DNV·GL

KEMA TYPE TEST CERTIFICATE OF PRODUCT SAFETY TESTS

Object	Bay control unit		**1523-19**
Type	DS Agile C264	**Serial No.**	-

Rated input voltage	110-250 Vdc 110-250 Vac	Ethernet ports Optical ports	4 4	(Up to 6) (Up to 6)

Manufacturer	GE Renewable Energy, Grid Solutions Stafford, United Kingdom Pallavaram, India *) The manufacturer assembles the products at the sites listed here.
Client	GE Renewable Energy, Grid Solutions Montpellier, France
Tested by	KEMA.V., Arnhem, the Netherlands
Date of tests	6 November 2018 to 18 October 2019

The object, constructed in accordance with the description, drawings and photographs incorporated in this Certificate, has been subjected to the series of proving tests in accordance with the complete type test requirements of

IEC 60255-27:2013

The results are shown in the record of proving tests and the oscillograms attached hereto. The values obtained and the general performance are considered to comply with the above standard(s) and to justify the ratings assigned by the manufacturer as listed on page 4.

This Certificate applies only to the object tested. The responsibility for conformity of any object having the same type references as that tested rests with the Manufacturer.
*) as declared by the manufacturer

This Certificate consists of 125 pages in total.

KEMA B.V.

Bas Verhoeven
Director, High-Voltage Laboratory

KEMA Laboratories

Arnhem, 10 March 2020

INFORMATION SHEET

1 KEMA Type Test Certificate

A KEMA Type Test Certificate contains a record of a series of (type) tests carried out in accordance with a recognized standard. The object tested has fulfilled the requirements of this standard and the relevant ratings assigned by the manufacturer are endorsed by DNV GL. In addition, the object's technical drawings have been verified and the condition of the object after the tests is assessed and recorded. The Certificate contains the essential drawings and a description of the object tested. A KEMA Type Test Certificate signifies that the object meets all the requirements of the named subclauses of the standard. It can be identified by gold-embossed lettering on the cover and a gold seal on its front sheet.
The Certificate is applicable to the object tested only. DNV GL is responsible for the validity and the contents of the Certificate. The responsibility for conformity of any object having the same type references as the one tested rests with the manufacturer.
Detailed rules on types of certification are given in DNV GL's Certification procedure applicable to KEMA Laboratories.

2 KEMA Report of Performance

A KEMA Report of Performance is issued when an object has successfully completed and passed a subset (but not all) of test programmes in accordance with a recognized standard. In addition, the object's technical drawings have been verified and the condition of the object after the tests is assessed and recorded. The report is applicable to the object tested only. A KEMA Report of Performance signifies that the object meets the requirements of the named subclauses of the standard. It can be identified by silver-embossed lettering on the cover and a silver seal on its front sheet.
The sentence on the front sheet of a KEMA Report of Performance will state that the tests have been carried out in accordance with …… The object has complied with the relevant requirements.

3 KEMA Test Report

A KEMA Test Report is issued in all other cases. Reasons for issuing a KEMA Test Report could be:

- Tests were performed according to the client's instructions.
- Tests were performed only partially according to the standard.
- No technical drawings were submitted for verification and/or no assessment of the condition of the object after the tests was performed.
- The object failed one or more of the performed tests.

The KEMA Test Report can be identified by the grey-embossed lettering on the cover and grey seal on its front sheet.
In case the number of tests, the test procedure and the test parameters are based on a recognized standard and related to the ratings assigned by the manufacturer, the following sentence will appear on the front sheet. The tests have been carried out in accordance with the client's instructions. Test procedure and test parameters were based on ..... If the object does not pass the tests such behaviour will be mentioned on the front sheet. Verification of the drawings (if submitted) and assessment of the condition after the tests is only done on client's request.
When the tests, test procedure and/or test parameters are not in accordance with a recognized standard, the front sheet will state the tests have been carried out in accordance with client's instructions.

4 Official and uncontrolled test documents

The official test documents of DNV GL are issued in bound form. Uncontrolled copies may be provided as a digital file for convenience of reproduction by the client. The copyright has to be respected at all times.

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1 SUMMARY

By order of the client type tests according to IEC 60255-27 have been performed on the test object.

Test / Measurement	Test result
Protection against electric shock, clause 5.	Passed
Mechanical aspects, clause 6.	Passed
Flammability and resistance to fire, clause 7.	Passed
General and fundamental design requirements for safety, clause 8.	Passed
Marking, documentation and packaging, clause 9	Passed
Type tests and routine tests, clause 10.	Passed

This report encloses the test results for the modified C264. The modified C264 encloses one TMU220 module and one of the three variants of the TMU210 (with sensible Ie current transformers 0,01 A/ 0,05 A/ 0,5 A) and a variant of the DIU module, the DIU221.

The modified C264 is a variant of the model C264 product range.

The modification consists of;

1. Modified PSU BIU261D
2. Modified HBU200, piggy back board carrying the MOV's. protective sheet applied on the top side of the HBU200
3. Addition of a new DIU221 module
4. Addition of a new TMU210 module.

The PSU modification consists of;

1. Main board:
- Replacement of R76 and R135: VB3000001 replaced with A01004717 (Higher power current sense resistors 50 mOhm)
- Addition of A01004658 TVS
- Changing of L3 (from A01001106 to A01005066)
- Changing of the PCB; PCB Blank updated for TVS footprint

2. Daughter board:
- Addition of F1 (A01004709) 5 A fuse – Schematics and BOM updated,
- Changing of the PCB; PCB Blank up issued for inclusion of Fuse
- Changing of the power rating to avoid the resistors R49-R52 burning on a continuous power on/off cycle, R49-R52 with 1 W power rating have been changed to R49-R52 with 3 W power rating.

The manufacturer declares the C264 assembly is done at Stafford UK or at Pavalavaram India depending on the order placed.
The board manufacturing is done by external suppliers, the same suppliers are used by Stafford UK and Palavaram India assembly sites.
The C264 used for the type test originates from Stafford UK.

2 IDENTIFICATION OF THE OBJECT TESTED

2.1 Ratings/characteristics of the object tested

Rated auxiliary voltage	110-250 Vdc +/- 20%
	110-250 Vac +/- 20%
Power frequency	44 - 66 Hz
Output contact continuous current (watchdog, alarm)	2 A
Output contact continuous current (DOU201, CCU)	5 A
Output contact continuous current (HBU200)	10 A
Output contact continuous current (AOU200)	2,5 A
CT nominal input current	1/5 A
VT nominal input voltage	57,73 - 500,0 V
Maximum operating temperature (version with LCD display)	55 °C
Minimum operating temperature (version with LCD display)	-25 °C
Maximum operating temperature (version without LCD display)	65 °C
Minimum operating temperature (version without LCD display)	-40 °C
Maximum storage temperature	70 °C
Minimum storage temperature	-40 °C

Classification

IP-class	IP 2X
IP-class TMU220 connector	IP 1X
Mechanical class	1
Overvoltage category	III
Pollution degree	2
Insulation type	Basic/double/reinforced

2.2 Description of the object tested

Manufacturer (as stated by the client)	GE Renewable energy, Grid Solutions Stafford, United Kingdom, Pallavaram, India
Type	C264 (HW66/HW67) and C264 (HW66, HW67, TMU 210 and DIU221 with CPU4)
Object	DS Agile C264 control unit

IED 1, Sample HW66

Slot	Module	Serial No.	Hardware	Software
A	BIU261_D	-	ZP0028001_G6	-
B	CPU4	-	-	-
C	SRP-v2 Switch Board	-	ZP0015003_A2	-
D	AIU211	-	2071652_A11	-
E	DOU201	-	2071730A1_C4	-
F	CCU211	-	2071732_B6	-
G	AOU200	-	2071441_E1	IC27_MSP430_PWM_20
H, I, J, K, L, M, N, O	DIU211	-	2071669_C2	-
P	HBU200	-	ZP0026001_H2	-
Q	TMU220	-	2071613A01_G7	-

IED 2, Sample HW67

Slot	Module	Serial No.	Hardware	Software
A	BIU261_D	-	ZP0028001_G6	-
B	CPU4	-	-	-
C	SRP-v2 Switch Board	-	ZP0015003_A2	-
D	AIU211	-	2071652_A11	-
E	DOU201	-	2071730A1_C4	-
F	CCU211	-	2071732_B6	-
G	AOU200	-	2071441_E1	IC27_MSP430_PWM_20
H, I, J, K, L	DIU211	-	2071669_C2	-
M	HBU200	-	ZP0026001_H2	-
N, O	TMU220	-	2071613A02_A8	-

IED 3, Sample HW67

Slot	Module	Serial No.	Hardware	Software
A	BIU261_D	-	ZP0028001_G6	-
B	CPU4	-	-	-
C	SRP-v2 Switch Board	-	ZP0015003_A2	-
D	AIU211	-	2071652_A11	-
E	DOU201	-	2071730A1_C4	-
F	CCU211	-	2071732_B6	-
G	AOU200	-	2071441_E1	IC27_MSP430_PWM_20
H, I, J, K, L	DIU211	-	2071669_C2	-
M	HBU200	-	ZP0026001_H2	-
N, O	TMU220	-	2071613A02_A8	-

Test object HW 66 board positions

Slot A: Power Supply (BIU261D)
Slot B: CPU4
Slot C: Switch Board (SRPv2)
Slot D: Analogue Input Board (AIU211)
Slot E: Digital Output Board (DOU201)
Slot F: Control Unit (CCU211)
Slot G: Analogue Output (AOU200)
Slot H: Digital Input (DIU211)
Slot I: Digital Input (DIU211)
Slot J: Digital Input (DIU211)
Slot K: Digital Input (DIU211)
Slot L: Digital Input (DIU211)
Slot M: Digital Input (DIU211)
Slot N: Digital Input (DIU211)
Slot O: Digital Input (DIU211)
Slot P: High Break / High Speed Board (HBU200)
Slot Q: Analogue Input Board (TMU220)

Test object HW 67 board positions

Slot A: Power Supply (BIU261D)
Slot B: CPU4
Slot C: Switch Board (SRPv2)
Slot D: Analogue Input Board (AIU211)
Slot E: Digital Output Board (DOU201)
Slot F: Control Unit (CCU211)
Slot G: Analogue Output (AOU200)
Slot H: Digital Input (DIU211)
Slot I: Digital Input (DIU211)
Slot J: Digital Input (DIU211)
Slot K: Digital Input (DIU211)
Slot L: Digital Input (DIU211)
Slot M: High Break / High Speed Board (HBU200)
Slot N: Analogue Input Board (TMU220)
Slot O: Analogue Input Board (TMU220)

IED 4, 5 and 6, Samples C264 with TMU210 (0,5 A respectively, 0,05 A and 0,01 A versions) and DIU221

Slot	Module	Hardware	Software
A	BIU261_D	GP0021001_B ZP0027001_G ZP0028001_I	ZP0027_IC2_R316 BIU261-FR-DB_SEC_DC_V2.5.0
B	CPU4	ZP0016001_J9 ZP0063001_B4	H49-2.0.0.2 image_sd_prod_cpu4_1010-b01
C	SRPv2	ZP0015001_R1 ZP0020001_L1	srp282-2.1.1.0-build03_failSafe U2_Power_Supply_Firmware
D	AIU211	2071652_C	AIU211_IC34_V2Z AIU211_IC35_V2Z
E	DOU201	2071730A01_D1	2071730_IC1_V1A
F	CCU211	2071732_C1	2071732IC25_C6
G	AOU200	2071441_F	IC1_MSP430_PPC_30.d43_V1A IC2_CPLD_V1B IC27_MSP430_PWM_20_V1A
H	DIU221	ZP0062001_A8	ZP0062001_FPGA V0.5 ZP0062_SW_IC9-IC16_DIU221_ADC.V1.08.production
I, J, K, L	DIU211	ZP0011001_C	2071669IC55_applicatif_V1F
M	HBU200	ZP0026001_H6 ZP0072001_A3 GP0103001_A	ZP0026_FW_IC1_CONTROL_V1.1 ZP0026_SW_IC2x_HBU_CHANNEL_CONTROL.SVN404.V_2_0
N	TMU220	2071613A01_G9	2071613D1_V1Z
O	TMU210 case Ax X=[3:1]	2071370A0x_C 2071469A0x_F	Master 2071370 IC9 V1D

Test object C264 board descriptions

Slot A : Power Supply (BIU261D)
Slot B : CPU Board (CPU4)
Slot C : Switch Board (SRPv2)
Slot D : Analog Input Board (AIU211)
Slot E : Digital Output Board (DOU201)
Slot F : Control Unit (CCU211)
Slot G : Analog Output (AOU200)
Slot H : Digital Input (DIU221)
Slot I : Digital Input (DIU211)
Slot J : Digital Input (DIU211)
Slot K : Digital Input (DIU211)
Slot L : Digital Input (DIU211)
Slot M : High Break / High Speed Board (HBU200)
Slot N : CT/VT Board (TMU220)
Slot O : CT/VT Board (TMU210)

2.3 List of drawings

According to the client the following drawings and/or documents number(s) refer(s).
KEMA Laboratories has not verified these drawings and/or documents.

Drawings HW66/HW67

Drawing no./document no.	Revision
2071441_E1 AOU200	-
2071441IssueStatus	E1
2071613A01_G7 TMU220	-
2071613A01_G7IssueStatus	G7
2071613A02_A8 TMU220	-
2071613A02_A8 IssueStatus	A8
2071652_A11 AIU211	-
2071652_A10IssueStatus	A10
2071669_C2 DIU211	-
20712071669IssueStatus	C2
2071730A1_C4 DOU201	-
2071730A01_C4IssueStatus	C4
2071732_B6 CCU211	-
2071732_B6IssueStatus	B6
ZP0027001_F3	-
ZP0027_IssueStatus_F3	F3
LVDR0054I_C264_BIU261_ZP0027_ZP0028	A
ZP0015003_A2	-
ZP0015003_IssueStatus	A2
ZP0015003-A2 SRP V2	-
ZP0015003_IssueStatus	A2
ZP0026001_H.2 HBU CPLD	-
ZP0026_H.2 IssueStatus	H2
ZP0028001_G6 BIU261 daughter board	G6
ZP0028_G6.IssueStatus	G6
020_C26x_enSA_C60 safety manual	-
2071441IssueStatus	E1
C264.309006-001 High Speed High Break Specification	A7
C264-0005-002 A7 Universal Input Power Supply Specification	A7
C264H-492-001 C264 Final Instrument Flash Test Specification	A7
LVDR0054L	I
LVDR0054Z	F
PACIS47x-MiCOMComputers-090816-1504-12	-
Pxxx-SG-4LM-2	-

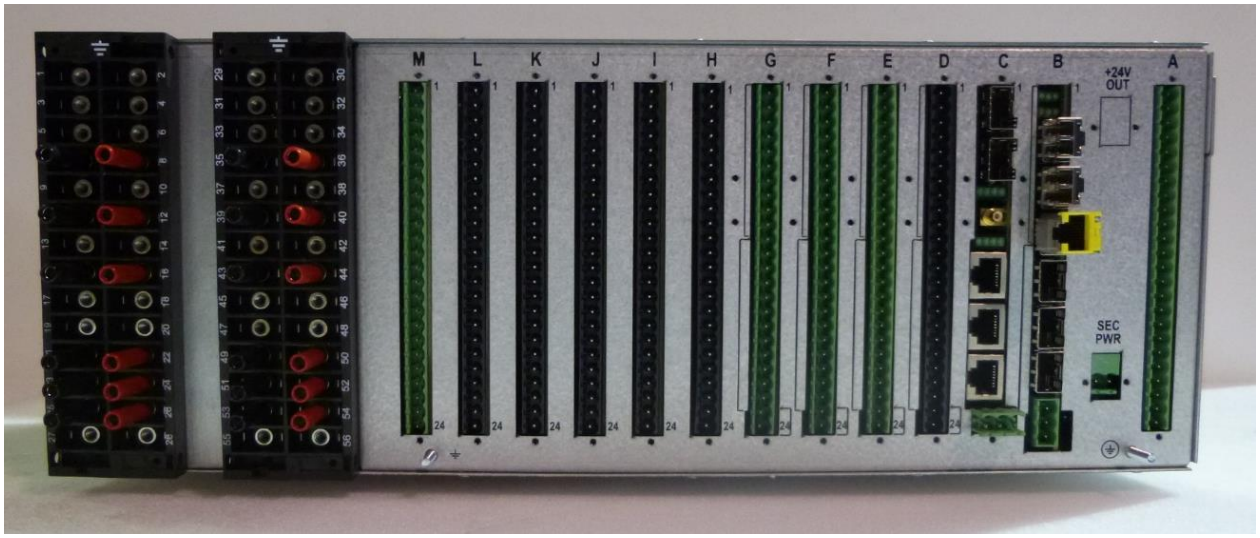
Drawings C264

Drawing no./document no.	Revision
2071441_F AOU200	F
2071441_F_IssueStatus	F
TMU210A01_2071370A01_C TMU210 version A01	C
2071370A01_C_IssueStatus	C
TMU210A01_2071469A01_F TMU210 version A01	F
2071469A01_F_IssueStatus	F
TMU210A02_2071370A02_C TMU210 version A02	C
2071370A02_C_IssueStatus	C
TMU210A02_2071469A02_F TMU210 version A02	F
2071469A02_F_IssueStatus	F
TMU210A03_2071370A03_C TMU210 version A03	C
2071370A03_C_IssueStatus	C
TMU210A03_2071469A03_F TMU210 version A03	F
2071469A03_F_IssueStatus	F
2071613A01_G9 TMU220	G9
2071613A01_G9IssueStatus	G9
AIU211_2071652_C AIU211	C
2071652_C_IssueStatus	C
DIU211_ZP0011001_C DIU211	C
ZP0011001_C_IssueStatus	C
DIU221_ZP0062001_A8 DIU221	A8
ZP0062001_A8_IssueStatus	A8
DOU201_2071730A1_D1 DOU201	D1
2071730A01_D1IssueStatus	D1
CCU211_2071732_C1 CCU211	C1
2071732_C1_IssueStatus	C1
BIU261_MB_ZP0027001_G BIU261_MB	G
ZP0027_IssueStatus_G	G
BIU261_DB_ZP0028001_I BIU261_DB	I
ZP0028_I.IssueStatus	I
BIU261D_GP0027001_B	B
GP0027001_B_IssueStatus	B
CPU4_GlobalA_ZP0063001_B4	B4
ZP0063001_IssueStatus_B4	B4
CPU4_ZP0016001_J9	J9
ZP0016001_IssueStatus_J9	J9
HBU200_MB_ZP0026001_H6 HBU-MB	H6
ZP0026_H.6 IssueStatus	H6
HBU200_DB_ZP0072001_A3 HBU-DB	A3
ZP0072001_IssueStatus_A.3	A3
HBU200_GlobalA_GP0103001_A	A
GP0103001_A_IssueStatus	A
SRPv2_GlobalA_ZP0020001_L01 SRPV2 board	L01
ZP0020001_IssueStatus	L01
DS agile C26x System Technical Manual	7.0.3.
TMU210 C26x/EN FT/HW/CO Functional HW description TMU210	-

2.4 Photograph of test object

HW66

HW67


M
L
K
J
I
H
G
F
E
D
C
B
+24V
OUT
A
SEC
PWR

HW67


5444 – 6100E
R&D System
A160009583

HW67

HW67

C264 with TMU210 (0,5 A / 0,05 A / 0,01 A version) and DIU221 modules

Label C264 with TMU210-A03 0,01 A module version

Label C264 with TMU210-A02 0,05 A module version

Label C264 with TMU210-A01 0,5 A module version

3 GENERAL INFORMATION

3.1 The tests were witnessed by

The tests were carried out without a representative of the client present.

3.2 The tests were carried out by

Name	**Company**
Gert van Wee	KEMA B.V. Arnhem, the Netherlands

3.3 Subcontracting

The following tests were subcontracted to Sebert Trillingstechniek, Bergschenhoek, the Netherlands:

- test of vibration response and endurance in accordance with IEC 60255-21-1
- test of shock response and withstand in accordance with IEC 60255-21-2
- bump test in accordance with IEC 60255-21-2
- seismic test in accordance with IEC 60255-21-3.

3.4 Purpose of the tests

Purpose of the tests was to verify whether the material complies with the specified requirements.

3.5 Laboratory environmental conditions

Tests have been performed in a controlled laboratory environment, where the environmental conditions are maintained within the applicable ranges.

Ambient temperature	15 °C – 25 °C
Relative Humidity	45% - 75%
Atmospheric pressure	86 kPa (860 mbar) to 106 kPa (1060 mbar)

When a condition has direct influence on a test, the value of the condition will be presented explicitly.

3.6 Instruments used

A detailed list with instruments used is enclosed in this Certificate.

3.7 Standards

The product standard IEC 60255-27 (2013-10) refers to documents, in whole or in part, these documents are normatively referenced to in this product standard and these documents are indispensable for its application. For dated references, only the edition cited applies. For undated references the latest edition of the referenced document (including any amendments) applies. KEMA Laboratories will use the latest edition of the referenced documents (including any amendments) in all cases, also in the cases reference is made to dated editions.

4 PRODUCT SAFETY

4.1 Inspection

4.1.1 Pre-inspection

The pre-inspection is performed to verify that the test object is in operating state. The pre-inspection is carried out previous to the test procedure.

The communication with the maintenance computer is verified. Signals are simulated to verify the functioning and operation with the specified performance specification for the following inputs and outputs:

- digital inputs
- contact outputs
- analogue inputs
- data communication.

4.1.2 Visual and functional inspection

No visual and/or functional inspection is required after the product safety tests. In general, the test object shall remain safe regarding the spread of fire or risk of having an electric shock. Specific assessment/test requirements are listed at each specific test.

4.2 Product safety assessment results

The product safety assessment results are listed in the IECEE TRF template format.

IEC 60255-27 Part 27: Product safety requirements Report Number. : Date of issue : Total number of pages	 1523-19 18 October 2019 125 (chapter 4)
Name of Testing Laboratory preparing the Report :	DNV-GL KEMA Laboratories, Arnhem, the Netherlands
Applicant's name : Address :	GE Renewable Energy, Grid Solutions Parc Eurêka 81 rue Euclide – CS11140 34060 Montpellier Cedex 2 France
Test specification: Standard : Test procedure : Non-standard test method :	 IEC 60255-27:2013 According IEC 60255-27 N/A
Test Report Form No. : Test Report Form(s) Originator : Master TRF :	- IECEE TRF-Template2015Final_IEC
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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 Testing Laboratory. The authenticity of this Test Report and its contents can be verified by contacting the Test laboratory responsible for this Test Report.	

Test item description : Trade Mark : Manufacturer : Model/Type reference : Ratings :	Bay control unit GE power GE Renewable Energy, Grid solutions DS Agile C264 110 - 250 Vac 110 - 250 Vdc	
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
☒ Testing Laboratory:	DNV-GL KEMA Laboratories, Arnhem, the Netherlands	
Testing location/ address :	Utrechtseweg 310 6812AR Arnhem the Netherlands	
Tested by (name, function, signature) :	Gert van Wee	Test engineer MPSA
Approved by (name, function, signature) :	Marc Achterkamp	Head of Section MPSA
☐ Testing procedure: CTF Stage 1:	N/A	
Testing location/ address :		
Tested by (name, function, signature) :		
Approved by (name, function, signature) :		
☐ Testing procedure: CTF Stage 2:	N/A	
Testing location/ address :		
Tested by (name + signature) :		
Witnessed by (name, function, signature) :		
Approved by (name, function, signature) :		
☐ Testing procedure: CTF Stage 3:	N/A	
☐ Testing procedure: CTF Stage 4:	N/A	
Testing location/ address :		
Tested by (name, function, signature) :	-	
Witnessed by (name, function, signature) :	-	
Approved by (name, function, signature) :	-	
Supervised by (name, function, signature) :	-	

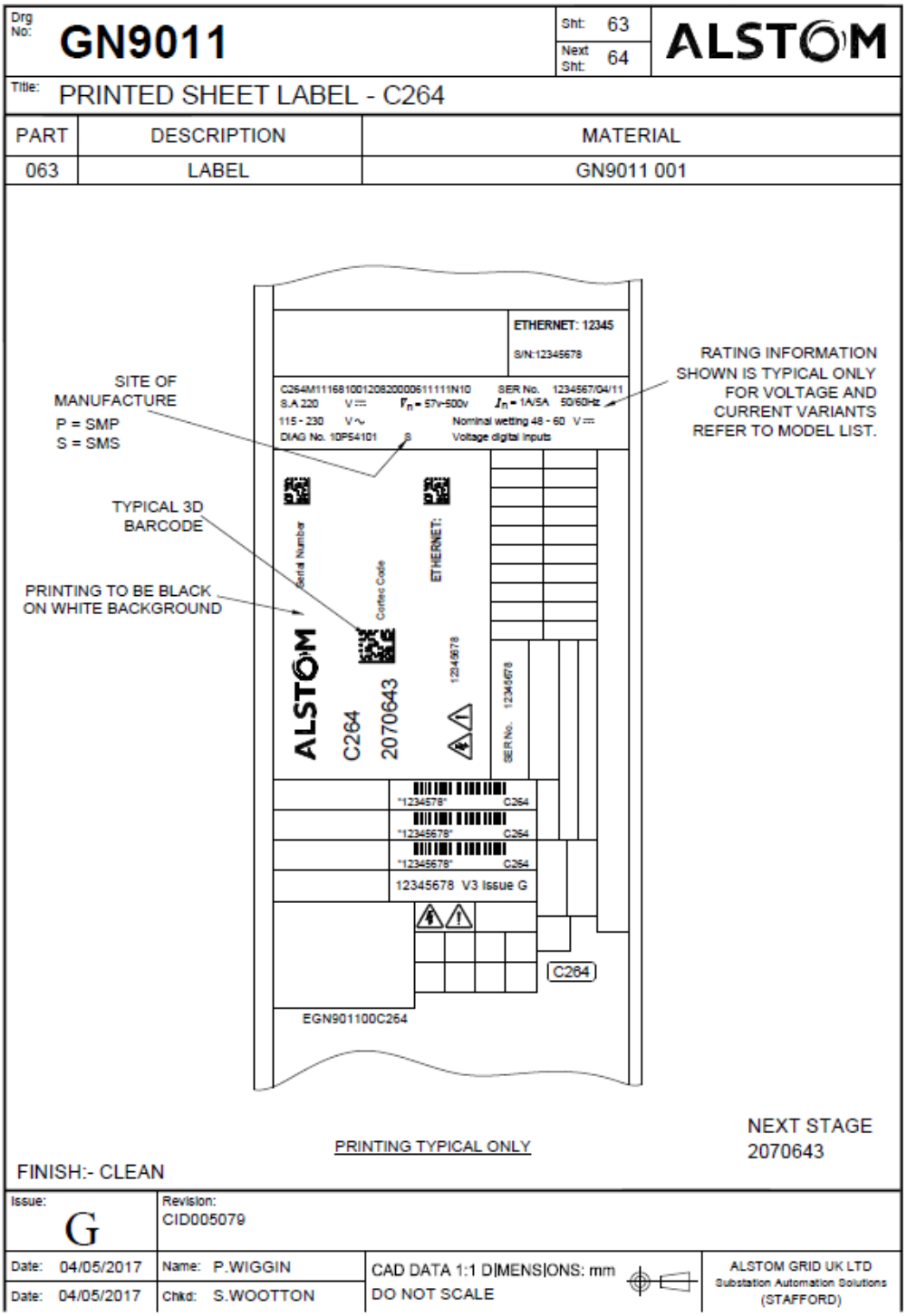
List of Attachments (including a total number of pages in each attachment): N/A
List of tables;
Table 1: Heating test normal operating conditions/abnormal operating conditions
Table 2: dielectric strength and insulation resistance
Table 3: Electrical data
Table 4: power input deviation
Table 5: clearance and creepage measurements
Table 6: distance through insulation measurements
Table 7: flammability data assessment
Table 8: needle flame test
Table 9: over-voltage and under-voltage test, reverse polarity test
Table 10: critical component information
Table 11: single fault testing

Summary of testing: The test object complies with the applicable requirements of the standard

Tests performed (name of test and test clause):	**Testing location:**
Protection against electric shock, clause 5. Mechanical aspects, clause 6. Flammability and resistance to fire, clause 7. General and fundamental design requirements for safety, clause 8. Marking, documentation and packaging, clause 9 Type tests and routine tests, clause 10.	DNV-GL KEMA Laboratories, Arnhem, the Netherlands

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

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 :	Test object C264 has been extended with new DIU 221 and TMU210 boards (A01, A02 and A03 versions)
Classification of installation and use :	
Supply Connection :	110 - 250 Vac, 44 – 66 Hz
:	110 - 250 Vdc
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 :	6 November 2018
Date (s) of performance of tests :	6 November 2018– 18 October 2019

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 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) :	GE Renewable Energy, Grid Solutions Stafford, United Kingdom and Pallavaram, India

General product information:
The C264 belongs to the C-range. The C-range are control units

DS Agile products include extensive facilities for recording information on the state of the power system using disturbance and fault records. They can also provide measurements of the system at regular intervals to a control centre enabling remote monitoring and control to take place.

The DS Agile C26x modular bay control unit is used to control and monitor switch bays. The information capacity of the DS Agile C26xis designed for controlling operated switchgear units equipped with electrical check-back signalling located in medium-voltage or high-voltage substations. External auxiliary devices are largely obviated by the integration of binary inputs and power outputs that are independent of auxiliary voltages, by the direct connection option for current and voltage transformers, and by the comprehensive interlocking capability. This simplifies handling of bay protection and control technology from planning to station commissioning.

During operation, the user-friendly interface makes it easy to set the unit and allows safe operation of the substation by preventing non-permissible switching operations.
Continuous self-monitoring reduces maintenance costs for protection and control systems. A built-in liquid crystal display (optional front face with LCD) shows not only switchgear settings but also measured data and monitoring signals or indications. The bay is controlled interactively by using the control keys and the display.

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Clause	Requirement + Test	Result - Remark	Verdict
4	**GENERAL SAFETY REQUIREMENTS**		
4.1	**General** The equipment shall not jeopardize the safety of people and property. Protection against electric shock for class I, II or III equipment is applicable to those parts accessible under normal conditions. ELV, PEB, PELV and SELV circuits provide protection from electric shock by hazardous live voltages, and are not necessarily related to class I, II or III equipment class.	No specific assessment requirements Achieved through compliance with the relevant clauses of this standard.	P
4.2	**Earthing requirements** Earthing in equipment may be required not only to reduce the effects of interference, but also, and more importantly, for reasons of personnel safety. Where there is any conflict between these two requirements, personnel safety shall always take precedence.	No specific assessment requirements Achieved through compliance with the relevant clauses of this standard.	P
5	**PROTECTION AGAINST ELECTRIC SHOCK**		
5.1	**General**		
5.1.1	Introductory remark Users shall be protected against electric shock hazards by use of good constructional and engineering practice. The testing of components and equipment with regard to protection against electric shock shall be conducted as type tests and routine tests as defined in Clause 10. Protection against contact with accessible hazardous live parts shall be provided. Any conductive part that is not separated from the hazardous live parts by at least basic insulation shall be considered to be a live part. A metallic accessible part is considered to be conductive if its surface is bare or is covered by an insulating layer which does not comply with the requirements of basic insulation. A single-fault condition applied to the equipment shall not cause an electric shock hazard. Unearthed accessible conductive parts which may become hazardous live under a single-fault condition shall be separated from hazardous live parts by double or reinforced insulation or be connected to the protective conductor or meet the requirements of 5.1 to 5.1.11.	No specific assessment requirements. Achieved through compliance with the relevant clauses of this standard. Type test executed. Metal case of equipment is protectively earthed (Class 1). BIU261 power supply: ELV circuit (0V) is directly connected to case earth via two PCB earth springs and a right-angled bracket retained with rivets and a self-tapping screw.	P

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Clause	Requirement + Test	Result - Remark	Verdict
	Annex A covers equipment isolation class. Annex C is for the determination of clearance and creepage distance and withstand type test voltages.	Basic, functional OVCIII and PD2, Table C.6	
5.1.2	Protection from contact with hazardous live parts	No specific assessment requirements	P
5.1.2.1	General Protection against direct contact with accessible hazardous live parts shall be provided by adequate insulation, the equipment case or a barrier.	The equipment case and the insulation provide adequate protection	P
5.1.2.2	Insulation The insulation requirements shall be determined after consideration of the following influencing factors: rated insulation voltage of the circuit under consideration (see 6.7 of IEC 61010-1:2010); overvoltage category (see Annex B and Annex C); pollution degree (see Annex C); isolation level, for example, ELV, SELV, PELV, or PEB (see Annex A); insulation prescription (see Annex A and Annex C).	Applicant claim; Uins = 300 V OVC = OVC III PD = PD 2 Isolation level = ELV Insulation prescription = Functional, basic or supplementary insulation 2x Communication ports on BIU261D = SELV	P
5.1.2.3	Equipment case and barriers Requirements for HLV parts located inside equipment case or behind barriers. These shall meet the requirements of clause 5.1 of IEC 60529:1989, Amendment 1:1999 Equipment case/barriers: IP 2X Requirement top surface of barriers: IP4X Mechanical strength/stability and durability HLV parts accidentally touched by maintenance: IP 2x according to 5.1 of IEC 60529:1989, Amendment 1:1999. Compliance with 5.1.2.3 is checked using a test finger as specified in 6.2 of IEC 61010-1:2010	Result; Equipment case/barriers: IP 2X Requirement top surface of barriers: IP 4X Mechanical strength/stability and durability. Tool needed to get access to HLV HLV parts accidentally touched by maintenance: IP 2x (rear terminals) Wiring behind a panel; IP 1x, see clause 5.1.5.2.6	P
5.1.2.4	Hazardous live terminations using stranded wire The end of a stranded wire shall not be consolidated by soft soldering at places where the wire is subject to contact pressure, unless the method of clamping is designed so as to reduce the likelihood of a bad contact due to cold flow of the solder. Terminals shall be located, guarded or insulated so that, should a strand of a flexible wire escape when the wire is fitted, there is no likelihood of accidental contact between such a strand and: accessible conductive parts; or unearthed conductive parts separated from accessible conductive parts by supplementary insulation only.	There are no soldered stranded wires subjected to contact pressure inside the test object. Connections are made by means of faston straight receptacles (TMU2201, TMU210). The ground connection on HBU200 is made by fastons provided with lugs. Lugs are secured with a spring washer.	P

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Clause	Requirement + Test	Result - Remark	Verdict
	A loose strand of 8 mm nominal length is normally considered for assessing this risk. If the manufacturer determines that there is a risk, a recommendation shall be given in the documentation and a warning symbol 14 from Table 10 marked on the equipment. The risk can be eliminated, for example, by the use of an insulated crimp terminal or a single-strand wire. Compliance with 5.1.2.4 is checked by inspection.	Connectors on the PCB's/modules are Phoenix combicon socket headers. Connectors on the TMU are 28 way terminal blocks which mate with the connector in the enclosure (these contacts bridge the external CT connections). Stranded wires are allowed to be connected to the mating parts which are provide with screw terminals. The technical manual specifies the wiring requirements. N/A	
5.1.3	Discharge of capacitors After switching off the equipment, capacitors shall be discharged within 5 s to a residual charge of 50 C or to a voltage of 20 V. In the case of installed equipment, where the voltage at the plug-and-socket devices can be touched and these devices may be pulled out when live, without the use of tools, the capacitors shall be discharged within 1 s to a charge of 50 C, or to a voltage of 20 V. With respect to the above two discharge cases, testing shall be by calculation of the energy, or measurement of the voltage, 5 s or 1 s after switching off the equipment. Where several	The equipment is not pluggable; discharge to 20 V within 5 s.	P
5.1.4	Protective impedance Protective impedance shall be one or more of the following so that unearthed accessible conductive parts cannot become hazardous live as a result of a single-fault condition. An appropriate high-integrity single component. Examples are high-voltage withstand capacitors and resistors rated at a minimum of 3 250 V r.m.s. for at least 1 min and shall meet the requirements of 5.1.5.3.2 under the normal conditions and 5.2.4.1.2 under a single-fault condition. The power rating, at maximum ambient temperature, of a high-integrity resistor, shall be at least twice that of the resistor dissipation, under normal use. If the predominant failure mode of the component is short circuit, then a single component shall not be used. A combination of components, for example, two Y rated capacitors in series, each rated for the total working voltage across the pair. Each capacitor shall have the same nominal capacitance value and a withstand voltage rating of at least 2 000 V r.m.s., 1 min. This provides basic protection against electric shock in the case of a single-fault condition.	Not present	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	A combination of basic insulation and a current- or voltage-limiting device. Compliance with protective impedance can be demonstrated by application of the appropriate voltage test for double/reinforced insulation in Table C.7 to Table C.10 for an altitude of 2 000 m. For test altitudes other than 2 000 m, the test voltage should be adjusted in accordance with Table C.11. Components, wires and connections shall be rated according to the requirements for both normal conditions and appropriate single-fault conditions. It is permissible for double insulation or reinforced insulation to be bridged by components meeting the requirement for protective impedance. Compliance of components with 5.1.4 and any associated basic insulation shall be checked after a single-fault condition assessment or test according to 10.6.5.5. Any associated basic insulation shall be checked by assessment, measurement or testing in accordance with Annex C of this standard and 6.7 of IEC 61010-1:2010.		
5.1.5	Accessible parts Compliance with 5.1.4 shall be demonstrated by visual inspection or test.		P
5.1.5.1	General Unless obvious, determination of whether a part is accessible, under normal use, shall be made as specified below and in 5.1.5.2. Circuits intended to be connected to an external accessible circuit shall be considered as accessible conductive parts, for example communication circuits. Appropriate test fingers, as specified in 5.1.5.2.2, shall be applied without force unless a force is specified. Parts are considered to be accessible if they can be touched with a finger or pin, or if the covering does not provide suitable protection when touched under normal use (see below). Where accessible conductive parts or circuits are separated from other parts by double insulation or reinforced insulation that is bridged by components in accordance with 5.1.4, the accessible parts or circuits shall comply with current limits in 5.1.5.3.2 for the normal condition and 5.2.4.1.2 for a single-fault condition. These requirements shall apply after dielectric voltage testing. For hazardous live parts, a part is considered to be accessible if the test finger or pin reaches a point nearer to the hazardous live part than the applicable clearance for basic insulation at the working voltage determined from IEC 60664-1 (see 5.1.6.4 below).	No specific assessment requirements. Detailed requirements are listed in the clauses 5.1.5.2.1 -5.1.5.1.6.	P

