898-1:2003 + A1:2004 + A11:2006 + A12:2008 + A13:2012**.

**See ATTACHMENT TO TEST REPORT IEC 60898-1 EUROPEAN GROUP DIFFERENCES AND NATIONAL DIFFERENCES ON PAGE 28.**

**Copy of marking plate:**



| | |
|---|---|
| **Test item particulars** ..... | |
| Type of circuit-breaker .....: | SGP |
| Number of poles .....: | ☐ 1-P ☐ 1-P+N ☒ 2-P<br>☐ 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<br>☐ associated with the mechanical mounting |
| Type of terminal .....: | ☐ screw [a) b)] ☒ pillar [a) b)] ☐ cage [a) b)] ☐ lug<br>☐ screw less[a)] ☐ flat quick connect [a)]<br>☐ plug-in ☐ screw-in<br>[a)] copper conductors<br>[b)] aluminium conductors |
| Instantaneous tripping current .....: | ☒B ☒ C ☐ D |
| $I^2t$ characteristic .....: | Energy limiting class 3 (In≤32A) |
| Value of rated operational voltage (Ue).....: | ☐ 120 V ☐ 230 V ☐ 240 V<br>☐ 120/240 V ☐ 230/400 V ☒ 400 V(230V)<br>☐ 240/415 V ☐ 415 V |
| Value of rated current (In).....: | 6, 10, 16, 20, 25, 32, 40, 50, 63A |
| 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<br>☐ 10 kA ☐ 15 kA ☐ 20 kA ☐ 25 kA |
| Rated impulse withstand voltage (Uimp) | ☐ 2,5 kV ☒ 4 kV ☐ declared ___kV |
| Material group and CTI declared by manufacturer…: | ☐ Group I, (600 V ≤ CTI)<br>☐ Group II, (400 V ≤ CTI < 600 V)<br>☒ Group IIIa, (175 V ≤ CTI < 400 V) |
| **Classification of installation and use .....** | Rail installed |
| **Supply Connection.....** | Cable connected |
| **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.....** | 2016-02-23 |
| **Date (s) of performance of tests.....** | From 2016-02-25 to 2016-04-12 |

**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.**

**This test report is valid only being read together with the test reports of 180801235SHA-001, -003, -004.**



**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**<br>☒ **Not applicable** |

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

**Name and address of factory (ies) ..... :** Wenzhou Huajia Electrical Equipment Co., Ltd.
No. 311, LATITUDE FIFTEEN ROAD, YUEQING ECONOMIC DEVELOPMENT ZONE, ZHEJIANG, CHINA.

**General product information:**

$U_e$= 230/400V~(1P), 400V~(230V~)(2P), 400V~(3P, 4P)

$I_n$= 6, 10, 16, 20, 25, 32, 40, 50, 63A

$I_{cs}$= $I_{cn}$= 6000A, B- and C-type

Energy limiting class 3 (6~32A, B- and C-type)

Number of tests for simplified test procedure, according to table C.3 and C.4

| Report ref.No | No. of poles | $I_n$(A) | Type | Test sequence and number of samples | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | A | B | $C_1$ | $C_2$ | $D_0$+$D_1$ | $D_0$ | $E_1$ | $E_2$ | $E_3$ [b)] |
| **180801235SHA-001** | **1P** | **63** | **C** | **x** | **x** | **x** | **x** | **x** | **-** | **x** | **-** | **-** |
| | **1P** | **63** | **B** | **-** | **x[d)]** | **-** | **-** | **-** | **x [a)]** | **-** | **-** | **-** |
| | **1P** | **50** | **B,C** | **-** | **-** | **-** | **-** | **-** | **x [a)]** | **-** | **-** | **-** |
| | **1P** | **40** | **B,C** | **-** | **-** | **-** | **-** | **-** | **x [a)]** | **-** | **-** | **-** |
| | **1P** | **32** | **B,C** | **-** | **-** | **-** | **-** | **-** | **x [a)]** | **-** | **x** | **-** |
| | **1P** | **25** | **B,C** | **-** | **-** | **-** | **-** | **-** | **x [a)]** | **-** | **-** | **-** |
| | **1P** | **20** | **B,C** | **-** | **-** | **-** | **-** | **-** | **x [a)]** | **-** | **-** | **-** |
| | **1P** | **16** | **B,C** | **-** | **-** | **-** | **-** | **-** | **x [a)]** | **-** | **x** | **-** |
| | **1P** | **10** | **B,C** | **-** | **-** | **-** | **-** | **-** | **x [a)]** | **-** | **-** | **-** |
| | **1P** | **6** | **B,C** | **-** | **-** | **-** | **-** | **-** | **x [a)]** | **x** | **-** | **-** |
| **180801235SHA-002** | **2P** | **63** | **C** | **x[e)]** | **-** | **-** | **x** | **-** | **-** | **x** | **-** | **-** |
| | **2P** | **32** | **B,C** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **x** | **-** |
| | **2P** | **16** | **B,C** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **x** | **-** |
| | **2P** | **6** | **C** | **-** | **-** | **-** | **-** | **-** | **-** | **x** | **-** | **-** |
| **180801235SHA-003[c)]** | **3P** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** |
| **180801235SHA-004** | **4P** | **63** | **C** | **x** | **x** | **x** | **x** | **x** | **-** | **x** | **-** | **-** |
| | **4P** | **63** | **B** | **-** | **x[d)]** | **-** | **-** | **-** | **-** | **-** | **-** | **-** |
| | **4P** | **32** | **B,C** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **x** | **-** |
| | **4P** | **16** | **B,C** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **x** | **-** |
| | **4P** | **6** | **C** | **-** | **-** | **-** | **-** | **-** | **-** | **x** | **-** | **-** |

Note:

a): For this test sequence only test of clause 9.10.2 (only for B type) is required according to the table C.4.

b): Test sequence in EN 60898-1, due to $I_{cn1}$=$I_{cn}$, the test sequence is omitted.

c): The tests of three-pole circuit-breakers are omitted when four-pole circuit-breakers have been tested according to IEC60 898-1 Annex C;

d): For this test sequence only test of clause 9.8 is required according to the table C.4

e): Only 8.11 and 9.15 of test sequence A2 is performed.

| IEC 60898-1 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |

| | **TESTS „$A_2$“ 3 samples: C63, 2P** | **$A_{2-1}$ $A_{2-2}$ $A_{2-3}$** | |
|---|---|---|---|
| **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 |
| | external parts retaining current-carrying parts and parts of the protective circuit<br>in position ..... (960 ± 15)°C | Enclosure | P |
| | all other external parts ..... (650 ± 10)°C | Handle | P |
| | No visible flames, no sustained glowing, or | Handle | P |
| | flames and glowing extinguish within 30 s after removal .....: | 5,5s Enclosure | P |
| | No ignition of tissue paper or scorching of the pinewood board | | P |

| | **TESTS „C“ 3 samples: C63, 2P** | | | |
|---|---|---|---|---|
| **9.12.11.2.2** | **Test „$C_2$“ Short-circuit test on circuit-breakers for use in IT systems** | | | |
| | Short-circuit test on circuit-breakers for use in IT systems: Fig. 4 | Figure 4 | | -- |
| | Test current: | Obtained | | |
| | - 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 | Itest= 760A | | -- |
| | Test voltage 1,05 Un | U test = 442V | | -- |
| | Power factor 0,93-0,98 | 0,96 | | -- |
| 9.12.9.2 | Test in free air<br>copper wire F': ☐ 0,12 mm / ☒ 0,16 mm<br>resistor R' : ☐ 0,75 Ohm / ☒ 1,5 Ohm | "a" = 35 mm | | P |
| 9.12.9.3 | Test in enclosures<br>copper wire F': ☐ 0,12 mm / ☐ 0,16 mm<br>resistor R' : ☐ 0,75 Ohm / ☐ 1,5 Ohm | dimension of enclosure:<br>_____x_____x_____mm | | N/A |
| | $I_{Peak}$ (A) max. value | 970A | | P |
| | Sequence: "O" + "CO" on each protected pole | [$kA^2s$] | [$kA^2s$] | -- |
| | Shifted point 30 ° on the other protected pole | **$C_{2-1}$** | **$C_{2-2}$** | -- |

| IEC 60898-1 | | | | |
|---|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | | Verdict |
| | Max. $I^2t \leq$ _____$kA^2s$ L1 | 14,7 | 15,7 | P |
| | L2 | 14,3 | 16,8 | P |
| | L3 | _ | _ | |
| | L4 (N) | _ | _ | |
| | - 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. | | | -- |
| | a) leakage current across open contacts, according to 9.7.5.3, each pole is supplied at a voltage 1,1 times Un.= 457 V. The circuit – breaker is in the open position | **$C_{2-1}$** [µA] | **$C_{2-2}$** [µA] | -- |
| | The leakage current shall not exceed 2 mA L1 | 6,20 | 7,40 | P |
| | L2 | 6,20 | 7,10 | P |
| | L3 | - | - | N/A |
| | L4(N) | - | - | N/A |
| | Electric strength test: | | | |
| | Test voltage 1500 V (see 9.7.2) | | | |
| | a) | | | P |
| | b) | | | P |
| | c) | | | P |
| | d) | | | N/A |
| | e) 2000 V | | | N/A |

| | **TESTS „$E_1$“ 3 samples: C63, 2P** | | | | |
|---|---|---|---|---|---|
| **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) .....: | $6,00x10^3$ A | | | |
| | Test circuit: figure .....: | Figure 3 | | | |
| | Test voltage 1,05 Un | 444V | | | |
| | Prospective current .....: | $6,00x10^3$ A | | | |
| | Prospective current obtained .....: | $6,04x10^3$ A | | | |
| | Power factor .....: | 0,65~0,70 | | | |
| | Power factor obtained .....: | 0,67 | | | |
| | Sequence .....: | O-O-CO | | | |
| | T (min) .....: | 3min | | | |

| IEC 60898-1 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |

| | | | | | |
|---|---|---|---|---|---|
| 9.12.9.2 | Test in free air<br>copper wire F': ☐ 0,12 mm / ☒ 0,16 mm<br>resistor R' : ☐ 0,75 Ohm / ☒ 1,5 Ohm | "a" = 45 mm | | | P |
| 9.12.9.3 | Test in enclosures<br>copper wire F': ☐ 0,12 mm / ☐ 0,16 mm<br>resistor R' : ☐ 0,75 Ohm / ☐ 1,5 Ohm | dimensions of enclosure:<br>_____x_____x_____mm | | | N/A |
| | $I_{Peak}$ (A) max. value.....: | 4,28x10$^3$A | | | |
| | $I^2t \leq$ _____ kA$^2$s | [KA$^2$S] | [KA$^2$S] | [KA$^2$S] | |
| | Max. $I^2t \leq$ _____kA$^2$s L1<br>L2<br>L3<br>L4(N) | 38,5<br>38,5<br>–<br>– | 46,8<br>46,8<br>–<br>– | 70,5<br>70,5<br>–<br>– | P |
| | - 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. | | | | |
| | a) leakage current across open contacts, according to 9.7.5.3, each pole is supplied at a voltage 1,1 times Un.= 457 V. The circuit – breaker is in the open position | **$E_{1-1}$** [µA] | **$E_{1-2}$** [µA] | **$E_{1-3}$** [µA] | -- |
| | The leakage current shall not exceed 2 mA L1 | 6,23 | 5,84 | 5,74 | P |
| | L2 | 5,21 | 6,11 | 6,03 | P |
| | L3 | - | - | - | N/A |
| | L4(N) | - | - | - | N/A |
| | Electric strength test: | | | | |
| | Test voltage 1500 V (see 9.7.2) | | | | |
| | a) | | | | P |
| | b) | | | | P |
| | c) | | | | P |
| | d) | | | | N/A |
| | e) 2000 V | | | | N/A |
| | Test current 0.85x non-tripping current (1,13 $I_N$ ) | 61,0A | | | |
| | - Passed for 1h | >1h | >1h | >1h | P |
| | - Passed for 2h | | | | N/A |
| | Current is then steadily increased to 1,1 x tripping current (1,45 $I_N$ ) within 5s | 101A | | | |

| IEC 60898-1 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |

| | | $E_{1-1}$ [min] | $E_{1-2}$ [min] | $E_{1-3}$ [min] | |
|---|---|---|---|---|---|
| | Tripping within ☒ 1 hour / ☐ 2 hour | 1,0 | 1,5 | 1,0 | P |