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Clause	Requirement + Test	Result - Remark	Verdict
	For equipment accepting plug-in modules, parts are considered to be accessible if they can be touched with the jointed test finger (see 5.1.5.2.2) up to a depth of 180 mm from the opening in the equipment. Materials which can easily be damaged are not considered to provide suitable insulation (for example, lacquer, enamel, oxides and anodic films). Non-impregnated hygroscopic materials, such as paper, fibres, fibrous material, are also not considered to provide suitable insulation. Compliance with 5.1.5.1 shall be demonstrated by visual inspection or test.		
5.1.5.2	Determination of accessible parts		P
5.1.5.2.1	General If the user is intended to perform any actions in normal use, with or without the aid of a tool (for example, a screwdriver, a coin, a key, etc.), which will increase the accessibility of parts, such actions shall be taken before performing the examinations of 5.1.5.2.2 to 5.1.5.2.4. Examples include: removing covers; adjusting controls; replacing consumable material; removing parts Compliance with 5.1.5.2.1 shall be demonstrated by visual inspection or test.	It is not intended to remove parts thus increasing accessibility to accessible parts	N/A
5.1.5.2.2	General examination The jointed test finger (see IEC 61032 and IEC 60529) shall be applied in every possible position Where a part could become accessible by applying a force, the rigid test finger (see 6.2 of IEC 61010-1:2010,) shall be applied with a force of 10 N. The force shall be exerted by the tip of the test finger so as to avoid wedge and lever action. The test shall be applied to all outer surfaces, including the bottom. Compliance with 5.1.5.2.2 shall be demonstrated by visual inspection or test.	The 4 mm test pin does not touch hazardous live parts except for the terminal block which is not accessible during normal use, This terminal block complies with the requirements of clause 5.1.5.2.6	P
5.1.5.2.3	Openings above parts, enclosed by the case, which are hazardous live A metal test pin 100 mm long and 4 mm in diameter shall be inserted in all openings in the equipment case, above parts (the test pin shall be freely suspended) which are hazardous live. The test pin shall penetrate up to 100 mm. This test shall not be applied to terminals. Compliance with 5.1.5.2.3 shall be demonstrated by visual inspection or test.	The 4 mm test pin does not penetrate any opening	P
5.1.5.2.4	Openings for pre-set controls A metal test pin 3 mm in diameter shall be	There are no pre-set controls present	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	inserted through holes, in the equipment case, intended to give access to pre-set controls which require the use of a screwdriver or other tool. The test pin shall be applied in every possible direction through the hole. Penetration shall not exceed three times the distance from the equipment case surface to the control shaft or 100 mm, whichever is smaller. Compliance with 5.1.5.2.4 shall be demonstrated by visual inspection or test.		
5.1.5.2.5	ELV rated or live parts accessible when cover removed If ELV rated or live parts, such as replaceable batteries or electromechanical relay contacts, are accessible when the cover is removed without the aid of a tool, then a warning label is required, visible when the cover is removed. This warning shall comprise of symbols 14 and/or 12 in Table 10. Compliance with 5.1.5.2.5 shall be demonstrated by visual inspection or test.	Covers cannot removed without a tool	N/A
5.1.5.2.6	Wiring terminals Wiring terminals which are behind a panel, or in a restricted access area, and cannot be touched in normal use shall be deemed non-accessible. However, a protection of at least type IP1X according to 5.1 of IEC 60529:1989, Amendment 1:1999 should be provided to prevent electric shock due to accidental contact. If at least a protection of type IP 1X, according to 5.1 of IEC 60529: 1989, Amendment 1:1999, is not provided then warning symbol 12 in Table 10, shall be used in the vicinity of accessible hazardous live wiring terminals. Compliance with 5.1.5 to 5.1.5.2.6 shall be demonstrated by visual inspection or test.	The power supply and I/O terminals meet IP 2x The CT/VT terminals meet IP 1x	P
5.1.5.3	Permissible limits for accessible parts		
5.1.5.3.1	General The voltage, current, charge or energy between an accessible part and reference test earth, or between any two accessible parts on the same piece of equipment within a distance of 1,8 m (over a surface or through air), shall not exceed the values of 5.1.5.3.2 in normal condition, nor those of 5.2.4.1.2 in single-fault condition.	Voltage requirement has been met.	P
5.1.5.3.2	Values under normal conditions Values under normal conditions are listed below. Values exceeding the levels/limits of items a) to c) below, in normal conditions, are deemed to be hazardous live. The limits of items b) and c) below apply only if the voltage exceeds the values of item a). a. Voltage levels: 33 V a.c. or 70 V d.c b. Current levels limits under normal conditions: indicated in Table 1. c. Charge or energy of capacitance levels limits under normal conditions: indicated in Table 2.	a. The measured voltage level is 27,3 V b. N/A c. N/A	P

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Clause	Requirement + Test	Result - Remark	Verdict
5.1.6	Bonding to the protective conductor	Test current 20A	P
5.1.6.1	Accessible conductive parts shall be bonded to the protective conductor terminal if they could become hazardous live in the case of a single fault of the primary protective means specified in 5.1.2. Alternatively, such accessible parts shall be separated from parts which are hazardous live by a conductive protective screen or barrier bonded to the protective conductor terminal. For measuring and test equipment, indirect bonding is permitted as an alternative to direct bonding. Unearthed accessible conductive parts shall meet one of the following criteria. Unearthed accessible conductive parts need not be bonded to the protective conductor if they are separated from all hazardous live parts by double insulation or reinforced insulation. Equipment of class I protection. A minimum of basic insulation between the unearthed accessible conductive part and live parts, provided that the insulation cannot be reduced to less than basic insulation by any single fault including mechanical impact, loose wires and terminals etc. Mechanical retention can be used to ensure maintenance of basic insulation under a single-fault condition. Screws or nuts with lock washers are not regarded as liable to become loose, nor are wires which are mechanically secured by more than soldering alone. Verification of clearance shall be made by measurement, where there is any doubt of compliance.	The equipment case is bonded to the PE terminal N/A There are no unearthed parts present. Basic insulation has been applied.	P
5.1.6.2	Protective bonding Accessible conductive parts shall be bonded to the protective conductor; it is not, however, essential when one of the following applies. When unearthed accessible conductive parts are exclusively related to electrical circuits with protection in case of direct contact according to 5.1.5, and the voltage does not exceed ELV limits (see Annex A). When magnetic cores are used, for example transformers, chokes and contactors. The unearthed accessible conductive parts are of small dimensions which in normal use are not intended to be grasped and which have a low probability of contact and are separated from hazardous live parts by at least basic insulation.	The accessible conductive parts are bonded to the protective conductor.	P
5.1.6.3	Bonding of parts connected to the protective conductor See 10.6.4.5 for protective bonding test requirements. The equipment design should ensure that any painting or coating of surfaces within the protective earth bonding circuit shall not affect the protective bonding resistance of that circuit.	See 10.6.4.5. No painting or coating present on the equipment case. Case is provided with AluZinc cladding.	P

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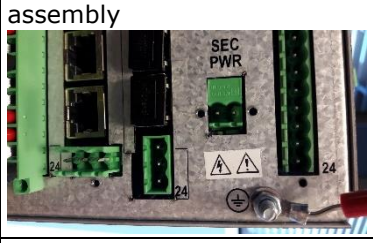
Clause	Requirement + Test	Result - Remark	Verdict
5.1.6.4	Protection against corrosion Conductive parts in contact at protective earthing terminals and connections shall not be subject to significant corrosion due to electrochemical action in any working, storage or transport environment conditions as specified in the instructions supplied with the equipment. Corrosion resistance can be achieved by suitable plating or coating process. Compliance with 5.1.6.4 is checked by determination of the electrochemical potential difference between the dissimilar metals, also by inspection after the normally conducted damp heat type test.	The metal parts are coated with a non-corrosive conductive sheet After the damp heat test no relevant corrosion has been observed As an alternative to the potential difference measurement, after the damp heat test, the bonding test has been performed. R ≤ 0,031 Ohm	P
5.1.6.5	Where the protective connection to a subassembly of equipment is made by a plug-and-socket device when it is live or conducting, the protective connection shall not be broken before the live conductors. On re-connection, the protective conductor shall re-connect before the live connection or, at the latest, together with the live conductors.	No pluggable connection has been applied	N/A
5.1.7	Protective conductor connection Equipment with internal protective bonding shall have means of connection for the external protective conductor, preferably near to the terminals for the respective live conductors. The protective conductor terminal shall be corrosion-resistant. It shall be capable of accommodating cables of at least the same cross-sectional area as the equipment circuit with the highest current/protection element rating, which may cause an earth fault. The means of connection for the protective conductor shall not be used as a part of the mechanical assembly of the equipment.	Internal connection present. Connection via terminal block A, pin22 PE bolt near to the mains power connection The PE bolt is Zinc plated The bolt is not part of the assembly 	P
5.1.8	High leakage current Where equipment has a continuous leakage current of more than 3,5 mA a.c. or 10 mA d.c. in normal use, the supply input shall be connected as for a permanently connected equipment (see Clause E.2); this shall be stated in the equipment documentation. Any current measurements shall be performed using the measuring circuit in Figure 4 of IEC 60990:1999. The equipment shall be isolated from earth and the measuring circuit connected between the protective conductor terminal and the protective conductor.	Measured weighted touch current << 3,5 mA	P
5.1.9	Solid insulation	See results below	P
5.1.9.1	General Solid insulation shall be designed to resist the stresses which occur, especially mechanical,		P

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Clause	Requirement + Test	Result - Remark	Verdict
	electrical, thermal and climatic stresses that are to be expected under normal conditions, and it shall have a sufficient resistance to ageing throughout the life of the equipment. Wire insulation shall be considered as solid insulation.		
5.1.9.1	Requirements The maximum temperature of the solid insulation, under normal conditions at maximum ambient temperature, shall be less than the temperature given for the appropriate class in Table 7, 7.11.2. Compliance of solid insulation shall be verified by performing dielectric voltage and impulse withstand type tests, according to the relevant rated working voltage and overvoltage category, determined from the appropriate Table C.1 to Table C.10, and Table C.11. The term solid insulation refers to material that provides electrical insulation between two opposite surfaces, not along an outer surface. Its required properties are specified either as the actual minimum distance through the insulation, or by other requirements and tests in this standard instead of a minimum distance. Any test therefore only proves the minimum distance through the insulation, not the creepage distance across the surface of the insulation. Compliance with 5.1.9 is checked by inspection, measurement and test.	Max. temperature specification of solid insulation: Coil former; PET glass reinforced, thermal resistance Class N, 200 °C Wire; TEX-E, thermal resistance class E, 120°C Tape: PPI-10260, thermal class B 130°C Maximum measured temperature at T1: 65 °C. Tamb 21 °C. Max specified ambient temperature: 65 °C (C264 without LCD). The calculated max. temperature is 65 + (65-21) = 109 °C. refer to table 1. Solid insulation has been subjected to the environmental tests. After the tests solid insulation has been inspected for damage. Dielectric test and impulse tests have been performed between independent circuits and between independent circuits and equipment case (PE)	P P
5.1.10	Clearances and creepage distances		P
5.1.10.1	General Clearance and creepage distances shall be determined from the appropriate Table C.1 to Table C.10. The minimum creepage distance shall not be less than the minimum clearance in air. These clearance and creepage distances are minimum values; manufacturing tolerances shall additionally be taken into account. Where there is any doubt that the required clearance and creepage distances are compliant,	See Table 5	P

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Clause	Requirement + Test	Result - Remark	Verdict
	measurements shall be made. If appropriate, type tests and routine testing or sample testing of clearances shall be carried out to determine compliance with 5.1.10, in accordance with Clause 10.		
5.1.10.2	Clearances		
5.1.10.2.1	General Clearances are specified to withstand the maximum transient overvoltage that can be present on the circuit, either as a result of an external event (such as a lightning strike, or a switching transient), or as the result of the operation of the equipment. Clearances shall be determined with reference to Annex A and Annex C. For clearances in primary circuits, Table B.1 should also be referred to. The design of the clearance between any two circuits shall conform to the greater clearance of the two. In order to maintain a fixed withstand test voltage, the clearances for equipment at altitudes greater than 2 000 m shall be multiplied by the factor given in Table 3. For installations above 2 000 m, refer to Table C.11. If necessary, take appropriate measures to limit the impulse voltages the equipment is subjected to, for example, use spark gaps or transient suppressors etc.	No specific assessment requirements	P
5.1.10.2.2	Clearances for primary circuits The clearances in air relating to primary circuits are determined by the rated impulse voltage (refer to C.1.4). Basic insulation is the minimum requirement between primary circuits and other circuits, (primary or non-primary circuits) including accessible parts and earthed parts. Additional insulation (for example, functional or supplementary insulation) may be required, depending upon the isolation class (see Annex A). To minimize the risk of fire, it is necessary to correctly design functional insulation, such as that across a primary circuit. Where the clearance does not comply with the relevant Table C.3 to Table C.10, this may be proven by testing using a test voltage determined by the multiplication of the withstand voltage, by the appropriate multiplication factor for altitude from Table C.11. The preferred method to prove the product is safe, where the clearance is below the minimum specified value, is to use the a.c. or d.c. value given in the table, rather than the impulse voltage, unless the impulse voltage generator characteristics and impulse voltage amplitude are according to 10.6.4.2.3. The clearance values are stated in Annex C, for impulse voltages other than those given in Annex C tables refer to IEC 60664-1:2007, Annex A.	See Table 7.	P

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Clause	Requirement + Test	Result - Remark	Verdict
5.1.10.2.3	Clearances for non-primary circuits Clearances for non-primary circuits shall withstand the maximum transient overvoltage that can be present on the circuit. If transient overvoltages cannot occur, clearances are based on the nominal working voltage. The clearance values are stated in Annex C; for impulse or working voltages other than those given in Annex C tables refer to Annex A of IEC 60664-1:2007.	See table 7	P
5.1.10.2.4	Creepage distances It shall be assumed that the equipment within the scope of this standard is subject to continuous voltage stress over a long period, requiring the design of appropriate creepage distances. Creepage distances shall be determined with reference to Annex A and Annex C. The design of creepage distance between any two circuits shall conform to the greater creepage distance of the two. If pollution degree 3 or 4 causes persistent conductivity, for example, due to carbon or metal dust, the dimensions for creepage distances cannot be specified. Instead, the surface of insulation has to be designed to avoid a continuous path of conductive pollution (for example, by means of ribs or grooves, as determined by 5.2.2.5 and 5.2.5 of IEC 60664-1:2007). Compliance of creepage distances with 5.1.10.2.4 shall be verified by measurement in the case of doubt. It cannot be verified by voltage withstand testing. Interpolation of creepage distances in Annex C tables is permitted, for both primary and non-primary circuits	See table 7 Equipment has been classified as PD2.	P
5.1.11	Functional earthing If functional earthing of accessible or other conductive parts is necessary, the following apply. It is permitted to connect the functional earthing circuit to a protective conductor terminal or to a protective bonding conductor. The functional (or protective) earthing circuit shall be separated from ELV, PEB, PELV and SELV circuits by at least functional insulation. The functional earthing circuit shall be separated from parts at hazardous voltage in the equipment by either: – double insulation or reinforced insulation; or – a protectively earthed screen or another protectively earthed conductive part, separated from parts at hazardous voltages by at least basic	Functional earth terminal available, connected to PE bolt via the equipment case  Basic insulation has been applied.	P

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Clause	Requirement + Test	Result - Remark	Verdict
	insulation. Compliance with 5.1.11 is checked by inspection.		
5.2	**Single-fault conditions**		
5.2.1	Testing in single-fault condition The equipment shall not present a risk of electric shock or fire after a single-fault test. It does not have to be functional after the test. Examination of the equipment and its circuit diagram will generally show the fault conditions which are liable to result in electric shock or fire hazards and which therefore shall be applied. Fault tests shall be made except where it can be demonstrated that it is improbable that a hazard will arise from a particular single-fault condition. It is not required that a single-fault condition is applied to double or reinforced insulation. The equipment shall be operated under the least favourable combination of reference test conditions. These conditions include worst-case tolerance of rated voltage and current, worst-case equipment orientation, whether covers or other removable parts may not be fitted during normal conditions, maximum specified external fuse rating.	Equipment has been subjected to the most unfavourable load conditions, including short circuit conditions. Result: during the test the 24 V power supply on the daughter board went defective. No electrical shock or fire hazard has been created. During the tests on the modified BIU261 the +55V main power supply went defective without creating a safety hazard. See table 11.	P
5.2.2	Application of single-fault condition		P
5.2.2.1	A single-fault condition shall be applied one at a time and shall be applied in turn in the most convenient order. Multiple simultaneous faults shall not be applied; they may, however, result from the application of a single-fault. After the application of a single-fault condition, the equipment or relevant part shall meet the requirements of 5.2.4. After the application of a single-fault condition, the equipment or relevant part shall meet the requirements of 5.2.4.	Considered	P
5.2.2.2	Protective impedance The following requirements apply. If protective impedance is formed by a combination of components, each component shall in turn be short-circuited or disconnected. If protective impedance is formed by a combination of basic insulation and a voltage- or current-limiting device, both the basic insulation and the voltage or current-limiting device shall be subjected to single faults, applied one at a time. Basic insulation shall be short- circuited. The voltage- or current-limiting device shall be short-circuited or disconnected, whichever is less favourable.	No protective impedance present in the product.	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Parts of a protective impedance which are high-integrity components need not be short circuited or disconnected.		
5.2.2.3	Transformers Transformer non-primary windings and sections of tapped windings, which are loaded under normal conditions shall be tested in turn, one at a time, to simulate short circuits in the load. All other windings are loaded or not loaded, whichever load condition is less favourable. The primary and non-primary windings of the transformer shall have a short circuit applied between them unless separated by reinforced or double insulation. The reinforced or double insulation shall be tested where thermal damage to the insulation may create a risk of electric shock. Short circuits shall also be made on the load side of any current-limiting impedance or over-current protective device which is connected directly to the winding.	The outputs of the SMPS has been loaded with a maximum load and have been short circuited. The transformer T1 has reinforced insulation (E-TEX wire and additional foil). No protective impedance present.	P N/A N/A
5.2.2.4	Outputs Outputs shall be short-circuited one at a time.	The internal power supplies have been short-circuited. See Table 11.	P
5.2.2.5	Insulation between circuits and parts Functional insulation between circuits and parts shall be short-circuited where this could cause overheating of any material creating a risk of fire, unless that material is of flammability class V-1 or better of IEC 60695-11-10. Basic insulation in primary circuits with less than the specified clearance distance shall be bridged to check against the spread of fire. Supplementary, reinforced and double insulation need not be short-circuited. The exception to this is where thermal damage to the insulation may create a risk of electric shock.	PCB material is rated UL 94-V0. N/A The com ports do have supplementary insulation.	P N/A N/A
5.2.2.6	Primary circuits and hazardous voltage non-primary circuits Single-fault conditions shall be applied by open-circuiting or short-circuiting components in primary circuits and hazardous voltage non-primary circuits, within the equipment, where these may create a risk of electric shock or fire.	The primary circuits are within a metal fire enclosure. The fire enclosure has been connected to PE.	P
5.2.2.7	Overloads Single-fault conditions shall be applied where a circuit or component overload may create a fire or electric shock hazard. This includes connection of the most unfavourable load impedances to terminals and connectors which deliver power or signal outputs from the equipment. It is permitted to use fusible links, overcurrent protection devices and the like to provide	The outputs of the power supply have been loaded with the maximum power. +5V loaded with 5A for 4 hrs +12V loaded with 3A for 4 hrs +24V loaded with 0,25A for 4 hrs + 55V loaded with 1,1A for 4	P

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Clause	Requirement + Test	Result - Remark	Verdict
	adequate protection. Where there are multiple outlets with the same internal circuitry, the single-fault test can be limited to one outlet only.	hrs +24V; resistors R49 and R50 started to smoke. After some time the +24V disappeared. No fire hazard appeared.	
5.2.2.8	Intermittently rated resistors Continuous dissipation in resistors designed for intermittent dissipation shall be considered under the single-fault condition assessment.	Not applied in the test object	N/A
5.2.2.9	DC inputs DC inputs shall be assessed for effects of reverse polarity under worst case conditions. It is permitted to use fusible links, overcurrent protection devices and the like to provide adequate protection. Where there are multiple inlets with the same internal circuitry, the test can be limited to one inlet only.	See Table 9	P
5.2.3	Duration of tests The equipment shall be operated until further change as a result of the applied fault is unlikely. Each test is normally limited to 1 h since a secondary fault arising from a single-fault condition will usually manifest itself within that time. If there is an indication that a risk of electric shock, spread of fire or injury to persons may eventually occur, for example if the temperature has not stabilized, the test shall be continued until one of these hazards does occur or for a maximum period of 4 h, unless a hazard occurs before then.	Single fault/overload tests have been performed with a duration of 4 hrs	P
5.2.4	Compliance		P
5.2.4.1	Compliance with requirements for electric shock protection		P
5.2.4.1.1	General A dielectric voltage withstand test according to 10.6.4.3 may be necessary to demonstrate that the equipment does not present an electric shock hazard following the application of a single-fault condition. PEB, PELV and SELV circuits shall remain safe to touch after the application of a single-fault condition. Following a single-fault condition; accessible parts shall not be hazardous live, as defined in 5.2.4.1.2.	 The secondary circuits are ELV The HLV circuits are within the metal case which is connected to PE (Class 1)	N/A N/A P
5.2.4.1.2	Values in single-fault condition Values in single-fault conditions are given below. Values exceeding the levels/limits of items a) to c) due to a single-fault condition are deemed to be hazardous live. The limits of items b) and c) apply only if the voltage exceeds the values of		P

<table>
<tr><td colspan="4">IEC 60255-27</td></tr>
<tr><td>Clause</td><td>Requirement + Test</td><td>Result - Remark</td><td>Verdict</td></tr>
<tr><td></td><td>item a).

a) Voltage levels are 55 V r.m.s. or 140 V d.c. For temporary voltages, the levels are those of 6.3 of IEC 61010-1:2010, measured across a 50 k resistor. For equipment rated for use in wet locations, the voltage levels are 33 V r.m.s. or 70 V d.c.
b) Current levels as shown in Table 4.
Table 4 – Current levels in single-fault condition
<table><tr><th>Installation location</th><th>Figure 3/Figure 4 of IEC 60990:1999 Measurement circuit to be used</th><th>Sinusoidal waveforms</th><th>Non-sinusoidal or mixed frequency waveforms</th><th></th></tr><tr><td></td><td></td><td>mA r.m.s.</td><td>mA peak</td><td>mA d.c.</td></tr><tr><td>Dry</td><td>Figure 4</td><td>3,5</td><td>5</td><td>15</td></tr><tr><td>Wet</td><td>Figure 3 with R_5 = 375 Ω (instead of 1 500 Ω)</td><td>3,5</td><td>5</td><td>15</td></tr><tr><td>Dry</td><td>Figure with R_5 = 75 Ω
Relates to possible burns in the frequency range 30 kHz to 500 kHz</td><td>500</td><td>---------</td><td>---------</td></tr></table>c) The capacitance level is that defined in Figure 3. in IEC 61010-1:2010.</td><td>The measured voltage is 27,3 Vac at an power supply voltage of 250 Vac

N/A

N/A</td><td></td></tr>
<tr><td>5.2.4.2</td><td>Compliance with requirements for temperature protection
Refer to sub clause 7.3.1</td><td></td><td>P</td></tr>
<tr><td>5.2.4.3</td><td>Compliance with requirements for protection against the spread of fire.
Refer to sub clause 7.11.3.</td><td></td><td>P</td></tr>
<tr><td>5.2.4.4</td><td>Compliance with requirements for hazardous gases and chemicals
Refer to sub clause 7.3.2.</td><td>No batteries present in the test object</td><td>P</td></tr>
<tr><td>5.2.4.5</td><td>Compliance with requirements for mechanical protection
Compliance with 5.2.4.5 is checked by inspection to ensure that no parts are expelled from the equipment due to parts exploding or imploding and that no mechanical hazard is caused by the application of a single-fault condition.

The means of protection against expelled parts should not be removable without the aid of a tool. If the protection is removable without the use of a tool, then Table 10, symbol 14 shall be used, and an appropriate warning provided in the documentation.</td><td>The test object has been provided with a suitable fire enclosure thus preventing particles expelling.

Tools are required to disassemble the test object</td><td>P

P</td></tr>
<tr><td>6</td><td>MECHANICAL ASPECTS</td><td></td><td></td></tr>
<tr><td>6.1</td><td>Protection against mechanical hazards</td><td></td><td></td></tr>
<tr><td>6.1.1</td><td>Stability
Under conditions of normal use, equipment shall not become physically unstable to the degree that it could become a hazard to the user.</td><td>The device shall be mounted in a 19” rack</td><td>P</td></tr>
<tr><td>6.1.2</td><td>Moving parts
Moving parts shall not be able to crush, cut or pierce parts of the body of the user likely to come into contact with them, nor severely pinch the user's skin under normal conditions and maintenance. This requirement does not apply to easily touched moving parts which are obviously intended to operate on parts of materials external to the equipment, for example tripping mechanism. Such equipment should be designed to minimize inadvertent touching of such moving</td><td>No moving parts present</td><td>N/A</td></tr>
</table>

<table>
<tr><td colspan="4">IEC 60255-27</td></tr>
<tr><td>Clause</td><td>Requirement + Test</td><td>Result - Remark</td><td>Verdict</td></tr>
<tr><td></td><td>parts (for example, by fitting of guards, handles, etc.).

Compliance with 6.1.2 is checked by inspection.</td><td></td><td></td></tr>
<tr><td>6.1.3</td><td>Edges and corners
All easily touched edges, projections, corners, openings, guards, handles and the like of the equipment case should be smooth and rounded so as not to cause injury during normal conditions

Compliance with 6.1.3 is checked by inspection.</td><td>The device is mounted in a 19” rack by means of a cassette/mounting fixture. This fixture has rounded edges</td><td>P</td></tr>
<tr><td>6.2</td><td>Mechanical requirements</td><td></td><td></td></tr>
<tr><td></td><td>The equipment should comply with the mechanical tests in 10.6.2.1 to 10.6.2.4.
Where higher severity levels are required, they shall be agreed between the manufacturer and the user.</td><td>The test object has been subjected to the vibration tests as specified in IEC 60255-21-1/2/3, class 1.</td><td>P</td></tr>
<tr><td>6.3</td><td>Mechanical security of terminations</td><td></td><td></td></tr>
<tr><td></td><td>Refer to Annex E.
Permanently connected equipment
Equipment designed for permanent connection and equipment with ordinary non-detachable power supply cables shall be provided with terminals in which connection is made by means of screws

Table E.1 – Range of conductor sizes to be accepted by terminals
<table><tr><th>Cable termination application</th><th>Recommended cable size
mm²</th></tr><tr><td>CT circuits</td><td>2,5 to 6,0</td></tr><tr><td>Alarm and signalling for example, SCADA</td><td>0,5 min.</td></tr><tr><td>Communication circuits for example, RS232</td><td>As recommended by the manufacturer</td></tr><tr><td>Other circuits for example, VT, auxiliary, etc</td><td>1,0 to 2,5</td></tr></table></td><td>With a set of screw terminals

Wire sizes have been specified in the documentation</td><td>P</td></tr>
<tr><td></td><td>E.4 Terminals
Table E.2 – Sizes of terminal studs or screws directly securing supply conductors
<table><tr><th rowspan="2">Rated current of equipment</th><th colspan="2">Minimum nominal thread diameter
mm</th></tr><tr><th>Pillar or stud size</th><th>Screw size[a] [b]</th></tr><tr><td>Up to and including 10 A</td><td>3,0</td><td>3,5</td></tr><tr><td>Over 10 A up to and including 16 A</td><td>3,5</td><td>4,0</td></tr><tr><td colspan="3">[a] Screw size refers to a terminal that clamps the conductor under the head of a screw, with or without a washer. This does not exclude the indirect securing of conductors by other means, for example, a ‘moving cage clamp’, using smaller screw sizes.
[b] If the screw size does not meet these requirements, the manufacturer shall demonstrate conformity by type testing. The resultant temperature at maximum current and at maximum ambient temperature, shall not exceed the ratings of the materials used. The terminations shall remain mechanically secure.</td></tr></table>Terminals shall be so designed that they clamp the conductor between metal surfaces with sufficient contact pressure and without damage to the conductor.
Terminals shall be so designed or located that the conductor cannot slip out when the clamping screws or nuts are tightened.
Terminals shall be so fixed that when the means of clamping the conductor is tightened or loosened:
a) the terminal itself does not work loose;
b) internal wiring is not subjected to stress;
c) creepage distances and clearances are not reduced below the values specified in Annex C.
Compliance with the requirements of Clause E.4 is checked by inspection and measurement.</td><td></td><td>P</td></tr>
</table>

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Clause	Requirement + Test	Result - Remark	Verdict
	For ordinary non-detachable power supply cables, each terminal shall be located in proximity to its corresponding terminal or terminals of different potential. Compliance of non-detachable power supply cables is checked by inspection.		
7	**FLAMMABILITY AND RESISTANCE TO FIRE**		P
7.1	**General** This clause provides methods and procedures to reduce the risk of fire associated with the equipment to a safe level, by one of the following means. Eliminating or reducing the sources of ignition within the equipment. Reducing the amount of combustible (or flammable) materials within the equipment. Containment of a fire within the equipment, should it occur.		P
7.2	**Rationale** Equipment or parts of equipment may cause excessive temperatures, under normal condition or single-fault condition, which could lead to a risk of fire within the equipment or to its surroundings. The flow chart in Figure 1 shows requirements for protection against the spread of fire. In the design of the test object the following solution for protection against the spread of fire has been selected; sub clause 7.10, 7.5, 7.6, 7.6.2, 7.8 and 7.10;		

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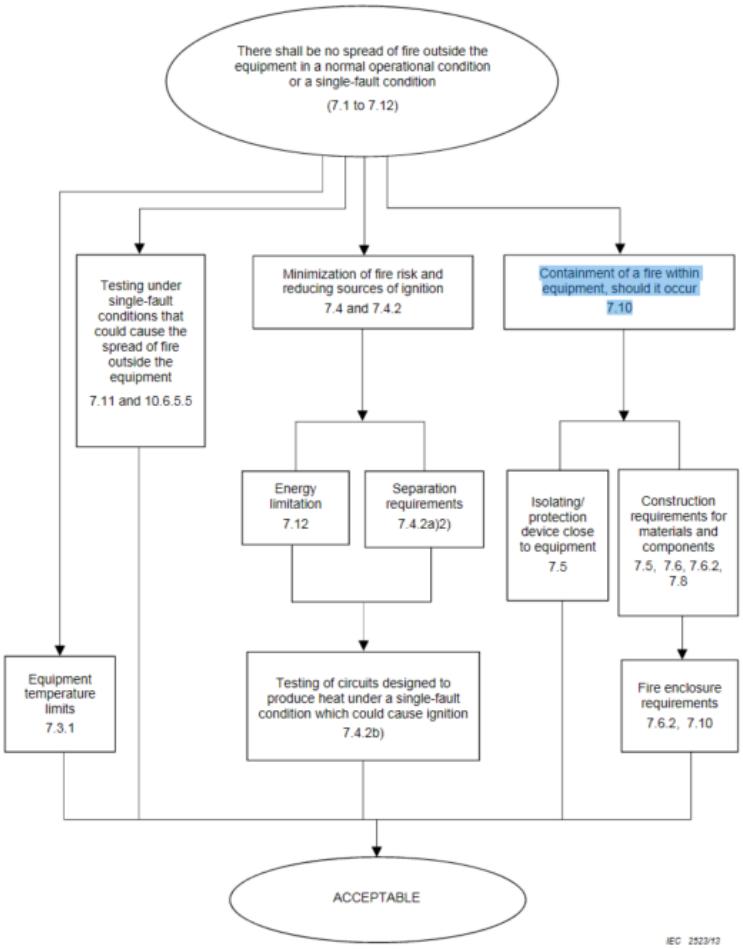
Clause	Requirement + Test	Result - Remark	Verdict
	 **Figure 1 – Flow chart showing requirements for protection against the spread of fire**		
7.3	**General hazards from overheating and fire**		
7.3.1	Equipment temperature limits Heating shall not cause a hazard under normal conditions or single-fault conditions, nor shall it cause spread of fire outside the equipment. Table 5 specifies the maximum acceptable temperatures under normal conditions at maximum ambient temperature. The temperatures in Table 5 can be exceeded under the following conditions; a) For areas unlikely to be touched, with no dimension exceeding 50 mm, 100 °C is allowable. b) Temperatures exceeding the limits, which are for an ambient temperature of 40 °C, are permitted provided that unintentional contact is unlikely and the part has a warning indicating that it is hot, for example, symbol 13 (or 14) of Table 10 Refer to 7.11 for the maximum acceptable temperatures under a single-fault condition.	The maximum temperature measured under single fault condition simulating an overload of the power supply results in a surface temperature of 62 °C at 22 °C ambient. The specified maximum temperature is 55 °C. the calculated max surface temperature is; 62 + 33 = 95 °C. This hot surface is not accessible to the user. No symbol warning required.	P

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Clause	Requirement + Test	Result - Remark	Verdict
	If easily touched heated surfaces are necessary for functional reasons, they are permitted to exceed the values in Table 5, but shall be recognizable as such by appearance or function or shall be marked. Symbol 13 of Table 10 should be used to indicate that a surface or part is hot. Compliance with 7.3.1 is checked by measurement and by inspection of guards and covers, to check that they protect against accidentally touching surfaces that are at temperatures above the values in Table 5. All guards and covers shall be in place when conducting the test. If the guards or covers can be removed without the aid of a tool, symbol 13 or symbol 14 of Table 10 shall be used.		
7.3.2	Hazardous gases and chemicals The equipment shall not liberate dangerous amounts of poisonous or injurious gases under normal operation. The manufacturer's documentation shall state which potentially poisonous or injurious gases may be liberated, and the quantities. Conformity is checked by inspection of the manufacturer's documentation. The wide variety of gases makes it impossible to specify conformity tests based on limit values, so reference should be made to tables of occupational threshold limit values.	No hazardous gasses and chemicals have been specified by the manufacturer. No batteries enclosed in the test object.	N/A
7.4	**Minimization of fire risk**		
7.4.1	General The minimization of fire risk, both within the equipment and to cabling and wiring, shall be a major consideration. Protection consistent with reliability and operational requirements shall be provided. In the event of a single-fault condition, any damage shall be contained within the equipment (see 7.11). Components and materials shall be chosen and used so that there is negligible risk of a fire being caused due to component failure or possible short circuit. Safety critical components of primary circuits and circuits exceeding ELV voltage limits should comply with Annex D. The equipment and its circuit diagrams shall be examined to determine if single-fault condition tests are necessary to demonstrate that there is a negligible risk of fire.		
7.4.2	Eliminating or reducing the sources of ignition within the equipment The risk of ignition and occurrence of fire is considered to be reduced to a tolerable level if the following requirements are met for each source of ignition hazard. Either 1) or 2) 1) The voltage, current and power available to the circuit or part of equipment is limited as	N/A	P

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Clause	Requirement + Test	Result - Remark	Verdict
	specified in 7.12. Conformity is checked by measurement of limited-energy values as specified in 7.12. 2) Insulation between parts at different potentials meets the requirements for basic insulation, or it can be demonstrated that bridging the insulation will not cause ignition. Conformity is checked by inspection and in case of doubt by test, applying the criteria of 7.11. In circuits designed to produce heat, no ignition occurs when tested in any single-fault condition (see 5.2) which could cause ignition. All circuits of the equipment which cannot be classified as limited-energy circuits (see 7.12) are considered to be an ignition source of fire, in which case either method i) or ii) below shall be used. Testing in the single-fault conditions (see 5.2) which could cause the spread of fire outside the equipment. Verifying as in 7.11 that if a fire occurs it will be contained within the equipment. Conformity is checked by the relevant tests of 5.2, applying the criteria of 7.11.	Applicable, checked by inspection applicable Tested in single fault condition by loading the power supply at its most unfavourable condition, causing maximum dissipation and by short circuiting the outputs of the power supply.	
7.5	**Cabling and fusing**		
	The manufacturer shall recommend the following to minimize the risk of fire and thermal overload of the a.c. or d.c. supply and protective conductors or other equipment fed by the product, taking into account worst-case single-fault conditions. Connection cables: minimum cross-section and voltage rating. Protection devices: fuse or circuit-breaker rating; this should include the protection device characteristic, voltage rating and that it should be close to the equipment. Failures or faults can be due to short circuits within the equipment or to accessible conductive parts, earth faults, short circuit in the output circuits, or control circuit failure.	The manufacturer specifies; PE wire; min 2,5 mm^2 Power supply wiring: 2,5 mm^2 CT/VT wiring 2 – 2,5 mm^2 The manufacturer specifies an external fuse; HRC fuse, for example NIT red spot or TIA; Current rating; 16A Min DC rating; 220 Vdc gG operating class in acc. With IEC 60269	P P
7.6	**Flammability of materials and components**		
7.6.1	General Conformity is checked by inspection of data on materials, or by performing the flammability tests specified in IEC 60695-11-10 on three samples of the relevant parts (see Table 12 and 10.6.5 of this standard). The samples may be any of the following: complete parts; sections of a part, including the area with the least wall thickness and any ventilation openings;	The flammability data has been checked	P