| | **TESTS „$E_1$“ 3 samples: C6, 2P** | | | | |
|---|---|---|---|---|---|
| **9.12.11.4.2** | **Test $E_1$: Test at service short-circuit capacity** | **$E_{1-4}$** | **$E_{1-5}$** | **$E_{1-6}$** | |
| | Service short-circuit capacity (Ics) .....: | 6,00x10³ A | | | |
| | Test circuit: figure .....: | Figure 3 | | | |
| | Test voltage 1,05 Un | 444V | | | |
| | Prospective current .....: | 6,00x10³ A | | | |
| | Prospective current obtained .....: | 6,05x10³ A | | | |
| | Power factor .....: | 0,65~0,70 | | | |
| | Power factor obtained .....: | 0,67 | | | |
| | Sequence .....: | O-O-CO | | | |
| | T (min) .....: | 3min | | | |
| 9.12.9.2 | Test in free air<br>copper wire F': ☐ 0,12 mm / ☒ 0,16 mm<br>resistor R' : ☐ 0,75 Ohm / ☒ 1,5 Ohm | "a" = 45 mm | | | P |
| 9.12.9.3 | Test in enclosures<br>copper wire F': ☐ 0,12 mm / ☐ 0,16 mm<br>resistor R' : ☐ 0,75 Ohm / ☐ 1,5 Ohm | dimensions of enclosure:<br>_____x_____x_____mm | | | N/A |
| | $I_{Peak}$ (A) max. value .....: | 3,02x10³A | | | |
| | $I^2t \leq$ _____ $kA^2s$ | [$KA^2S$] | [$KA^2S$] | [$KA^2S$] | |
| | Max. $I^2t \leq$ _____$kA^2s$ L1<br>L2<br>L3<br>L4(N) | 32,5<br>32,5<br>_<br>_ | 22,3<br>22,3<br>_<br>_ | 25,8<br>25,8<br>_<br>_ | P |
| | - 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. | | | | |
| | a) leakage current across open contacts, according to 9.7.5.3, each pole is supplied at a voltage 1,1 times Un.= 457 V. The circuit – breaker is in the open position | **$E_{1-4}$** [µA] | **$E_{1-5}$** [µA] | **$E_{1-6}$** [µA] | -- |

| IEC 60898-1 | | | | | |
|---|---|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | | | Verdict |
| | The leakage current shall not exceed 2 mA L1 | 10,5 | 10,8 | 10,6 | P |
| | L2 | 11,3 | 10,7 | 10,4 | P |
| | L3 | - | - | - | N/A |
| | L4(N) | - | - | - | N/A |
| | Electric strength test: | | | | |
| | Test voltage 1500 V (see 9.7.2) | | | | |
| | a) | | | | P |
| | b) | | | | P |
| | c) | | | | P |
| | d) | | | | N/A |
| | e) 2000 V | | | | N/A |
| | Test current 0.85x non-tripping current (1,13 $I_N$ ) | 5,8A | | | |
| | - Passed for 1h | >1h | >1h | >1h | P |
| | - Passed for 2h | | | | N/A |
| | Current is then steadily increased to 1,1 x tripping current (1,45 $I_N$ ) within 5s | 9,6A | | | |
| | | **$E_{1-4}$** [min] | **$E_{1-5}$** [min] | **$E_{1-6}$** [min] | |
| | Tripping within ☒ 1 hour / ☐ 2 hour | 0,6 | 1,5 | 0,5 | P |

| | **TESTS „$E_2$“ 3 samples: C32, 2P** | | | | |
|---|---|---|---|---|---|
| **9.12.11.4.3** | **Test: E2 (Test at rated short-circuit capacity)** | **$E_{2-1}$** | **$E_{2-2}$** | **$E_{2-3}$** | |
| | Rated short-circuit capacity (Icn)..... : | 6,00x10$^3$ A | | | -- |
| | Test circuit: figure ..... : | Figure 3 | | | -- |
| | Test voltage 1,05 Un | 444V | | | -- |
| | Prospective current ..... : | 6,00x10$^3$ A | | | |
| | Prospective current obtained ..... : | 6,05x10$^3$ A | | | |
| | Power factor ..... : | 0,65~0,70 | | | |
| | Power factor obtained ..... : | 0,67 | | | |
| | Sequence ..... : | O-CO | | | |
| | T (min) ..... : | 3min | | | |
| 9.12.9.2 | Test in free air<br>copper wire F': ☐ 0,12 mm / ☒ 0,16 mm<br>resistor R' : ☐ 0,75 Ohm / ☒ 1,5 Ohm | “a” = 45 mm | | | P |
| 9.12.9.3 | Test in enclosures<br>copper wire F': ☐ 0,12 mm / ☐ 0,16 mm<br>resistor R' : ☐ 0,75 Ohm / ☐ 1,5 Ohm | dimensions of enclosure:<br>_____x_____x_____mm | | | N/A |
| | $I_{Peak}$ (A) max. value ..... : | 3,80X10$^3$A | | | -- |

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|---|---|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | | | Verdict |
| | $I^2t \leq$ 52 $kA^2s$ | [$KA^2S$] | [$KA^2S$] | [$KA^2S$] | -- |
| | Max. $I^2t \leq 52\ kA^2s$ L1<br>L2<br>L3<br>L4(N) | 45,1<br>45,1<br>___<br>___ | 28,7<br>45,1<br>___<br>___ | 45,6<br>45,1<br>___<br>___ | P |
| | - 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: | | | | -- |
| 9.12.12.2 | 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.= 457 V. The circuit – breaker is in the open position | **$E_{2-1}$**<br>[µA] | **$E_{2-2}$**<br>[µA] | **$E_{2-3}$**<br>[µA] | -- |
| | The leakage current shall not exceed 2 mA L1 | 8,00 | 9,50 | 8,80 | P |
| | L2 | 8,90 | 9,10 | 8,60 | P |
| | L3 | - | - | - | N/A |
| | L4(N) | - | - | - | N/A |
| | Electric strength test: | | | | |
| | Test voltage 900 V (see 9.7.3) | | | | |
| | a) | | | | P |
| | b) | | | | P |
| | c) | | | | P |
| | d) | | | | N/A |
| | e) | | | | N/A |
| | Test current 2,8 $I_N$ | 89,6A | | | |
| | Tripping within > 0,1 s up to | [S] | [S] | [S] | |
| | - 60 s | 10 | 8 | 8 | P |
| | - 120 s | - | - | - | N/A |

| | **TESTS „$E_2$“ 3 samples: C16, 2P** | | | | |
|---|---|---|---|---|---|
| **9.12.11.4.3** | **Test: E2 (Test at rated short-circuit capacity)** | **$E_{2-4}$** | **$E_{2-5}$** | **$E_{2-6}$** | |
| | Rated short-circuit capacity (Icn)..... : | $6,00x10^3$ A | | | -- |
| | Test circuit: figure..... : | Figure 3 | | | -- |
| | Test voltage 1,05 Un | 444V | | | -- |

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|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |

| | | | | | |
|---|---|---|---|---|---|
| | Prospective current .....: | $6{,}00 \times 10^3$ A | | | |
| | Prospective current obtained .....: | $6{,}05 \times 10^3$ A | | | |
| | Power factor .....: | 0,65~0,70 | | | |
| | Power factor obtained .....: | 0,67 | | | |
| | Sequence .....: | O-CO | | | |
| | T (min) .....: | 3min | | | |
| 9.12.9.2 | Test in free air<br>copper wire F': ☐ 0,12 mm / ☒ 0,16 mm<br>resistor R' : ☐ 0,75 Ohm / ☒ 1,5 Ohm | "a" =45mm | | | P |
| 9.12.9.3 | Test in enclosures<br>copper wire F': ☐ 0,12 mm / ☐ 0,16 mm<br>resistor R' : ☐ 0,75 Ohm / ☐ 1,5 Ohm | dimensions of enclosure:<br>_____x_____x_____mm | | | N/A |
| | $I_{Peak}$ (A) max. value .....: | $2{,}90 \times 10^3$ A | | | -- |
| | $I^2t \leq$ 40 $kA^2s$ | [$KA^2S$] | [$KA^2S$] | [$KA^2S$] | -- |
| | Max. $I^2t \leq$ 40 $kA^2s$ L1 | 16,4 | 8,1 | 26,2 | P |
| | L2 | 16,4 | 8,1 | 26,2 | |
| | L3 | ___ | ___ | ___ | |
| | L4(N) | ___ | ___ | ___ | |
| | - 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: | | | | -- |
| 9.12.12.2 | 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.= 457 V. The circuit – breaker is in the open position | **$E_{2\text{-}4}$** [µA] | **$E_{2\text{-}5}$** [µA] | **$E_{2\text{-}6}$** [µA] | -- |
| | The leakage current shall not exceed 2 mA L1 | 8,40 | 8,70 | 8,50 | P |
| | L2 | 8,50 | 8,40 | 8,60 | P |
| | L3 | - | - | - | N/A |
| | L4(N) | - | - | - | N/A |
| | Electric strength test: | | | | |
| | Test voltage 900 V (see 9.7.3) | | | | |
| | a) | | | | P |
| | b) | | | | P |
| | c) | | | | P |
| | d) | | | | N/A |

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|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |

| | | | | | |
|---|---|---|---|---|---|
| | e) | | | | N/A |
| | Test current 2,8 $I_N$ | 44,8A | | | |
| | Tripping within > 0,1 s up to | [S] | [S] | [S] | |
| | - 60 s | 24,0 | 48,0 | 44,0 | P |
| | - 120 s | - | - | - | N/A |

| | | | | | |
|---|---|---|---|---|---|
| | **TESTS „$E_2$“ 3 samples: B32, 2P** | | | | |
| **9.12.11.4.3** | **Test: E2 (Test at rated short-circuit capacity)** | **$E_{2-7}$** | **$E_{2-8}$** | **$E_{2-9}$** | |
| | Rated short-circuit capacity (Icn)..... : | 6,00x10³ A | | | -- |
| | Test circuit: figure..... : | Figure 3 | | | -- |
| | Test voltage 1,05 Un | 444V | | | -- |
| | Prospective current ..... : | 6,00x10³ A | | | |
| | Prospective current obtained ..... : | 6,05x10³ A | | | |
| | Power factor ..... : | 0,65~0,70 | | | |
| | Power factor obtained ..... : | 0,67 | | | |
| | Sequence ..... : | O-CO | | | |
| | T (min) ..... : | 3min | | | |
| 9.12.9.2 | Test in free air<br>copper wire F': ☐ 0,12 mm / ☒ 0,16 mm<br>resistor R' : ☐ 0,75 Ohm / ☒ 1,5 Ohm | “a” =45mm | | | P |
| 9.12.9.3 | Test in enclosures<br>copper wire F': ☐ 0,12 mm / ☐ 0,16 mm<br>resistor R' : ☐ 0,75 Ohm / ☐ 1,5 Ohm | dimensions of enclosure:<br>_____x_____x_____mm | | | N/A |
| | $I_{Peak}$ (A) max. value..... : | 2,89x10³ A | | | -- |
| | $I^2t \leq$ 45 $kA^2s$ | [$KA^2S$] | [$KA^2S$] | [$KA^2S$] | -- |
| | Max. $I^2t \leq$ 45 $kA^2s$ L1<br>L2<br>L3<br>L4(N) | 20,2<br>20,2<br>___<br>___ | 16,1<br>16,1<br>___<br>___ | 25,6<br>25,6<br>___<br>___ | P |
| | - 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: | | | | -- |
| 9.12.12.2 | 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.= 457 V. The circuit – breaker is in the open position | **$E_{2-7}$** [µA] | **$E_{2-8}$** [µA] | **$E_{2-9}$** [µA] | -- |
| | The leakage current shall not exceed 2 mA L1 | 10,9 | 10,5 | 11,7 | P |
| | L2 | 11,4 | 11,1 | 12,0 | P |
| | L3 | - | - | - | N/A |
| | L4(N) | - | - | - | N/A |
| | Electric strength test: | | | | |
| | Test voltage 900 V (see 9.7.3) | | | | |
| | a) | | | | P |
| | b) | | | | P |
| | c) | | | | P |
| | d) | | | | N/A |
| | e) | | | | N/A |
| | Test current 2,8 $I_N$ | 89,6A | | | |
| | Tripping within > 0,1 s up to | [S] | [S] | [S] | |
| | - 60 s | 9 | 14 | 13 | P |
| | - 120 s | - | - | - | N/A |

| | | | | | |
|---|---|---|---|---|---|
| | **TESTS „$E_2$“ 3 samples: B16, 2P** | | | | |
| **9.12.11.4.3** | **Test: E2 (Test at rated short-circuit capacity)** | **$E_{2-10}$** | **$E_{2-11}$** | **$E_{2-12}$** | |
| | Rated short-circuit capacity (Icn)..... : | 6,00x10$^3$ A | | | -- |
| | Test circuit: figure..... : | Figure 3 | | | -- |
| | Test voltage 1,05 Un | 444V | | | -- |
| | Prospective current ..... : | 6,00x10$^3$ A | | | |
| | Prospective current obtained ..... : | 6,05x10$^3$ A | | | |
| | Power factor ..... : | 0,65~0,70 | | | |
| | Power factor obtained ..... : | 0,67 | | | |
| | Sequence ..... : | O-CO | | | |
| | T (min)..... : | 3min | | | |
| 9.12.9.2 | Test in free air<br>copper wire F': ☐ 0,12 mm / ☒ 0,16 mm<br>resistor R' : ☐ 0,75 Ohm / ☒ 1,5 Ohm | “a” =45mm | | | P |
| 9.12.9.3 | Test in enclosures<br>copper wire F': ☐ 0,12 mm / ☐ 0,16 mm<br>resistor R' : ☐ 0,75 Ohm / ☐ 1,5 Ohm | dimensions of enclosure:<br>_____x_____x_____mm | | | N/A |
| | $I_{Peak}$ (A) max. value..... : | 3,19x10$^3$ A | | | -- |
| | $I^2t \leq$ 35 kA$^2$s | [KA$^2$S] | [KA$^2$S] | [KA$^2$S] | -- |