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Clause	Requirement + Test	Result - Remark	Verdict
	specimens in accordance with IEC 60695-11-10. Where safety is involved, components shall meet one of the following: the flammability requirements of a relevant IEC component standard which includes such requirements; where no relevant IEC standard exists, the flammability requirements of this standard; applicable flammability requirements of a non-IEC standard where these are at least as high as those of the relevant IEC standard, provided that the component has been approved to the non-IEC standard by a recognized testing authority.	Not applied UL 94 has been applied UL 94 has been applied	P
7.6.2	Materials for components and other parts inside fire enclosures Materials for use within fire enclosures shall comply with any of the following. Electrical components which do not present a fire hazard under abnormal operating conditions when tested according to 5.2. Materials and components within an equipment case of volume 0,06 m 3 or less, consisting totally of metal and having no ventilation openings, or within a sealed unit containing an inert gas. One or more layers of thin insulating material, such as adhesive tape, used directly on any surface within the fire enclosure, including the surface of current-carrying parts, provided that the combination of the thin insulating material and the surface of application comply with the requirements of flammability class V-2, or better, of IEC 60695-11-10. Where the thin insulating material is on the inner surface of the fire enclosure itself, the requirements for fire enclosure construction in 7.10 apply. Electronic components, such as integrated circuit packages, opto-coupler packages, capacitors and other small parts mounted on material of flammability class V-1, or better, of IEC 60695-11-10. Wiring, cables and connectors insulated with PVC, TFE, PTFE, FEP or neoprene or polyimide or insulated wire with a flammability class equivalent V-1, or better, of IEC 60695-11-10 Individual clamps (not including helical wraps or other continuous forms), lacing tape, twine and cable ties used with wiring harnesses.	Applicable No such components present An insulation film has been attached at the metal enclosure at BIU261D solder side. Applicable Applicable Not applicable	P
7.6.3	Materials for fire enclosures		P

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Clause	Requirement + Test	Result - Remark	Verdict
	Materials for components which fill an opening in a fire enclosure, and which are intended to be mounted in that opening shall: be of flammability class V-1, or better, of IEC 60695-11-10; or pass the flammability test of IEC 60695-11-10; or comply with the flammability requirements of the relevant IEC component standard. NOTE Examples of these components are fuse-holders, switches, connectors and appliance inlets. Plastic materials of a fire enclosure shall be located more than 13 mm through air from arcing parts such as unenclosed switch contacts. Plastic materials of a fire enclosure located less than 13 mm through air from non-arcing parts which, under any condition of normal or abnormal operation, could attain a temperature sufficient to ignite the material, shall be capable of passing the test of IEC 60695-2-20. The average time to ignition of the samples shall be not less than 15 s. If a sample melts through without igniting, the time at which this occurs is not considered to be the time to ignition. Compliance with 7.6.3 is checked by inspection of the equipment and material data sheets and, if necessary, the appropriate flammability test.	The applied connectors comply with at least class V1. The fire enclosure is made of metal. See Table 7. N/A The material datasheets have been checked	
7.6.4	Materials for components and other parts outside fire enclosures Except as otherwise noted below, materials for components and other parts (including mechanical enclosures, electrical enclosures and decorative parts), located outside fire enclosures, shall have a minimum flammability class HB75 if the thinnest significant thickness of this material is 3 mm, or flammability class HB40 if the thinnest significant thickness of this material is 3 mm, or flammability class HBF. Where a mechanical or an electrical enclosure also serves as a fire enclosure, the requirements for fire enclosures apply (see 7.6.3 and 7.10). be made of material of flammability class V-1, or better, of IEC 60695-11-10; pass the tests of IEC 60695-11-10; comply with the flammability requirements of the relevant IEC component standard; be located in a secondary circuit supplied by a power source that is limited to a maximum of 15 VA or complies with limited-energy circuit requirements (see 7.12) under normal operating conditions and after a single fault in the equipment (see 5.2).	See Table 7.	P

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Clause	Requirement + Test	Result - Remark	Verdict
7.6.4	The above flammability requirements do not apply to any of the following: electrical components which do not present a fire hazard under abnormal operating conditions when tested according to 5.2; materials and components within an enclosure of 0,06 m 3 or less, consisting totally of metal and having no ventilation openings or within a sealed unit containing an inert gas; components meeting the flammability requirements of a relevant IEC component standard which includes such requirements; electronic components, such as integrated circuit packages, opto-coupler packages, capacitors and other small parts that are: – mounted on material of flammability class V-1, or better, of IEC 60695-11-10; – supplied from a power source of no more than 15 VA, or complies with limited-energy circuit requirements (see 7.12), under normal operating conditions or after a single fault in the equipment and mounted on material of flammability class HB75 if the thinnest significant thickness of this material is 3 mm; – flammability class HB40 if the thinnest significant thickness of this material is 3 mm. Connectors shall comply with one of the following: be made of material of flammability class V-1, or better, of IEC 60695-11-10; pass the tests of IEC 60695-11-10; comply with the flammability requirements of the relevant IEC component standard; be located in a secondary circuit supplied by a power source that is limited to a maximum of 15 VA or complies with limited-energy circuit requirements (see 7.12) under normal operating conditions and after a single fault in the equipment (see 5.2).	 Applicable Not applicable Not applicable PCB's have classification UL94-V-0 See Table 7, Flammability data assessment Testing not required Not applicable	P
7.7	**Fire ignition sources**		
	All circuits of equipment which can be classified as including primary circuits or circuits exceeding ELV voltage limits (see above) shall be considered to be an ignition source of fire. All electrical components of such circuits are considered likely to be an ignition source of fire.	The primary circuits are HLV; Primary/secondary input power supply circuits Voltage measurement circuits Binary input circuits	-
7.8	**Conditions for a fire enclosure**		
7.8.1	General A fire enclosure is required when temperatures of parts under fault conditions could be sufficient for ignition	A metal fire enclosure has been applied	P
7.8.2	Parts requiring a fire enclosure The following are considered to have a risk of ignition and therefore require a fire enclosure. Components in primary circuits. Except where equipment has had all the applicable single-fault	A metal fire enclosure has been applied. Abnormal operating conditions have been applied on the power supply circuits	P

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Clause	Requirement + Test	Result - Remark	Verdict
	tests of 5.2 applied. Components in non-primary circuits supplied by power sources which exceed the limits specified in 7.12. Components in non-primary circuits supplied by a source complying with limited-energy circuits as specified in 7.12, but not mounted on material of flammability class V-1, or better, of IEC 60695-11-10. Components within a power supply unit or assembly having an output complying with a limited-energy circuit, as specified in 7.12, including overcurrent protective devices, limiting impedances, regulating networks and wiring (see 7.8.3 for exceptions), up to the point where the source output criteria for a limited-energy circuit are met. Components having unenclosed arcing parts, such as open switch and relay contacts in a circuit at hazardous voltage or at a hazardous energy level. Insulated wiring, except as permitted in 7.8.3.	powered by the HLV power supply input (over-loading the power supply outputs until the main power supply (+ 55 V) failed). Not applicable Not applicable. Power supply input relay is closed. Applicable; for CT and VT input circuit wiring. Thermal withstand tests have been performed (100 x In)	
7.8.3	Parts not requiring a fire enclosure The following do not require a fire enclosure: motors; transformers; electromechanical components complying with 7.6; components, including connectors, meeting the requirements of 7.10, which fill an opening in a fire enclosure; wiring and cables insulated with PVC, PTFE, TFE, FEP, neoprene or polyimide; plugs and connectors forming part of a power supply cord or interconnecting cable; connectors in non-primary circuits supplied by power sources which are limited to a maximum of 15 VA under normal operating conditions and after a single-fault in the equipment; connectors in non-primary circuits supplied by limited-energy circuits complying with 7.12; other components in non-primary circuits: – supplied by a limited-energy circuit complying with 7.12 and mounted on materials of flammability class V-1 or better, of IEC 60695-11-10; – supplied by internal or external power sources which are limited to a maximum of 15 VA under normal operating conditions and after a single-fault in the equipment and mounted on material having a minimum flammability class HB75, if the thinnest significant thickness of this material is ≤		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	3 mm or flammability class HB40 if the thinnest significant thickness of this material is ≥ 3 mm; equipment which has had all the applicable single-fault tests of 5.2 applied to both the primary and non- primary circuits; small parts, such as paper labels, up to 1 500 mm^2. If the components become excessively hot under a single-fault condition and are mounted within 13 mm of non-metallic materials of V-2 rating or worse, then a hot wire ignition (HWI) test to IEC 60695-2-12 can be carried out on the non-metallic material, of minimum thickness, to determine if there is a risk of fire. Compliance with 7.8.2 and 7.8.3 is checked by inspection and by evaluation of the data provided by the manufacturer. In the case where no data is provided, compliance is determined by tests.		
7.9	**Requirements for primary circuits and circuits exceeding ELV limits** The risk of fire in primary circuits and circuits exceeding ELV limits shall be considered to be reduced to a tolerable level if such circuits of the equipment, and the equipment case, comply with the constructional requirements of 7.10 or the transformers etc., have overcurrent or over-temperature protection which complies with the relevant IEC standard.		P
7.10	**Fire enclosures and flame barriers**		
	The fire enclosure shall meet the following requirements. The bottom shall have no openings or, to the extent in Figure 3, shall be constructed with baffles as specified in Figure 2 or be made of metal, perforated as specified in Table 6 or be a metal screen with a mesh not exceeding 2 mm centre to centre and a wire diameter of at least 0,45 mm. The sides shall have no openings within the area that is included within the inclined line C in Figure 3. The equipment case, and any baffle or flame barrier, shall be made of metal (except magnesium) or of non-metallic materials having a flammability class of V-1, or better, of IEC 60695-11-10. The equipment case, and any baffle or flame barrier, shall have adequate rigidity. A flame barrier and the bottom of a fire enclosure are considered to comply without test, if in the smallest thickness used, the material is of flammability class V-1 of IEC 60695-11-10 or better. Compliance with 7.10 is checked by inspection. In case of doubt the flammability class of V-1, or better, is checked on three samples according to IEC 60695-11-10 See fig 2. Baffle plate and fig. 3 location and extent of a flame barrier.	The equipment enclosure entirely is made of metal. (ventilation) holes meet the requirements regarding spacing and diameter.	P
7.11	**Assessment of the fire risk due to a single-fault condition**		

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Clause	Requirement + Test	Result - Remark	Verdict
7.11.1	Guidelines for maximum acceptable temperatures when subjecting a circuit or component to a single-fault condition Where it is not practical to protect components against overheating, under a single-fault condition, the components shall be mounted on materials of flammability class V-1 or better, of IEC 60695-11-10. Additionally, such components shall be separated from material of a class lower than flammability class V-1 by at least 13 mm of air or by a solid barrier of material of flammability class V-1, or better. The temperatures specified shall be at the hottest point on the surface of a component or material or within it. Where it is not possible to meet the above criteria for components/circuits subject to overheating under fault conditions, these should be effectively shielded or separated to prevent overheating of their surrounding materials and components (see 7.10). Alternatively, the equipment, mounted under normal conditions may be subjected to the compliance test in 7.11.3.	The components are mounted on a printed circuit board with flammability class UL 94 V-0 The heat dissipating components are located in a metal fire enclosure	P P
7.11.2	Temperature of windings under a normal condition or a single-fault condition If a hazard could be caused by excessive temperature, the temperature of the insulating material of windings shall not exceed the values of Table 7 in normal condition or single-fault condition. The values in Table 7 are not applicable for short term overloads and if the temperature of a winding is determined using thermocouples, the values in the table are reduced by 10 °C, except in the case of a motor, or a winding with embedded thermocouples. Refer to table 7; insulation material of windings Compliance with 7.11.2 is checked by measurement in the normal condition and in the applicable single-fault condition.	See Table 1. Heating test. Thermocouples have been applied.	P
7.11.3	Compliance of equipment with requirements for protection against the spread of fire Refer to 10.6.5.5 for single-fault testing Compliance of equipment to 7.11.3 with requirements for protection against the spread of fire is checked, as a safety type test, by placing the equipment on wrapping tissue (wrapping paper of between 12 g/m^2 and 30 g/m^2), covering a softwood surface and covering the equipment with a single layer of cheesecloth (bleached cotton of approximately 40 g/m^2). No molten metal, burning insulation, flaming	As a result of the single fault test (overload and short circuit conditions) no fire hazard has been created.	P

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Clause	Requirement + Test	Result - Remark	Verdict
	particles, etc., shall fall on the surface on which the equipment stands, and there shall be no charring, glowing, or flaming of the tissue paper or cheesecloth. Melting of insulation material which is not of importance according to the requirements of this standard shall be ignored.		
7.12	**Limited-energy circuit**		
	A limited-energy circuit is a circuit that meets all the following criteria. The potential appearing in the circuit is not more than 33 V RMS. or 70 V d.c. b) The current that can appear in the circuit is limited by one of the following means: 1) the maximum available current is limited inherently or by impedance so that it cannot exceed the relevant value of Table 8; 2) current is limited by an overcurrent protective device according to Table 9; 3) a regulating network limits the maximum available current so that it cannot exceed the relevant value of Table 8 under normal conditions or as a result of one fault in the regulating network. c) It is separated by at least basic insulation from other circuits that would result in energy values exceeding criteria a) and b) above. If an overcurrent protective device is used, it shall be a fuse or a non-adjustable non-self-resetting electromechanical device. Conformity to 7.12 is checked by inspection and by measuring the potentials appearing in the circuit, the maximum available current, under the following conditions. The potentials appearing in the circuit are measured in the load condition that maximizes the voltage. Output current is measured after 60 s of operation, with the resistive load (including short circuit) which produces the highest value of current. Refer to Table 8 – Limits of maximum available current Refer to Table 9 – Overcurrent protective device	There is no limited energy circuit implemented.	N/A
8	**GENERAL AND FUNDAMENTAL DESIGN REQUIREMENTS FOR SAFETY**		P
8.1	**Climatic conditions for safety**		P
	Climatic conditions of equipment denote the conditions in the immediate environment. The equipment safety shall not be impaired by the environmental ranges declared by the manufacturer. These conditions include:	Climate tests, together with insulation and dielectric strength tests have been conducted on the equipment under test. The climate tests have been	P

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Clause	Requirement + Test	Result - Remark	Verdict
	temperature, operation and storage; humidity, non-condensing; atmospheric pressure.	performed with the temperature settings according the manufacturer specification.	
8.2	**Electrical connections**		
	The design of electrical terminations and connection points shall be such that the expected reliability will be maintained throughout the life of the equipment. Allowance shall be made for the conditions normally encountered in service, for example, corrosion due to humidity, shocks, heat and creep. Compliance of protective bonding, with 8.2, shall be verified by test. Wires and cables shall be in accordance with IEC standards. Conductors and their cross-sections shall comply with the electrical, mechanical and climatic requirements of this standard. Furthermore, the structure of the conductors and their cross-sections shall be matched to the connection method used (for example, connection method without screws or soldering shall be according to IEC 60352-1 or IEC 60352-2). Current-carrying parts should have the necessary mechanical strength and current-carrying capacity for their intended use. For electrical connections, no contact pressure should be transmitted through insulating material other than ceramic or other material with characteristics no less suitable, unless there is sufficient resilience in the metallic parts to compensate for any possible shrinkage or yielding of the insulation material	The connection points of the device have been subjected to the climate tests. No corrosion has been observed after these tests. The measured protective bonding is < 0,031 Ω The TMU210/TMU220 wiring complies with UL 200 degr. C Refer to the chapter connection C26X/EN CO/Z01 which is part of the product documentation. Each connector has been specified regarding wire cross section and electrical ratings. The CT circuits have been subjected to the thermal withstand test; 100 Arms, 1 s on the 1A input 500 Arms, 1 s on the 5A input Fastons are used for connecting the CT/VT circuits to the terminal block (direct contact to the wire, not via insulation)	P P P P
8.3	**Components**		
8.3.1	General		N/A
	Refer to Annex D for safety-related guidance on the design and application of components for use in equipment within the scope of this standard.		N/A
8.3.2	High-integrity part or component		P
	High-integrity parts or components shall be used in positions (see 5.1.4 and 5.2.2.2) where if short-circuiting or disconnection occurred, an infringement of the requirements in a single-fault condition would be caused. High-integrity parts and components shall be constructed, dimensioned and tested to IEC publications (where applicable) so that safety and reliability for the expected application is assured. They may be regarded as fault-free in relation to this standard.	No protective impedance has been applied. The following safety related components/ highly integrated parts have been applied. For further information refer to Table 10, critical component information.	P

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Clause	Requirement + Test	Result - Remark	Verdict
	Examples of such requirements and tests are: dielectric voltage tests appropriate to double or reinforced insulation; dimensioning of at least twice the dissipation (resistor); climatic tests and endurance tests to ensure reliability throughout the life of the equipment; withstand test for resistors, i.e. either an impulse voltage withstand test to IEC 61180-1, source impedance 2 Ω, or a dielectric voltage test. The withstand test voltage shall be determined from Table C.9 or Table C.10. A single electronic device which employs electron conduction in a vacuum, gas or semi-conductor is not regarded as a high integrity part. Compliance with 8.3 is checked by inspection of component manufacturers data or, by performing the relevant tests.	Applicable tests are performed on all independent circuits, thereby the high integrity parts have been included in these tests (climate tests, dielectric voltage test, impulse voltage tests, insulation measurements).	
8.4	**Connection to telecommunication networks**		
	IEC 62151 shall be used for ports intended to be connected to telecommunication networks. (TNV-0 circuits and TNV-1/2/3 circuits) TNV-0 equals the IEC 60950 SELV circuit definition		N/A
8.5	**Connection to other equipment**		
	Where equipment is intended to be electrically connected to another product, to an accessory, or to a communication circuit/network, interconnection circuits shall be selected to provide continued performance to the requirements of Table A.1. This is normally achieved by connecting ELV circuits to ELV circuits, SELV circuits to SELV circuits, PELV circuits to PELV circuits, PEB circuits to PEB circuits and TNV circuits to TNV circuits (For definitions and information on TNV circuits, refer to IEC 62151.) Interconnecting cables can carry more than one type of circuit (SELV circuit, TNV circuit, ELV circuit, hazardous voltage circuit, etc.) provided that they are separated as required by this standard. HLV circuits may be connected to other HLV circuits of other equipment which have compatible electrical ratings. Compliance with 8.5 is checked by inspection. Where additional products are specifically complementary to the host (first) equipment (for example, a separate control interface for the equipment) ELV circuits are permitted as interconnection circuits between these items, provided that these continue to meet the requirements of this standard when connected together.	The documentation shows how to connect to other equipment, the intended connections for safe operation N/A	P

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Clause	Requirement + Test	Result - Remark	Verdict
8.6	**Laser sources**		
	The equipment shall be designed in accordance with IEC 60825-1.	Eye safety class; US FDA CDRH AEL Class 1 EN(IEC)60825-1,2, EN60950 Class 1 Safety warnings are included in the documentation, not to look into the laser	P
8.7	**Explosion**		P
8.7.1	General		N/A
	For information on components not covered by 8.7, see 8.3 and Annex D.		N/A
8.7.2	Components at risk of explosion		P
8.7.2.1	General		
	When components liable to explode if overheated or overcharged are not provided with a pressure-release device, protection for the user shall be incorporated in the equipment (see 5.2.4.5). Pressure-release devices shall be located such that a discharge will not cause danger to the user. The construction shall be such that any pressure-release device shall not be obstructed.	Electrolytic capacitors are provided with a means for pressure release. These components are also enclosed in the equipment housing which is intended to be a fire enclosure	P
8.7.2.2	Batteries		N/A
	Batteries shall not cause explosion or produce a fire hazard as a result of excessive charge or discharge or if installed with incorrect polarity. Where necessary, protection shall be incorporated in the equipment, unless the manufacturer's instructions specify that it is for use only with batteries which have built-in protection. See Annex F for examples of battery protection circuits. If an explosion or fire hazard could occur through fitting a battery of the wrong type (for example, where a battery with built-in protection is specified), there shall be a warning marking (see 9.1.10) on or near the battery compartment or mounting and a warning in the manufacturer's instructions. An acceptable marking is symbol 14 of Table 10 (refer to documentation from the manufacturer). If the equipment has means for charging rechargeable batteries, and if non-rechargeable cells could be fitted and connected in the battery compartment, there shall be a warning marking in or near the compartment (see 9.1.8 and 9.1.10). The battery compartment shall be designed so that there is no possibility of explosion or fire caused by build-up of flammable gases. Batteries shall be so mounted that safety cannot be impaired by leakage of their electrolyte. For batteries intended to be replaced by the user, if an attempt is made to install a battery with its polarity reversed, no hazard shall arise. Conformity is checked by inspection, including inspection of battery data, to establish that failure of a single component cannot lead to an explosion or fire hazard. If necessary, a short circuit and an open circuit are made on any single component	No batteries present in the equipment	N/A

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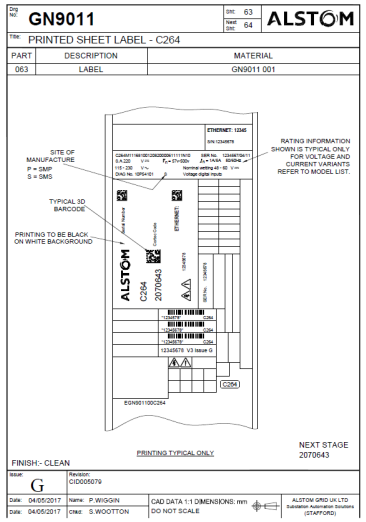
Clause	Requirement + Test	Result - Remark	Verdict
	(except the battery itself) whose failure could lead to such a hazard.		
9	**MARKING, DOCUMENTATION AND PACKAGING**		
9.1	**Marking**		
9.1.1	General	The following document has been applied for the markings assessment; DS Agile C26x System version: 7.6.2 Technical Manual Publication Reference: C26x/EN M/E62	
	When mounted in its normal operating position, the equipment should carry, where possible, markings in accordance with 9.1.2 to 9.1.11 inclusive. These markings shall, where possible, be visible from the exterior of the equipment or be visible by removing a cover or the opening of an aperture without the aid of a tool, if the cover or aperture is intended to be removed by the user. Where, because of space limitations, it is not possible for these markings to be visible in the normal operating position or are found elsewhere on the equipment, an explanation of these symbols shall be included in the equipment documentation (see Table 10 for the description of the symbols). For rack or panel equipment, markings are permitted to be on any surface that becomes visible after removal of the equipment from the rack or panel. Markings that apply to the whole equipment shall not be placed on parts that can be removed by the user without the use of a tool. For the values of preferred voltages, currents, frequency and their tolerances, IEC 60255-1 should be referred to. The markings listed in Clause 9 shall be considered to be safety-related. Safety marking shall wherever possible take precedence over any functional markings.	 	P
9.1.2	Identification		
	The equipment shall, as a minimum, be marked with: the name or trade mark of the manufacturer or supplier; the model or type reference; if equipment bearing the same distinctive designation (model number) is manufactured at more than one location, the manufacturing location (factory location can be in code).	Inspected. The official label was not attached to the test objects therefore the label design drawing has been inspected.	P

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Clause	Requirement + Test	Result - Remark	Verdict
	The above are the minimum mandatory requirements that shall be marked on the equipment. If the equipment consists of two parts, the part accessible under normal conditions shall be marked with type and manufacturer. The other part should have all markings in accordance with 9.1. Compliance with 9.1 shall be checked by inspection.		
9.1.3	Auxiliary supplies, VT, CT, I/O (Input/Output)		
9.1.3.1.	General requirements for marking	Inspected	P
	For marking the following shall be taken into account: a.c. – with symbol 2 of Table 10 and rated frequency or frequency range; d.c. – with symbol 1 of Table 10; symbol 3 of Table 10 on equipment for a.c. and d.c. supply; symbol 4 of Table 10 on equipment for 3 phase a.c. supply; a hyphen (-) shall be used to separate the lower and upper nominal voltages / measurands, for example, 125 V-230 V; for selectable voltage or current markings: – the lower and upper selectable values shall be separated by means of a solidus, i.e. forward slash (/), for example, 125 V/230 V, 1 A/5 A; – when equipment uses voltages or frequencies where switching is automatic then the markings shall be according to symbol 15 of Table 10 or the word "AUTO" (see the examples in Table 10); – where an operating voltage is achieved using an external, separate device, for example, an additional series resistor, then the equipment shall be marked with this operating voltage followed by the legend EXT.R. (in capital letters), for example, 125 VEXT.R;	Inspected are the label drawing and technical manual C26x/EN M/E03 (system version 7.0.3) See the subclauses 9.1.3.1 – 9.1.3.5	P
9.1.3.1	Auxiliary supplies, VT, CT, I/O (Input/Output)		
	the burden in watts (active power) or volt-amperes (apparent power) or the rated input current, with all accessories or plug-in modules connected; the documentation shall specify the burden of individual digital inputs, output relays and other I/O ports of significant burden in order for the user to calculate the worst-case burden for the equipment application; the values shall be measured with the equipment powered at nominal voltage, but without being operational; the measured value shall not exceed the marked value by more than 10 %; the rated supply voltage(s) or the rated supply voltage range. -If the equipment can be used on more than one voltage range then the separate voltage ranges		P

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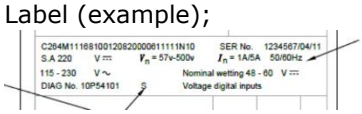
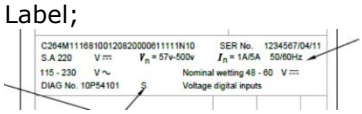
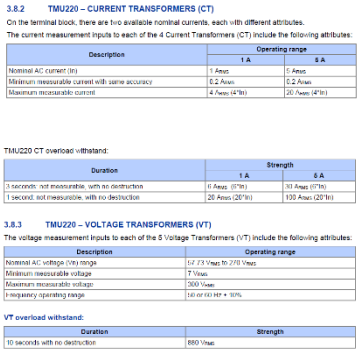
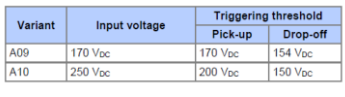
Clause	Requirement + Test	Result - Remark	Verdict
	shall be marked unless their maximum and minimum values do not differ by more than 20 % of the mean value. -If a user can set different rated supply voltages on the equipment then a means of indication for the set voltage shall be provided on the equipment. If a.c. or d.c. supply setting alteration can be achieved without the use of a tool, then the action of changing the setting shall also change the indication.		
9.1.3.2	Auxiliary supply		
	The following information shall be provided: on the equipment and in the documentation: – a.c. and/or d.c. supply; – the rated values; in the documentation: – the burden; – the operating voltage range (in accordance with IEC 60255-1).	Label (example);  C264M1116810012082000061111N10 SER No. 1234567/04/11 S.A 220 V ⎓ V_n = 57v-500v I_n = 1A/5A 50/60Hz 115 - 230 V ~ Nominal wetting 48 - 60 V ⎓ DIAG No. 10P54101 S Voltage digital inputs Documentation;  BIU261D: Main power supply input Nominal ranges / Operative DC range / Operative AC range 110 to 250 Vdc / 85 to 300 Vdc / - 110 to 250 Vac / - / 90 to 300 Vac BIU261D: Backup power supply input (DC range only) Nominal ranges / Operative DC range 110 to 250 Vdc / 85 to 300 Vdc Burden (C264 with DIU221, TMU210 and TMU220); Maximum power supply output load; 60 W Measured max. burden at 220 Vac; 86,9 VA 220 Vdc; 38,7 W	P
9.1.3.3	Measurands		
	The following information shall be provided: on the equipment and in the documentation: – the nominal values, for example, voltage, current, frequency; in the documentation: – the burden; – the operating voltage range (in accordance with IEC 60255-1); – the overload withstand.	Label;  C264M1116810012082000061111N10 SER No. 1234567/04/11 S.A 220 V ⎓ V_n = 57v-500v I_n = 1A/5A 50/60Hz 115 - 230 V ~ Nominal wetting 48 - 60 V ⎓ DIAG No. 10P54101 S Voltage digital inputs Documentation (TMU 220);  3.8.2 TMU220 – CURRENT TRANSFORMERS (CT) On the terminal block, there are two available nominal currents, each with different attributes. The current measurement inputs to each of the 4 Current Transformers (CT) include the following attributes: Description / Operating range: 1 A / 5 A Nominal AC current (In) / 1 Arms / 5 Arms Minimum measurable current with same accuracy / 0.2 Arms / 0.2 Arms Maximum measurable current / 4 Arms (4*In) / 20 Arms (4*In) TMU220 CT overload withstand: Duration / Strength: 1 A / 5 A 3 seconds: not measurable, with no destruction / 6 Arms (6*In) / 30 Arms (6*In) 1 second: not measurable, with no destruction / 20 Arms (20*In) / 100 Arms (20*In) 3.8.3 TMU220 – VOLTAGE TRANSFORMERS (VT) The voltage measurement inputs to each of the 5 Voltage Transformers (VT) include the following attributes: Description / Operating range Nominal AC voltage (Vn) range / 57.73 Vrms to 278 Vrms Minimum measurable voltage / 7 Vrms Maximum measurable voltage / 300 Vrms Frequency operating range / 50 or 60 Hz +-10% VT overload withstand: Duration / Strength 10 seconds with no destruction / 880 Vrms	P
9.1.3.4	Inputs		
	The following information shall be provided: in the documentation: a.c. and/or d.c. supply; the rated values; the burden.	See the example for DIU221;  Variant / Input voltage / Triggering threshold: Pick-up / Drop-off A09 / 170 Vdc / 170 Vdc / 154 Vdc A10 / 250 Vdc / 200 Vdc / 150 Vdc	P

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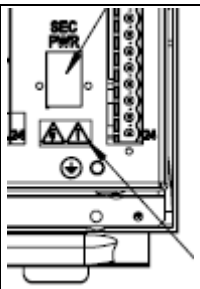
Clause	Requirement + Test	Result - Remark	Verdict
		4.3.3 DIU221 BINARY INPUT BURDEN The DIU221 board includes the following binary input burdens: Voltage level / Maximum Power For 1 Input / Maximum Power For 8 Inputs / Maximum Power For 4/5/6 boards / Maximum Power For 16 boards 19.2 Vdc / 0.03 W / 0.23 W / 0.93 W / 1.15 W / 1.38 W / 3.0 W 48 Vdc / 0.07 W / 0.6 W / 2.3 W / 2.9 W / 3.5 W / 6.7 W 110 Vdc / 0.17 W / 1.3 W / 5.3 W / 6.6 W / 7.9 W / 15.6 W 220 Vdc / 0.33 W / 2.7 W / 10.6 W / 13.2 W / – / 29.6 W 291 Vdc / 0.4 W / 3.2 W / 12.7 W / / / 47.6 W	
9.1.3.5	Outputs		
	The following information shall be provided in the documentation: the kind of output, for example, relay, optocoupler etc; burden on the supply input; the characteristics of the contact in accordance with IEC 60255-1. Compliance with 9.1.3.1 to 9.1.3.5 is checked by inspection or by measurement.	See …, example DOU201; 3.5.1 DOU201 DIGITAL OUTPUTS The DOU201 board provides: • 10 insulated digital outputs (with relays) • 8 single pole relays with one normally open (NO) contact • 2 double pole relays with 1 common for 2 output contacts (NO/NC changeover) External connections remain the same as for earlier versions of the board. The characteristics of the output relay contacts of a DOU201 board are given in this table: Description / Values Nominal operating voltage range / 24 to 250 Vac / 230 Vdc Carry (steady state current) / 5 A Description / Values Making capacity (rated inrush current) / 5 A continuously; 30 A for 500 ms (open for 40 s afterwards); or 250 A for 30 ms Making time / < 7 ms Breaking capacity / Breaking capacity for 900 000 operations: DC: 150 W resistive, 15 W inductive (L/R = 20 ms); AC: 1500 VA resistive; Breaking capacity reduced to 90 000 operations: AC: 1500 VA inductive (power factor = 0.7); Breaking capacity confirmed after 10 000 operations (contact resistance still lower than 250 mΩ): DC: 30 W inductive (L/R = 40 ms) 8 single-pole relays / Normally open contacts 2 double-pole relays / 1 common for 2 output contacts (NO/NC changeover) Number of operations / Unloaded contact: > 100 000; Loaded contact: > 10 000	P
9.1.4	Fuses		
	Where a replaceable equipment fuse is used, the fuse rating and type (for example, the indication of rupturing speed) shall be marked adjacent to the fuse and details provided in the user manual. If the fuse is soldered into the printed circuit board, or there is not sufficient space on the board, then fusing details may be provided in the user manual only. Rupturing speed codes of IEC 60127-1 should be used, as follows: very quick-acting: FF or black; Quick-acting: F or red; medium time lag: M or yellow; time lag: T or blue; long time lag: TT or grey. The recommended ratings of protective fuses or other external protective devices necessary to ensure that the equipment is safe under single-fault conditions shall be detailed in the equipment installation and technical documentation. Compliance with 9.1.4 shall be checked by inspection.	An external fuse has been specified. Caution: A high rupture capacity (HRC) fuse must be used for auxiliary supplies (for example Red Spot type NIT or TIA) with the following characteristics: • Current rating: 16 Amps • Minimum dc rating: 220 Vdc • gG operating class in accordance with IEC 60269 The fuses must be connected in series with the positive auxiliary supply input connections for both primary (Pin 23) and secondary (Pin 1) BIU261D inputs. The internal fuse MT1 on the BIU261D daughter board cannot be replaced by the user.	P
9.1.5	Measuring circuit terminals		
	Marking shall be adjacent to the measuring terminals. Where there is insufficient space (as in multi-port equipment), it is permissible for the marking to be on the rating plate or for the terminal to be marked with symbol 14 of Table 10 . Where space permits, voltage and current terminals of measuring circuits shall be marked with the rated maximum working voltage or current as applicable, otherwise symbol 14 of Table 10 shall be used. If there is a direct risk of electric shock due to accidental contact i.e. terminal access does not	 Marking according symbol 14 The terminals comply with	P

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Clause	Requirement + Test	Result - Remark	Verdict
	comply with protective type IP1X according to 5.1 of IEC 60529:1989, Amendment 1:1999, then symbol 14 and/or 12 of Table 10 shall be used. Unless the equipment is clearly marked that it is not intended to be connected to voltages above 33 V a.c. or 70 V d.c. with respect to earth, then the voltage and current input circuit terminals accessible to the user shall be marked with the rated voltage to earth. A permitted exception is where circuit terminals are dedicated to specific terminals of other equipment, which are provided with a means of identity. An example is a measuring circuit interconnection between two protective equipments. Compliance with 9.1.5 shall be checked by inspection.	IP1X N/A N/A	
9.1.6	Terminals and operating devices		
	Where necessary for safety, an indication using words, numbers or symbols shall be given of the purpose of all terminals, connectors, controls and indicators, including any operating sequences. Where there is insufficient space, it is permissible to use symbol 14 of Table 10. In such cases, the relevant information shall be provided in the equipment documentation. AC or d.c. supply input connection terminals shall be identifiable. Other terminal and operating device markings should be adjacent to or on the terminal but preferably should not be on a part, which can be removed without the aid of a tool. The markings apply to the following. Functional earth terminals with symbol 5 of Table 10. Protective conductor terminals with symbol 6 of Table 10. If the protective conductor terminal is part of a component (for example, terminal block) or subassembly and there is insufficient space, then it may be marked with symbol 5 of Table 10. Marking should not be indicated on easily changeable fixtures such as screws. Where the power and earth connections are provided by a plug/socket device, there is no requirement to mark the earth connection adjacent to such a device. Circuit terminals designed to be accessible, floating at a voltage which is not hazardous live, are permitted to be connected to a common functional earth terminal or system (for example, a co-axial screening system). This terminal shall	See clause 9.1.5. marking symbol 14 present. There is no space for detailed indications on nearby the connectors. Connectors have been identified with letters (Slot A – O)	P

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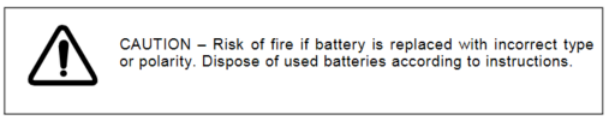
Clause	Requirement + Test	Result - Remark	Verdict
	be marked with symbol 7 of Table 10, if this connection is not self-evident. If the equipment contains lasers or high-intensity infra-red diodes of class 2 rating or higher, and the output of these can be viewed under normal conditions or maintenance conditions, then the equipment shall be marked in accordance with IEC 60825-1. Compliance with 9.1.6 shall be checked by inspection.		
9.1.7	Equipment protected by double or reinforced insulation		
	Equipment protected throughout by double or reinforced insulation shall be marked with symbol 11 of Table 10, unless this equipment is provided with a protective conductor terminal or if a functional earth connection (for example, via cable screen) can be made to the equipment, under normal conditions. Equipment which is only partially protected by double or reinforced insulation shall not bear symbol 11 of Table 10. Basic insulation is acceptable in the terminal area of insulation class II equipment if it is accessed only under maintenance conditions. Compliance with 9.1.7 shall be checked by inspection.	The equipment is only partially provided with double/reinforced insulation (transformer T1 / 2x Communication ports on BIU261M = SELV). The equipment is class I equipment and has been provided with a PE connection terminal and a PE stud on the housing near to the terminal.	P
9.1.8	Batteries		
	If the equipment has replaceable batteries and the replacement of these by an incorrect type of battery could result in an explosion (for example, in the case of certain types of Lithium batteries) then: if a user can access the battery, there shall be a marking close to the battery or a statement in both the operating instructions and servicing instructions; if the battery is elsewhere in the equipment, marking is required; this shall be close to the battery or in a statement included in the servicing instructions. The marking or statement shall be similar to the following.  It is permissible, where space is limited on the equipment, to use symbol 14 of Table 10. The polarity of the battery shall be marked on the equipment unless it is not possible to insert the	No batteries enclosed.	N/A

<table>
<tr><td colspan="4">IEC 60255-27</td></tr>
<tr><td>Clause</td><td>Requirement + Test</td><td>Result - Remark</td><td>Verdict</td></tr>
<tr><td></td><td>battery with incorrect polarity.</td><td></td><td></td></tr>
<tr><td>9.1.8.2</td><td>Charging</td><td></td><td></td></tr>
<tr><td></td><td>Equipment which has facilities for the re-charging of internal batteries where non-re-chargeable cells could be fitted and connected in the battery compartment shall be marked in or near to this compartment, warning against the charging of non-rechargeable batteries. This warning shall also indicate the type of rechargeable battery that shall be used within the recharging circuit.
Where space does not permit, this information shall be provided in the equipment documentation. In such cases, it is preferred that symbol 14 of Table 10 be adjacent to the battery.