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|---|---|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | | | Verdict |
| | Max. $I^2t \leq$ 35 $kA^2s$ L1 | 32,2 | 28,7 | 31,8 | P |
| | L2 | 32,2 | 28,7 | 31,8 | |
| | L3 | ___ | ___ | ___ | |
| | L4(N) | ___ | ___ | ___ | |
| | - 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: | | | | -- |
| 9.12.12.2 | 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.= 457 V. The circuit – breaker is in the open position | **$E_{2\text{-}10}$** [µA] | **$E_{2\text{-}11}$** [µA] | **$E_{2\text{-}12}$** [µA] | -- |
| | The leakage current shall not exceed 2 mA L1 | 7,80 | 8,00 | 9,00 | P |
| | L2 | 7,80 | 8,40 | 9,20 | P |
| | L3 | - | - | - | N/A |
| | L4(N) | - | - | - | N/A |
| | Electric strength test: | | | | |
| | Test voltage 900 V (see 9.7.3) | | | | |
| | a) | | | | P |
| | b) | | | | P |
| | c) | | | | P |
| | d) | | | | N/A |
| | e) | | | | N/A |
| | Test current 2,8 $I_N$ | 44,8A | | | |
| | Tripping within > 0,1 s up to | [S] | [S] | [S] | |
| | - 60 s | 7 | 19 | 11 | P |
| | - 120 s | - | - | - | N/A |

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|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| | **Annex E** | | |
| | Special requirements for auxiliary circuits for safety extra-low voltage | | |
| **8.1.3** | **Clearances and creepage distances** | | |
| | Additional note to table 4<br>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 | | N/A |
| **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 | | N/A |
| | **Annex J** | | |
| | Particular requirements for circuit-breakers with screw less type terminals for external copper conductors (In not exceeding 20 A, cross-sectional area up to 4 $mm^2$ | | |
| **J.6** | **Marking** | | |
| | Universal terminals | | -- |
| | - no marking | | N/A |
| | 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 | | N/A |
| **J.8** | **Constructional requirements** | | |
| | Clause 8 applies with the follow modifications: | | N/A |
| | In clause 8.1.5 only –5.1, -5.2. –5.3, - 5.6 and - 5.7 apply | | N/A |
| | Compliance is checked by inspection and by the tests of J.9.1 and J.9.2 | | N/A |
| **J.8.1** | **Connection or disconnection of conductors** | | |
| | The connection or disconnection shall be made by: | | N/A |

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|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| | A general purpose tool or by a convenient device integral with the terminal or | | N/A |
| | for rigid conductors by simple insertion | | N/A |
| | For disconnection an operation other than a pull shall be necessary (push-wire terminals) | | N/A |
| | Universal terminals shall accept rigid (solid or stranded and flexible unprepared conductors | | N/A |
| | Non-universal terminals shall accept conductors declared by the manufacturer | | N/A |
| | Compliance is checked by inspection and by the tests of J.9.1 and J.9.2 | | N/A |
| **J.8.2** | **Dimensions of connectable conductors** | | |
| | The dimensions of connectable conductors are given in table J.1 | | N/A |
| | The ability to connect these conductors shall be checked by inspection and by the tests of J.9.1 and J.9.2 | | N/A |
| **J.8.3** | **Connectable cross-sectional areas** | | |
| | The nominal cross-sections to be clamped are given in table J.2 | | N/A |
| | Compliance is checked by inspection and by the tests of J.9.1 and J.9.2 | | N/A |
| **J.8.4** | **Insertion and connection of conductors** | | |
| | The insertion and disconnection of the conductors shall be made in accordance with the manufacturer's instructions | | N/A |
| **J.8.5** | **Design and construction of terminals** | | |
| | Terminals shall be designed and constructed that: | | N/A |
| | - each conductor is clamped individually | | N/A |
| | - connection or disconnection connectors connected or disconnected separate or same | | N/A |
| | - inadequate insertion of the conductor is avoided | | N/A |
| | Compliance is checked by inspection and by the tests of J.9.1 and J.9.2 | | N/A |
| **J.8.6** | **The terminals shall be resistant to ageing** | | |
| | Compliance is checked by the tests of J.9.3 | | N/A |
| **J.9** | **Tests** | | -- |
| | Clause 9 applies, by replacing 9.4 and 9.5 by the follow | | N/A |
| **J.9.1** | **Test of reliability of screw less terminals** | | |
| **J.9.1.1** | **Reliability of screw less system** | | |
| | 5 times connection and disconnection | | N/A |

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|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| | 3 rigid conductors min. cross-section<br>max. cross-section | _____$mm^2$<br>_____$mm^2$ | N/A |
| | 3 flexible conductors min. cross-section<br>max. cross-section | _____$mm^2$<br>_____$mm^2$ | N/A |
| | After tests, the terminal shall not be damage in such a way as to impair its further use | | N/A |
| **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 | | N/A |
| | rigid conductors min. cross-section<br>max. cross-section | _____$mm^2$<br>_____$mm^2$ | N/A |
| | flexible conductors min. cross-section<br>max. cross-section | _____$mm^2$<br>_____$mm^2$ | N/A |
| | Each conductor is either pushed as far as possible into the terminal or shall be inserted so that adequate connection is obvious | | N/A |
| | After tests, no wire of the conductor shall have escaped outside the terminals | | N/A |
| **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. | | N/A |
| | Each conductor is subjected to a pull force of value shown in table J.3. for 1 min | | N/A |
| | Terminal screw torque : $^2/_3$ of table 11 | _____ Nm | N/A |
| | rigid conductors min. cross-section<br>max. cross-section | _____ $mm^2$ / _____N<br>_____ $mm^2$ / _____N | N/A |
| | flexible conductors min. cross-section<br>max. cross-section | _____ $mm^2$ / _____N<br>_____ $mm^2$ / _____N | N/A |
| | During the test the conductor shall not slip out of the terminal | | N/A |
| **J.9.3** | **Cycling test** | | |
| | The test is carried out with new copper conductors having a cross sectional area according table 10 | _____ $mm^2$ | N/A |
| | 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 | | N/A |
| | - universal terminals for rigid (solid and stranded) and flexible conductors | 3 + 3 samples | N/A |
| | - non-universal terminals for solid conductors only | 3 samples | N/A |

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|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| | -- non- universal terminals for rigid (solid and stranded) conductors | 3 + 3 samples | N/A |
| | - non-universal terminals for flexible conductors only | 3 samples | N/A |
| | The conductors are connected in series as in normal use to each of the three samples as defined on fig. J.1. | | N/A |
| | The sample is provided with a hole or equivalent in order to measure the voltage drop on the terminal | | N/A |
| | The test arrangement is placed in a heating cabinet which is initially on 20°C | | N/A |
| | Except the cooling period the test current (rated current) is applied to the circuit | I test _____ A | N/A |
| | The samples shall be subjected to 192 temperature cycles, each cycle having a duration of +/- 1 hour | | N/A |
| | Description of the temperature cycle:<br>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 | | N/A |
| | 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<br>- either 22,5 mV<br>- or 1,5 times the value measured after the 24 cycle | Uv max. _____ mV | N/A |
| | Sample<br>after 24 cycles: rigid conductors (mV)<br>flexible conductors (mV) | $J_1$ $J_2$ $J_3$<br>_____ _____ _____<br>_____ _____ _____ | N/A |
| | Sample<br>after 192 cycles: rigid conductors (mV)<br>flexible conductors (mV) | $J_1$ $J_2$ $J_3$<br>_____ _____ _____<br>_____ _____ _____ | N/A |
| | After this test the samples shall show no changes evidently impairing further use, such as cracks, deformations or like | | N/A |

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|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |

| | Annex K | | |
|---|---|---|---|
| | 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 | | N/A |
| | a) manufacturers name or trade mark | | N/A |
| | b) type reference | | N/A |
| | c) information on cross-sections of conductors and colour code of insulating female connectors (see table K.1) | | N/A |
| | d) the use of only silver or tin-plated copper alloys | | N/A |
| **K.7** | **Standard conditions for operation in service** | | |
| | Clause 7 applies | | N/A |
| **K.8** | **Constructional requirements** | | |
| | Clause 8 applies with the follow modifications: | | N/A |
| | replacement of 8.1.3 by: | | N/A |
| **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 | | N/A |
| | Replacement of 8.1.5 by: | | N/A |
| **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 | | N/A |
| 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<br>NOTE 1: The use for rated currents up to and including 20 A is accepted in BE, FR, IT, PT, ES and US | | N/A |
| | 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 | | N/A |
| | The dimensions of the female connector which may be fitted-on are given in figure K.6 and in table K.4 | | N/A |

| IEC 60898-1 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| | Compliance is checked by inspection and by measurement | See table on page _____ | N/A |
| **K.8.2.3** | **Male tabs shall be securely retained** | | |
| | Compliance is checked by the mechanical overload test of K.9.1 | | N/A |
| **K.9** | **Tests** | | |
| | Clause 9 applies, with follow modifications: | | N/A |
| | Replacement of 9.5 by: | | N/A |
| **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<br>pull force 88 N | N/A |
| | No damage which could impair further use shall occur to the tab or to the circuit-breaker in which the tab is integrated | | N/A |
| | 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 | | N/A |

| IEC 60898-1 | | | |
|---|---|---|---|
| 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 | _____ | N/A |
| | Hole | 0,5 | 1,0 | _____ | N/A |
| B | Dimple | 7,8 min | | _____ | N/A |
| | Hole | 7,8 min | | _____ | N/A |
| C | Dimple | 0,77 | 0,84 | _____ | N/A |
| | Hole | 0,77 | 0,84 | _____ | N/A |
| D | Dimple | 6,20 | 6,40 | _____ | N/A |
| | Hole | 6,20 | 6,40 | _____ | N/A |
| E | Dimple | 3,6 | 4,1 | _____ | N/A |
| | Hole | 4,3 | 4,7 | _____ | N/A |
| F | Dimple | 1,6 | 2,0 | _____ | N/A |
| | Hole | 1,6 | 2,0 | _____ | N/A |
| J | Dimple | 8° | 12° | _____ | N/A |
| | Hole | 8° | 12° | _____ | N/A |
| M | Dimple | 2,2 | 2,5 | _____ | N/A |
| | Hole | --- | --- | --- | N/A |
| N | Dimple | 1,8 | 2,0 | _____ | N/A |
| | Hole | --- | --- | --- | N/A |
| P | Dimple | 0,7 | 1,8 | _____ | N/A |
| | Hole | 0,7 | 1,8 | _____ | N/A |
| Q | Dimple | 8,9 min | --- | _____ | N/A |
| | Hole | 8,9 min | --- | _____ | N/A |
| B3 | | | 7,8 max | _____ | N/A |
| L2 | | | 3,5 max | _____ | N/A |

| IEC 60898-1 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |

| | Annex L | | |
|---|---|---|---|
| | 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:<br>Copper only<br>Aluminium only<br>Aluminium and copper | <br>☐ None<br>☐ "Al"<br>☐ "Al/Cu" | N/A<br>N/A<br>N/A<br>N/A |
| | 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<br>_____ mm² | N/A |
| **L.7** | **Standard conditions for operation in service** | | |
| | Clause 7 applies | | N/A |
| **L.8** | **Constructional requirements** | | |
| | Clause 8 applies with the following exceptions: | | N/A |
| 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 | | N/A |
| | 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. | | N/A |
| | 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 | | N/A |
| 8.1.5.4 | Terminals shall allow the conductors to be connected without special preparation | | N/A |
| | Compliance is checked by inspection and by the tests of L.9 | | N/A |
| **L.9** | **Tests** | | |

| IEC 60898-1 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |

| | | | | |
|---|---|---|---|---|
| | Clause 9 applies with the following modifications/additions: | | | N/A |
| | 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 | | | N/A |
| | Additionally the test of L.9.2 is carried out on terminals separated from the circuit-breaker | | | N/A |
| **L.9.2** | **Current cycling test** | | | |
| | This test is carried out on separate terminals | | | N/A |
| | The general arrangement of the samples shall be as shown in figure L.1 | | | N/A |
| | 90 % of torque stated by the manufacturer or selected in table 11 used for the specimens | torque:_____Nm | | N/A |
| | The test is carried out with conductors according to table L.5. 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:_____$mm^2$<br>minimum conductor length:_____mm | | N/A |
| | Cross section of equalizer not greater than that given in table L.7 | max. crosssection_____$mm^2$ | | N/A |
| 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.8 | 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 $25^{th}$ 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 | | | |
| | For each screw-type terminal | | | |
| | - the temperature rise shall not exceed 110 K | | | N/A |
| | - the stability factor Sf shall not exceed ± 10 °C | | | N/A |
| | ambient air temperature: _____°C | max. temperature rise [K] | max. stability factor Sf [°C] | N/A |
| | Terminal 1 | | | N/A |

| IEC 60898-1 | | | | |
|---|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | | Verdict |
| | Terminal 2 | | | N/A |
| | Terminal 3 | | | N/A |
| | Terminal 4 | | | N/A |
| | Terminal 5 | | | N/A |
| | Terminal 6 | | | N/A |
| | Terminal 7 | | | N/A |
| | Terminal 8 | | | N/A |

| IEC60898_1C - ATTACHMENT | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |

# ATTACHMENT TO TEST REPORT IEC 60898-1
# EUROPEAN GROUP DIFFERENCES AND NATIONAL DIFFERENCES
# Circuit-breakers for over current protection for household and similar installations