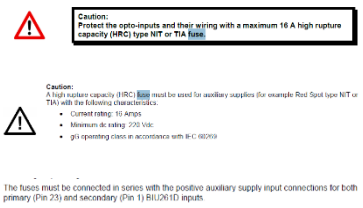
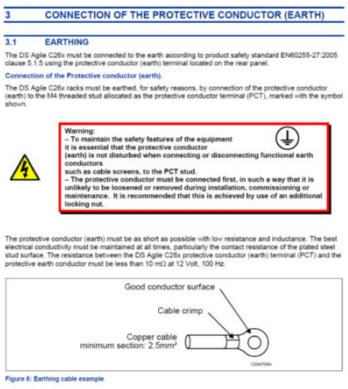
Compliance with 9.1.8.1 and 9.1.8.2 is checked by inspection.</td><td>No chargeable battery present in the equipment</td><td>N/A</td></tr>
<tr><td>9.1.9</td><td>Test voltage marking
The symbols indicated in Table 11 shall be used for marking of the test voltage(s) if the manufacturer chooses to mark the equipment.
Table 11
<table><tr><th>Dielectric test voltage</th><th>Symbol</th></tr><tr><td>Test voltage 500 V</td><td>  </td></tr><tr><td>Test voltage above 500 V
(for example, 2 kV)</td><td>  </td></tr><tr><th>Impulse test voltage</th><th>Symbol</th></tr><tr><td>Test voltage 1 kV</td><td>  </td></tr><tr><td>Test voltage 5 kV</td><td>  </td></tr></table>Compliance with 9.1.9 shall be checked by inspection.</td><td>The manufacturer did not apply any test voltage marking</td><td>N/A</td></tr>
<tr><td>9.1.10</td><td>Warning markings
In general, for rack- or panel-mounted equipment, markings are permitted on any surface that becomes visible after removal of the equipment from the rack or panel. Markings should not be on the bottom of the equipment, except on hand-held equipment or where space is limited.

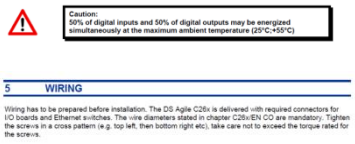
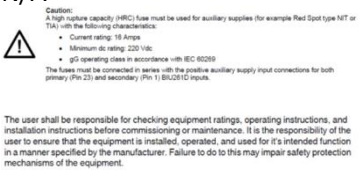
This is also applicable to the rear plate of rack- or panel-mounted equipment where there is insufficient space for warning markings. Symbols 14 and/or 12 of Table 10 shall be used in this case, as close as possible to the rear plate.

Where access in normal use presents a risk of electric shock, the warning marking symbol 12 of Table 10 shall be used; this shall be visible either from the front panel or be visible after removing</td><td>Symbol 14 has been applied on the label.</td><td>P</td></tr>
</table>

IEC 60255-27			
Clause	Requirement + Test	Result - Remark	Verdict
	a cover or opening a door or flap without the aid of a tool. If the user needs to refer to equipment documentation or instruction literature then the equipment shall be marked with symbol 14 of Table 10. The equipment documentation shall state that the equipment shall be isolated or disconnected from hazardous live voltage before access to potentially hazardous live parts is affected. Equipment having batteries shall be marked according to the requirements of 9.1.8. The size of warning markings shall be as follows; Symbols shall be at least 2,75 mm high. Text shall be at least 1,5 mm high and contrast in colour with the background. Symbols or text moulded, stamped or engraved in a material shall be at least 2,0 mm high. If not contrasting in colour, they shall have a depth or raised height of at least 0,5 mm. Compliance with 9.1.10 shall be checked by inspection.		
9.1.11	Marking durability All markings shall remain clear and legible under conditions of normal use and shall resist the effects of cleaning agents as specified by the manufacturer. This shall also include the effect of natural or artificial light. An adhesive that is permanent shall be used to secure adhesive labels. After compliance testing these labels shall not have become loose nor shall the edges and corners curl. Compliance shall be checked by inspection and by rubbing, by hand, without undue pressure: for 15 s with a cloth soaked with a cleaning agent(s) as specified by the manufacturer; if no agent is specified then with water.	Tested by rubbing with water	P
9.2	**Documentation**		
9.2.1	General The equipment documentation shall clearly identify the equipment and include the name and address of the manufacturer or its agent. Information for safety shall be delivered with the equipment as a printed document. The manufacturer shall provide, on request, documentation that includes the technical specification, instructions for commissioning and	See the technical manual "DS Agile C26x" System version: 7.0.3. Publication reference: C26x/EN M/03. The latest version has also been applied; DS Agile C26x System version: 7.6.2 Technical Manual	P

IEC 60255-27			
Clause	Requirement + Test	Result - Remark	Verdict
	for the use of the equipment. Where relevant, the documentation shall cover any calibration, maintenance and subsequent safe disposal and decommissioning of the equipment and any of its replaceable parts. Manufacturers shall supply, on request, documentation relating to equipment type tests and routine testing. Where applicable, warning statements and a clear explanation of warning symbols marked on the equipment shall be included in the documentation. In particular, wherever Symbol 14 of Table 10 is used, there shall be a statement to the effect that the documentation shall be consulted to establish the nature of any potential hazard and any actions which need to be taken to eliminate or minimize this hazard. The documentation shall include the following: a statement that the integrity of any protective conductor connections shall be checked before carrying out any other actions; a statement that the equipment ratings, operating instructions and installation instructions shall be checked before commissioning or maintenance; the information specified in 9.2.2 to 9.2.5; the intended use of the equipment. Compliance with 9.2.1 is checked by inspection.	Publication Reference: C26x/EN M/E62. This latest version of the technical manual has been modified regarding; - P :426 , P :444 and figure 22 addition of the configuration with 1 TMU220 board and 1 TMU 210 board. - P :1402 Burden of the BIU261 updated. - P :1407 §6.2 operating temperature updated.	
9.2.2	Equipment ratings		
9.2.2.1	General The equipment documentation shall include the following: the installation category (overvoltage category) for which the equipment is intended (this is related to the ability of the equipment to withstand transient overvoltages); the supply voltage or voltage range, frequency or frequency range and power or current rating of the equipment; the permitted fluctuation from the nominal functional value should also be stated, for example, the lower and upper functional voltages; a description of all input and output connections. Compliance with 9.2.2.1 is checked by inspection.	The equipment has been specified for application of OVCIII, PD2, working voltage 250Vac. 110 – 250 Vac/110 – 250 Vdc Max. 60 W. 90 – 300 Vac / 85 – 300 Vdc Available in the Technical Manual C26x/EN M/E03, in the chapter ”Connection”	P
9.2.2.2	Fuses and external protective devices The type, current rating and voltage rating of any internal fuse shall be stated according to 9.1.4. This shall include fuses that may or may not be	The internal fuse is located on the daughter board, ref. MT1. It is rated T 2.5A.	P

IEC 60255-27			
Clause	Requirement + Test	Result - Remark	Verdict
	accessed by a user for replacement. The recommended fuse type or other protective means shall take into account the switching capacity and interrupting speed. The type, current rating and voltage rating of any external fuse or protective device required for safe operation of the equipment shall be given in the product documentation. Where it is recommended that an external switch, circuit breaker or other protective device be connected near to the equipment, this shall be stated. Compliance 9.2.2.2 is checked by inspection.	It cannot be replaced by the user. From the safety information chapter of the Technical Manual; 	
9.2.2.3	Environmental requirement The equipment documentation shall state the following. The IP rating at the front of the equipment when it is mounted in its normal position of use. The pollution degree for the equipment for example, pollution degree 2 when mounted in its normal position of use. The insulation class of the equipment for example, Class I equipment when mounted in its normal position of use. Compliance with 9.2.1 to 9.2.2.3 is checked by inspection.	 IP 2X PD2 Class I (with PE)	P
9.2.3	Equipment installation		
	For installation purposes, the equipment documentation shall include, as appropriate. Instructions relating to the safe mounting of the equipment shall be stated including any specific location and assembly requirements. Instructions relating to the protective earthing of the equipment shall be stated. This shall include a recommendation of the size of wire to be used and a statement indicating that protective earth connections should not be removed when the equipment is energized. Any special ventilation requirements shall be stated. This is related to the heat dissipated by the equipment. The manufacturer shall also indicate the maximum number or percentage of digital input circuits and output relays, which may be energized simultaneously at the maximum ambient temperature. Wire type, size and rating necessary for correct installation of the equipment shall be indicated.	 According to the manufacturer the equipment shall be installed in an environment in which the ambient temperature shall be conditioned (below 55/65 degr. C.)	P

IEC 60255-27			
Clause	Requirement + Test	Result - Remark	Verdict
	Information regarding the requirement for and the specification of any external devices required for the safe operation of the equipment, as in 9.2.2.2 shall be included. Compliance with 9.2.3 is checked by inspection.	 Also an external fuse is required.	
9.2.4	Equipment commissioning and maintenance		
	Equipment instructions concerning preventative maintenance and inspection shall be given in sufficient detail to ensure the safety of these procedures. Instructions shall include recommendations relating to safety earthing and de-energization of the equipment, where applicable. • Instructions for fault-finding and repair, where applicable, shall be given to the extent that is relevant for operation and maintenance. • The manufacturer shall specify any parts, which shall only be examined or supplied by the manufacturer or his agent. • The manufacturer shall specify the safe methods for changing and disposal of: – any accessible fuses including type and ratings as per 9.1.4; – any replaceable batteries, for example, Lithium, and/or suitable replacements where applicable; – the method of safe re-charging and/or replacement for re-chargeable batteries with recommendation of suitable replacements where applicable; – where fibre-optic communication output devices are fitted, warnings shall be given that these should not be viewed directly. Compliance with 9.2.4 is checked by inspection.	N/A. no fault finding and repair instructions provided/applicable N/A  No re-chargeable battery present. No non-rechargeable batteries present 	P
9.2.5	Equipment operation		
	Operating instructions for the equipment shall include the following. • Before working on CT circuits, these shall be short-circuited. • A statement indicating that it is the responsibility of the user to ensure that the equipment is installed, operated and used for its intended function in the manner specified by the manufacturer. Also that, if this is not the case, then any safety protection provided by the equipment may be impaired. • An explanation of, and where possible pictures of, symbols used on the equipment according to 9.1.	See safety guide (4LM) Pxxx-SG-4LM-1 2014 See Chapter 3.8 See Chapter 3.2 -3.9 See Chapter 2	P

9.3	**Packaging**		P
	The scope of this standard does not cover the transportation of equipment between the manufacturer and the customer. However, the manufacturer shall, ensure that the equipment is suitably packaged to withstand, without damage, reasonable handling and environmental conditions appropriate to the method(s) of transportation to the customer's delivery address. A visual inspection should be made by the customer to check that the equipment has not been damaged during transportation.	The applied packing has been inspected; -No damage observed. -Packing is expected to be suitable. Information provided in the packing; Safety guide FAT/test report Manufacturing quality plan Dielectric test report Software composition Product composition Panel mounting detail Stickers for labelling of the applied phoenix connectors	P
10	**TYPE TESTS AND ROUTINE TESTS**		
10.1	**General**		
	Testing, as defined in this clause, is required to demonstrate that the equipment is fully in accordance with the safety requirements specified in this standard and also the manufacturer's claims. The type test requirements are listed in table 12-overview of type tests. Single-fault testing shall be carried out unless it can be demonstrated that it is improbable that a hazard may arise from a particular single-fault condition (see 5.2).	The test object meets the type test requirements as stated in table 12 – overview of tests of the standard. Additional; the following validation tests have been performed; Environmental tests Insulation resistance tests in combination with environmental and dielectric strength tests Electrical environmental tests (thermal short time/max temperature of parts) See also table 1, abnormal operation and table 11, single fault testing	P P P P
10.2	**Safety type tests**		
	Safety type tests are normative and carried out in order to verify that the equipment complies with the safety requirements of this standard. Unless otherwise specified, safety type tests may be carried out in any appropriate sequence. A safety type test may be carried out on a pre-production sample or on different samples of the same type. Unless otherwise agreed, safety type tests shall be performed on all equipment which has not previously been the subject of satisfactory safety type testing or which has been the subject of modifications which could affect the performance of the equipment. Where certain details of the equipment are altered, the particular safety type test(s) whose results could be affected by the alterations shall be repeated.	Power supply has been modified. Safety type tests have been repeated; cl. 10.6.3, 10.6.4.3, 10.6.4., 10.6.5.2, 10.6.5.5 (single fault) N/A	P P N/A

	The safety type test may be carried out by the manufacturer or an independent test house. The manufacturer shall provide the customer with access to documentary evidence of satisfactory results when required to do so.	Test are performed at KEMA. Safety related documentation has been assessed by KEMA	P
10.3	Routine testing or sample testing		
	It is normative to conduct either a routine test or a sample test to confirm that the equipment's design features for protection against electric shock have been maintained. Unless otherwise specified, these tests may be carried out in any sequence. (See 10.6.4.3.2.2 for further detail on routine testing and 10.6.4.3.2.3 for the necessary requirements for sample testing.)	Sample test performed	P
10.4	Conditions for testing		
	The tests shall be performed under the common test conditions given in IEC 60255-1. The following data for each test to be conducted shall be accessible from the manufacturer on request: the cross-sectional area and length of connecting cables, if these can affect the type test results for example, temperature rise; for vibration testing, details of cable terminations and looming, including the position of wire loom supports; measurement accuracy and tolerance permitted for all measurements. Where applicable, the data shall include: initial measurement; measurement during the individual test; final measurement.		P
10.5	Verification procedure		
	The verification procedure shall ensure that the equipment is in accordance with its specification and that it functions correctly during the initial measurement at the beginning of the test sequence and maintains its design characteristics throughout all the following individual tests where this has been specified. The order for testing is initial measurement, measurement during the individual test and final measurement.	Before, during and after the test the correct functioning has been checked whenever applicable. Declared performance has been observed.	P
10.6	Tests		
10.6.1	Climatic environmental tests According IEC 60255-1		P
10.6.1.1	Dry-heat test – operational	With LCD: +55; 96 h Without LCD: +65 °C; 96 h	P
10.6.1.2	Cold test – operational	With LCD: -25 °C; 96 h Without LCD: -40 °C; 96 h	P
10.6.1.3	Dry heat test at maximum storage temperature	+85 °C; 96 h	P
10.6.1.4	Cold test at minimum storage temperature	-40 °C; 96 h	P
-	Change of temperature test Nor required by IEC 60255-27 but specified in IEC 60255-1.	-40 °C - +55 °C/+65 °C; 3 hours / 5 cycles of 3 + 3 hours	P

10.6.1.5	Damp heat test, steady state	+40 °C, 93 % RH, 10 days	P
10.6.1.6	Cyclic temperature with humidity test	+25 - +55 °C, 97 % RH, 6 cycles	P
10.6.2	Mechanical tests Compliance: there shall be no electrical shock or fire hazard during or after conducting the normally applied type tests to demonstrate claimed compliance with 10.6.2.1 to 10.6.2.4.		P
10.6.2.1	Vibration	According IEC 60255-21-1 class 1 (Vibration response acc. Class 2)	P
10.6.2.2	Shock	According IEC 60255-21-2 class 1 (shock response test: acc. Class 2)	P
10.6.2.3	Bump	According IEC 60255-21-2 class 1	P
10.6.2.4	Seismic	According IEC 60255-21-3 class 2	P
10.6.2.5	Accessible parts test		P
	This test is to verify that equipment cases, barriers or mounting panels prevent hazardous live parts being accessible in normal use. This test shall be carried out as a type test for the equipment to verify that hazardous live parts cannot be accessed by the standard jointed test finger in 6.2 of IEC 61010-1:2010 and that the test finger voltage or energy does not exceed the safe limits for normal use, defined in 5.1.5.3.2.	The jointed test finger does not touch hazardous live terminals and parts. The IP3x and 4x test probes do not penetrate the enclosure.	P
10.6.2.6	Dust/water ingress protection		P
	Unless otherwise agreed, tests shall be carried out to confirm that the equipment case meets the manufacturer's claimed IP class in normal use. The tests shall be in accordance with those specified in IEC 60529 for the equipment case class.	Enclosure; IP 2x Connectors at the rear side; IP1x (CT & VT terminal blocks) IP 2x (all other terminal blocks)	P
10.6.3	Clearances and creepage distances		P
	Where there is any doubt that the required clearance and creepage distances are compliant with the values in the appropriate Annex C table, measurements shall be made. Where the minimum clearance value is not met, then the clearance may be proven by testing (see 5.1.10.2.2). Testing to prove the clearance in air cannot be used to demonstrate compliance of the associated creepage distance. Where a transient suppressor is used to reduce the overvoltage, the circuit shall be tested to show that it withstands the application of 5 positive and 5 negative impulses from a source impedance of 2 . Surge test generator characteristics and impulse voltage amplitude for a differential and/or common mode supply input according to IEC 60255-26 shall be used.	Initial assessment on C264 (version HW66 and HW67) and additional assessment of the modified power supply, new DIU221 and new TMU210 A01/A02/A03 modules. All creepage and clearances do meet the requirements of annex C of IEC 60255-27. Transient suppressors have been subjected to the surge test during EMC immunity testing according IEC 61850-3/IEC 61000-4-5.	P
10.6.4	Safety-related electrical tests	On the C264	P
10.6.4.1	General The purpose of the voltage tests in this clause is to prove clearances and solid insulation.		

	The test voltage level shall be the open-circuit voltage of the generator before connection to the equipment.		
10.6.4.2	Impulse voltage test		P
10.6.4.2.1	General The impulse voltage type test is carried out with a voltage having a 1,2/50 us waveform (see Figure 1 of IEC 61180-1:1992) and is intended to simulate overvoltages of atmospheric origin. It also covers overvoltages due to switching of low-voltage equipment.	Impulse test applied with the specified waveform	P
10.6.4.2.2	Test procedures The impulse voltage test shall be carried out in accordance with the following. The impulse voltage shall be applied to the appropriate points accessible from the outside of the equipment, the other circuits and the accessible conductive parts shall be connected together and to earth. The tests for proving clearances shall be conducted for a minimum of three impulses of each polarity with an interval of at least 1 s between impulses. The same test procedure also applies for proving the capability of solid insulation; however, five impulses of each polarity shall be applied in this case, and the wave shape of each impulse shall be recorded. Both tests, for proving clearances and solid insulation, may be combined in one common test procedure.	Impulse and dielectric strength tests have been performed after the climate tests	P
10.6.4.2.3	Waveform and generator characteristics A standard impulse voltage in accordance with IEC 61180-1 shall be used. The generator characteristics shall be verified according to IEC 61180-2. The parameters are: open circuit voltage: 1 or 5 kV front time: 1,2 s ±30 %; time to half-value: 50 s ±20 %; output impedance: 500 Ohm ±10 %; output energy: 0,5 J ±10 %. The length of each test lead shall not exceed 2 m.	Impulse test applied with the specified waveform and according test configuration requirements. Levels; 5 kV and 1 kV.	P
10.6.4.2.4	Selection of impulse test voltage		P
10.6.4.2.4.1	General The applicable rated impulse test voltage shall be selected from one of the following nominal values: 0, 1, 5 kV peak. When zero-rated impulse test is specified for particular equipment circuits, these shall be exempt from the impulse voltage test. The specified impulse test of 5 kV peak applies to altitudes up to 200 m. For altitudes above 200 m,	5 kV has been applied onto the other independent circuits 1 kV has been applied onto the LAN ports	P

	Table C.11 shall be used to reduce the test voltage. When the test is between two independent equipment circuits, the higher of the two rated impulse voltages shall be used for the test.		
10.6.4.2.4.2	Equipment to be tested at 5 kV peak nominal An equipment circuit, classed as a primary circuit, according to Clause 3, shall be tested at 5 kV peak nominal, in accordance with 10.6.4.2.4.	5 kV impulse voltage applied.	P
10.6.4.2.4.3	Equipment to be tested at 1 kV peak nominal Equipment circuits may be tested at 1 kV peak nominal, in accordance with 10.6.4.2.4, if the following apply. The auxiliary (power supply) circuits are connected to a battery used exclusively for the power supply of equipment covered by this standard. This battery shall not be used for switching inductive loads. The equipment is not powered via current or voltage transformers. I/O circuits required to be tested are not subjected to induced or inductive load transients in excess of 1 kV peak.	The exclusion has not been declared by the manufacturer therefore the 5 kV test has been applied.	N/A
10.6.4.2.5	Performing of tests The impulse voltage type test is applicable whether or not the equipment under test is fitted with surge suppression. If surge suppression devices are fitted these shall not be removed for the test. Unless otherwise specified, the impulse voltage test shall be performed: between each circuit (or each group of circuits) specified for the same impulse voltage and the accessible conductive parts at the impulse voltage specified for this circuit (or this group of circuits); between independent circuits, the terminals of each independent circuit being connected together; across the terminals of a given circuit to validate the manufacturer's claim. Unless obvious, the independent circuits are those which are so described by the manufacturer. For equipment with an insulated case, the accessible conductive parts shall be represented by a metal foil covering the whole equipment case except the terminals around which a suitable gap shall be left so as to avoid flashover to the terminals. The test between two independent circuits shall be carried out, unless otherwise specified, at the higher impulse voltage specified for the two circuits.	Independent circuits are; Power (Primary) (slot A); Power (Secondary) (slot A); Binary output (slot A); LAN port (Slot B); LAN port (Slot C); Analogue input AIU211 (slot D); Digital output (DOU201) (slot E); Digital output/control unit (CCU) (slot F); Analogue output (AOU200) (slot G); Digital input (DIU211) (slot H); Digital output (HBU200) (slot M); Analogue input (TMU220) (slot N); Analogue input (TMU220) (slot O); Analogue input (TMU210) (slot O); Digital input (DIU221) (slot H). All circuits have been tested with 5 kV except the LAN ports which have been tested with 1 kV.	P
10.6.4.2.6	Test acceptance criteria There shall be no disruptive discharge (spark-over, flashover or puncture) during test. Partial discharges in clearances which do not result in	No sparkover, flashover or puncture observed during the tests.	P

	breakdown are disregarded. After this type test, the equipment shall comply with all relevant performance requirements. It is permissible for an impulse voltage waveform applied across test points connected to surge suppression, inductive devices or potential dividers, to be attenuated or distorted if this is not due to electrical breakdown. The waveform applied to test points not connected to such devices, will not be noticeably distorted or attenuated unless the insulation does not withstand the impulse voltage test.		
10.6.4.2.7	Repetition of the impulse voltage test For equipment in a new condition, impulse voltage tests may be repeated, if necessary, to verify performance. The test voltage value shall be equal to 0,75 times the value originally specified or indicated by the manufacturer.	The repetition of the impulse voltage test is not required for a type test. Only samples in a new condition have been tested.	N/A
10.6.4.3	AC or DC. dielectric voltage test		P
10.6.4.3.1	General Guidance for routine and sample dielectric voltage testing for safety is provided in Table 13; see 10.6.4.3.2.3 for testing to a sampling plan.	This is an informative clause	N/A
10.6.4.3.2	Performing the dielectric voltage test		P
10.6.4.3.2.1	Type tests Type tests shall be applied: between each circuit and the accessible conductive parts, the terminals of each independent circuit being connected together; between independent circuits, the terminals of each independent circuit being connected together. Unless obvious, the independent circuits are those which are so described by the manufacturer. If applicable, the manufacturer shall declare the dielectric voltage withstand, for open metallic contacts and verify this by type testing. No test should be applied across contacts when transient suppression devices are fitted. Circuits not involved in the tests shall be connected together and to earth. Circuits specified for the same rated insulation voltage may be connected together when being tested to the accessible conductive parts. The test voltages shall be applied directly to the terminals. For equipment with an insulating case, the accessible conductive parts shall be represented by a metal foil covering the whole equipment case except the terminals around which a suitable gap shall be left so as to avoid flashover to the terminals. Insulation tests requiring this metal foil shall be performed as type tests only.	Independent circuits; see clause10.6.4.2.5 Not applicable.	P
10.6.4.3.2.2	Routine tests	Not applicable since this report lists the type test results	N/A

<table>
<tr>
<td>10.6.4.3.3</td>
<td>Value of the dielectric test voltage
Dielectric voltage tests shall be made by applying the appropriate voltages in Table 14. The test voltage should be declared by the manufacturer.
<table>
<tr><th>Rated insulation voltage
V</th><th>AC test voltage, 1 min.
kV</th></tr>
<tr><td>Up to 63</td><td>0,5</td></tr>
<tr><td>125 to 500</td><td>2,0</td></tr>
<tr><td>630</td><td>2,3</td></tr>
<tr><td>800</td><td>2,6</td></tr>
<tr><td>1 000</td><td>3,0</td></tr>
</table>
For circuits directly energized via instrument transformers (VTs and standard CTs), or connected to a station battery, the test voltage shall not be less than 2,0 kV r.m.s., 1 min. Where this is not the case, Table 14 may be used to determine the appropriate test voltage. (See C.1.3 for the determination of the rated insulation voltage for circuits energized from various supplies.)

A higher test voltage of 2,5 kV r.m.s. 1 min for CT circuits may be claimed by the manufacturer. Higher test voltages shall be specified for pilot wire circuits where short-circuit current induced overvoltages on the pilot wires are to be expected. The applicable test voltage shall, in this case, be declared by the manufacturer.

For commoned circuits such as CTs, VTs and digital inputs connected by a common connection to earth or neutral, a test voltage of 500 V may be used. If applicable, the manufacturer shall declare the dielectric voltage withstand for open metallic contacts and verify this by type testing. No test shall be applied across contacts when transient suppression devices are fitted.</td>
<td>Applied test voltages are;
2 kVac
0,5 kVac (LAN)

Applicable for CT and VT inputs of tMU210 and TMU220 modules

Not declared by the manufacturer

Not applicable</td>
<td>P</td>
</tr>
<tr>
<td>10.6.4.3.4</td>
<td>Test voltage source
The test voltage source shall be such that, when applying half the specified value to the equipment under test, the voltage drop observed is less than 10 %.

The source voltage value shall be verified with accuracy better than 5 %.

The test voltage shall be substantially sinusoidal and at a frequency between 45 Hz and 65 Hz. However, tests may alternatively be performed with a d.c. voltage (positive and negative polarity) the value of which shall be 1,4 times that given in Table 14. Capacitors to earth for EMC compliance will lead to increased test current and thus make detection of a breakdown condition difficult. This problem can be overcome by using a d.c. test voltage (2 r.m.s.) or by measuring a.c. resistive current only.</td>
<td>Tests have been conducted with 50 Hz test voltage.</td>
<td>P</td>
</tr>
</table>

10.6.4.3.5	Test method For type tests the open-circuit voltage of the test generator is applied to the equipment at zero volts. The test voltage shall be raised smoothly to the specified value in such a manner that no appreciable transients occur and shall be maintained for 1 min minimum. It shall then be reduced smoothly to zero as rapidly as possible. For routine tests, the test voltage may be maintained for 1 s minimum. In this case, the test voltage shall be 10% higher than the specified 1 min type test voltage.	1 minute test time has been applied	P
10.6.4.3.6	Test acceptance criteria During the dielectric voltage test, no breakdown or flashover shall occur. Partial discharges which do not cause the maximum test current level set by the manufacturer to be exceeded, shall be disregarded.	No breakdown or flashover observed	P
10.6.4.4	Insulation resistance The measurement may be performed as a test following environmental testing to ensure that the insulation has not been over-stressed and weakened by the applied tests. The measuring voltage shall be applied directly to the equipment terminals. The insulation resistance shall be determined when a steady value has been reached and at least 5 s after applying a d.c. voltage of 500 V ±10 %. For equipment in a new condition, the insulation resistance shall not be less than 100 MΩ 500 V d.c. (A lower value may be used where EMC suppression or other functional components connected in parallel with the circuit under test may reduce the insulation resistance). After the damp-heat type test, the insulation resistance shall not be less than 10 MΩ at 500 V d.c., after a recovery time of between 1 h and 2 h, at reference ambient conditions.	The insultation test has been performed on a new test object, before the environmental and dielectric strength tests. Test sequence; 1. insulation test 2. climate tests 3. insulation test 4. dielectric strength test 5. insulation test Measured insulation resistance; >550 MΩ	P
10.6.4.5	Protective bonding tests		

10.6.4.5.1	Protective bonding resistance – Type test Accessible conductive parts and terminations connected to the protective conductor for protection against any electric shock hazard shall not have excessive resistance. For equipment where the protective conductor connection is by means of one core of a multi-cored cable, the cable is not included in the measurement, provided that the cable is supplied by a suitably rated protective device which takes into account the size of the conductor. The compliance of such parts with protective bonding resistance type test requirements shall be determined using the following test parameters: • the test current shall be twice that of the maximum current rating of the overcurrent protection means, specified in the user documentation, but not less than 20 A; • the test voltage shall not exceed 12 V r.m.s. a.c. or 12 V d.c.; • the test duration shall be 60 s; • the resistance between the protective conductor terminal and the part under test shall not exceed 0,1Ω.	The measured max. bonding resistance is 31 mΩ. Test current: 20 A. Test points w.r.t. PE connection on connector slot A; • Upper mounting flag screw on most right side of the enclose • Earth screw close to slot A • front side, middle screw • Rear side, top of the enclosure	P

10.6.4.5.2	Protective bonding continuity – Routine test	Not applicable, this report lists the results of the performed type test	N/A

10.6.5	Electrical environment and flammability	

10.6.5.1	Maximum temperature of parts and materials Tests may be required to determine the maximum temperature of parts and materials under normal use (see 7.3) and under a single-fault condition (see 7.11).	Normal use; TC1 = ambient = 21 gr TC2 = transformer T1 = 65 °C TC3 = coil L2 = 52 °C TC4 = mosfet Q11 = 59 °C TC5 = Q14 = 62 °C TC6 = L4 = 65 °C TC 7 = enclosure at the power supply = 49 °C Abnormal use; TC1 = ambient = 21 gr TC2 = transformer T1 = 90 °C TC3 = coil L2 = 94 °C TC4 = mosfet Q11 = 96 °C TC5 = Q14 = 87 °C TC6 = L4 = 92 °C TC 7 = enclosure at the power supply = 60,5 °C After 1,5 hours the device went defective without creating a safety hazard	P
10.6.5.2	Flammability of insulating materials, components and fire enclosures Testing of parts may be necessary where either the material does not meet the minimum flammability requirements specified in Clause 7, or its thickness is below the minimum specified for that material to achieve the required minimum flammability. Tests shall not be required to determine the flammability of insulating materials and components providing they meet the requirements of 7.6.2 to 7.6.4 and fire enclosures 7.10.	The enclosure has been designed to be a fire enclosure. The connectors are classified to have at least a UL94-V1 Flammability class rating. See Table 7.	P

10.6.5.3	Thermal short-time test The maximum temperature of the insulating materials, during the following tests, shall be within the limits given for the appropriate insulation class in Table 7. <u>Overvoltage:</u> The equipment VT input circuits shall withstand overvoltages declared by the manufacturer, without damage, both continuously and for 10 s duration. <u>Overcurrent:</u> The equipment CT input circuits shall withstand overcurrents declared by the manufacturer, both continuously and for 1 s duration, without creating a fire or electric shock risk. However, the manufacturer shall only state safe withstand values. Safety requirements for protection equipment, with CTs rated between 0,5 A and 5 A are as follows: • minimum 1 s overcurrent withstand should be 100 In; • continuous withstand should be at least 4 In. For protection equipment and measuring relays which do not meet these requirements, the manufacturer shall declare the overcurrent withstand and continuous withstand. For CTs with no declared rated current value, for example, sensitive earth fault, the continuous and 1 s overcurrent withstand for safety shall be declared by the manufacturer.	Negligible temperature rise observed. TMU220: 880 Vrms, 10 s. TMU210: 338 Vrms, 10 s. TMU220: 100 x In, 1s (100 A resp. 500 A) TMU210: 100 x In, 1s. (100 A resp. 500 A)	P
10.6.5.4	Output relay parameters The manufacturer shall test the output trip relay parameters to ensure performance is in accordance with IEC 60255-1.	No output trip relay present, only alarm/status relays.	N/A
10.6.5.5	Single-fault condition Refer to 5.2 for single-fault condition assessment and 7.11.3 for compliance with the requirements for protection against the spread of fire when conducting a single-fault type test on fully assembled equipment. It is sufficient to carry out a single-fault test(s) on a particular module variation, once only, where the common module is used throughout a platform range. The need for any single-fault testing will depend on the result of the single-fault condition assessment.	Internal outputs of the power supply circuits have been loaded with maximum load and have been short circuited. No risk of fire has been created due to these conditions No burning particles fall out. No shock hazard has been created See Table 11.	P
10.6.6	Reverse polarity and slow ramp test The manufacturer shall test the power supply inputs to ensure that reverse application of the supply voltage does not cause excessive internal temperatures, spread of fire or risk of electrical shock. The supply voltage shall be applied reverse polarity for sufficient time to enable equilibrium to be achieved. This test is applicable for d.c. powered products only.	The product can be powered with both AC and DC power. Start up voltage (DC-powered); Primary input: 32,3 V Secondary input: 46,7 V	P

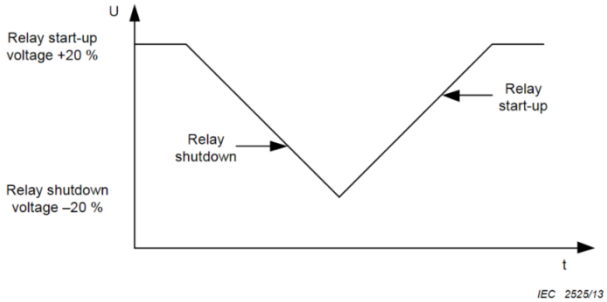
	The manufacturer shall test the power supply inputs to ensure that slow variations in supply voltage do not cause excessive internal temperatures or damage of the product. The supply voltage shall be varied in accordance with Figure 4, the internal temperatures of the power supply shall be monitored to ensure that excessive temperatures are not seen. During the testing, the equipment under test shall be in a quiescent state with half the binary inputs/outputs energized and communications ports exercised (where fitted). The supply voltage shall be varied with a defined gradient for ramp down/up of 1 V/min in accordance with Figure 4. This test is applicable for d.c. powered products only. 	Shut down voltage; Primary input: 27,4 V Secondary input: 16,5 V No excessive temperature or damage has been observed.	

	TABLE 1a: Heating Test (normal conditions)		P
	Test voltage (V) :	88 Vac	—
	Ambient (°C) :	21	—

Thermocouple Locations	**Max. temperature measured, (°C)**	**Max. temperature limit, (°C)**
TC1 = ambient	21	-
TC2 = transformer T1	65 (75)	120[1), 4)]
TC3 = coil L2	52 (62)	155
TC4 = semiconductor Q11	59	105[2)]
TC5 = semiconductor Q14	62	105[2)]
TC6 = coil L4	65 (75)	125
TC 7 = enclosure, above the power supply module BIU261	49	51[3)]

Supplementary information:
Before the heating tests a thermal image camera has been used to locate the dissipating parts. These are located in the power supply module.
The specified max ambient temperature is; +55 °C (C264 with display module), + 65 (C264 without display module)

[1)]The T1 wire has been specified 120 °C (Class E acc. Table 7 of IEC 60255-27, single fault conditions temperature 165 °C).
The E-TEX winding wire has been specified as Class A-E. (UL: class A (105 °C), IEC: class E (120 °C). The manufacturer declares Class E wire is applicable[4)]. A TC has been applied for measuring coil/transformer temperatures: extra 10 °C has been added (these are the temperature values in parentheses)

All other parts have higher temperature specs. See Wide Voltage Range BIU261 Transformer Assy BOM GP0007001, PDM A01000342.

[2)]The semiconductors have been rated to a max temperature of 105 °C. See manufacturer safety report "PRODUCT SAFETY REVIEW – PSR0054I, issue C, 15 January 2018".
The critical margin is for the C264 without display which has a rated ambient temperature of +65°C. The calculated max temperature would be for Q11; 59-21 + 65 = 103 °C.

[3)]External surfaces of equipment which may be touched, see table 5 of IEC 60255-27, recalculated temperature value requirement for an ambient temperature of 21 °C.

[4)] Manufacturers declarations retrieved from "PRODUCT SAFETY REVIEW – PSR0054I, issue D. 27 February 2018", version control;
Component temperature limits raised, based on reinterpretation of datasheets:
ZP0027 IC25, ZP0028 IC3, IC4, IC33 now 175°C based on TSI value according to IEC 60747-5-2.
T1 now 120°C (Class E) based on VDE/BSI/TUV rather than UL Class A.

	TABLE 1b: Heating Test (abnormal condition)		P
	Test voltage (V) :	88 Vac	—
	Ambient (°C) :	21	—

Thermocouple Locations	**Max. temperature measured, (°C)**	**Max. temperature limit, (°C)**
TC1 = ambient	21	-
TC2 = transformer T1	90	165[1), 3)]
TC3 = coil L2	94	155
TC4 = semiconductor Q11	106	150[2)]
TC5 = semiconductor Q14	87	175[2)]
TC6 = coil L4	92	125
TC 7 = enclosure, above the power supply module BIU261	61	N/A

Supplementary information:
Before the heating tests a thermal image camera has been used to locate the dissipating parts. These are located in the power supply module.

The specified max ambient temperature is; +55 °C (C264 with display module), + 65 (C264 without display module)

[1)]The T1 wire has been specified 120 °C (Class E acc. Table 7 of IEC 60255-27, single fault conditions temperature 165 °C).

[2)]All other parts have higher temperature specs. See Wide Voltage Range BIU261 Transformer Assy BOM GP0007001, PDM A01000342. For the semiconductors the max. junction temperature has been applied.

[3)]Manufacturers declarations retrieved from "PRODUCT SAFETY REVIEW – PSR0054I, issue D. 27 February 2018", version control;
Component temperature limits raised, based on reinterpretation of datasheets:
ZP0027 IC25, ZP0028 IC3, IC4, IC33 now 175°C based on TSI value according to IEC 60747-5-2.
T1 now 120°C (Class E) based on VDE/BSI/TUV rather than UL Class A.

	TABLE 2: Dielectric Strength and insulation resistance			**P**
Voltage applied to Circuit/terminals	Insulation resistance at 500 Vdc (before the test) MΩ	Voltage applied kVac	Insulation resistance at 500 Vdc (after the test) MΩ	Observations
Power (Primary) (slot A)	> 550	2	> 550	No breakdown No flashover
Power (Secondary) (slot A)	> 550	2	> 550	No breakdown No flashover
Binary output (slot A)	> 550	2	> 550	No breakdown No flashover
LAN port (slot B)	> 550	0,5	> 550	No breakdown No flashover
LAN port (slot C)	> 550	0,5	> 550	No breakdown No flashover
Analogue input AIU211 (slot D)	> 550	2	> 550	No breakdown No flashover
Digital output (DOU201) (slot E)	> 550	2	> 550	No breakdown No flashover
Digital output/control unit (CCU) (slot F)	> 550	2	> 550	No breakdown No flashover
Analogue output (AOU200) (slot G)	> 550	2	> 550	No breakdown No flashover
Digital input (DIU211) (slot H)	> 550	2	> 550	No breakdown No flashover
Digital output (HBU200) (slot M)	> 550	2	> 550	No breakdown No flashover
Analogue input (TMU220) (slot N)	> 550	2	> 550	No breakdown No flashover
Analogue input (TMU220) (slot O)	> 550	2	> 550	No breakdown No flashover
Analogue input (TMU210) (slot O)	> 550	2	> 550	No breakdown No flashover
Digital input (DIU221) (slot H)	> 550	2	> 550	No breakdown No flashover
Supplementary information:	Each circuit has been tested against all other circuits and earth connected together The test has been performed after completion of the climatic tests.			

TABLE 3: Electrical Data (in normal conditions)						
Fuse #	I rated A	U V	P W	I mA	I fuse mA	Condition/status
MT2	T 5A H 250V	110 (ac)	72,2	656	556	Normal operation, running macro for activation I/O
		220 (ac)	86,9	395	395	Normal operation, running macro for activation I/O
		110 (dc)	38,5	350	350	Normal operation, running macro for activation I/O
		220 (dc)	38,7	176	176	Normal operation, running macro for activation I/O
Supplementary information: The device has been provided with one main fuse which is located on the BIU261 daughter board.  The power supply can provide maximum 60 W to the modules in the device. The typical power consumption is presented in Table 5.						

TABLE 4: Power Input Deviation					
Input deviation of/at:	P rated W/VA	P measured W/VA	Δ P	Required Δ P	Remark
Primary power supply input 220 Vdc	38,7 W	38,7	-	No requirements	See below
Primary power supply input 110 Vdc	38,5 W	38,5	-	No requirements	See below
Secondary power supply input 220 Vdc	38,7 W	38,7	-	No requirements	See below
Secondary power supply input 110 Vdc	38,5 W	38,5	-	No requirements	See below
Primary power supply input 230 vac	86,9 VA	86,9	-	No requirements	See below
Primary power supply input 110 vac	72,2 VA	72,1	-	No requirements	See below
Secondary power supply input 230 vac	86,9 VA	86,9	-	No requirements	See below
Secondary power supply input 110 vac	72,2 VA	72,2	-	No requirements	See below
Supplementary information: The total power is taken by one of the power supply inputs, there is no power sharing between the inputs The values measured are the burden values of the power supply input according clause 9.1.3. The burden values shall be present on the equipment and in the documentation.					

TABLE 5: Clearance And Creepage Distance Measurements P						
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
Basic insulation (CT/VT/BI/BO/alarm outputs)	-	300	3	>3	3	>3
Reinforced insulation (12 V power supply, transformer T1)	-	300	5,5	>5,5	5,5	>5,5
Supplementary information: See detailed creepage and clearance measurement results below.						

Characteristic test data

Serial number sample	A160009583
PCB Coating	No
Pollution degree	2
Over-voltage category	III

Requirements

Nominal rated insulation voltage or working voltage: 300 Vac / 300 Vdc.

Requirement IEC 60255-27, Category; OVC-III, PD2. IEC 60255-27 Annex C. for creepage and clearance requirements.

Creepage requirement for functional, basic or supplementary insulation.

1. Non-coated PCB; creepage distance = 3 mm (table C.6)
2. For double or reinforced insulation; creepage distance = 5,5 mm (table C.10).

Clearance requirement for basic functional or supplementary insulation

1. Clearance; 3 mm (table C.6)
2. For double or reinforced insulation; clearance distance = 5,5 mm (table C.10).

Nominal rated insulation voltage or working voltage: 150 Vac / 150 Vdc.

Requirement IEC 60255-27, Category; OVC-III, PD2. IEC 60255-27 Annex C. for creepage and clearance requirements.

Creepage requirement for functional, basic or supplementary insulation.

1. Non-coated PCB; creepage distance =1,5 mm (table C.6)
2. For double or reinforced insulation; creepage distance = 3,0 mm (table C.10).

Clearance requirement for basic functional or supplementary insulation

1. Clearance; 1,5 mm (table C.6)

For double or reinforced insulation; clearance distance = 3,0 mm (table C.10).

Nominal rated insulation voltage or working voltage: 50 Vac / 50 Vdc.

Requirements; Category; OVC-III, PD2. IEC 61850-3 refers to IEC 60255-27 Annex C. for creepage and clearance requirements.

Creepage requirement for functional, basic or supplementary insulation.

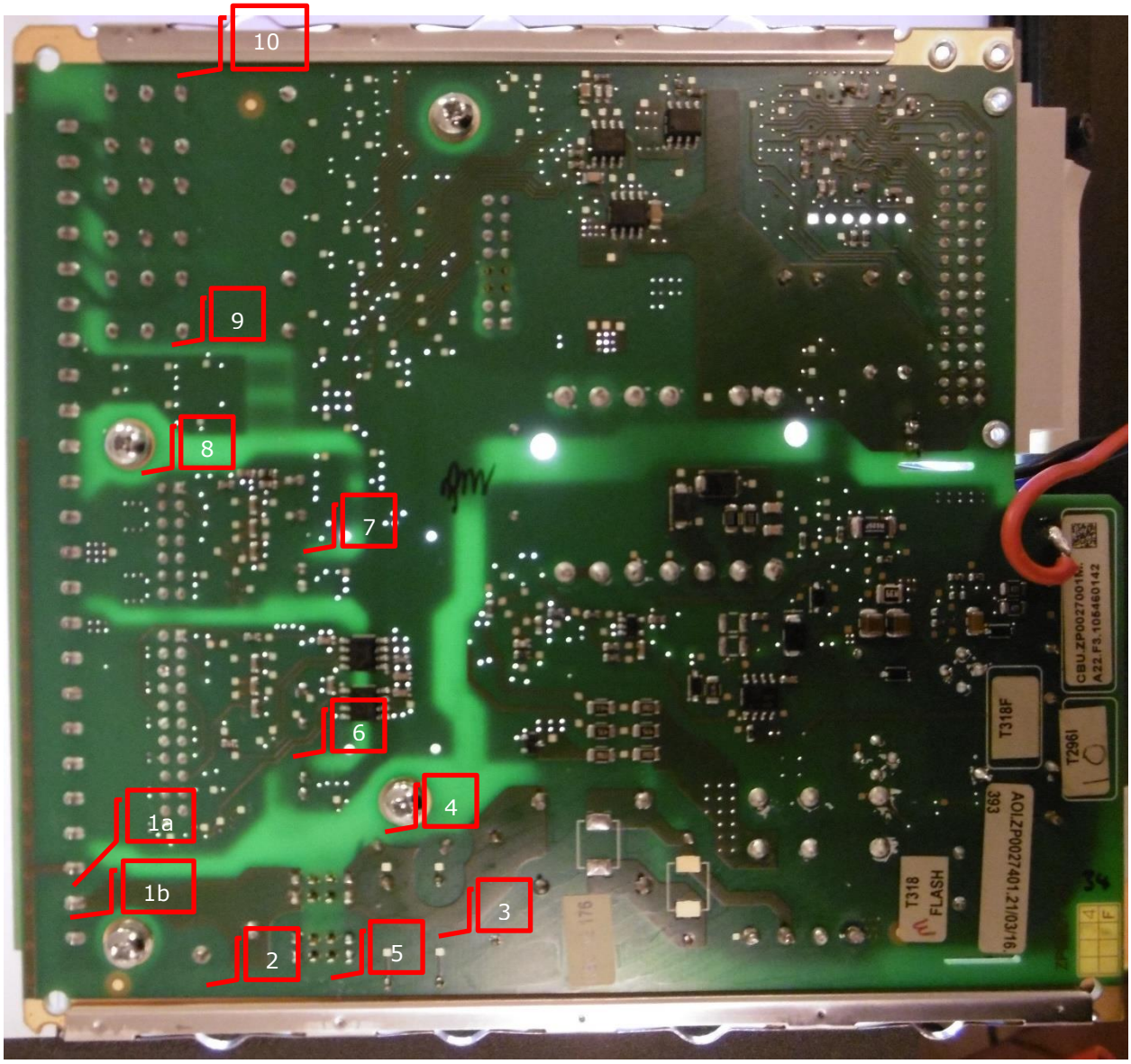
1. Non-coated PCB; creepage distance =0,15 mm (table C.6)
2. For double or reinforced insulation; creepage distance = 0,5 mm (table C.10).

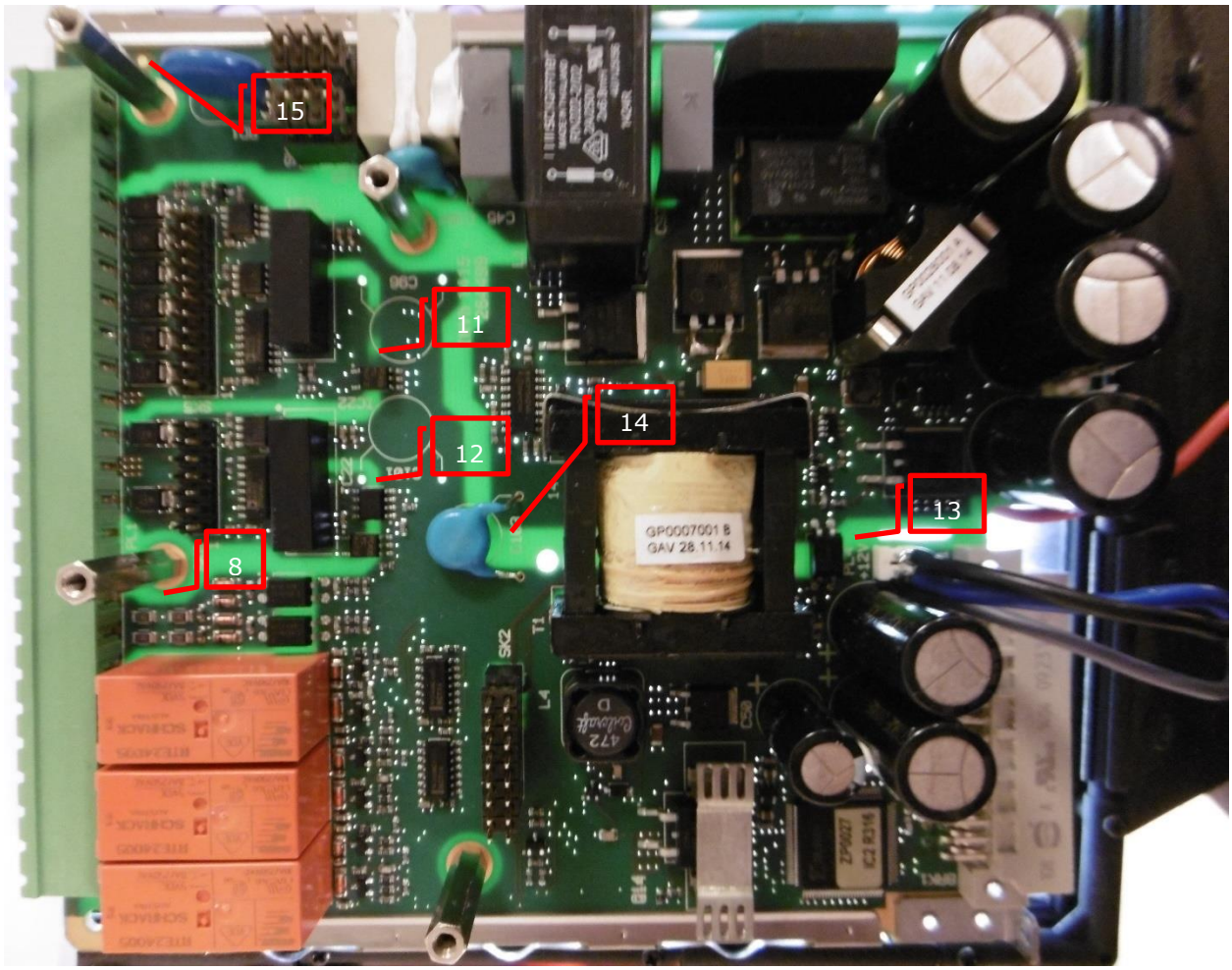
Clearance requirement for basic functional or supplementary insulation

1. Clearance; 0,15 mm (table C.6)
2. For double or reinforced insulation; clearance distance = 0,5 mm (table C.10).

Measurements of creepage and clearance

BIU261M (Motherboard - ZP0027001)



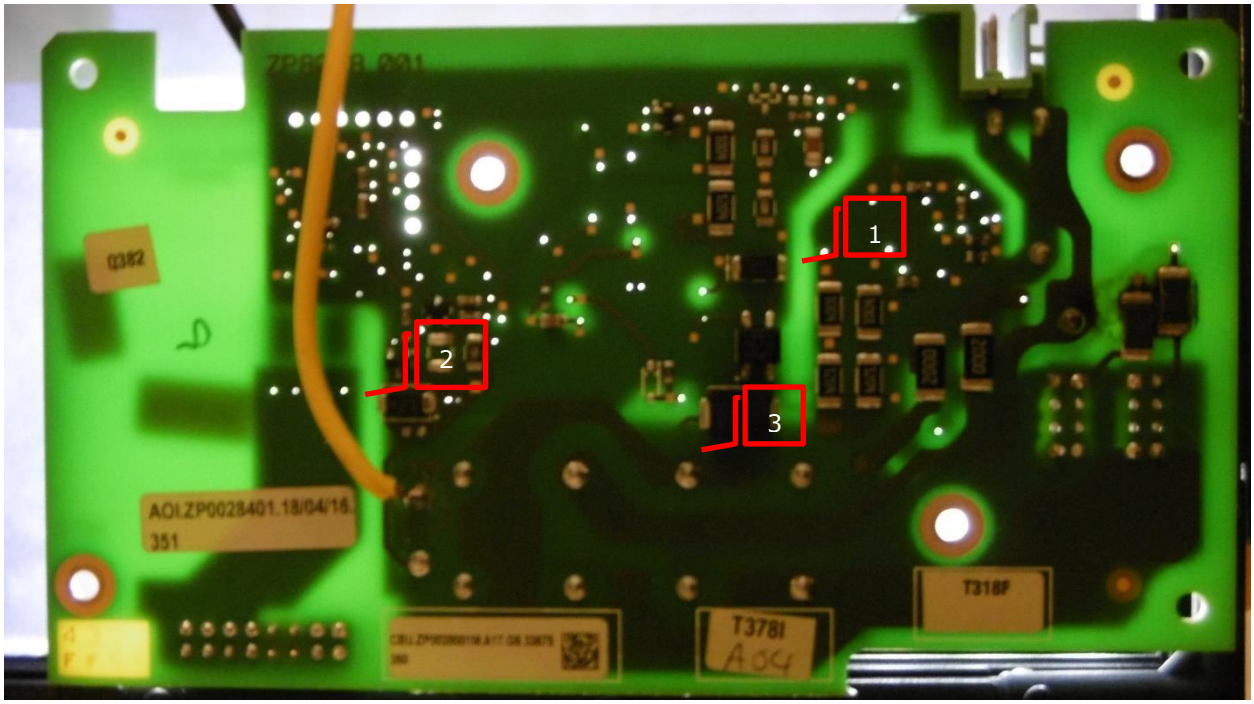


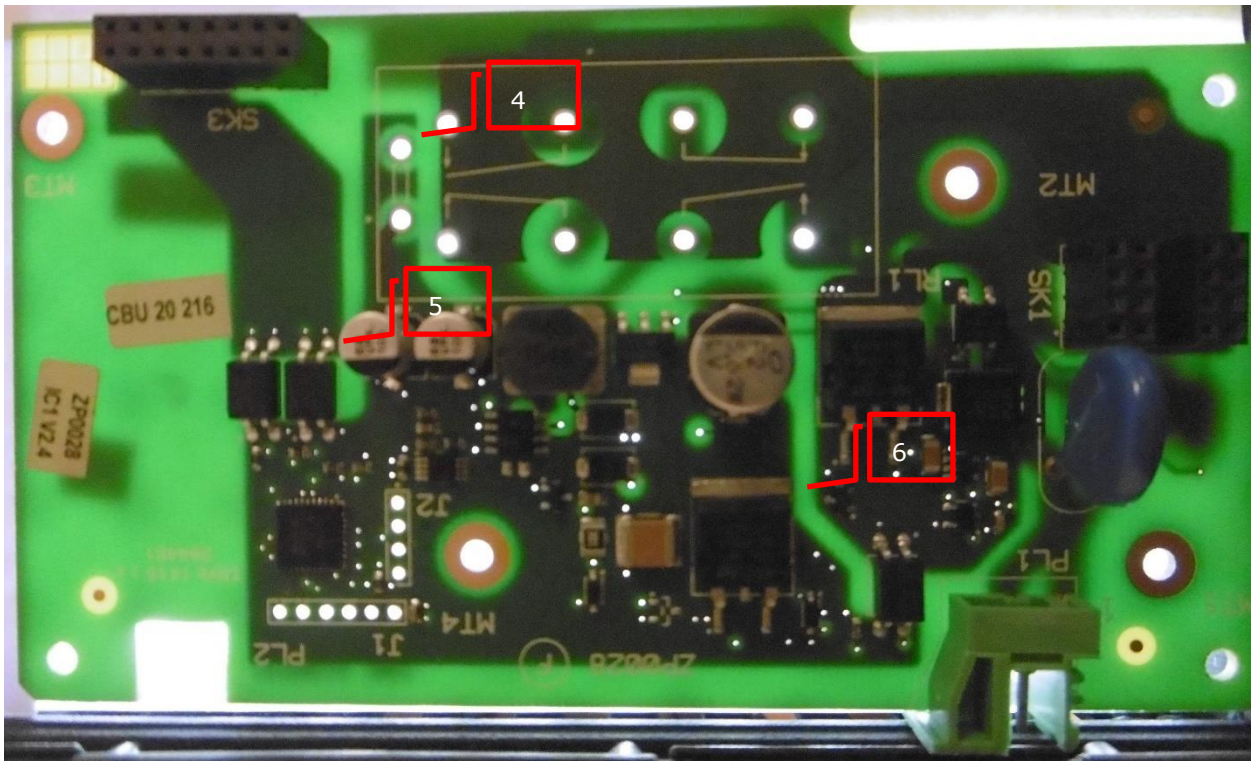
Creepage

Measurement point	Required mm	Measured mm	Result
1a; connector PL1 power input to PE	3,0	3,0	Passed
1a; connector PL1 power input, line to neutral	3,0	3,0	Passed
2; RD1 to conductive PCB card guide	3,0	3,0	Passed
3; Y capacitor C46A/C47A to PE	3,0	3,0	Passed
4; HLV to mounting stud	3,0	3,0	Passed
5; SK4 header to conductive PCB card guide	3,0	> 4,5	Passed
6; IC 21 isol. DC/DC converter comm I/F 1	0,15	3,0	Passed
7; IC 22 isol. DC/DC converter comm I/F 2	0,15	3,0	Passed
8; isolated serial interface and isolated input to HLV	3,0	3,0	Passed
9; isolated input to output relay RL1	3,0	3,0	Passed
10; relay RL4 to conductive PCB card guide	3,0	3,0	Passed
11; optocoupler comm I/F1	0,15	> 3,5	Passed

Measurement point	Required mm	Measured mm	Result
12; opto coupler comm I/F 2	0,15	> 3,5	Passed
13; HLV-ELV (opto coupler PSU)	3,0	> 6,0	Passed
14; HLV-ELV (Y-cap C103)	3,0	> 10,0	Passed
15; RD1 to PE (conductive PCB card guide)	3,0	> 4,0	Passed

BIU261D (Daughterboard - ZP0028001)





Creepage

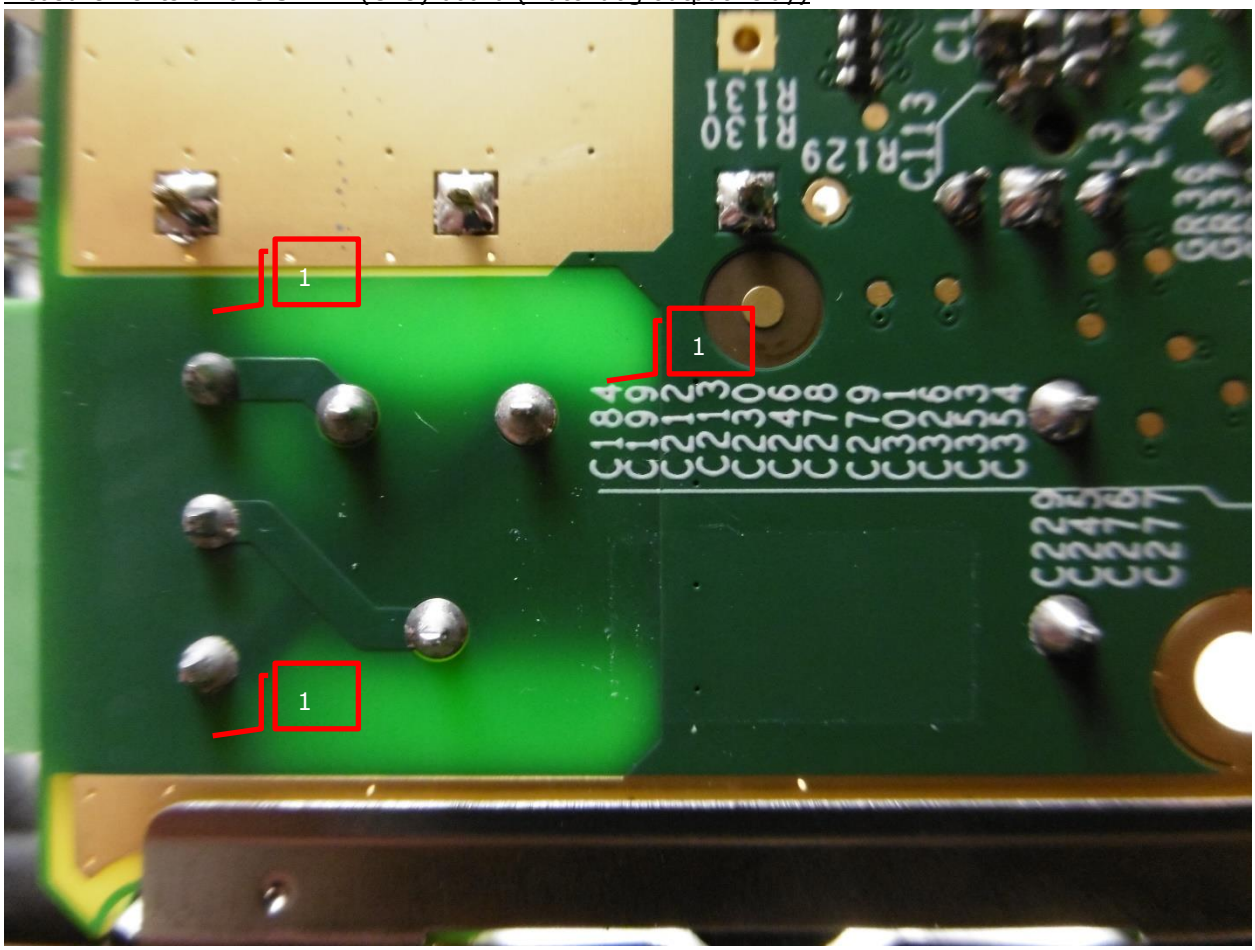
	Required mm	Measured mm	Result
1; 24 V power supply to secondary power supply input	3,0	3,0	Passed
2; HLV to ELV	3,0	3,0	Passed
3; 24 V power supply to RL1	3,0	3,0	Passed
4; RL1, coil to contacts	3,0	3,0	Passed
5; HLV to ELV (between capacitor and optocoupler)	3,0	3,0	Passed
6; 24 V power supply to secondary power supply input	3,0	3,0	Passed

Clearance

The observed clearance is well above the required clearance distance. No measurements required.

"IEC 61850-3 clause 6.6.1.1 General
Where there is any doubt that the required clearance and creepage distances are compliant with the values in the appropriate table from Annex C of IEC 60255-27:2013, measurements shall be made".

Measurements on the SRPv2 (CPU) board (watchdog output relay)



Creepage

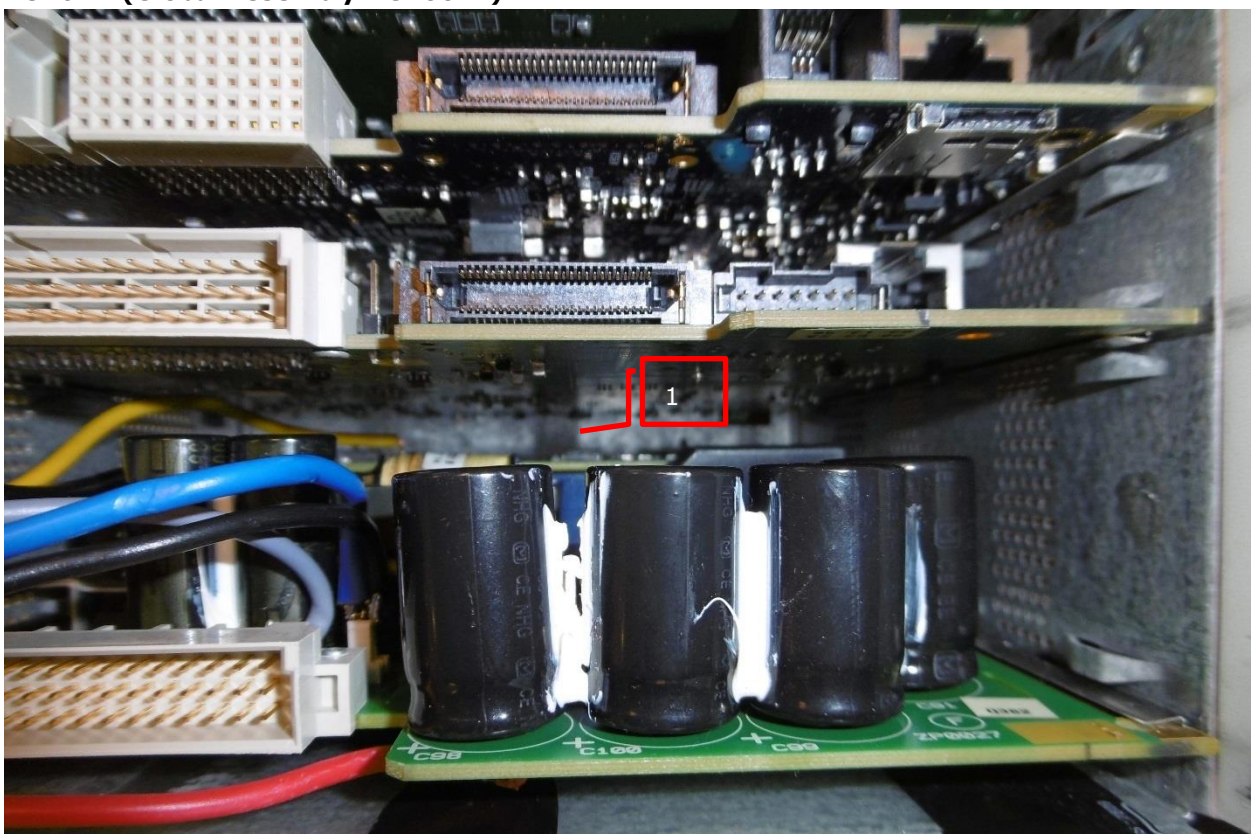
	Required mm	Measured mm	Result
1; relay contact to ELV (GND)	3,0	3,0	Passed

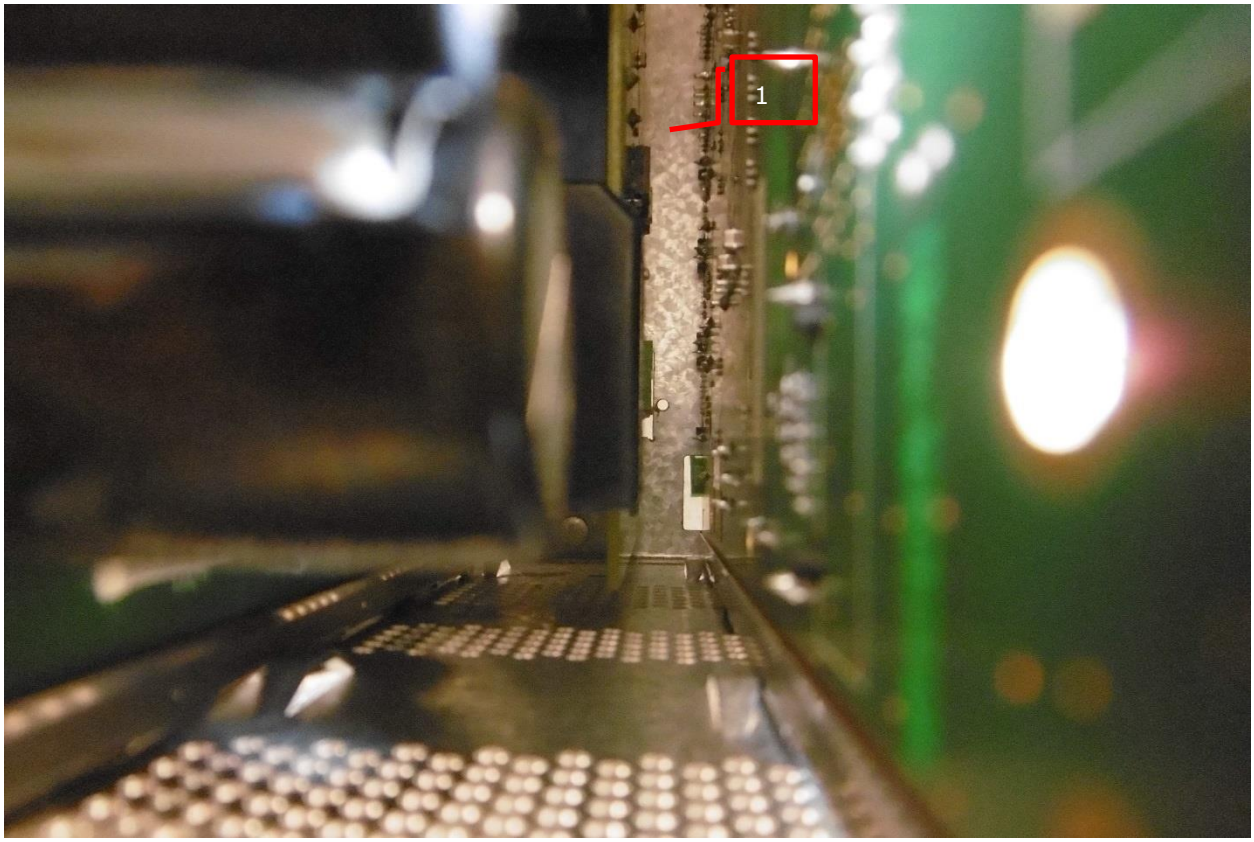
Clearance

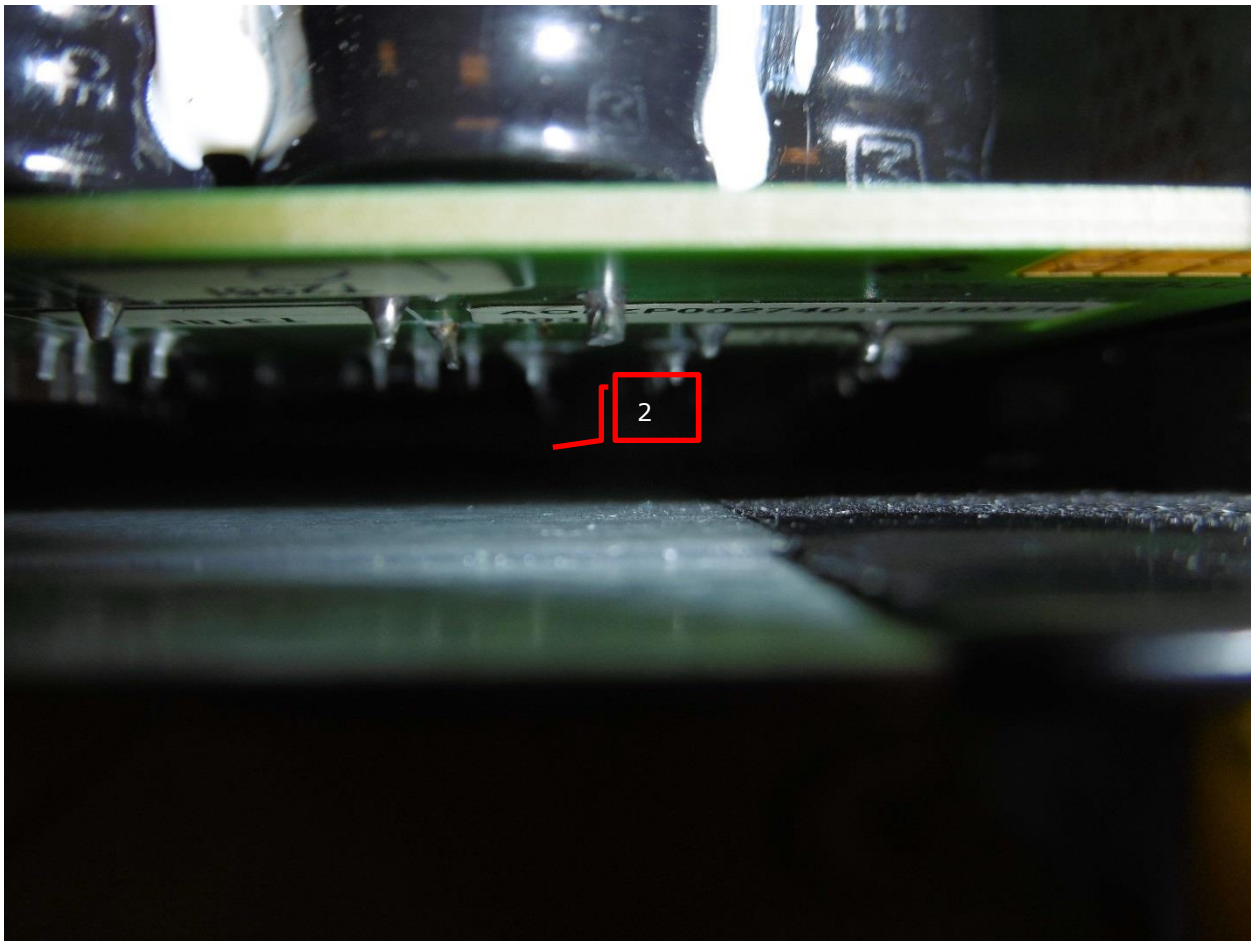
The observed clearance is well above the required clearance distance. No measurements required.

"IEC 61850-3 clause 6.6.1.1 General
Where there is any doubt that the required clearance and creepage distances are compliant with the values in the appropriate table from Annex C of IEC 60255-27:2013, measurements shall be made".

BU261D (Global Assembly - GP0027)







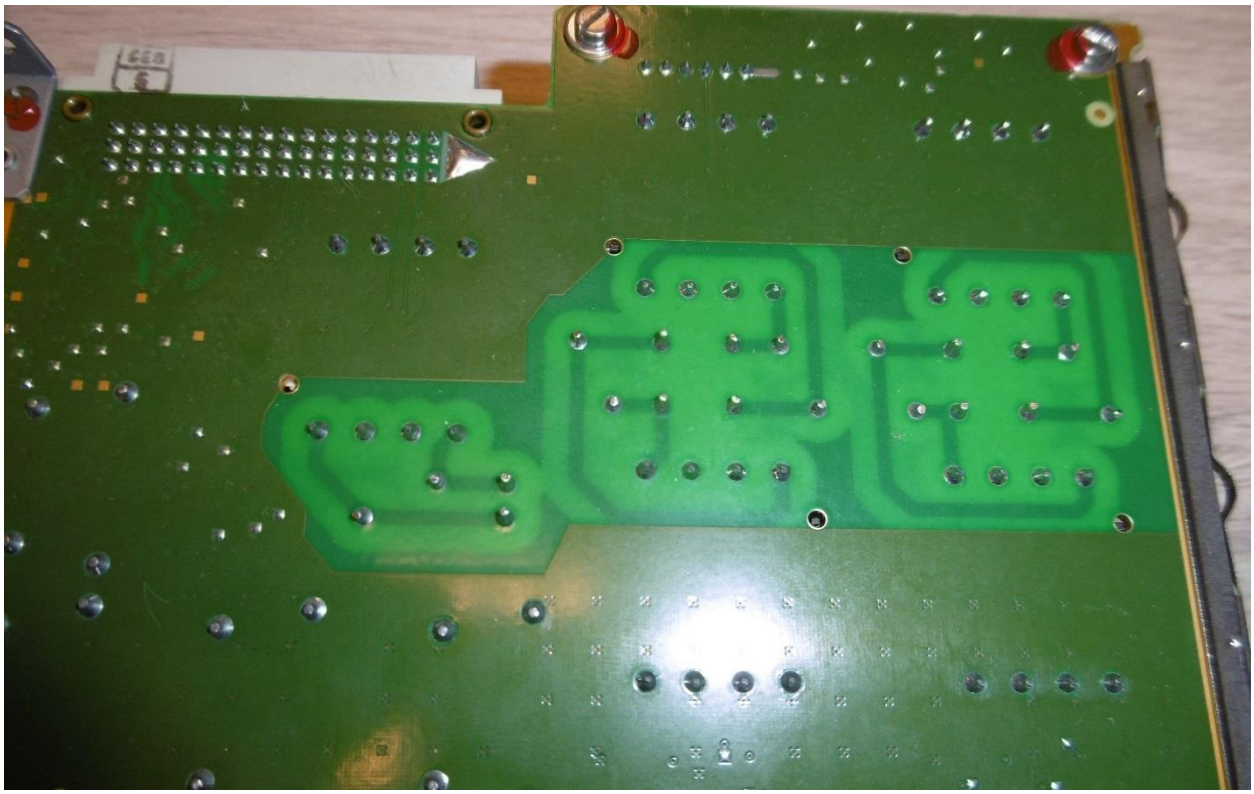
Clearance

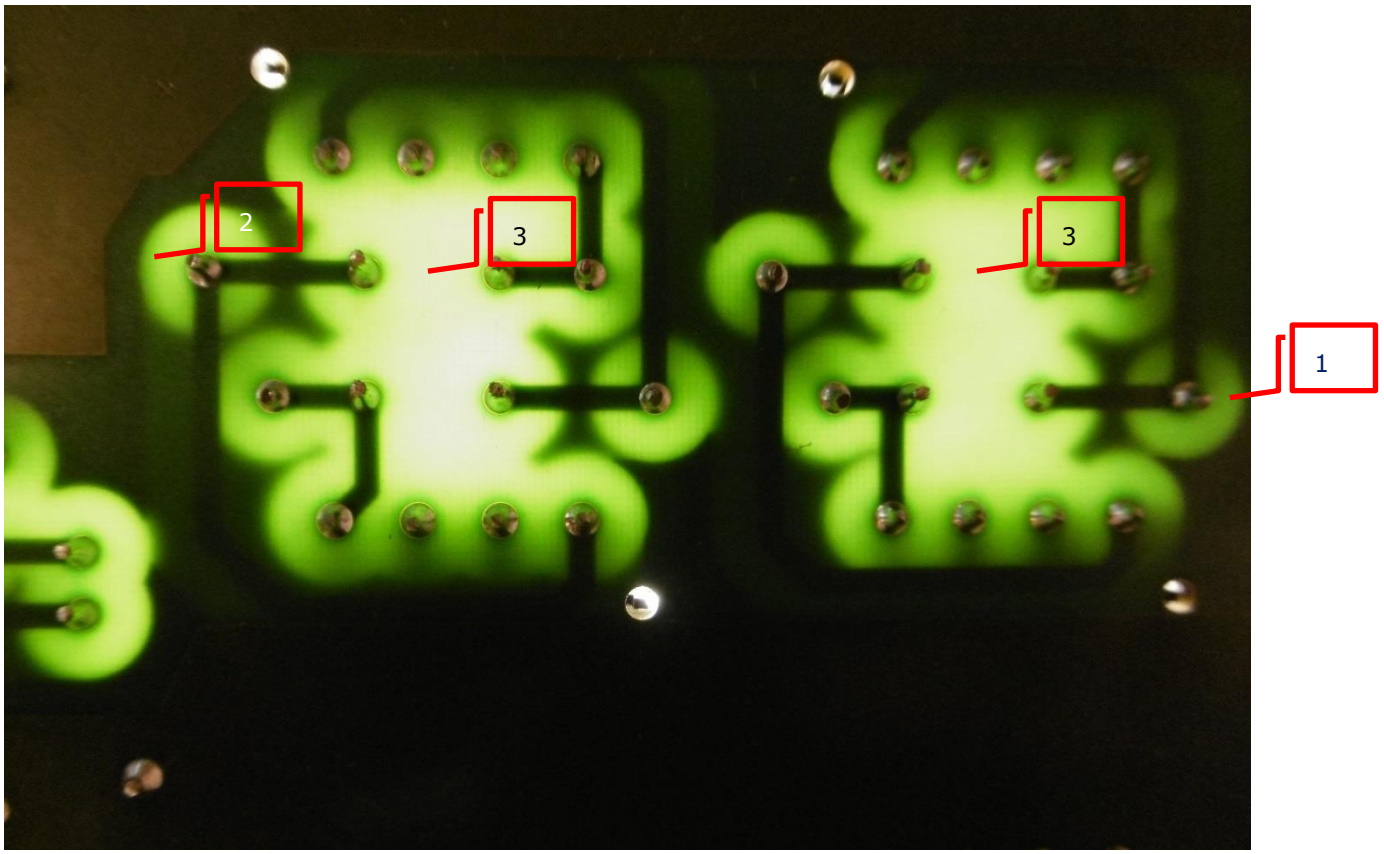
Measurement point	Required mm	Measured mm	Result
1: between BIU261D and CPU4 board	3,0	> 8,0	Passed
2: between BIU261 motherboard and rack	3,0	> 5,0	Passed

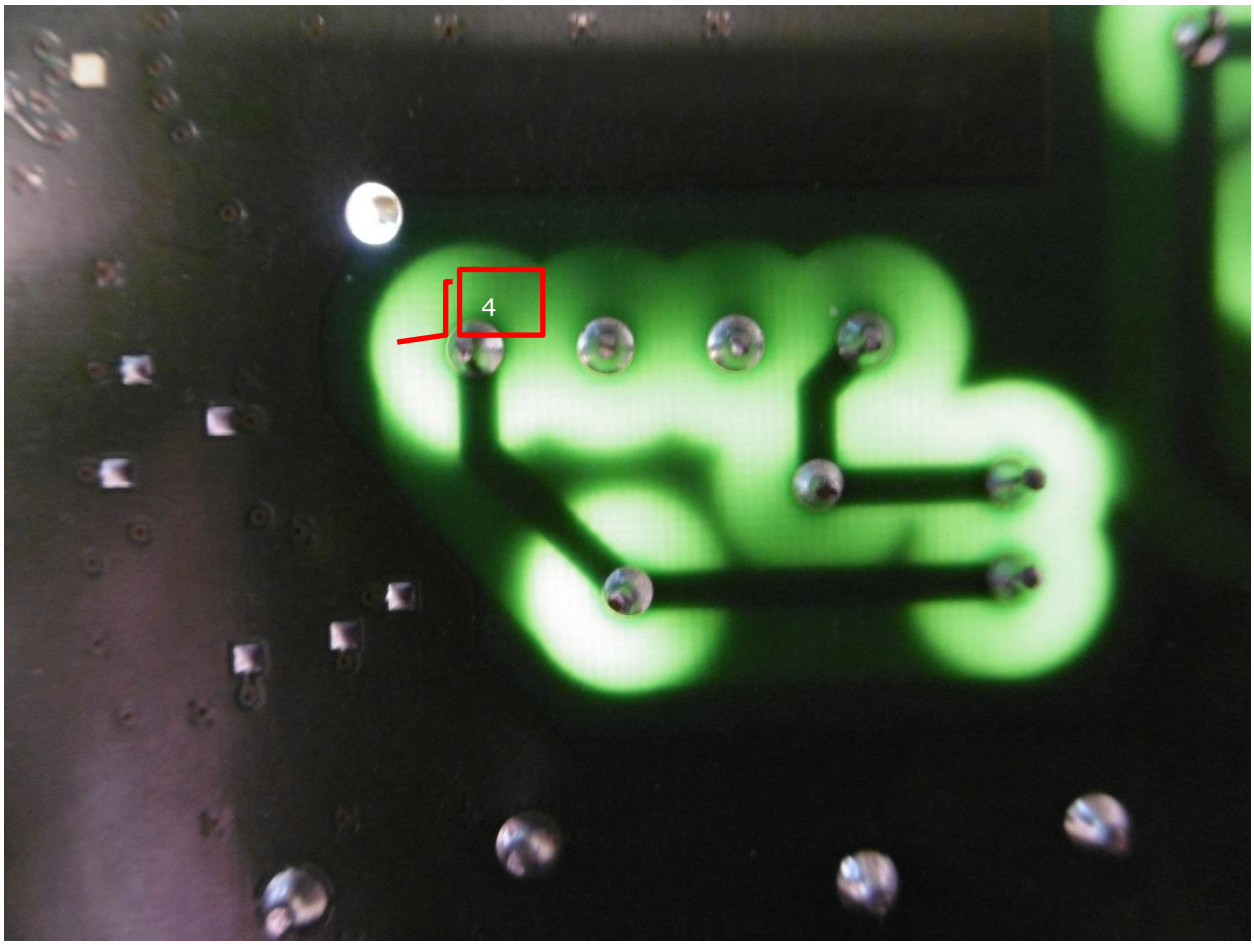
Note

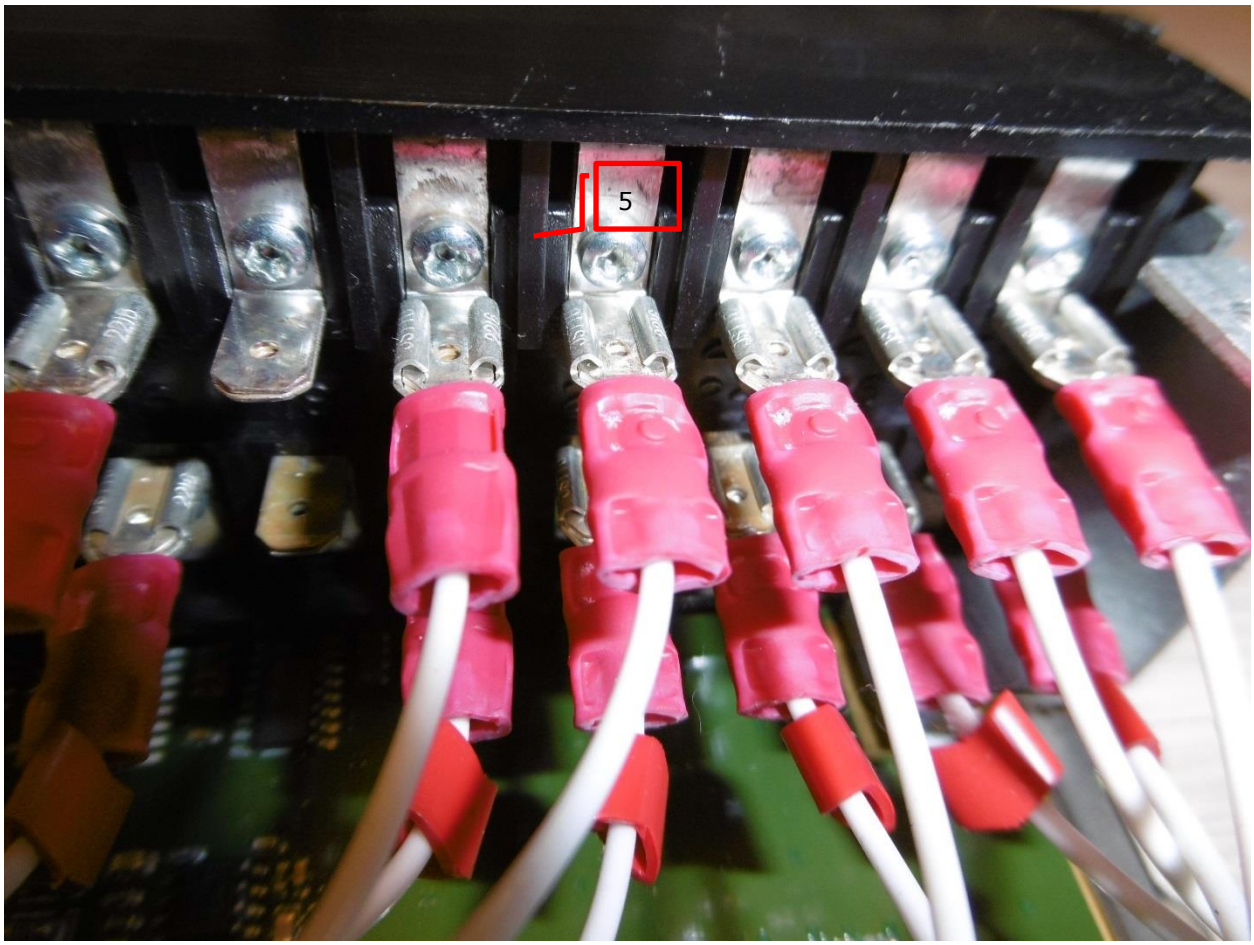
In model C264 an insulation foil has been applied to improve clearance.

TMU220



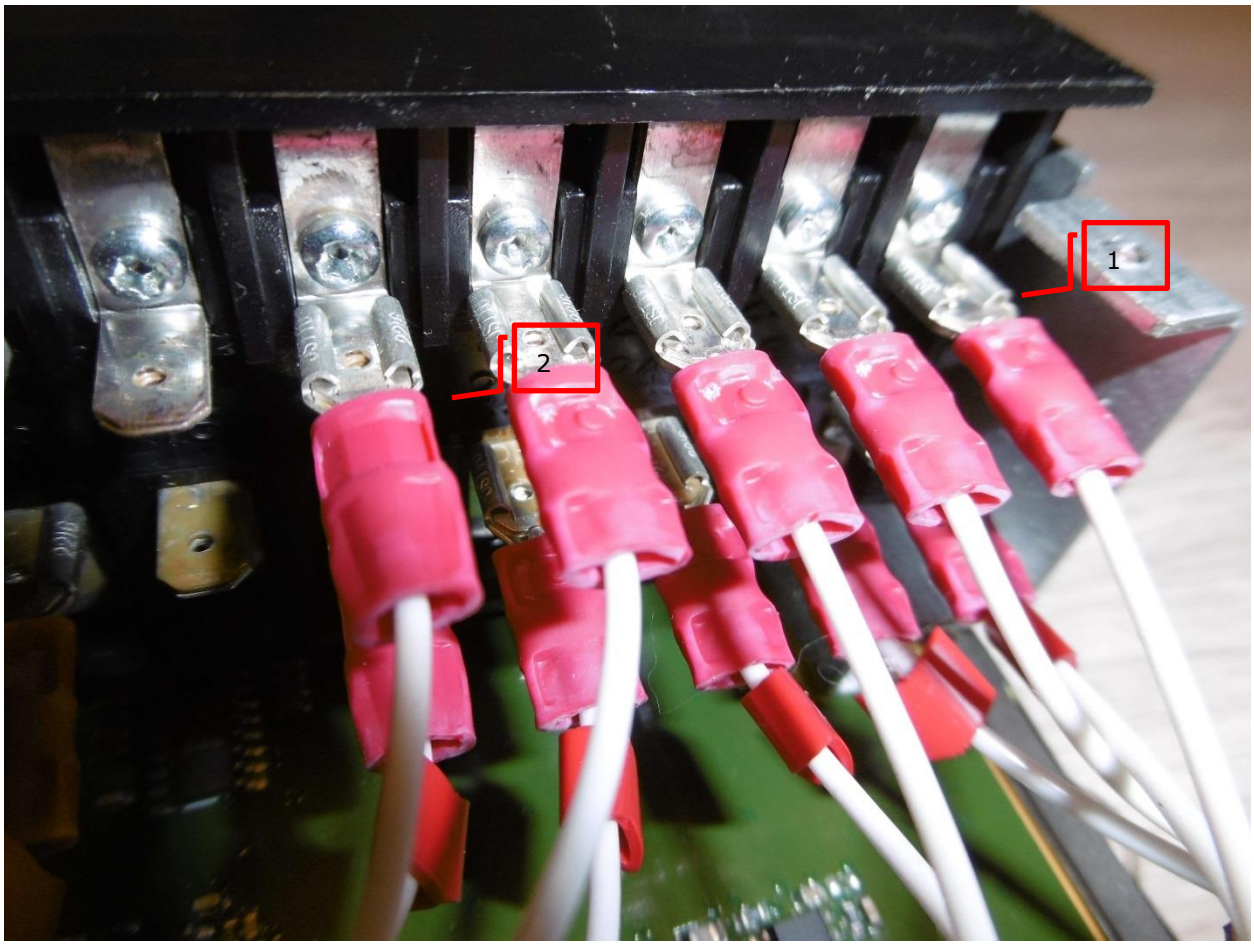


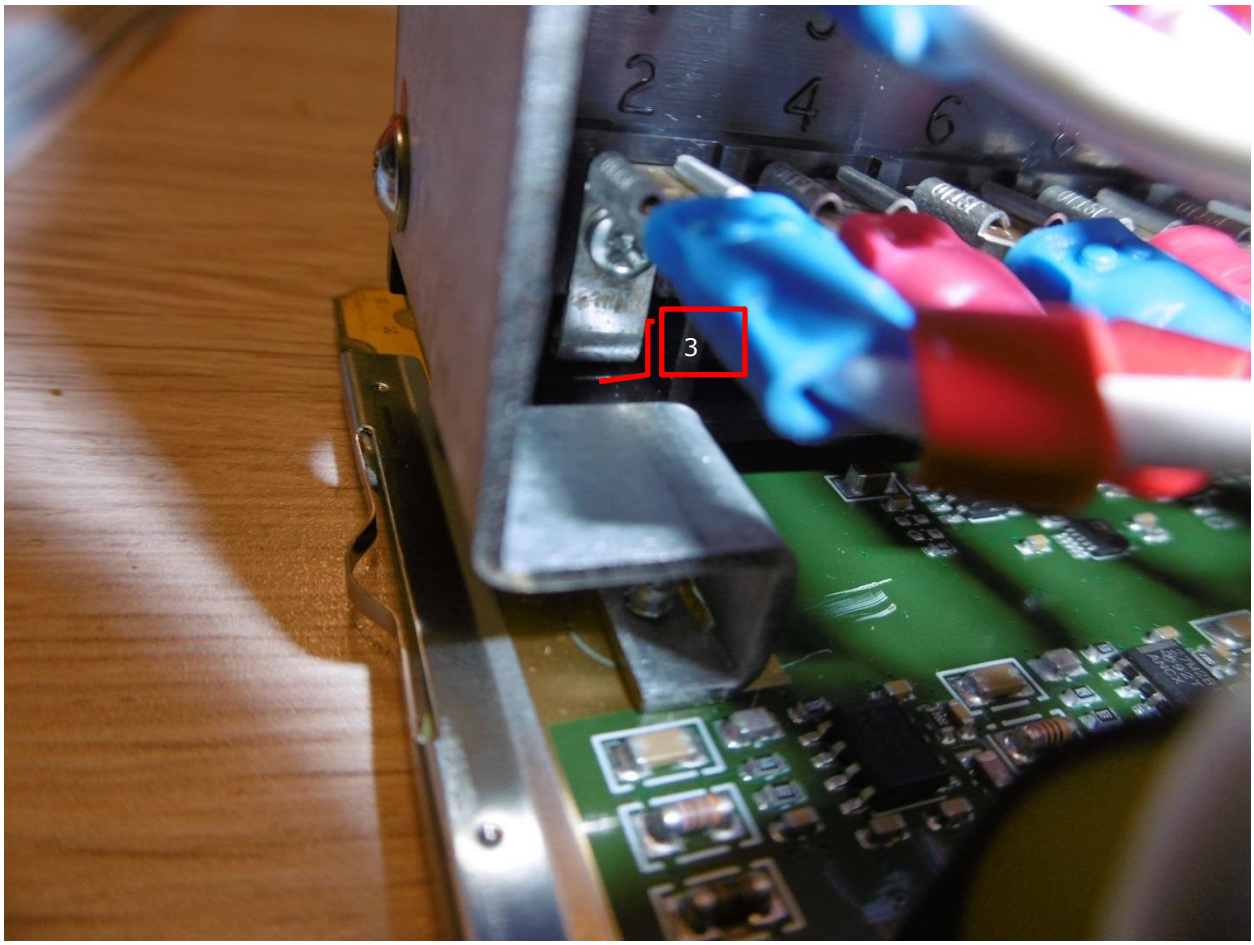

4



Creepage

Measurement point	Required mm	Measured mm	Result
1: MOV to conductive card guide (PE)	3,0	> 4,5	Passed
2: MOV to PE	3,0	> 4,5	Passed
3: between analogue voltage input circuits	3,0	> 4,5	Passed
4: analogue voltage input circuit to PE	3,0	> 4,5	Passed
5: CT/VT input connector between terminals	3,0	> 4,5	Passed

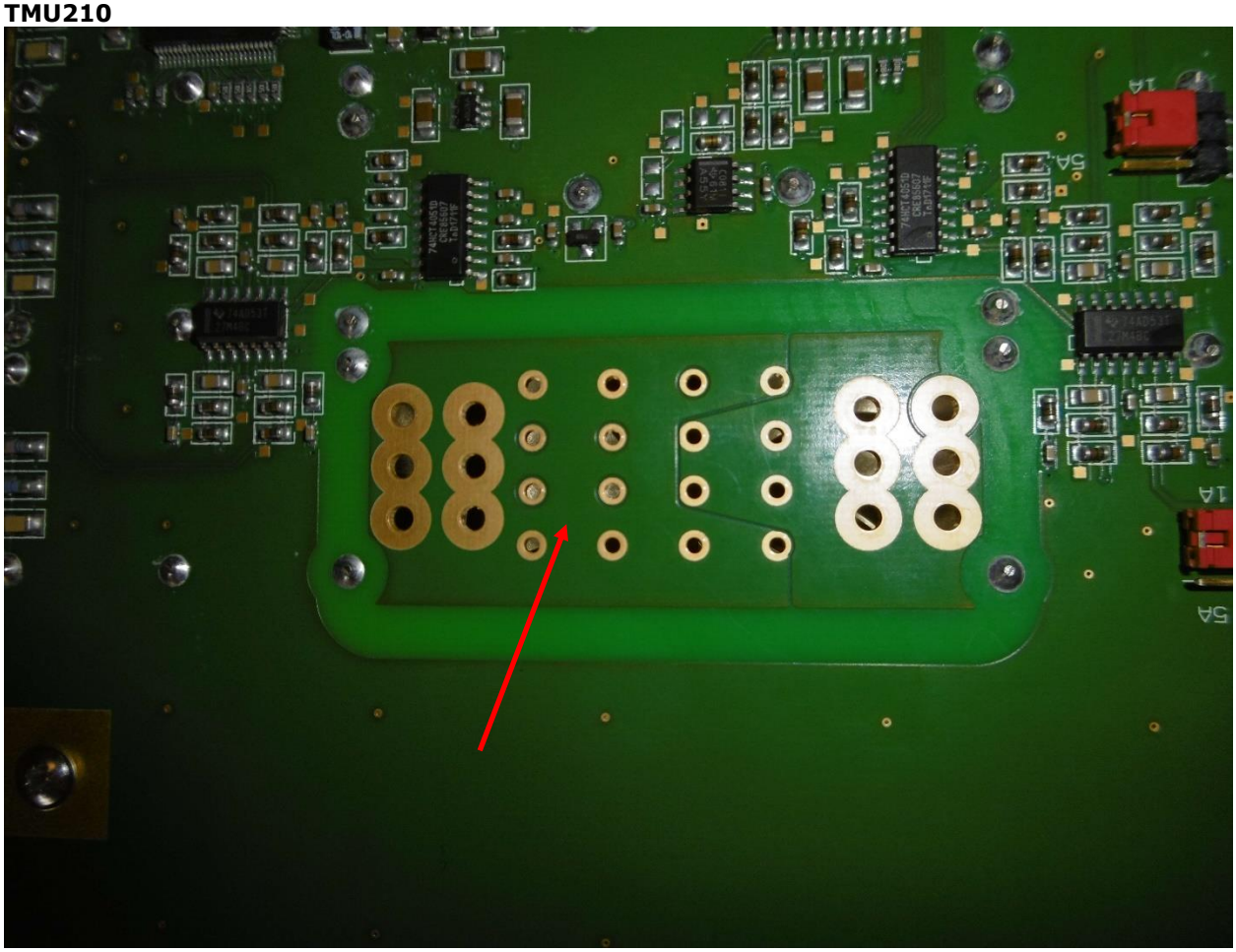

1
2



Clearance

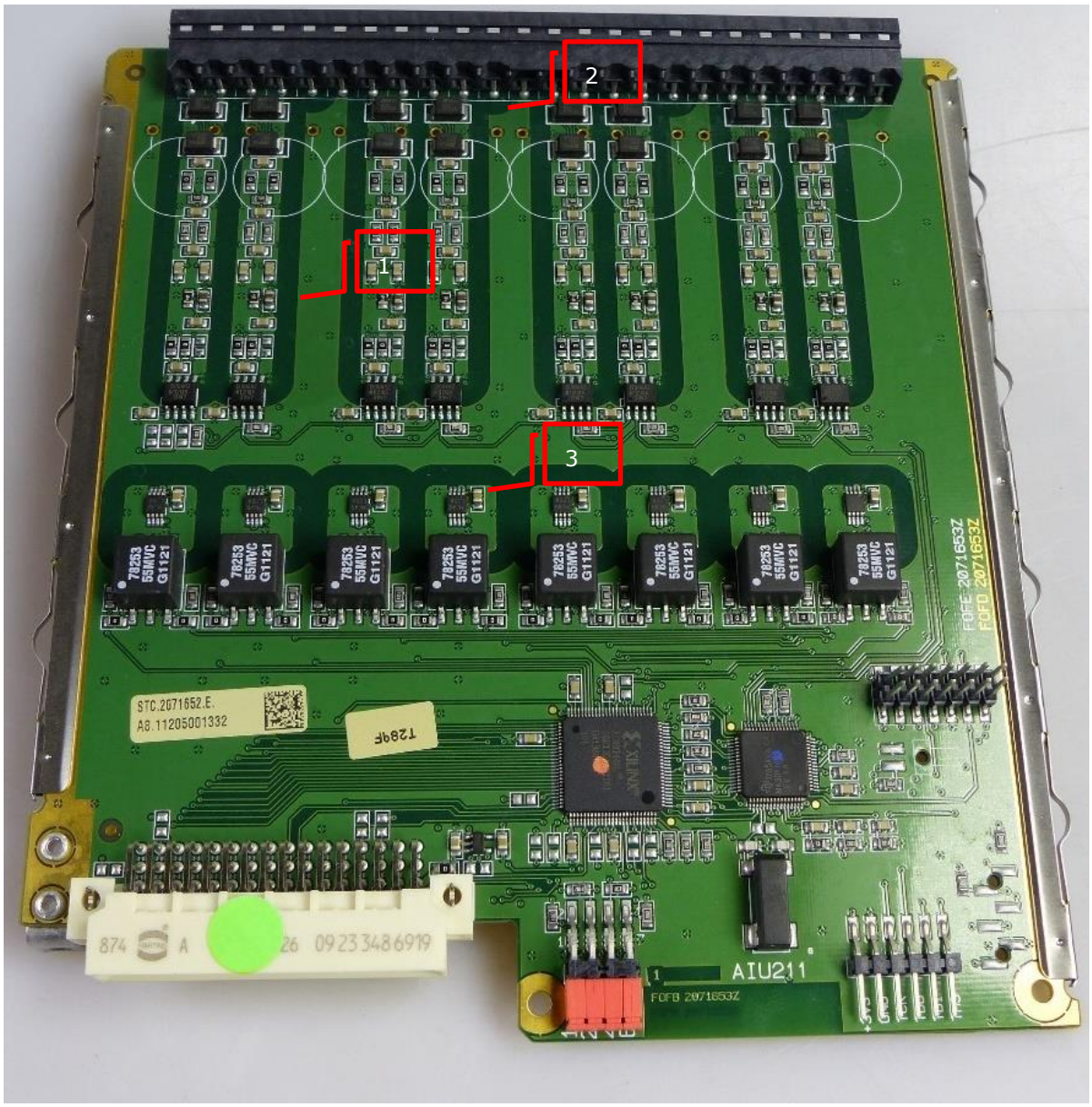
Measurement point	Required mm	Measured mm	Result
1: CT/VT input terminals to mounting bracket	3,0	3,0	Passed
2: between CT/VT input terminals	3,0	3,0	Passed
3: CT/VT input terminals to mounting bracket	3,0	3,0	Passed

TMU210



The isolated part on the pcb is unused. It is indicated by the arrow in the photo. The insulation has been implemented in the CT/VT's and TMU CT/VT input connector. Therefore no creepage/clearance measurements on the pcb required. For the measurements on the CT/VT connector, refer to the results for TMU220.

AIU211



Creepage

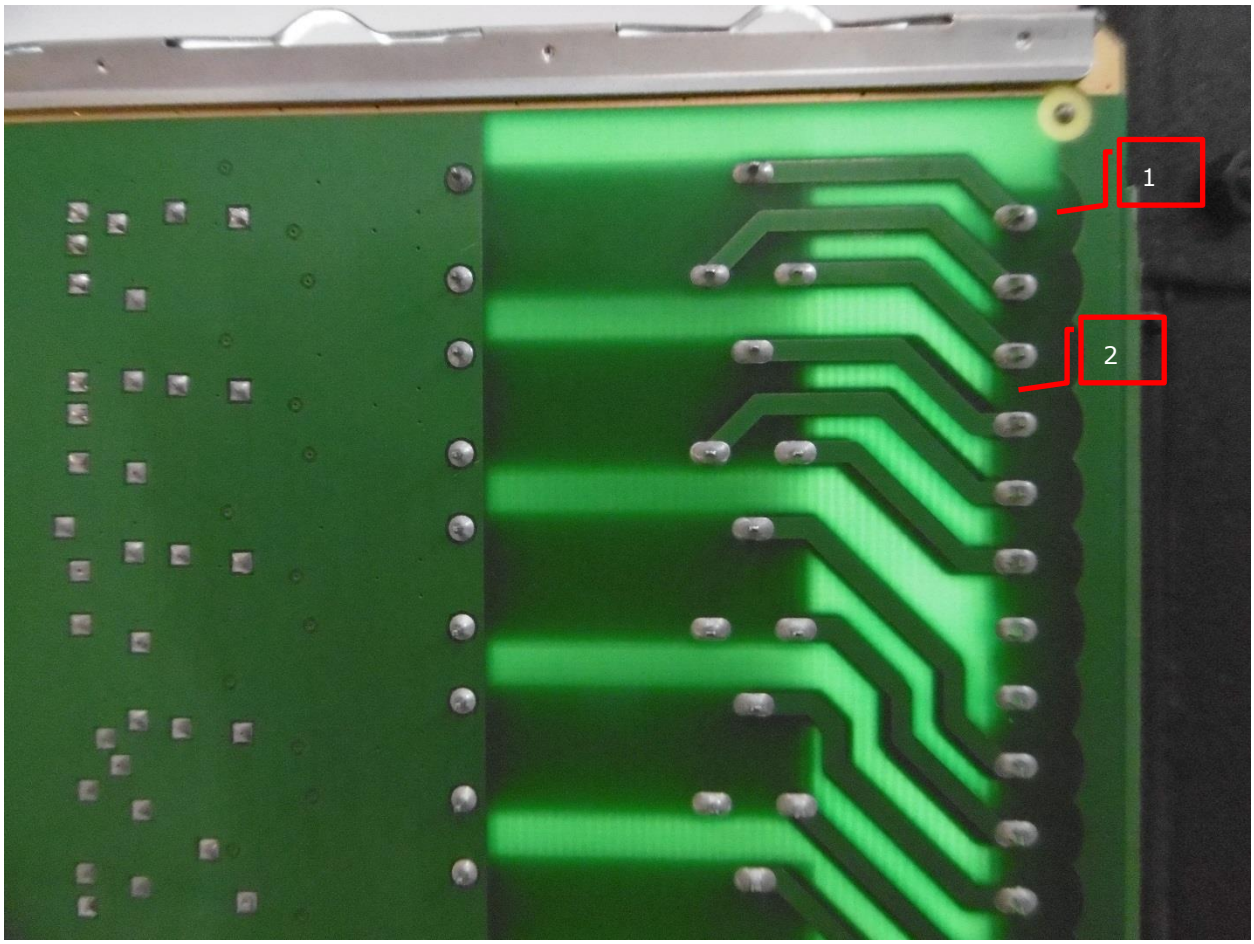
Measurement point	Required mm	Measured mm	Result
1: between voltage input and PE	3,0	3,0	Passed
2: between connector terminals	3,0	3,0	Passed
3: between current input and PE	3,0	3,0	Passed

Clearance

The observed clearance is well above the required clearance distance. No measurements required.

"IEC 61850-3 clause 6.6.1.1 General
Where there is any doubt that the required clearance and creepage distances are compliant with the values in the appropriate table from Annex C of IEC 60255-27:2013, measurements shall be made".

DOU201



Creepage

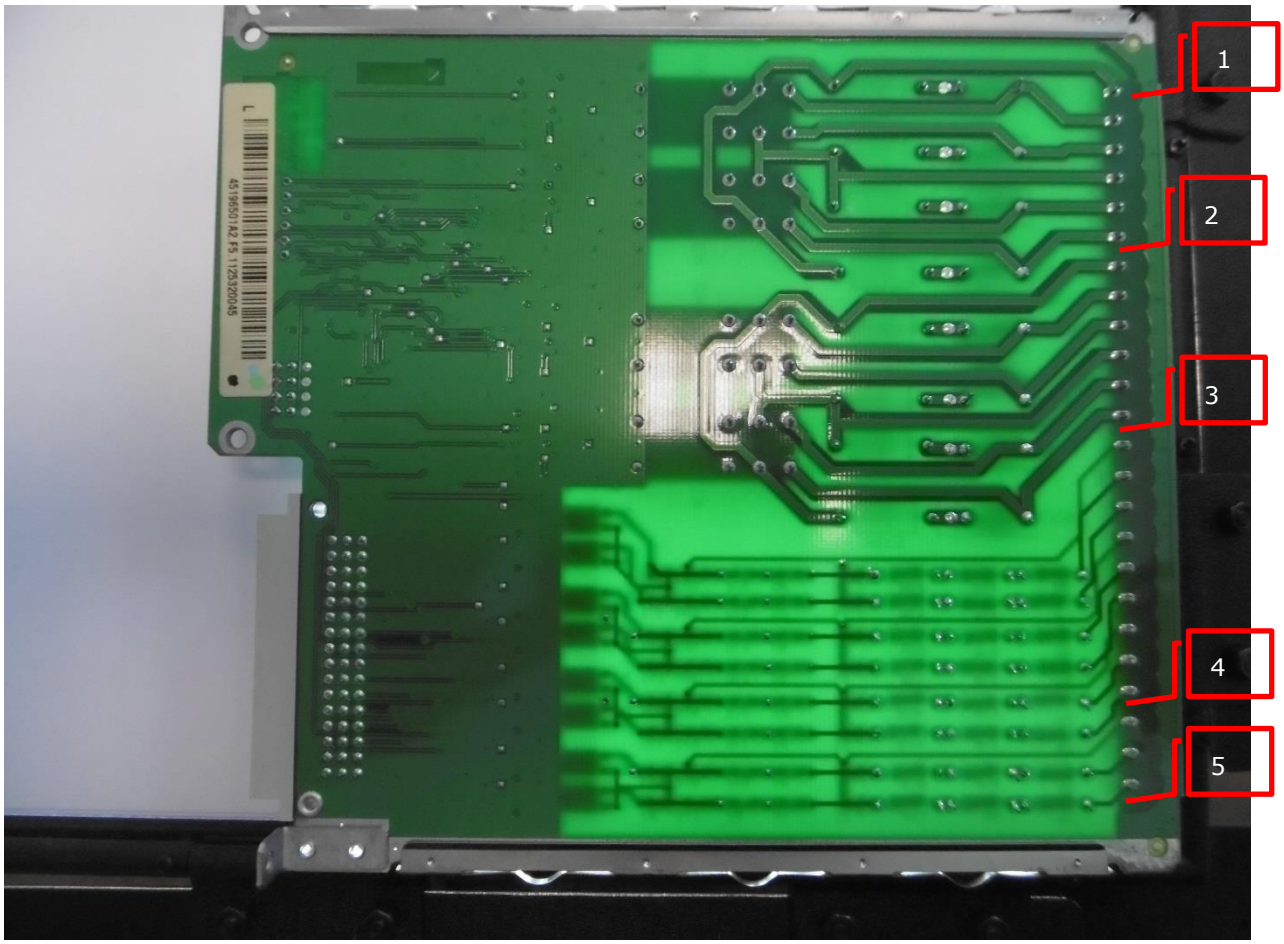
Measurement point	Required mm	Measured mm	Result
1: between relay output and PE	3,0	3,0	Passed
2: between adjacent relay outputs	3,0	3,0	Passed

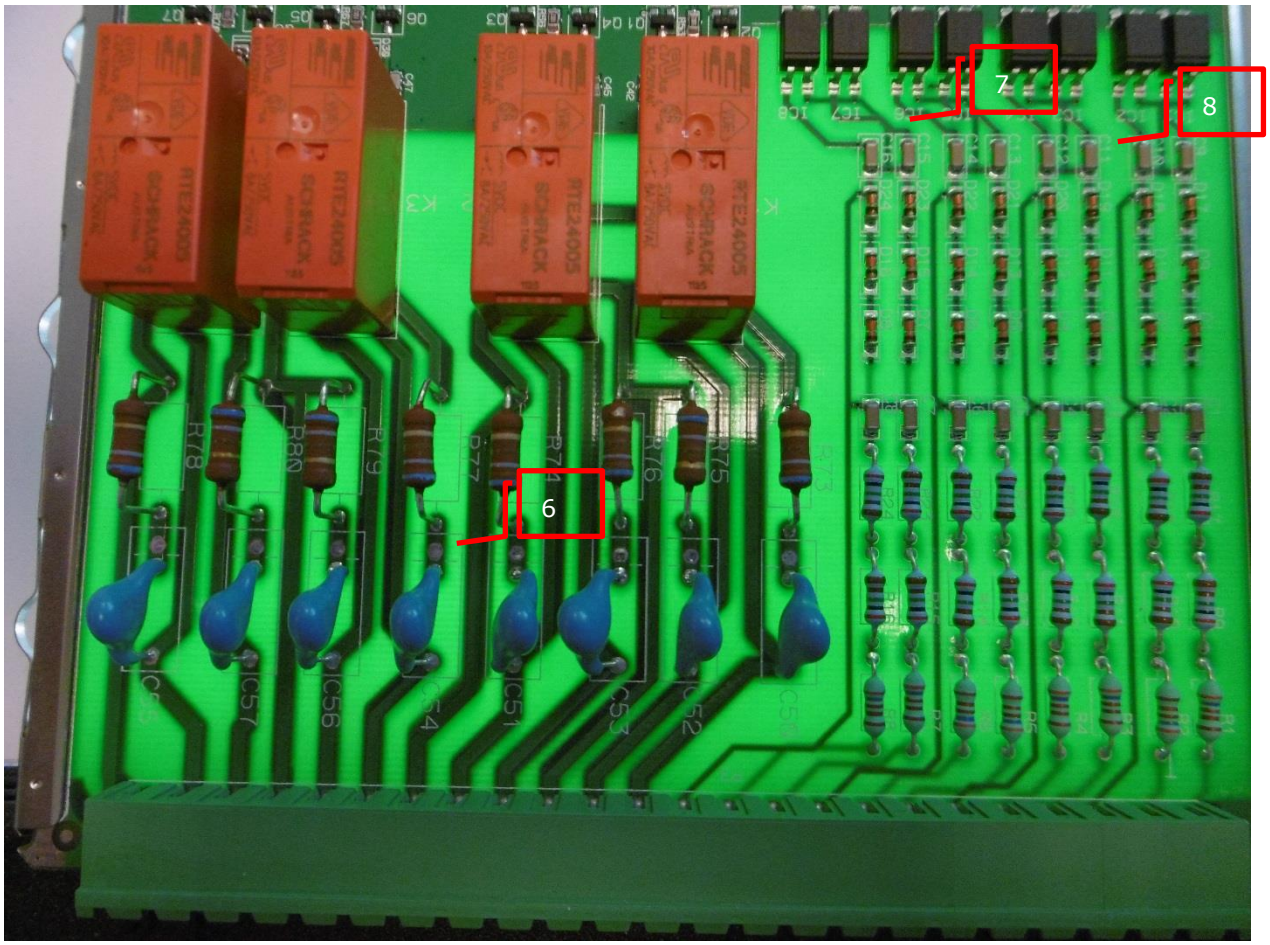
Clearance

The observed clearance is well above the required clearance distance. No measurements required.

"IEC 61850-3 clause 6.6.1.1 General
Where there is any doubt that the required clearance and creepage distances are compliant with the values in the appropriate table from Annex C of IEC 60255-27:2013, measurements shall be made".

CCU211





Creepage

Measurement point	Required mm	Measured mm	Result
1: between connector pin of P3 and PE	3,0	3,0	Passed
2: between adjacent relay outputs	3,0	3,0	Passed
3: between relay output and optocoupler input	3,0	3,0	Passed
4: between 2 opto coupler inputs	3,0	3,0	Passed
5; between optocoupler input :nd PE	3,0	3,0	Passed
6: between K2 and K3 relay sections	3,0	3,0	Passed
7: between optocoupler IC 7 and IC6	1,5[1]	2,0	Passed
8: between 2 opto coupler input circuits (IC2 and IC3)	1,5[1]	3,0	Passed

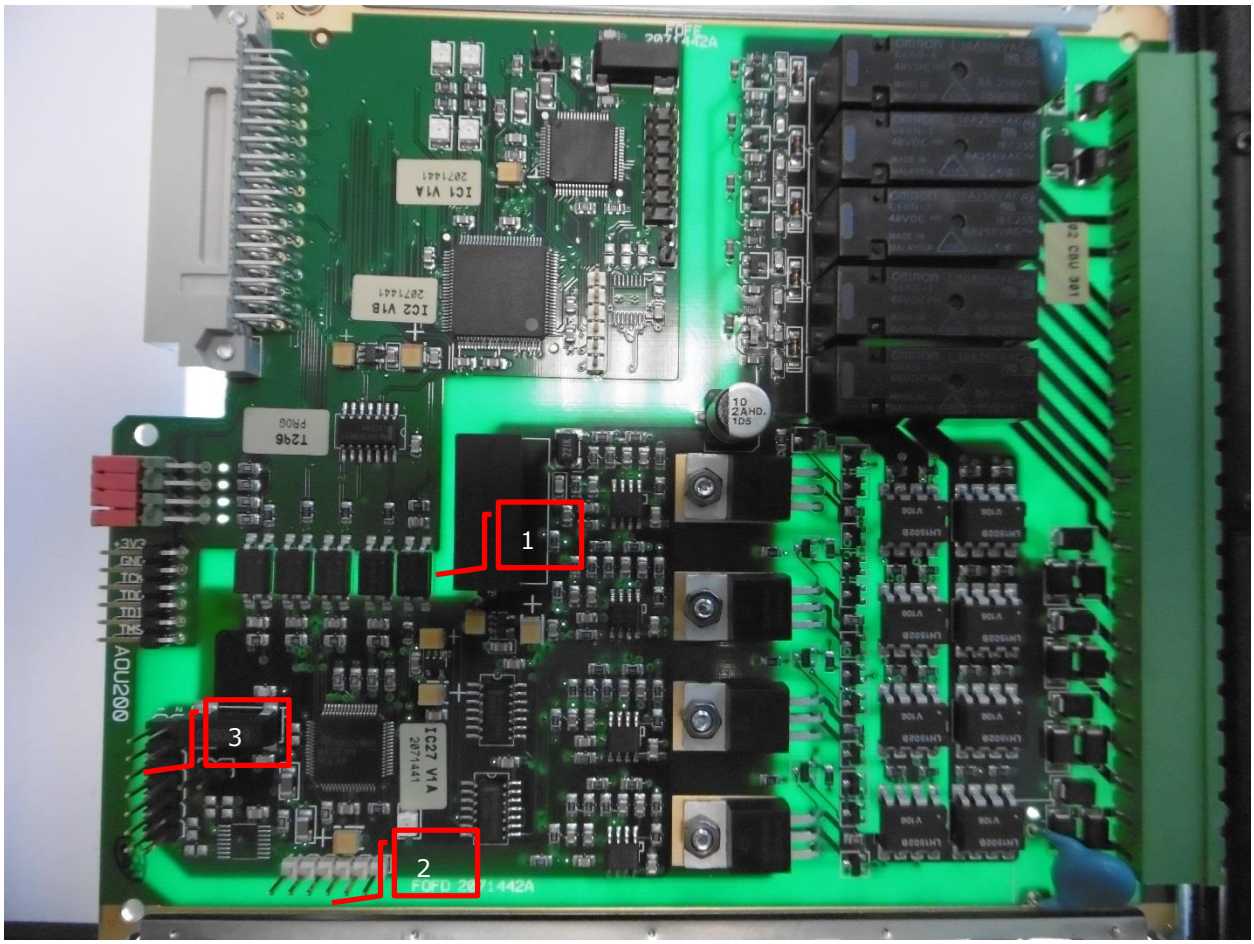
Note

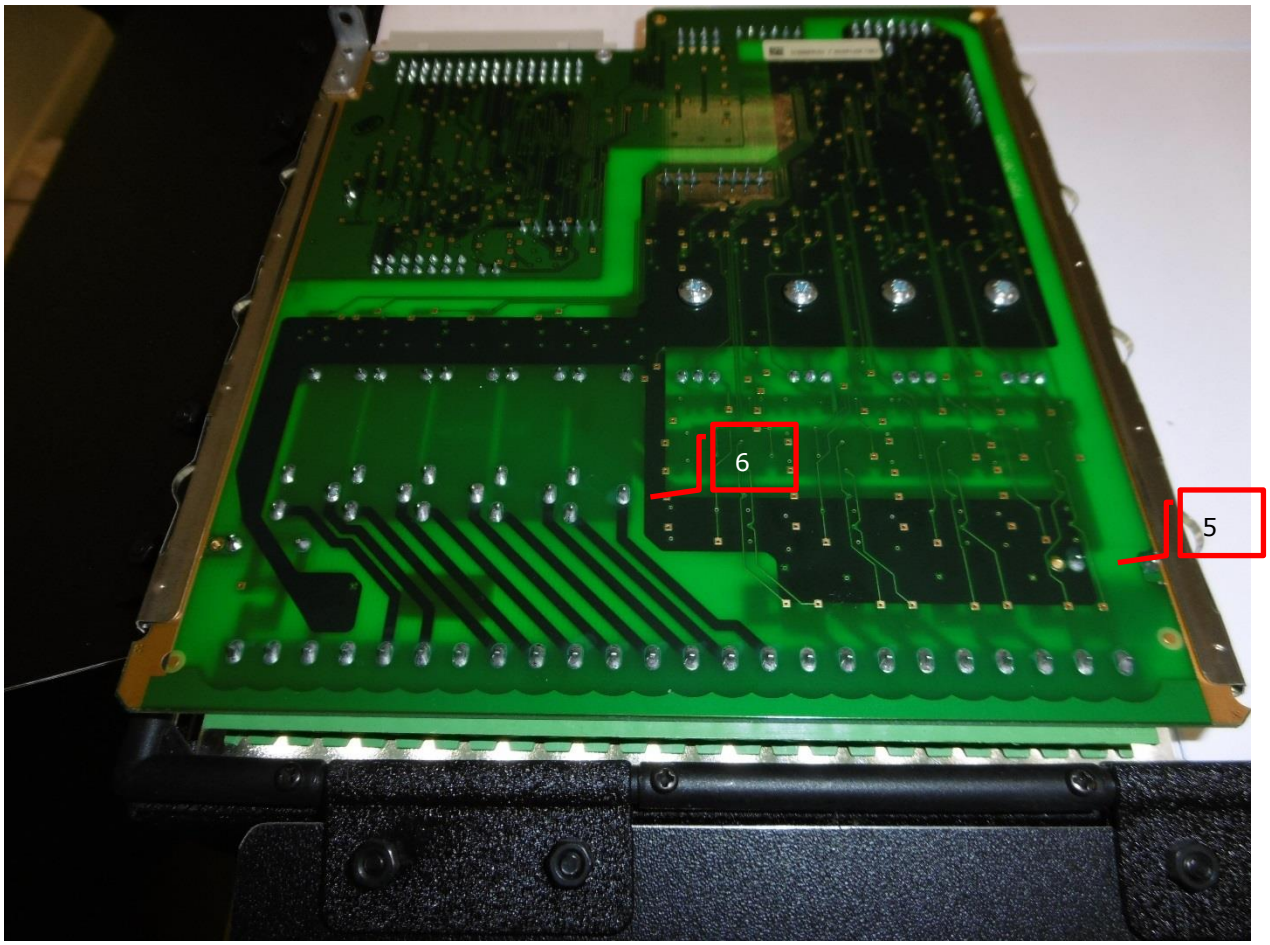
[1]The customer derated the working voltage specification for the optocoupler inputs to 125 Vdc. The required creepage distance is 1,5 mm.

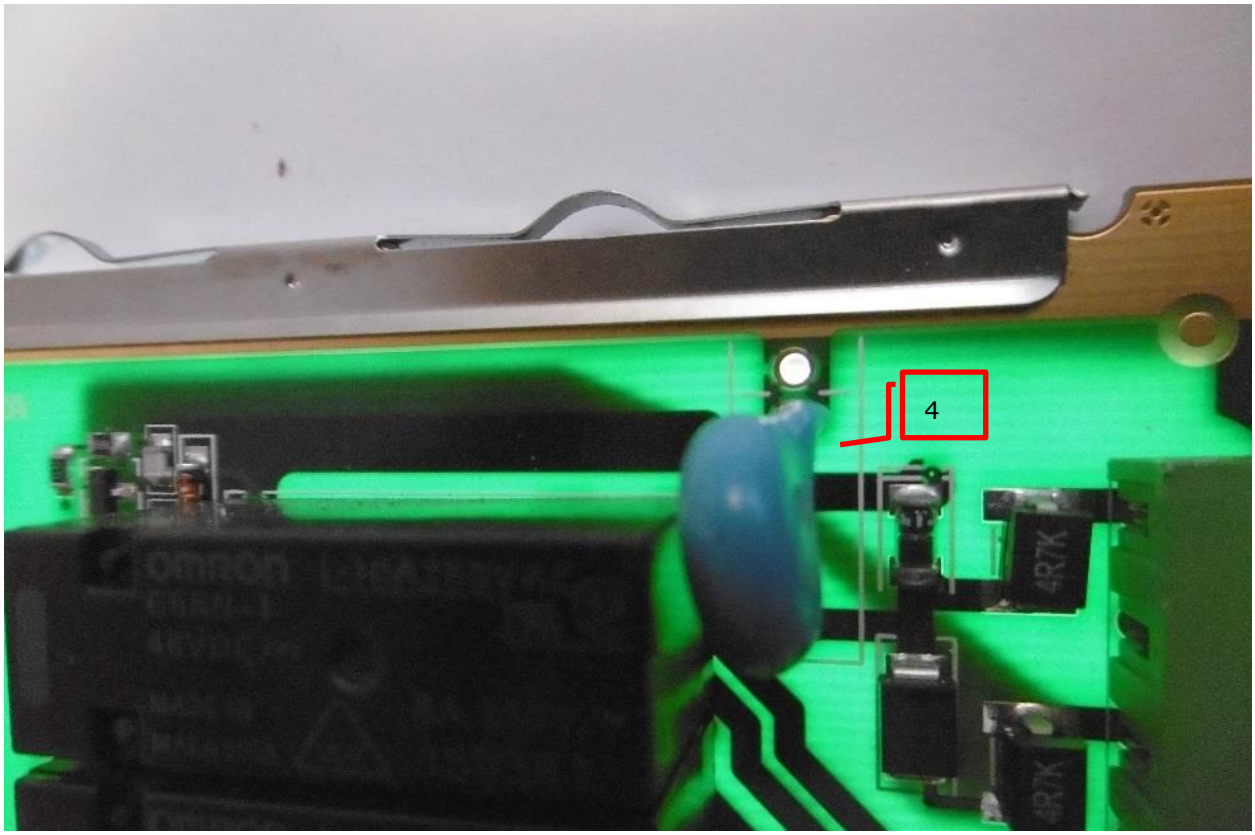
Clearance
The observed clearance is well above the required clearance distance. No measurements required.

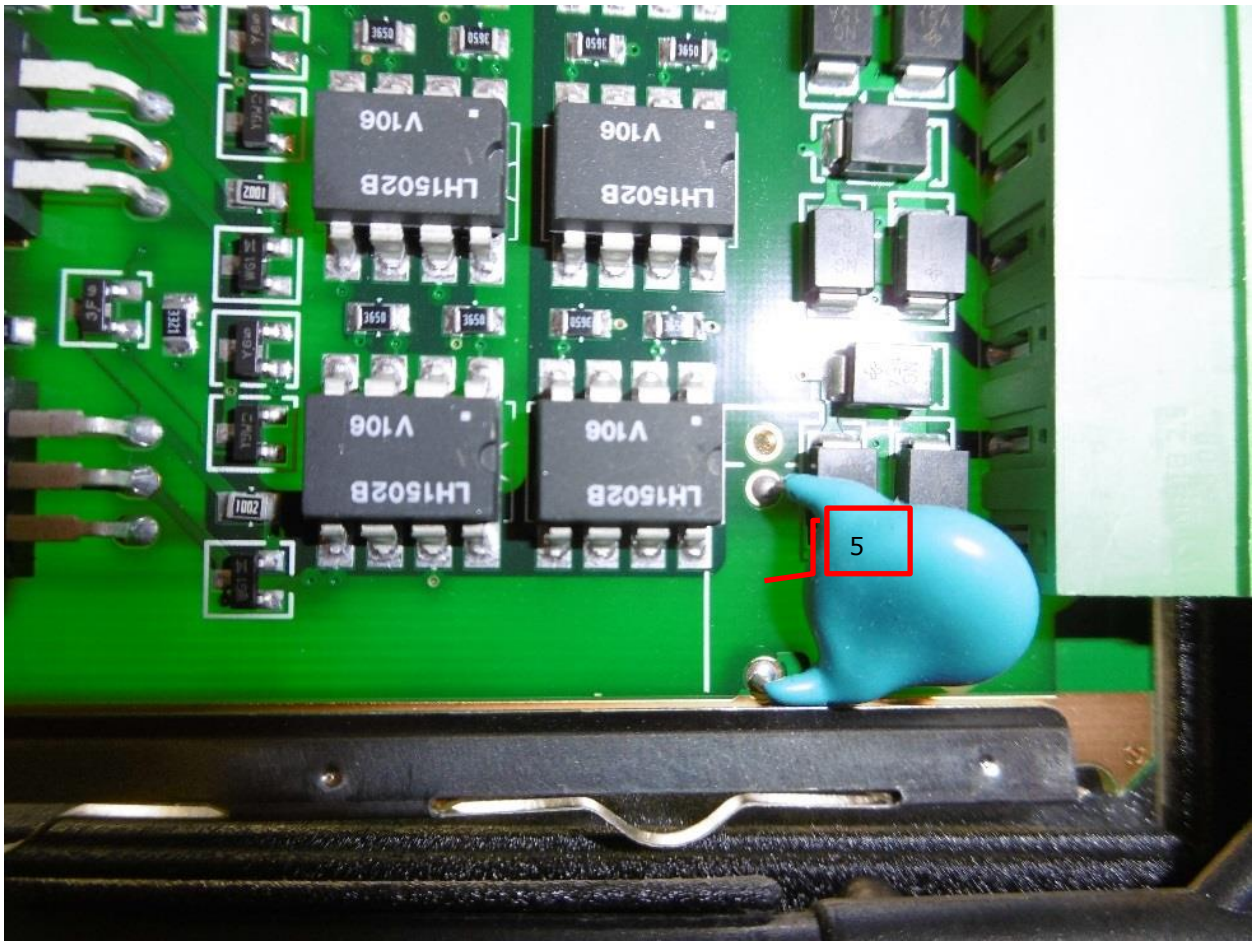
"IEC 61850-3 clause 6.6.1.1 General
Where there is any doubt that the required clearance and creepage distances are compliant with the values in the appropriate table from Annex C of IEC 60255-27:2013, measurements shall be made".

AOU200




6
5


4



Creepage

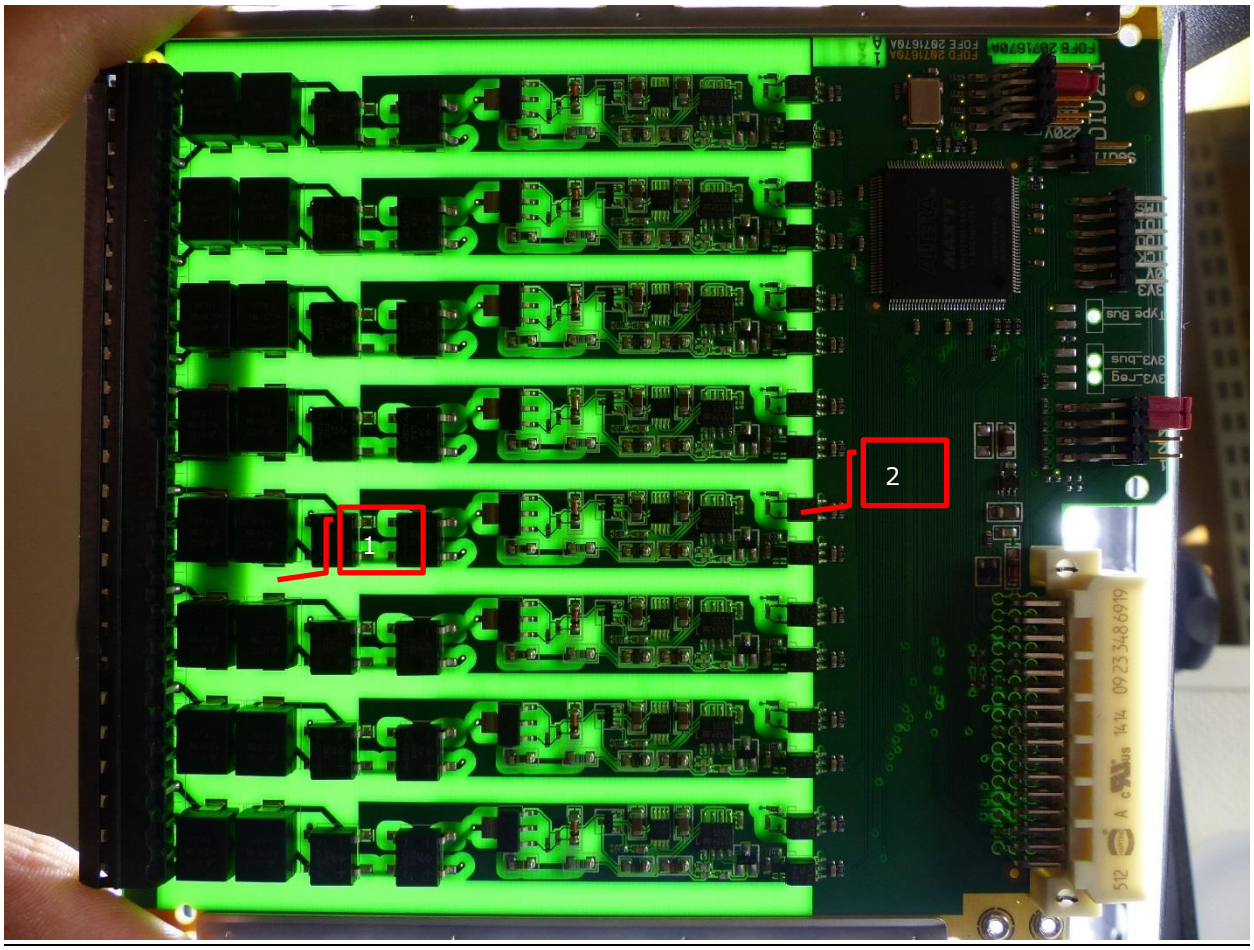
Measurement point	Required mm	Measured mm	Result
1: optocouplers	3,0	> 6,0	Passed
2: between header and PE	3,0	5,0	Passed
3: between header and PE	3,0	3,0	Passed
4: between Y-capacitor and diode	3,0	4,0	Passed
5: over the Y-capacitor	3,0	> 6,0	Passed
6: between relay and LM1502 circuit	3,0	3,0	Passed

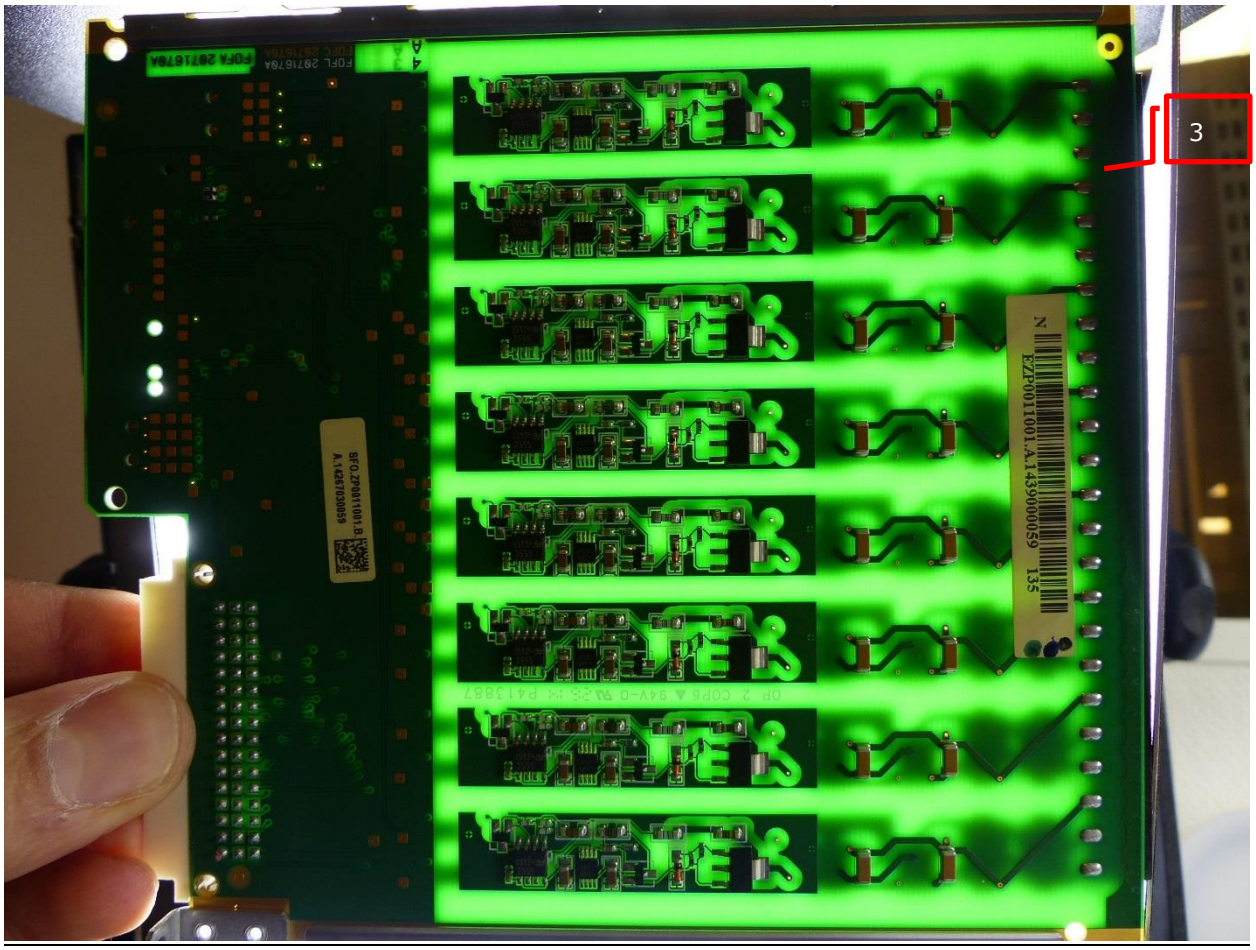
Clearance

The observed clearance is well above the required clearance distance. No measurements required.

"IEC 61850-3 clause 6.6.1.1 General
Where there is any doubt that the required clearance and creepage distances are compliant with the values in the appropriate table from Annex C of IEC 60255-27:2013, measurements shall be made".

DIU211





Creepage

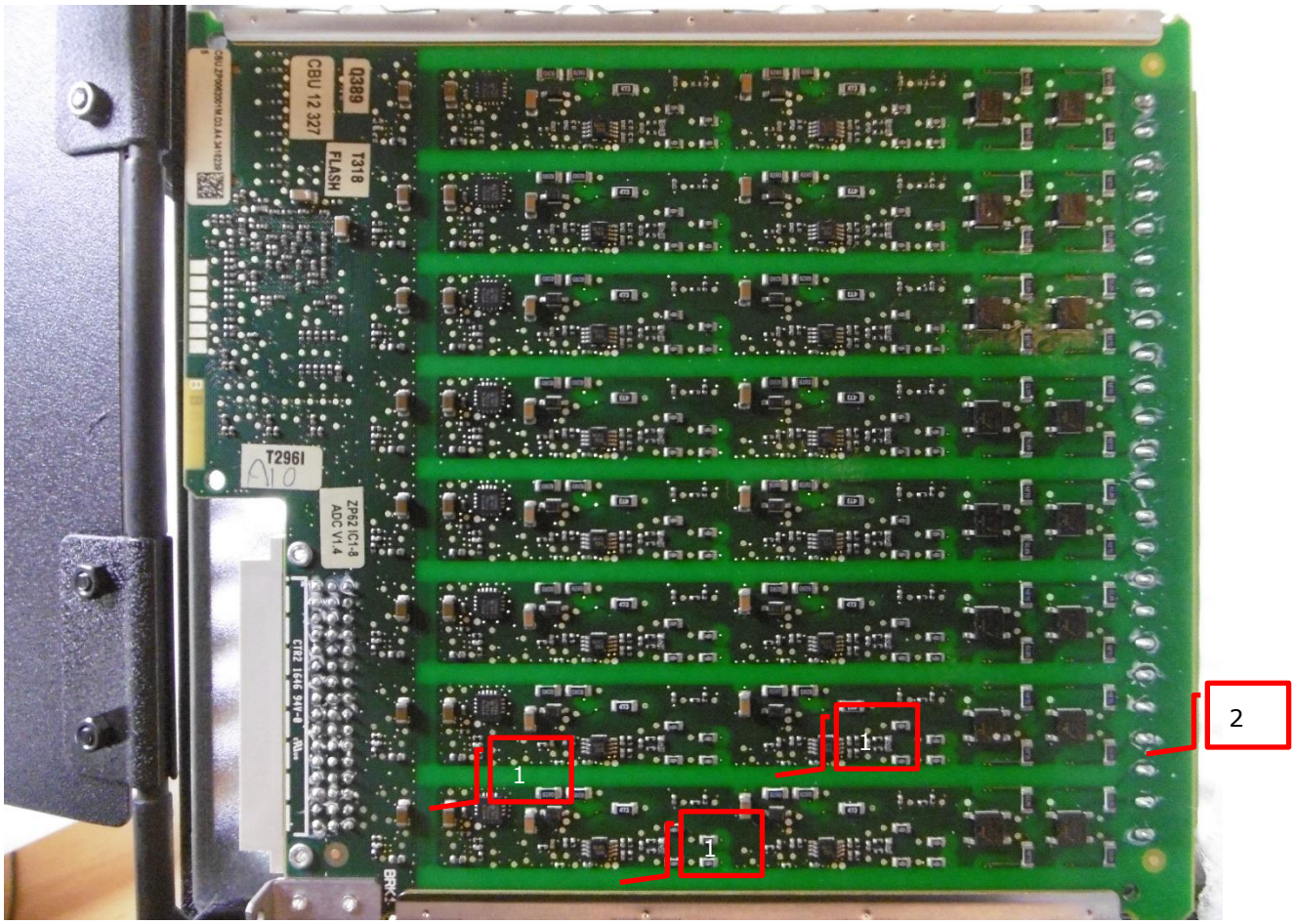
Measurement point	Required mm	Measured mm	Result
1: between transient suppressors of adjacent input circuits	3,0	3,5	Passed
2: over the optocouplers	3,0	> 4,0	Passed
3: between connector pins of adjacent circuits	3,0	3,0	Passed

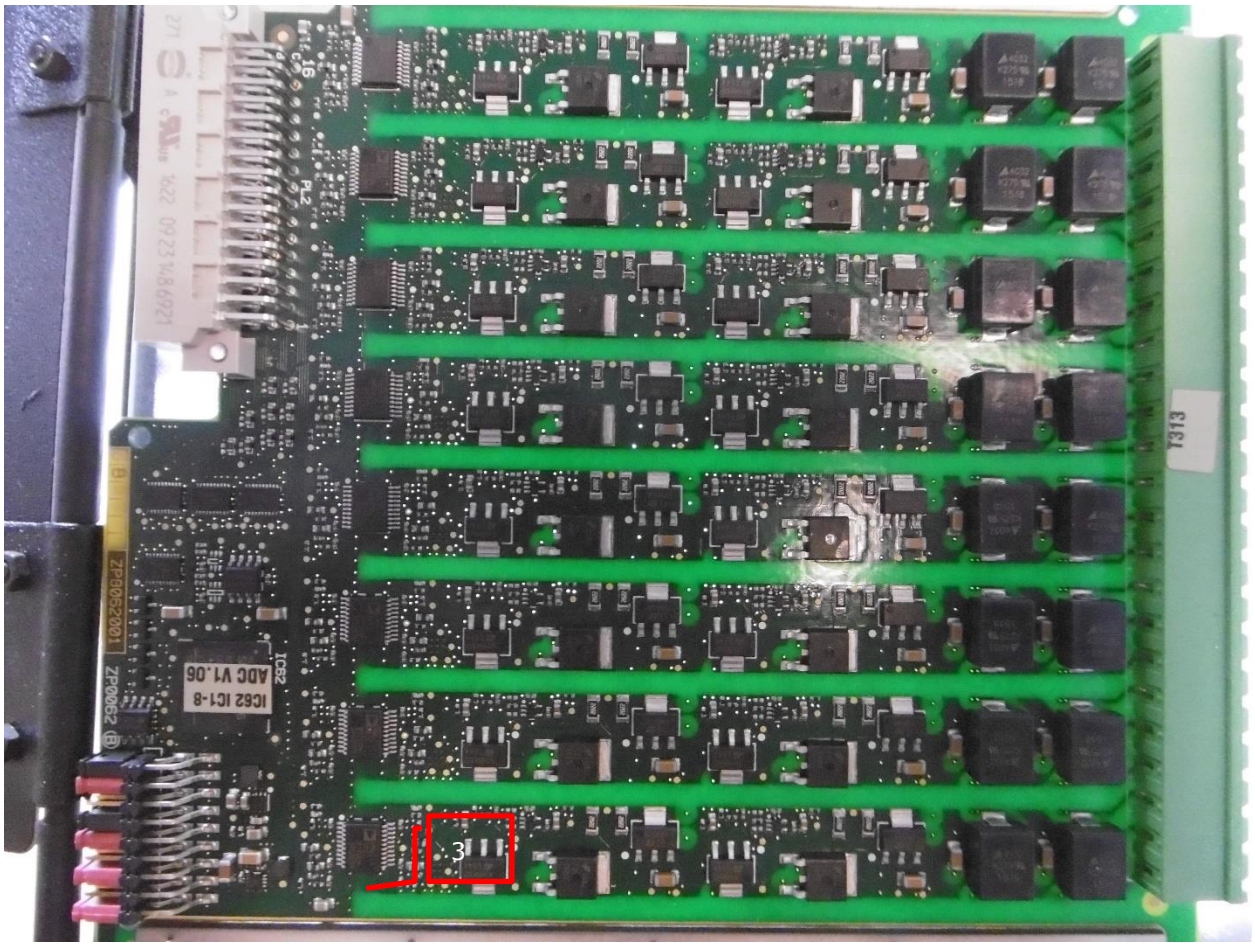
Clearance

The observed clearance is well above the required clearance distance. No measurements required.

"IEC 61850-3 clause 6.6.1.1 General
Where there is any doubt that the required clearance and creepage distances are compliant with the values in the appropriate table from Annex C of IEC 60255-27:2013, measurements shall be made".

DIU221





Creepage

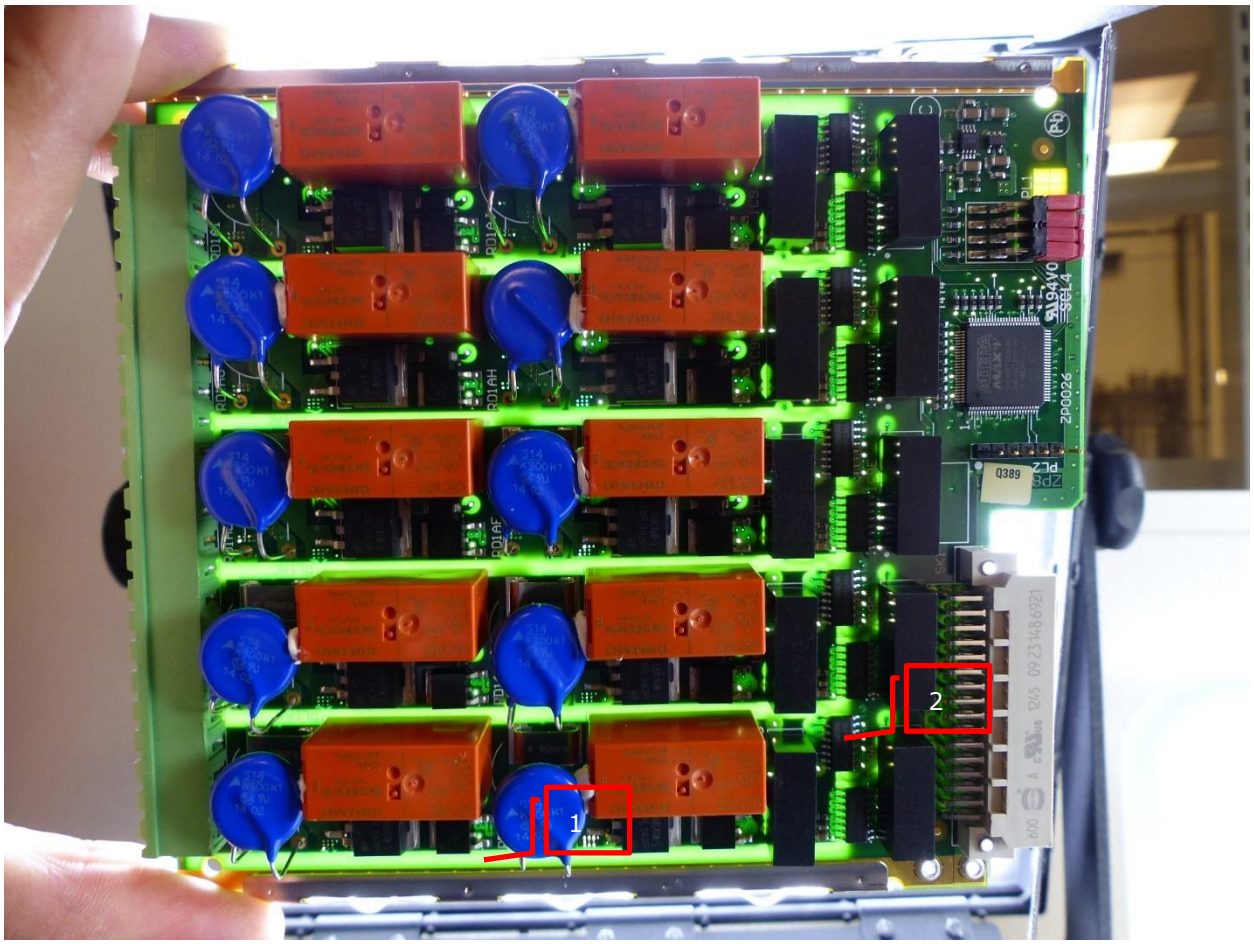
Measurement point	Required mm	Measured mm	Result
1: between adjacent input circuits and between ELV and input circuits	3,0	3,5	Passed
2: between connector pins of adjacent circuits	3,0	> 4,0	Passed
3: between ELV and input circuits at the isolation IC	3,0	3,0	Passed

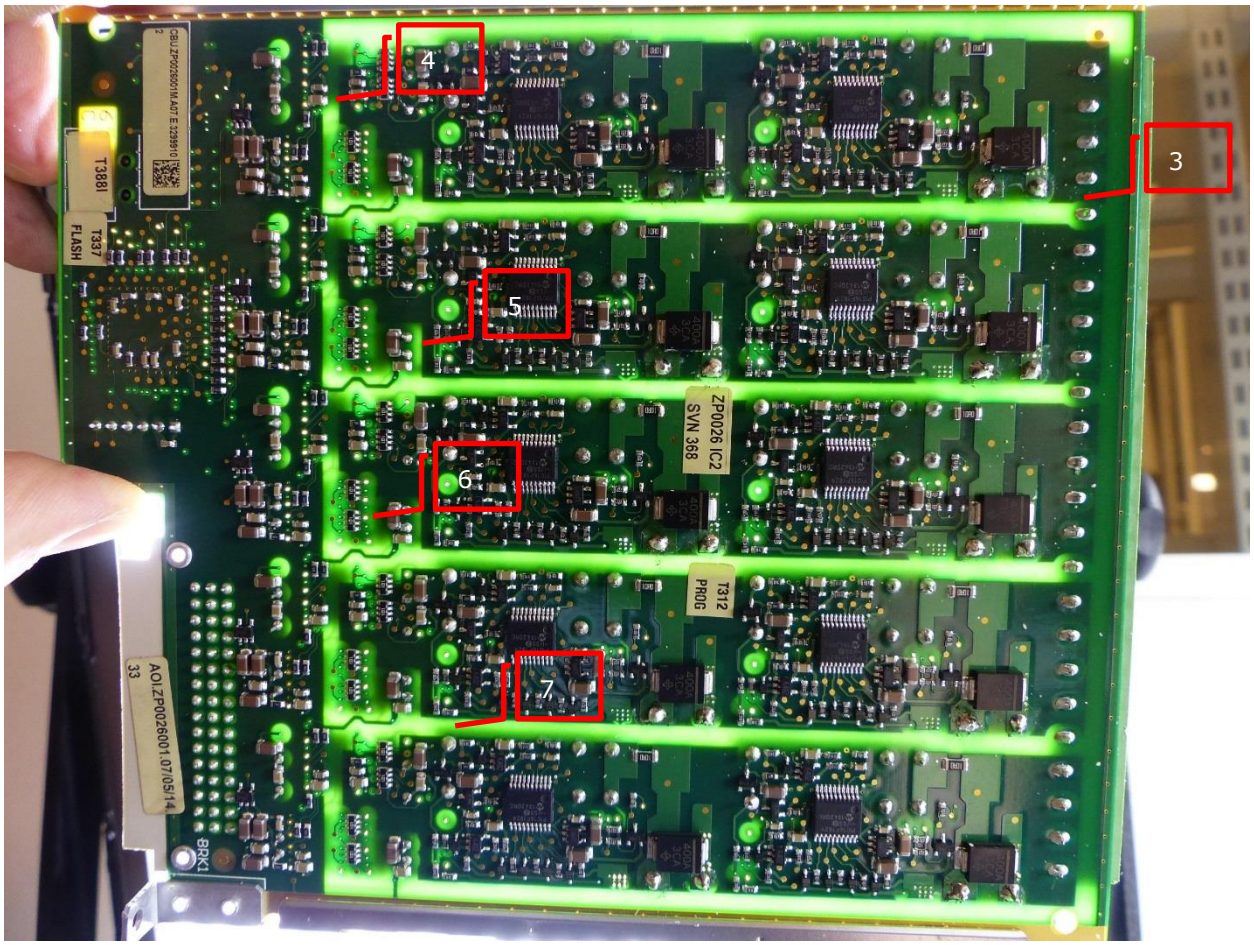
Clearance

The observed clearance is well above the required clearance distance. No measurements required.

"IEC 61850-3 clause 6.6.1.1 General
Where there is any doubt that the required clearance and creepage distances are compliant with the values in the appropriate table from Annex C of IEC 60255-27:2013, measurements shall be made".

HBU200





Creepage

Measurement point	Required mm	Measured mm	Result
1: between RD1AB and conductive card guide (PE)	3,0	3,0	Passed
2: over IC Si8462BB	3,0	> 4,0	Passed
3: between connector pins of adjacent circuits	3,0	3,0	Passed
4: between ELV and output circuits	3,0	3,0	Passed
5: between ELV and output circuits	3,0	3,0	Passed
6: between ELV and output circuits	3,0	3,0	Passed
7: between adjacent circuits	3,0	3,0	Passed

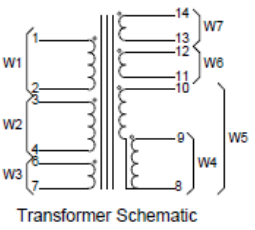
Clearance
The observed clearance is well above the required clearance distance. No measurements required.

IEC 60255-27, subclause 5.1.6.1. "Verification of clearance shall be made by measurement, where there is any doubt of compliance"

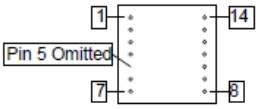
Requirement
The DUT shall comply with the applicable creepage and clearance requirements of IEC 60255-27 annex C.

Result
The object passed the test.

TABLE 6: Distance Through Insulation Measurements				
Distance through insulation di at/of:	U r.m.s. V	Test voltage V rms	Required di mm	di mm
Inner layer insulation (transformer T1)	230	2000	-	-
Supplementary information: see below. IEC 60255-27 requires not distance through Insulation measurements. The transformer T1 technical documentation has been assessed. No measurements performed.				



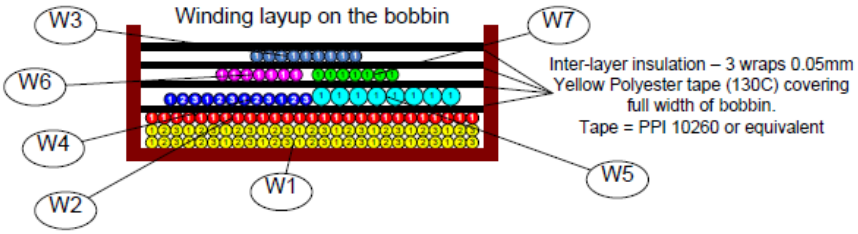
Transformer Schematic



Former Pins – View from Above

Winding	Pins	Function	Turns	Wire
W1	1(S) to 2(F)	Main Primary	18	3 off 0.5mm dia TEX-E laid side by side
W2	3(S) to 4(F)	Aux Primary	27	1 off 0.5mm dia TEX-E
W3	6(S) to 7(F)	System Power	9	1 off 0.5mm dia TEX-E
W4	9(S) to 8(F)	5V Secondary	4	3 off 0.5mm dia TEX-E laid side by side
W5	10(S) to 8(F)	12V Secondary	8	1 off 0.8mm dia TEX-E
W6	12(S) to 11(F)	Com 1 Power	7	1 off 0.5mm dia TEX-E
W7	14(S) to 13(F)	Com 2 Power	7	1 off 0.5mm dia TEX-E

Winding details – Wire Size and number of turns



	W1	W2	W3	W4	W5	W6	W7
W1		N/A	N/A	2kVRMS	2kVRMS	2kVRMS	2kVRMS
W2	N/A		N/A	2kVRMS	2kVRMS	2kVRMS	2kVRMS
W3	N/A	N/A		2kVRMS	2kVRMS	2kVRMS	2kVRMS
W4	2kVRMS	2kVRMS	2kVRMS		N/A	500VRMS	500VRMS
W5	2kVRMS	2kVRMS	2kVRMS	N/A		500VRMS	500VRMS
W6	2kVRMS	2kVRMS	2kVRMS	W4	500VRMS		500VRMS
W7	2KVRMS	2kVRMS	2kVRMS	W4	500VRMS	500VRMS	

Dielectric Withstand Levels

	Resistance	Inductance
W1	TBC	TBC
W2	TBC	TBC
W3	TBC	TBC
W4	TBC	TBC
W5	TBC	TBC
W6	TBC	TBC
W7	TBC	TBC

Core	Ferroxcube ETD29/16/10-3C94
Former	Miles Platts FD6990 – Remove Pin 5
Clips	Miles Platts TCL29

Note – Alternative formers can be substituted, ensure the correct clips for the former are selected

GN0007001 – BIU261 Transformer Winding Information

	TABLE 7: Flammability data assessment		P
module	part	Rating (UL)	
Enclosure	Metal enclosure. Ventilation holes in top and bottom of metal case are 1.9mm diameter with a center to center spacing of 3.4mm. Material thickness is 1mm.	Equipment enclosure is a fire enclosure	P
Plastic front cover	Front panel moulding part; GN6022-001	94 V-0	P
Plastic foil over display (membrane)	Front panel membrane material: PET Autotex F200	94 HB	P
CPU4	Connector J3; TH HEADER - 3 WAY - MALE - 12-15A / 250-300V - HORIZONTAL - GREEN - PCC 5.08mm Part; 1515 LED array D1/D11; 2x3mm QUAD-LEVEL LED INDICATOR	94 V-0 94 V-0	P
Switch board	Connector J10; Base strip - MSTBO 2,5/ 3-GL-5,08 - 1850440 Connector J3/J4/J5; Ethernet Connectors r/a 8 pos t/h black	94 V-0 94 V-0	P
BIU261D	Main board connector PL1, TH HEADER 24 WAY MALE - RIGHT-ANGLED - PCC 5.08mm Part; VB9501580 Daughter board PL1; HEADER - 2 WAY - VERTICAL - PCC 5.08mm - 12A - 320V – MSTBO Part; A01000567	94 V-0	P
SRP	TH 90° Right angle RJ45 connector SFP Cage SFP cover TH HEADER - 3 WAY - MALE - 12-15A / 250-300V - HORIZONTAL - GREEN - PCC 5.08mm	94 V-0 94 V-0 94 V-0 94 V-0	P
AIU211	Connector J2	94 V-0	P
DOU201	Connector PL2	94 V-0	P
CCU	Connector P3, TH HEADER 24 WAY MALE - RIGHT-ANGLED - PCC 5.08mm Part; VB9501580	94 V-0	P
AOU200	Connector X2, TH HEADER 24 WAY MALE - RIGHT-ANGLED - PCC 5.08mm Part; VB9501580	94 V-0	P
DIU211 DIU221	Connector P2, TH HEADER 24 WAY MALE - RIGHT-ANGLED - PCC 5.08mm Part; VB9501580	94 V-0	P
HBU200	Connector PL3	94 V-0	P
TMU210 and TMU220	External field wiring terminal/internal cradle mounted connector, UL file QMFZ2.E41938	94 V-0	P

Applied printed circuit boards have flammability class UL94-V-0.

	TABLE 8: Needle- flame test (NFT)				N/T
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 9: Over-voltage and Under-voltage Test, polarity reversal test				P
Test	Operating condition	Rated voltage V	Test voltage V	Temperature °C	Comments
Under-voltage test AC	Normal operating	110 V	88 V	-	No damage, no change of operating state
Over voltage test AC	Normal operating	250 V	300 V	-	No damage, no change of operating state
Under-voltage test DC	Normal operating	110 V	85 V	-	No damage, no change of operating state
Over voltage test AC	Normal operating	250 V	300 V	-	No damage, no change of operating state
Polarity reversal	Normal operating	-	-	N/A	No damage, device is operational when the polarity has been reversed
Supplementary information: negligible rise of temperature observed.					

	TABLE 10: Critical components information						
Brief Description	Used On	Circuit Ref.	Type No.	Bin No. Part No.	Ratings	Approvals (VDE, UL,etc)	Comments
Mains Capacitors (X & Y rated etc)							
Power Supply – Capacitor	24VDC power supply – 2070879A01A01 48/60 VDC power supply – 2070879A01A02 110/125VDC, 110/125VAC power supply – 2070879A01A03 220 VDC, 150/230VAC power supply – 2070879A01A04	C58, C59 C57, C41, C56 C66	Vishay Roederstein WKP102MCPEJOK Ceramic Disc Vishay Roederstein WKP102MCPEJOK Ceramic Disc	9027694 9027694	1000pF, 4kV, Y1 1000pF, 4kV, Y1	UL, VDE, CSA UL, VDE, CSA	Pass – Suitable for the application. Pass – Suitable for the application.
Power Supply – Capacitor	24VDC Power supply – 2070879A01A01 48/60VDC Power supply – 2070879A01A02 110/125VDC power supply – 207087901A03 220VDC/320VDC, 150VAC/230VAC power supply – 2070879A01		BC Components 2222 336 20224 (MKP336) 15mm X2 RATED CAPACITOR	ZB9058810	220nF - 275V - 20%	UL, VDE, CSA	Pass – Suitable for the application

Brief Description	Used On	Circuit Ref.	Type No.	Part No.	Ratings	Approvals (VDE, UL,etc)	Comments
Voltage limiting devices e.g. MOVs/Varistors							
Power supply – Varistor	24VDC power supply – 2070879A01A01	VR2	Littlefuse Varistor V68ZA20	9566507	460V 6500A 52J	UL E135010 VDE 116895E	Pass – Suitable for the application
Power supply – Varistor	48/60VDC power supply – 2070879A01A01	VR2	Epcos SIOVS14K60	658050011010	100V, 4500A, 17J	UL, CSA, VDE	Pass – Suitable for the application
Power supply – Varistor	110VAC power supply – 2070879A01A03	VR2	Epcos SIOVS14K230	6580500110800	250V, 4500A, 60J	UL, CSA, VDE	Pass – Suitable for the application
Power supply – Varistor	220/230 VAC, 150/230 VAC power supply – 2070879A01A04	VR2	Littlefuse V300LA20 A	ZB9411323	300V, 4500A, 77W	UL, CSA, VDE	Pass – Suitable for the application.
CT/VT Module - Varistor	TMU220 – 2071614	VR1 – VR5	Littlefuse V1000LA80A	ZB9411351	1000V 6500A 360J	UL VDE	Pass – Suitable for the application.

Brief Description	Used On	Circuit Ref.	Type No.	Part No.	Ratings	Approvals (VDE, UL,etc)	Comments
PCB Material							
All boards – PCB Material	All boards	-	FR4	-	-	-	Pass – Suitable for the application.

Brief Description	Used On	Circuit Ref.	Type No.	Part No.	Ratings	Approvals (VDE, UL,etc)	Comments
Line filters							
Power supply – Line filters	24 VDC power supply – 2070879A01A01 48/60 VDC power supply – 2070879A01A02 110/125 VDC, 110/125 VAC power supply – 2070879A01A03 220VDC, 150/230VAC power supply – 2070879A01A04	L1	Schaffner RN214	9065701	2.5mH, 35mΩ, 4A, 250V	UL, VDE	Pass – Suitable for the application.

Brief Description	Used On	Circuit Ref.	Type No.	Part No.	Ratings	Approvals (VDE, UL,etc)	Comments
Opto Isolators							
Power supply – Opto isolators	24 VDC power supply – 2070879A01A01 48/60 VDC power supply – 2070879A01A02 110/125 VDC, 110/125 VAC power supply - 2070879A01A03 220VDC, 150/230VAC power supply – 2070879A01A04	IC3, IC4, IC23	Siemens SFH6156-3T	VB3053100	5.3 kV rms Isolation between input and output	UL, VDE	Pass – Suitable for the application.
Power supply – Opto isolators	24VDC power supply – 2070879A01A01 48/60 VDC power supply – 2070879A01A02 110/125 VDC, 110/125VAC power supply – 2070879A01A03 220/320 VDC, 150/230VAC power supply – 2070879A01A04	IC9 – IC12, IC17 – IC19, IC22	Sharp PC400	ZB3490100	3.75 kV rms isolation between input and output	UL, VDE	Pass – Suitable for the application.
Analogue Output Module – Opto isolators	AOU200 - 2071442A	IC10, IC13, IC16, IC19, IC28	SFH6156-2 Infineon Technologies	ZB3490106	5.3 kV rms Isolation between input and output	UL, VDE	Pass – Suitable for the application.
Digital Output Module – Opto isolators	DIU220 – 2071620A	MX1 – MX16	SFH6156-2 Infineon Technologies	ZB3490106	5.3 kV rms Isolation between input and output	UL, VDE	Pass – Suitable for the application.
Digital Input/Output Module – Opto isolators	DSPIO – 2071415A	IC7 – IC11	SFH6156-2 Infineon Technologies	ZB3490106	5.3 kV rms Isolation between input and output	UL, VDE	Pass – Suitable for the application.

Brief Description	Used On	Circuit Ref.	Type No.	Part No.	Ratings	Approvals (VDE, UL,etc)	Comments
Transformers and power supply components							
Power supply – transformer	24VDC power supply – 2070879A01A01	T1	BACS	2070909A01	24VDC	-	Pass – Windings use TEX-E triple insulated wire and transformers withstood 5kV rms 60 sec type test, suitable for the application.
Power supply – transformer	48/60VDC power supply – 2070879A01A02	T1	BACS	2070909A02	60VDC	-	
Power supply – transformer	110/125VDC,110/125 VAC power supply – 2070879A01A03	T1	BACS	2070909A03	125VAC	-	
Power supply – transformer	220VDC, 230VAC power supply 2070879A01A04	T1	BACS	2070909A04	250VAC	-	
CT/VT module - Current transformer	TMU220 – 2071371A	I1 – I4	TAEHWATRANS TZ77V	ZB9011090	1/5A	-	Pass – Dielectric type test completed between primary and secondary circuits at a test level of 4.0 kV rms 60 sec with no flash over. Suitable for the application
CT/VT module – Voltage transformer	TMU220 – 2071371A	U1 – U5	MECOM Drawing No. ZC0407Split bobbin material Nylon 66	ZC0407001	636V	-	Pass – Suitable for the application
Switch Ethernet Module - Communications transformer	SWR21 – 2071593B	T1 – T5	Halo TG110 – E055N5	9566200	1.5kV isolation provided between input and output	-	Pass – Suitable for the application

Brief Description	Used on PCB	Circuit Ref.	Manufacturer and Type No.	Part No.	Ratings	Approvals (UL, VDE etc)	Comments
CCU211 Board:							
PCB Material	-	-	No information in BOM	2071733	UL94V-0	UL	Suitable for application
Opto Isolator	CCU211, FOFB 2071733Z	IC17 IC18 IC19 IC20 IC21 IC22 IC23 IC24	Sharp Microelectronics, PC400	ZB3490100	3750Vrms isolation	None submitted	Suitable for application
Relay	CCU211, FOFB 2071733Z	K1 K2 K3 K4	Schrack, RTE24005	9565780	8A/250V	None submitted	Suitable for application Marked VDE, UL & CSA
Connector	CCU211, FOFB 2071733Z	P3	Weidmuller, SL-SMT5.08/24/90 1.5SN	9566480	13A/400V	None submitted	Suitable for application Marked UL & CSA
DIU211 Board:							
PCB Material	-	-	No information in BOM	2071670	UL94V-0	UL	Suitable for application
Opto Isolator	DIU211, FOFB2071670A	IC33 – IC48	Sharp Microelectronics, PC400	ZB3490100	3750Vrms isolation	None submitted	Suitable for application
Connector	CCU211, FOFB 2071733Z	P2	Weidmuller, SL-SMT5.08/24/90 1.5SN	9566480	13A/400V	None submitted	Suitable for application Marked UL & CSA

Brief Description	Used on PCB	Circuit Ref.	Manufacturer and Type No.	Part No.	Ratings	Approvals (UL, VDE etc)	Comments
DOU201 Board:							
-	PCB Material	-	No information in BOM	2071731	UL94V-0	UL	Suitable for application
DOU201 FOFD2071731	Relay	K1 – K10	Schrack, RY611005	9514155	10A/250V	None submitted	Suitable for application Marked VDE, UL & CSA
CCU211, FOFB 2071733Z	Connector	PL2	Weidmuller, SL-5.08/24/90 3.2SN ORANGE	9565870	13A/400V	None submitted	Suitable for application Marked UL & CSA

Brief Description	Used on PCB	Circuit Ref.	Manufacturer and Type No.	Part No.	Ratings (i)	UL CCN & File Number(ii)	Comments
PCB Material	ZP0015	CI	INVOTEC HDTZP0015	ZP8015001/ 53759	Tg = 170 °C	FR4 HTG material (refer to drawing FDFC_ZP8015001_D2.pdf)	PCB BLANK - CARTE SRP V2
Miniature Relay	ZP0015	K1-K2	OMRON G6RN-1-5VDC	A00015136/ 4027	-40/+85 UL94V-0 4,000 VAC between coil and contacts 1,000 VAC between contacts	NRNT2 E41515	MINIATURE RELAY - 5V - 8A - 220mW - 113R - 1C/O - AgNi - 3.2mm - WASH TIGHT
Miniature Relay	ZP0015	K1-K2	TYCO – SCHRACK RY611-005	A00015136/ 11514	-40/+70 UL94V-0 5,000 VAC between coil and contacts 1,000 VAC between contacts	NLDX2 E214025	MINIATURE RELAY - 5V - 8A - 220mW - 113R - 1C/O - AgNi - 3.2mm - WASH TIGHT
Isolating transformers (e.g. K Bus, IRIG-B, RS-485)	ZP0015	T1-T4	WURTH ELEKTRONIK 7490140110	A01000335/ 52987	-40/+85 for 7490140110 part 4,000Vrms/60s	-	Ethernet isolation Ethernet 10/100 transformer 4.5kV
Isolating transformers (e.g. K Bus, IRIG-B, RS-485)	ZP0015	T6	ETAL P2781	A00008550/ 1271	-25/+85 3.8kVrms	-	IRIG-B isolation TRANSFORMER SMD - P2781
Mains (CM) Y rated capacitors. Y2 generally unsuitable.	ZP0015	C99, C110, C121, C132, C292	MURATA DE1E3KX102MA 5BA01	A01000326/ 52967	-25/+85 4kVac	-	10mm X1/Y1 RATED CAPACITOR - 1nF - 4kV - 20%
Mains (CM) Y rated capacitors. Y2 generally unsuitable.	ZP0015	C99, C110, C121, C132, C292	TDK CD85E2GA102M YAS	A01000326/ 52966	-25/+105 4kVac	-	10mm X1/Y1 RATED CAPACITOR - 1nF - 4kV - 20%
Terminal blocks	ZP0015	J10	PHOENIX CONTACT	A00009067/ 11325	UL 94V-2, No tempe-rature rating	-	HEADER - MALE - 8A - 250V - 3 WAY - PCC

Brief Description	Used on PCB	Circuit Ref.	Manufacturer and Type No.	Part No.	Ratings (i)	UL CCN & File Number(ii)	Comments
5.08mm - VERTICAL 90? - SOLDERED PINS			MSTBO 2,5/ 3-GL-5,08 (1850440)				
Ethernet RJ-45 connectors	ZP0015	J2-J5	TYCO 1-406541-1	A01001295/ 53043	1kVrms UL 94V-0 -40°C to 70°C 150VAC max.	**E81956**	RJ45 1x1 WAY - TAB UP
IRIG-B connector	ZP0015	J8	RADIALL R114665000W	A00015263/ 9390	-65/+165 1kVrms	-	CONNECTOR 50 OHM COAXIAL
Fibre Optic devices/connectors.	ZP0015	Port A Port B	Avago HFBR 57E5APZ	A00024942 / 48861	-40/+85 UL 94V-0 Class 1 eye safety	-	Multimode Small Form Factor Pluggable Transceivers with LC connector and DMI for FDDI and Fast Ethernet

DIU221 board ;							
Brief Description	Used on PCB	Circuit Ref.	Manufacturer and Type No.	Part No.	Ratings (i)	UL CCN & File Number(ii)	Comments
Varistor/MOV (Voltage limiting devices)	ZP0062	VR1-VR16	TDK – EPCOS B72660-M271-K72 / SIOV CU4032K275G	A00017697 /468	275VAC / 350VAC –40 to +85°C 710V Max clamping voltage UL94V-0 Component body withstand ≥2.5kVrms	VZCA2	Acceptable SMT VARISTOR - 275VAC / 350VAC - 10%
PCB Material	ZP0062	PCB1 ZP8062001	TIS CIRCUITS - Tunisia SFO Technologies Digital Pvt Ltd	A01003550	130°C 94V-0	-	Acceptable "Assemble to AUT PROD-IND-PR-06" FR-4 UL 94V-0 IPC - 4101/126 or 129 grade laminate (130°C)
Terminal blocks	ZP0062	PL1	PHOENIX CONTACT 1759237 (MSTB 2,5/24-G-5,08)	A00015256/ 691	250V, 12A, UL94-V0 4kVp surge (interpreted as 4kVp or 2.2kVrms withstand as per 60664-1 Table A.1) Datasheet "1_HK_GE_13_EN_LR.pdf" page 312 specifies that MSTB 2,5/..-G of more than 12 positions are manufactured in PBT material. Page 847, defines properties for PBT as RTI Electrical: 105°C and minimum temperature for use without mechanical load: -40°C.	-	Acceptable
Dual-Channel Isolator with Integrated DC to DC Converter	ZP0062	IC9,IC10, IC11,IC12, IC13,IC14, IC15,IC16	Analog Devices ADUM6211ARSZ ADUM6211ARSZ RL7	A01003190 / 57997 / 57477	SMT DUAL-CHANNEL ISOLATORS WITH INTEGRATED DC-TO DC CONVERTER - SSOP-20 -40 to + 105C Dielectric Withstand 3750 Vrms/60s Creepage and clearance 5.3mm CTI >400V, Material group II. Ts=150°C Max continuous working voltage applied across barrier for a minimum 50 year insulation lifetime = 560Vpeak AC/DC	-	Acceptable Where RL7 suffix indicates a 7" tape and reel option.
SMT DUAL SIGNAL DIODE - 70V - 450mA - 0.3W - SOT-23 - BAV99	ZP0062	D35,D36,D37 ,D38	Vishay BAV99	VB3044014	70V -55 to + 150C - 450mA - 0.3W	-	Not safety critical
SMT SINGLE-PHASE BRIDGE RECTIFIER - 1000V - 1A - MICRODIP-4	ZP0062	D39,D40,D41 ,D42,D43,D44,D45,D46,D47,D48,D49, D50,D51,D52 ,D53,D54	Fairchild MDB10S	A01003543	1000V - 1A -55 to + 150C	-	Not safety critical
DIN 41612 - 48 WAY - MALE - ANGLED SOLDER PINS - PCC 2.54mm - LEVEL 2 - TYPE 2C (A/B/C)	ZP0062	PL2	AVX 8457	ZB9031988	LEVEL 2 - TYPE 2C (A/B/C) -55 to +125C	-	Not safety critical
SMT N-CHANNEL MOSFET - 600V - 0.4A - 8.5R - SUPERMESH - SOT-223	ZP0062	Q1-Q32	STN1HNK60	A01001015	600V - 0.4A -55 to +150C	-	Not safety critical
SMT N-CHANNEL MOSFET - 800V - 1A - 20R - DPAK-3	ZP0062	Q33-Q48	Fairchild FQD1N80	A01003458	800V - 1A -55 to +150C	-	Not safety critical

	TABLE 11: Single fault testing	
The power supply BIU261M/D has been tested without C264 as a load, on the test bench. The power supplies have been loaded to create the condition these supplies were at the voltage fold back limiting point.		
Abnormal condition (only external load applied)		
Circuit under test	Test	Observation
+ 5 V power supply	Loaded with 5 A for 4 hours	Remains operational
+ 12 V power supply	Loaded with 3 A for 4 hours	Remains operational
+ 24 V power supply on daughter board	Loaded with 0,25 A for 4 hours	Resistors R49 and R50 started to smoke. After some time the +24 volt disappeared
+ 55 V power supply	Loaded with 1,1 A for 4 hours	Remains operational
Short circuit		
Circuit under test	Test	Observation
+ 5 V power supply	Increase the load until the output voltage decreases. Finally a short circuit is created.	Current folds back and voltage goes to zero. Current > 10 A Power of required for a restart.
+ 12 V power supply	Increase the load until the output voltage decreases. Finally a short circuit is created.	The 12 V supply went defective
+ 24 V supply on daughter board	Increase the load until the output voltage decreases. Finally a short circuit is created.	2 resistors (R49 and R50) burned (see picture). No fire hazard arises during the test. No burned particles were found.
+ 55 power supply	Increase the load until the output voltage decreases. Finally a short circuit is created.	Current folds back and voltage drops. Current > 2,7 A

Additional test on modified BIU261D Abnormal condition		
The power supply BIU261D installed in the version of the C264 with TMU 210 and DIU222 has been tested in the C264 enclosure. Additional external load has been connected to the power supply outputs to create overload conditions. The power supplies have been loaded to create the condition these supplies were at the voltage fold back limiting point.		
Circuit under test	Test	Observation
+ 5 V power supply	Extra Load of 2 A	No output due to failing +55V supply
+ 12 V power supply	Extra Load of 2 A	No output due to failing +55V supply
+ 24 V power supply on daughter board	No extra load (not tests in overload condition because no change has been applied to this circuit)	Remains operational
+ 55 V power supply	Extra load 1 A	The +55 V supply went defective after 1,5 hours without causing a safety hazard

5 LIST OF INSTRUMENTS USED

5.1 Insulation test equipment

EMC test equipment			
Description	**Manufacturer**	**Type**	**ORS number**
Oscillatory wave test system	**EMC partner**	**MIG0603OMI**	**150022**
Insulation tester	FLUKE	1503	150150
Insulation Combitester	FLUKE	1653B	150738
Dielectric 50Hz AC Voltage test	SQS Electronic	HA3300D	105156
Dielectric 50Hz AC Voltage test	SQS Electronic	HA4000D	125345
Multi EMC generator	**EMC-Partner**	**IMU3000 F6SRTDVC**	**152084**
CDN	EMC-Partner	CDN3000A-08-32 690V	152089
Power supply	EMC-Partner	PS3 Pwr1	152087
Power supply	EMC-Partner	PS3 Pwr2	152088
IEC 61000-4-5 CDN	EMC-Partner	CDN-UTP8 ED3	152077
IEC 61000-4-5 CDN	EMC-Partner	ADAPTER BOX RJ45	152079
HYPOTULTRA	AR	7854	152281

5.2 Environmental Measurement equipment

Environmental instrumentation S2T			
Description	**Manufacturer**	**Type**	**Serial number**
ICP Accelerometer (reference point)	PCB Piezotronics	353B34	203417
Shaker control system	Dactron	Laser	4816833
ICP Accelerometer (reference point)	PCB Piezotronics	353B18	175664
ICP Accelerometer (check point)	PCB Piezotronics	353B18	6419
Monitoring of the enviromental conditions	Novasina	ClimaLog 30	1206059
Signal Conditioner	PCB Piezotronics	482C16	440
Position Drop Table	Lansmont Corporation	PDT-56^{E}	PT-56E-0216
Electric-dynamic shaker	Tira	TV59355/AIT-440 TGT Model 48XXL	036/07

Environmental instrumentation			
Description	**Manufacturer**	**Type**	**ORS number**
Climate chamber	ESPEC	ARS-1100	151485
Test finger	PL Contactvingers	Test vinger 12,5mm	150691
Test probe 2.5mm	PL Contactvingers	Test vinger 2,5mm	150692
Test probe 1mm	PL Contactvingers	Test vinger 1mm	150693
Test probe 1 mm	Stahl GmbH	MP-100.04J	152411
Test probe 2,5 mm	Stahl GmbH	MP-100.04G	152407
Test probe 3 mm	Stahl GmbH	MP-100.04R	152405

Environmental instrumentation			
Test probe 4 mm	Stahl GmbH	MP-100.04S	152406
Test probe 12 mm	Stahl GmbH	MP-100.04Y	152408
Test probe 12 mm	Stahl GmbH	MP-100.04D	152409
Test probe 50 mm (ball)	Stahl GmbH	MP-100.04F	152410
Test probe 12 mm (finger)	Stahl GmbH	MP-100.04G	152412
Signal source (sounder)	Stahl GmbH	MP-100.09B	152413
Digital force gauge	PCE instruments	PCE-FM 200	152414

5.3 Measurement equipment

Measurement equipment			
Description	**Manufacturer**	**Type**	**ORS number**
Oscilloscope	Rohde & Schwarz	RTB2002	152140
Oscilloscope	Rohde & Schwarz	RTB2002	152287
Oscilloscope	Rohde & Schwarz	RTB2004	152142
Oscilloscope	Rohde & Schwarz	RTM3002	152229
Current probe	Tektronix	TCP A300&303	151982 151983
Current probe	Tektronix	TCP A300&303	151942 151937
Oscilloscope	Tektronix	TBS 1052B	151943
Oscilloscope	Tektronix	TBS 1052B	151500
Oscilloscope	Tektronix	TBS 1052B	151519
Oscilloscope	Tektronix	TBS 1064	152001
Differentiaal probe	Testec	TT-SI 9010A	151822
Differentiaal probe	Testec	TT-SI 9010	152277
Multimeter	Fluke	8840A	069145
Analogue multimeter	avometer	MK.6	067424
Multimeter	Fluke	8846A	152266
Multimeter	Fluke	8846A	152265
Multimeter	Fluke	8846A	152264
Multimeter	Keysight	34465A	152269
Multimeter	Keysight	34465A	152268
Multimeter	Keysight	34465A	152267
Multimeter clamp meter	Fluke	365	152024
Multimeter clamp meter	Fluke	365	152025
Current clamp meter			77395
Multimeter clamp meter	Fluke	337	104632
Multimeter 179	Fluke	179	152027
Multimeter 179	Fluke	179	152028