## Part 1 - Circuit-breakers for a.c. operation

**Differences according to** ..... EN 60898-1:2003+A1:2004+A11:2006+A12:2008+A13:2012

**Attachment Form No**. ..... EU_GD_IEC60898_1C

**Attachment Originator** ..... DEKRA

**Master Attachment** ..... 2014-03



| | **CENELEC COMMON MODIFICATIONS (EN)** | | |
|---|---|---|---|
| **Test item particulars** ..... | | | |
| Type of circuit-breaker .....: | SGP | | |
| Energy limiting class .....: | ☐ Class 1<br>☒ Class 3 (In≤32A) | | |
| Value of rated operational voltage (Ue).....: | ☐ 230 V<br>☐ 230/400 V<br>☐ 240/415 V | ☐ 240 V<br>☒ 400 V (230V)<br>☐ 415 V | |
| Rated impulse withstand voltage (Uimp) .....: | 4 kV | | |

| | **Requirements for construction and operation** | | |
|---|---|---|---|
| **9.6** | **Test of protection against electric shock** | | -- |
| | In case of knock-outs the test finger is applied with a force of 10 N | | P |

| | **GENERAL** | | |
|---|---|---|---|
| **9.12** | **Short-circuit tests** | | |
| 9.12.2 | Value of the power frequency recovery voltage shall be equal to 110 % of the rated voltage. | | P |
| 9.12.3 | Tolerances on test quantities | | |
| | voltage (including recovery voltage) : 0, -5% | | P |

| | | | |
|---|---|---|---|
| **9.12.11.2.2** | **Test $C_2$ : Short-circuit test on circuit-breakers for use in IT systems**<br>**2 samples: C63, 2P** | | -- |
| | Test voltage 105 % of 400 V | 442V | P |

| IEC60898_1C - ATTACHMENT | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |

| | | | | | |
|---|---|---|---|---|---|
| | ***TESTS „D“*** | | | | |
| ***9.10*** | ***Tests: $D_O$*** | **$D_{1-1}$** | **$D_{1-2}$** | **$D_{1-3}$** | |
| | If the tests are made in a test chamber, it shall be made in still air; the volume of the chamber shall not affect the test results. | | | | |
| 9.10.2.2 | ☐ For circuit-breakers of the B – Type | | | | |
| | Test current $3I_N$ (A), starting from cold | _____ A | | | |
| | Opening time: | [S] | [S] | [S] | |
| | - 0,1s ≤ t ≤ 45s (≤ 32A) | | | | N/A |
| | - 0,1s ≤ t ≤ 90s (> 32A) | | | | N/A |
| | Moreover the CB shall perform following test: | | | | |
| 9.10.1.2 | Test current 2,55 $I_N$ (A) starting from cold for: | _____ A | | | |
| | opening time not less than 1 s or more than | [S] | [S] | [S] | |
| | - 60 s (≤ 32 A) | | | | N/A |
| | - 120 s (> 32 A) | | | | N/A |
| 9.10.2.3 | ☐ For circuit-breakers of the C – Type | | | | |
| | Test current $5I_N$ (A), starting from cold | | | | |
| | Opening time: | [S] | [S] | [S] | |
| | - 0,1s ≤ t ≤ 15 s (≤ 32A) | | | | N/A |
| | - 0,1s ≤ t ≤ 30 s (> 32A) | | | | N/A |
| | Moreover the CB shall perform following test: | | | | |
| 9.10.1.2 | Test current 2,55 $I_N$ (A) starting from cold for: | | | | |
| | opening time not less than 1 s or more than | [s] | [s] | [s] | |
| | - 60 s (≤ 32 A) | | | | N/A |
| | - 120 s (> 32 A) | | | | N/A |
| 9.10.2.4 | ☐ For circuit-breakers of the D – Type | | | | |
| | Test current $10I_N$ (A), starting from cold | | | | |
| | Opening time: | [S] | [S] | [S] | |
| | - 0,1s ≤ t ≤ 4s (10 A < In ≤ 32 A) | | | | N/A |
| | - 0,1s ≤ t ≤ 8s ( 10 A ≥ In > 32A) | | | | N/A |
| | Test current 20 $I_N$ (A) starting from cold | | | | N/A |
| | Tripping less than 0,1 s | | | | N/A |
| | Moreover the CB shall perform following test: | | | | |
| 9.10.1.2 | Test current 2,55 $I_N$ (A) starting from cold for: | | | | |
| | opening time not less than 1 s or more than | [s] | [s] | [s] | |
| | - 60 s (≤ 32 A) | | | | N/A |
| | - 120 s (> 32 A) | | | | N/A |

| IEC60898_1C - ATTACHMENT | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |

| | **TESTS „$E_3$“** | | | | |
|---|---|---|---|---|---|
| ***9.12.11.4.4*** | ***Test: $E_3$ (Test at making and breaking capacity on an individual pole (Icn1)*** | **$E_{3-1}$** | **$E_{3-2}$** | **$E_{3-3}$** | |
| | Service short-circuit capacity.....: | _____ A | | | -- |
| | Test circuit: figure .....: | *(Simplification of the figures for short circuit tests in IEC 60898-1:2015)* | | | -- |
| | Test voltage.....: | V | | | |
| | Prospective current.....: | _____ A | | | -- |
| | Prospective current obtained.....: | _____ A | | | -- |
| | Power factor.....: | _____ | | | -- |
| | Power factor obtained.....: | _____ | | | -- |
| | Sequence.....: | O – t –CO<br>15° 45° 75° | | | -- |
| | T (min) .....: | _____ min | | | -- |
| 9.12.9.1 | Test in free air<br>copper wire F': ☐ 0,12 mm / ☐ 0,16 mm<br>resistor R' : ☐ 0,75 Ohm / ☐ 1,5 Ohm | "a" = _____ mm | | | |
| 9.12.9.2 | Test in enclosures<br>copper wire F': ☐ 0,12 mm / ☐ 0,16 mm<br>resistor R' : ☐ 0,75 Ohm / ☐ 1,5 Ohm | dimension of enclosure:<br>_____x_____x_____mm | | | |
| | $I_{Peak}$ (A) max. value .....: | _____ A | | | -- |
| | $I^2t \leq$ _____ $kA^2s$ | [$KA^2S$] | [$KA^2S$] | [$KA^2S$] | -- |
| | Max. $I^2t \leq$ _____$kA^2s$ L1<br>L2<br>L3 | | | | N/A |
| | - No permanent arcing | | | | N/A |
| | - No flash-over between poles or between poles and frame | | | | N/A |
| | - No blowing of the fuses F and F′ | | | | N/A |
| | - Polyethylene foil shows no holes | | | | N/A |
| | 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. | | | | |
| | a) leakage current across open contacts, according to 9.7.6.3, each pole is supplied at a voltage 1,1 times Un.= _____ V. The circuit –breaker is in the open position<br>The leakage current shall not exceed 2 mm | **$E_{3-1}$** [µA] | **$E_{3-2}$** [µA] | **$E_{3-3}$** [µA] | |
| | L1 | | | | N/A |
| | L2 | | | | N/A |

| IEC60898_1C - ATTACHMENT | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |

| | | | | | |
|---|---|---|---|---|---|
| | L3 | | | | N/A |
| | L4(N) | | | | N/A |
| | Electric strength test: | | | | |
| | Test voltage 900 V (see 9.7.3) | | | | |
| | a) | | | | N/A |
| | b) | | | | N/A |
| | c) | | | | N/A |
| | d) | | | | N/A |
| | e) 2000 V | | | | N/A |
| | Test current 2,8 $I_N$ | _____ A | | | |
| | Tripping within > 0,1 s up to | [S] | [S] | [S] | |
| | - 60 s | | | | N/A |
| | - 120 s | | | | N/A |

| IEC60898_1C - ATTACHMENT | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |

# Annex ZA
# EN 60898-1:2003/A13:2012
(normative)

**EN 60898-1**

**Classification of circuit-breakers into energy limiting classes**

Circuit-breakers of B-type and C-type, when classified into energy limiting classes 1, 2, 3 in accordance with tables ZA1 or ZA2, as applicable, shall be marked with the number of the energy limiting class in a square adjoining the symbol given in f) of clause 6. — P

**Table ZA.1 – Permissible $I^2t$ (let-through) values for circuit-breakers type B with rated current up to and including 63 A** — P

| Rated shortcircuit capacity A | Type B | | | | |
|---|---|---|---|---|---|
| | Class 1 | Class 3 | | | |
| | ≤ 63 A | ≤ 16 A | 20 A, 25 A, 32 A | 40 A | 50 A, 63 A |
| 3 000 | No limits specified | 15 000 | 18 000 | 21 600 | **28 000** |
| 4 500 | | 25 000 | 32 000 | 38 400 | **48 000** |
| 6 000 | | 35 000 | 45 000 | 54 000 | **65 000** |
| 10 000 | | 70 000 | 90 000 | 108 000 | **135 000** |

**Table ZA.2 – Permissible $I^2t$ (let-through) values for circuit breakers type C with rated current up to and including 63 A**

| Rated shortcircuit capacity A | Type C | | | | |
|---|---|---|---|---|---|
| | Class 1 | Class 3 | | | |
| | ≤ 63 A | ≤ 16 A | 20 A, 25 A, 32 A | 40 A | 50 A, 63 A |
| 3 000 | No limits specified | **17 000** | **20 000** | **24 000** | **30 000** |
| 4 500 | | **28 000** | **37 000** | **45 000** | **55 000** |
| 6 000 | | **40 000** | **52 000** | **63 000** | **75 000** |
| 10 000 | | **80 000** | **100 000** | **120 000** | **145 000** |

The maximum $I^2t$ values measured during the test of I cn (test sequence $E_1$ or $E_2$ as applicable) in accordance with 9.12.11.4 serve as reference values for the classification. — P

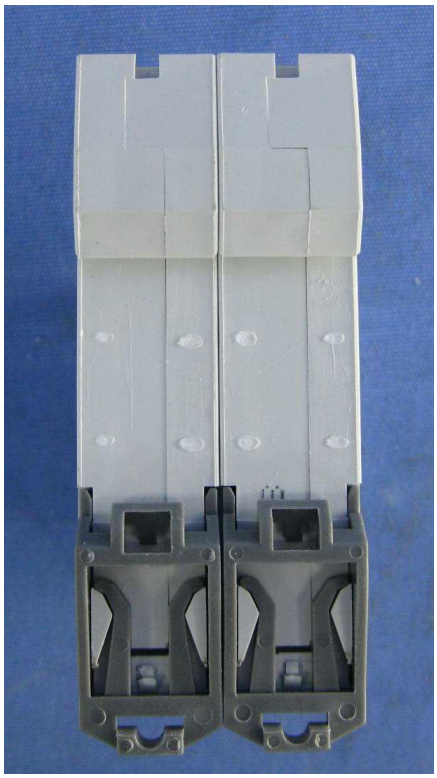
| IEC60898_1C - ATTACHMENT | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |

| | | |
|---|---|---|
| | Compliance with the requirements of Tables ZA.1 and ZA.2 is checked on the circuit-breakers with the highest rated current available within the range covered by each of these tables. | P |
| | If these current ratings are not included in the samples submitted to test sequence $E_1$ or $E_2$ of Annex C, the appropriate number of samples of these ratings shall be additionally submitted to that test sequence. None of the values measured shall exceed the permissible $I^2t$ value of the proposed energy limiting class in accordance with Tables ZA.1 and ZA.2. | P |
| | If circuit-breakers rated 40 A are submitted with the range of circuit-breakers with rating exceeding 16 A and their measured $I^2t$ values are lower than those indicated in Table ZA.1 or Table ZA.2 for rating 32 A, no relevant test is necessary for the circuit-breakers rated 32 A. | N/A |
| | If circuit-breakers rated 50 A or 63 A are submitted with the range of circuit-breakers with rating exceeding 32 A and their measured I 2 t values are lower than those indicated in Table ZA.1 or Table ZA.2 for rating 40 A, no relevant test is necessary for the circuit-breakers rated 40 A. | N/A |

| | | |
|---|---|---|
| | **Annex ZC**<br>(Informative) | |
| | **EN 60898-1**<br>**Special national conditions** | |
| | For the countries in which the relevant special national conditions apply these provisions are normative, for other countries they are informative. | |
| **J.1** | **Austria, Czech Republic, Denmark, Netherlands, Norway and Switzerland** | |
| | The upper limit of current for use of screw less terminals is 16 A | |
| **J.3.3** | **Austria, Belgium, Denmark, France, Germany, Italy, Portugal, Spain, Sweden, Switzerland, and United Kingdom** | |
| | Only universal screwless type terminals are accepted. | |
| **K1** | **Belgium, France, Italy, Portugal, Spain, and United Kingdom** | |
| | The use of circuit-breakers with flat quick-connect terminations for rated currents up to and including 20 A is accepted. | |
| **K.8.2.2** | **Belgium, France, Italy, Portugal, Spain, and United Kingdom** | |
| | The use for rated currents up to and including 20 A | |

| | | |
|---|---|---|
| | **Annex ZD**<br>**EN 60898-1:2003/A13:2012**<br>(normative) | |
| | **Based on EN 60898-1:2003, A1:2004, A11:2005 and A12:2008, the following tests and/or requirements have been technically modified and may require retesting or inspection as applicable:**<br>- **6.3 Guidance table for marking, line j) of the table (including the comparison of already measured $i^2t$ values with new Tables ZA.1 and ZA.2** | |

Photos of samples:

Photos of samples:


Photos of samples: